Working Group on Leading Edge Applications

Strategic Applications Agenda

Version 3

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January 2010

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Abstract

*e*Mobility (www.emobility.eu.org) aims at reinforcing Europe's leadership in Mobile and Wireless Communications, which have created unprecedented possibilities for people to communicate and have become a key driver of economic growth. Within the activities of *e*Mobility, a Working Group on Leading-Edge Applications has been formed, in order to address non-technological aspects related to services and applications in Mobile and Wireless Communications. Among the objectives of this Working Group, the establishment of an SAA (Strategic Applications Agenda) is the more tangible one, which constitutes this document. The SAA focuses on 3 areas that are currently of paramount importance in Mobile and Wireless Communications, i.e., Health and Inclusion, Transport, and Environment, to which Future Internet was added, together with another on Enabling Technologies. For each of the focus areas, a vision and core topics are defined, followed by a state of the art, and then future challenges are assessed.

Keywords

Mobile and Wireless Communications. Services. Applications. Health. Inclusion. Transport. Environment. Future Internet.

Preface

This Strategic Applications Agenda puts together ideas for applications of Mobile and Wireless Communications. The basic idea developed from the need to show what applications one may have for the various technologies being developed in this area of Telecommunications (with a broader view), so that it becomes apparent that, together with the work on new and (r)evolutionary approaches to systems and networks, there is also a world where they can be applied, for the benefit of users, and the society at large.

The original idea of establishing an SAA was implemented via a Working Group in *e*Mobility, based on voluntary work from its members. Putting together the information on existing applications, and ideas for new applications, together with their characterisation, was a challenge addressed by the Working Group since 2008, which ended up in a very first version of the SAA by the end of that year. This document is an updated version of that initial document, where further inputs were included.

This report is based on the voluntary work of many people (chapter editors and contributors) that gave their time and effort to put together this report. My sincere thanks to all of them, without whom, this report would have never been possible.

I hope that the readers find this document useful.

Luis M. Correia

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List of Acronyms

2D	2 Dimensions
3.5G	3.5 Generation
3D	3 Dimensions
3G	3rd Generation
3GPP	3rd Generation Partnership Project
4G	4th Generation
AAA	Access, Authentication and Authorisation
ACC	Adaptive Cruise Control
AGPS	Assisted GPS
AHS	Assist Highway Systems
AT	Assistive Technologies
ATC	Area Traffic Control
AVL	Automatic Vehicle Location
B	Byte
BP	Blood Pressure
bps	bits per second
C2C	Citizen to Carer
C2P	Patient to Carer
CAA	Context-Aware Application
CAPEUS	Context-Aware Packets Enabling Ubiquitous Services
CCTV	Closed Circuit TV
CHF	Congestive Heart Failure
CICAS	Cooperative Intersection Collision Avoidance Systems
CM	Communication Model
CoBrA	Context Broker Architecture
COPD	Chronic Obstructive Pulmonary Disease
CPR	Cell Phone Radar
CT	Computed Tomography
CVIS	Communication Vehicle Infrastructure Systems
D2D	Data to Doctor
D2P	Patient to Doctor
DL	Downlink
DSR	Distributed Speech Recognition
DSRC	Dedicated Short-Range Communications
DSTM	Data Services for Transport and Mobility Users
DVB-H	Digital Video Broadcast - Handheld
EC	European Commission
ECG	Electrocardiogram
ECTP	European Construction Technology Platform
eHealth	Electronic services in healthcare
EMG	Electromyography
ETC	Electronic Toll Collection
ETP	European Technology Platforms
EU	European Union
ev-DO	Evolution-Data Optimized
FM	Frequency Modulation
FP5	5th Framework Programme
FP6	6th Framework Programme
FP7	7th Framework Programme
GAN	Generic Access Network
GANC	Generic Access Network Controller
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
GST	Global System for Telematics
HCI	Human-computer interaction
HSPA	High Speed Packet Access
HSxPA	High Speed UL or DL Packet Access
HVAC	Heating, ventilation and air conditioning
HVS	Human Visual System
ICT	Information and Communication Technologies

ICU	Intensive Care Unit
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPD	Image and Patient Data
IST	Information Society Technologies
IT	Information Technology
ITS	Intelligent Transport System
ITU-R	International Communication Union – Radiocommunication sector
KA	Key Action
LAN	Local Area Networks
LBS	Location Based Service
LRM	Location Representation Model
LTE	Long Term Evolution
M&WCs	Mobile and Wireless Communications
MAN	Metropolitan Area Networks
MANET	Mobile Ad-Hoc Networks
MBT	Meteor Burst Technology
MIE	Multisensory & Immersive Experiences
MMS	Multimedia Messaging Service
MoEA	Ministry of Economic Affairs
MOS	Mean Opinion Score
MP3	MPEG-1/2 Audio Layer 3
MPEG-4	Moving Picture Experts Group - 4
MRI	Magnetic Resonance Imaging
P2C	Patients to Carers
P2P	Peer-to-Peer
PAN	Personal Area Networks
PC	Personal Computer
PDAs	Personal Digital Assistants
PmEB	A mobile phone application for monitoring caloric balance
POI	Points Of Interest
PS	Packet Switched
PTS	Public Transport Surveillance
QoS	Quality of Service
R&D	Research and Development
RFID	Radio Frequency Identification
ROI	Regions Of Interest
s	Seconds
SAA	Strategic Applications Agenda
SAR	Synthetic Aperture Radar
sCAP	Smart Context-Aware Packets
SES	Speech Enabled Services
SME	Small and Medium Enterprises
SMS	Short Message Service
SOA	Service Oriented Architecture
SpO2	Saturation of Peripheral Oxygen
SRA	Strategic Research Agenda
TCSS	Traffic Control and Surveillance System
TIS	Transport Information System
TMIC	Traffic Management and Information Centre
TV	Television
UAV	Unmanned Aerial Vehicle
UEs	User Equipment
UFS	Urban Forest Surveillance
UICC	Universal Integrated Circuit Card
UL	Uplink
UMA	Unlicensed Mobile Access
UMPC	Ultra Mobile Portable Computers
UMTC	Urban Traffic Management and Control
UMTS	Universal Mobile Telecommunications System
V2C	Vehicle-to-Centre
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle
VANETs	Vehicular Ad-Hoc Networks

VII	Vehicle Infrastructure Integration
VoIP	Voice over IP
VSC	Vehicle Safety Communications
WAP	Wireless Application Protocol
WASP	Web Architectures for Services Platforms
WAVE	Wireless Access for a Vehicular Environments
WG	Working Group
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network
WSL	WASP Subscription Language
WSNs	Wireless Sensor Networks

I. Introduction

In recent years, consumer demand for Mobile and Wireless Communications (M&WCs) has become a global mass market business, from which European organisations have greatly benefited and Europe has consolidated its leading position in mobile communications. However, uptake of wireless and mobile technologies as an integral part of professional application systems, designed to be stand-alone or integrated into wider systems, has yet to reach mass market proportions and is largely untapped as a market in Europe and globally. Many small scale prototypes and some field trials have demonstrated the technical feasibility of solutions, but market exploitation of the results has often not taken place, or not had lasting success, when it was attempted. The reasons why M&WCs have not yet successfully been integrated into applications on a mass market scale, generating economies of scale and scope, are often not clear and the barriers to progress are often not of a technical nature. Current understanding of the barriers to exploitation is fragmented and exists in partial form in some application domains.

The revised Lisbon Agenda, seeing the opportunity presented to Europe, calls for further R&D investment in advanced applications based on new technologies. Specific strategies and road maps are needed to guide investments so that the European economy reaps the maximum benefit from the productivity increase and improvement in the quality of life that M&WC technologies offer.

The launching of a range of European Technology Platforms (ETPs) in recent years in various application sectors provides an unprecedented opportunity for the mobile and wireless sector to compare its Strategic Research Agenda (SRA) with those of a range of application sectors. The synergies between the domains can now be systematically investigated to develop road-maps and scenarios for the integration of mobile and wireless capabilities into a range of mass market applications. Developing such road-maps, and creating awareness of the opportunities in the R&D community, has the potential to provide the European Information and Communication Technology sector organisations with a competitive edge, which will allow them to extend their share of global markets and providing new market opportunities for service and network providers, as well as manufacturers and system integrators in the mobile domain. The potential for the applications sectors to enjoy economic success, which common standards, such as GSM and 3G, have brought to the mobile and wireless sector in Europe, could be established if applications integrating M&WCs could be based on the development of standard specifications for the systems.

*e*Mobility's aim is to (www.emobility.eu.org) reinforce Europe's leadership in M&WCs, which have created unprecedented possibilities for people to communicate and become a key driver of economic growth. Additionally, *e*Mobility wants to master the future development of this technology, so that it best serves Europe's citizens and the European economy. In order to achieve this goal, several activities are being held within *e*Mobility, for which Working Groups (WGs) have been established.

A WG on Leading-Edge Applications has been formed, in order to address non-technological aspects related to services and applications in M&WCs. This WG aims to:

- Establish further links between M&WCs and other areas.
- Find new applications for M&WCs.
- Develop disruptive ideas for R&D in M&WCs.
- Gather further contributions to the SRA (Strategic Research Agenda).
- Establish an SAA (Strategic Applications Agenda).

One of the main objectives is to establish links to players in various sectors, to identify applications and services with the purpose of fostering their rapid development through the definition and maintenance of an SAA. As a global leading technology sector, the European mobile and wireless community has a lot to offer to applications sector actors. The SAA intends to capture the mobile and wireless requirements of promising new applications in various areas, through the road-maps available in these sectors, and identifying synergies between these road-maps and those of the mobile and wireless sectors, leading to the definition on new joint priorities for research and development.

The task of addressing all areas of applications for M&WCs would require an enormous effort, beyond the reach of this WG. Therefore, initially, it was decided to focus on three areas: Health and Inclusion, Transport, and Environment. The first two, Health and Inclusion, and Transport, play a central role in Challenges 5 and 6 of Framework Programme 7, whereas the third one, Environment, clearly constitutes one of the main concerns of civil society. Additionally, given the focus that it has recently received, the area of Future Internet was added as another area of focus just prior to completion of this version of the SAA. As a result the new area at present is less developed compared with the other areas. Finally, it was felt that, without competing with the SRA, some technological information should be included as well, i.e., Enabling Technologies, providing a means for bridging the gap to the SRA.

The approach for establishing this report was to combine the use of desk research with published calls for ideas and contributions, inputs being solicited from a wide range of projects and programmes, together with workshops to consult a wider audience of interested parties, particularly in the involvement of the *e*Mobility constituency. Detailed information on this, namely the workshops proceedings, is available at http://www.emobility.eu.org/WorkingGroups/Applications/Applications.html.

The remainder of this report is structured into seven chapters, corresponding to the application areas addressed, conclusions and references, followed by the logos of some of the entities involved in this document. For each of the areas, a vision and core topics are defined, followed by a state of the art, and then future challenges are assessed. At the end of the document, annexes present a survey of projects in each of the areas, addressing the proposed applications as well as their characteristics.

II. Health and Inclusion

II.1. Description

II.1.1. Vision

The core vision considered is stated by "Support individuals and professionals via future mobile applications to enhance healthcare delivery, clinical performance and lifestyle".

We identified four key areas where wireless health applications are of particular interest:

- Future wireless diagnostic and disease management systems.
- Hospital consultation and emergency scenarios.
- Assistive technologies.
- Well being and personalisation.

These areas will be addressed in the following sections, where relevant applications and services will be described and the main challenges for each area will be outlined.

"Health informatics and telemedicine" is one of the key areas of change in the health and social services sector.

Mobile technologies enable in particular new services that could lead to a dramatic change in health organizations and healthcare delivery practices. We will refer in the following to the concept of "M-health", defined as the 'emerging mobile communication and network technologies for healthcare systems' [1], including sensors, WLANs, satellite, 3G, 3.5G and future generation (e.g., LTE/4G) mobile systems.

Recent changes in society demand for new specific services. Such changes include an ageing society and ageing workforce, increasing life expectancy, changing family forms with an increase in people living alone. New challenges relevant to the changes above have to be faced, such as chronic and degenerative diseases, addictions, obesity, depression, etc.

Mobile services can have a massive impact on all aspects of healthcare, from delivering the information people need to lead a healthy lifestyle to making healthcare systems more efficient, proactive and responsive and providing 'in the home' and mobile healthcare technologies. Prevention will have a key role in this scenario.

Biosensors and other new medical technologies reduce costs dramatically and lead to do-it-yourself home care. Recent advances in image and wireless video transmission will enable remote diagnosis also in wireless and mobile scenarios (e.g. ambulances).

Regardless of technology advances, the health sector currently lags behind other sectors in the use of recent advances in information and communications technology. This is both due to technical barriers and to limited professionals' adoption of mobile technologies for healthcare. Table II.1 reports the main factors having an impact on health professionals' adoptions of mobile technologies for healthcare.

Addressing these challenges will result in great potential for rapid sustained growth [2].

Future wireless health and inclusion applications represent one of the main areas of application envisaged by the eMobility platform.

Table II.1 – Research issues on health professionals' adoptions of mobile technologies for healthcare work.

End-user factors	Attributes
Technological	• Software-device fit and adaptability [3]. • Type, nature, age of devices [3]-[6]. • End-user interface problems (data entry, display visibility, navigation, locating information, speed) [7], [8]. • Medical Contents developments [7], [8]. • Data security and patient confidentiality [9]. • Speed, nature and type of wireless telecommunication bandwidth [3], [10]. • Devices connectivity and Interactivity [3], [11]. • Software design & development [12]. • Negative impacts of legacy technologies [3]. • Power requirements for devices [13].
Human	• Unintended uses of devices for social and personal reasons [3]. • Time constraints on adoption [14]. • Applications & devices underutilization & limited adoption [15]. • Health professionals involvement in design process [16]. • Legacy systems on adoption process [3]. • Users' satisfaction and poor computer literacy skills [18]. • Health Professionals prior experience [18]. • Health professionals Age [18]. • Perception of privacy [17].
Organizational/ Administrative	• Technology- Clinical organization & workflow fit & realignment [19]. • Role of Organizational Policy or Strategy [16]. • Patient-Provider clinical interaction [19]. • Infection control [20]. • Financial & Economic constraints (High cost of devices and connectivity charges) [5], [6]. • Health Professionals-Organizational-Technology needs fit & mismatch [3], [21] and [22]. • Institutional technical capacity and support [23]. • Health professional training and capacity building [14], [24]. • Device ownership (Organization issued vs. Personal devices) [25]. • Regulatory issues [26].

II.1.2. Future wireless diagnostic and disease management systems

In the future mobile applications will lead to simpler, safer and more personalized care. Everyone will be able to monitor his/her own health status, with wearable, smart and portable connected devices, and to share the relevant data with health personnel and doctors who will be empowered with a view of health records across multiple sources.

Pervasive healthcare systems (wireless diagnostic and disease management systems) involve the sensing of a patient's physiological and physical parameters and transmitting them to a remote medical centre, where expert medical knowledge resides [27], [28]. A typical pervasive healthcare system has the ability to record physiological parameters and provide information to the doctor in real time through a wireless connection. Unobtrusive wireless sensors are used to measure critical parameters like arterial blood pressure, heart rate, breath rate, oxygen saturation, electrocardiogram (ECG), skin temperature, respiration, and glucose or patient position and activity [29]-[34]. Advanced and miniature sensors, portable and wearable electronics, active and intelligent implants such as defibrillators, as well as RFID and bio-diagnostic systems at the point-of-care, are examples of state-of-the-art pervasive healthcare systems.
Wearable monitoring sensors can be classified as invasive, non invasive and internal sensors.

- Wearable sensors must be small and light enough to fit inside textile, e.g. shirts or integrated with accessories like belt, watch and others.
- Implanted sensors include heart defibrillators and pace makers that transmits data about functionality and battery as much as well as physiological data (ECG trace) to a cell phone and through this to a health center.
- Sensors for monitoring internal parts of the human body, e.g in the form of pills. These can transmit to a cell phone or a different mobile unit data about activity, temperature, time reference, or even monitor through internal images (e.g. bowel) and transmit these to a mobile phone.

Integration of sensors into compact devices, together with wireless gateways, ubiquitous communication technology and penetration of mobile phones and wireless technologies, deliver mobility solutions that open up immense potential for technology-enabled proactive healthcare and independent living. The most common protocols for pervasive wearable e-health systems are Bluetooth and ZigBee (IEEE 802.15.4 standard).

Such pervasive systems, including portable and handheld ICT devices as well as wearable systems, in most wireless diagnostic and disease management applications are divided in two categories:

A. Point-of-care diagnostics enables early diagnosis of a disease and indications of suitable treatments. This scenario could occur when the patient does not feel well and, thus, decides to initiate an out-of-schedule session, or when the monitoring device detects a problem and automatically initiates the transfer of data to the corresponding centre (emergency episode detection).

More specifically this category includes the following applications:

- Mobile applications to monitor and transmit to a data base cardiovascular and hemodynamic parameters.
- Mobile applications to monitor and transmit to a data base other human vital signs and images.

B. Treatment management systems (patient follow up and "personal assistance").
This category refers to the everyday monitoring process, where vital signs are acquired and transmitted periodically to a health-monitoring centre. The received data are monitored by the doctor on-duty and then stored into the patient's electronic health record maintained by a healthcare centre. A managed timely feed back from a health professional is needed, resulting in the need for the provision of mobile connectivity to the health professional, to obtain information about the patient and provide feedback.

These systems include the **patient-care unit**, communication systems (e.g. mobile phones), RFID technologies etc. and are used for personalised health status monitoring for chronic disease management such as diabetes and cardio-vascular disease. This category mainly concerns patients who have been recently discharged from hospital after some form of intervention, for instance, after a cardiac incident, cardiac surgery, or a diabetic comma and require enhanced care. Current conditions where home monitoring might be provided include hypertension, sleep apnoea monitoring, ECG arrhythmia monitoring, post surgical monitoring, diabetes (monitoring glucose), obesity and CHF (monitoring weight), asthma and COPD (monitoring spirometry/peak flow), and, in the near future, conditions utilizing oximetry monitoring. Other home-monitoring conditions might include preeclampsia, anorexia, low birth-weight infants, growth abnormalities, and arrhythmias.

More specifically this category includes the following applications:

- Mobile applications to monitor and transmit to a data base cardiovascular and hemodynamic parameters.
- Mobile applications to monitor and transmit to a data base human activity parameters.
- Mobile applications to monitor and transmit to a data base other human vital signs and images.

The following target groups are considered [35] to be best suited to adopt the above mobile applications:

- Teenagers: Systems that encourage young people to adopt healthy lifestyles by preventive actions (hypertension, cholesterol).
- Healthy people: Wellness applications, heart arrest and stroke (interventions and timing of interventions).
- Elderly persons: Monitoring of mobility decrease, constipation, catheters and infections.
- Chronic patients: Epilepsy, hypertension, asthma, respiratory, smoking, treatment and medication.

All of the above systems may include alerting and management support systems which incorporate new tools for prediction, detection and monitoring of adverse event. An alarm represents a change in the status of a physiological condition or a sensor reading state outside of agreed limits.

II.1.3. Hospital consultation and emergency scenarios

Hospital consultation and emergencies are among the most challenging scenarios, due in particular to the requirements of high medical quality for multimedia data and often high mobility and real-time operation.

Hospital consultation includes streaming of medical video data from the patient site to the hospital, where specialists can perform a diagnosis according to the data received.

Emergency scenarios include data transfer between ambulance and hospital and temporary communication systems deployed after disasters (earthquakes, war ...).

Real-time Mobile/Wireless Telemedicine services for teleconsultation (videoconferencing), teleradiology and medical images and video transmission through IP and Mobile Web platforms could be useful in patients to carers (P2C) communication and also in health providers' interaction. Devices such as mobile phones, personal digital assistants, laptops, ultra mobile portable computers (UMPC) and tablet PCs are proposed for accessing these services. Broadband wireless networks such as WiMAX, WLAN, 3G/HSPA, digital TV, broadband satellite and mobile TV (terrestrial and satellite) are becoming increasingly available and affordable to permit these applications.

A demanding real-time hospital consultation application consists of wireless robotic ultrasonography. A fully integrated end-to-end mobile tele-echography system for people that are not served locally, either temporarily or permanently, by medical ultrasound experts was developed in the OTELO [36], [37] project, comprising a fully portable tele-operated robot allowing a specialist sonographer to perform a real-time robotised tele-echography to remote patients.

An important example of what an emergency application consists is the transmission of medical data from an ambulance. If the ambulance is equipped with a portable ultrasound device, an ultrasonography can be performed on the patient on the way to the hospital, in order to check possible internal injuries or heart problems, and the acquired video sequence can be sent to the hospital via a mobile broadband platform (such as WiMAX). The proper actions can be prepared in the hospital according to the diagnostic data received. A videoconference session with the specialists at the hospital can also be set-up and live images of the patient can be transmitted. Similarly, a medical doctor may be traveling and his expertise may be urgently required. In this case, patient's data can be immediately transferred to the specialist's PDA enabling an immediate first diagnosis.

The described telemedicine scenarios require real time services and applications such as voice and video over IP in an environment capable to support real time communication in case of emergency. Such telemedical applications can be classified in terms of [38]:

- Needed bandwidth.
- Tolerated delay.
- Minimum accepted quality.
- Security (integrity of data / secure authentication / privacy / QoS - availability of the System).
- Need for real-time operation.
- Main direction of data flow (uplink/downlink).
- Need for mobility (Is mobility needed? Where? At the patient site or at the specialist site?).

II.1.4. Assistive technologies

Assistive technologies, which support people with disabilities and chronic diseases, including robotic applications and new ways of man-computer/machine interaction, represent one of the main areas envisaged by the eMobility platform.

The decrease in mortality rates among elderly people is increasing the ageing population in Europe. As a result governments must spend more money to assist these seniors' needs.

Disability problems as well as co-existence of several chronic conditions (co-morbidity) are increasingly common situations mainly for the elderly. These situations require the development of integrated technological solutions in a flexible and appropriate way.

Hopefully, advances in networking, mobile communications and wireless sensor technologies as well as Information and Communication Technologies (ICTs) offer great potential to support disabled and elderly people, their relatives and the health providers. ICTs also enable the delivery of assistive services at a distance hence providing the opportunities to improve quality of life.

Advances in Assistive Technologies (AT) over the last decade or two have significantly influenced the life of people with disabilities.

II.1.5. Well being and personalisation

Well being and personalisation technologies enable all citizens at home, work and leisure, to utilize and make the most of the technologies available in the benefit of health, fitness and independent living. Of course these technologies have an increasingly possibility to play a key role in health and care-services for elderly people. This is especially important for Europe where the progressive ageing of the population is leading to an increase in the proportion of the people with mental disabilities and chronic illnesses asking for new demands for society's care and medical services.

Well being and personalisation technologies include independent living applications, such as nutritional advice, activity coaching, brain trainers and autonomous mobility and smart workplace applications such as elderly-friendly route guidance, personal mobility, tourism, leisure and smart workplaces. These services are personalised and adapted to the profile of the users, to their preferences and to their health status. Well being and personalisation technologies include the following broad areas:

A. Fitness. Fitness and rehabilitation are important for well-being and health. Fitness technologies consist of smart fitness and rehabilitation devices as well as concepts for fitness-training, nutrition and top-sport. These solutions exploit various technologies and applications such as wireless solutions, networks, multimedia, WAP, Bluetooth, digiTV, biotechnology, biosignals and nanotechnology. Heart rate monitoring can be combined with these devices. The objective is to brand wellbeing and services for use in everyday life. These applications target younger people and workplace exercise.

B. Personalised applications. Well being technologies are those that support people in their daily lives and enhance their capacity. Personalisation refers to the principle of making systems and services completely adapted to the real necessities of the final users. Although personalised applications concern all citizens, people more affected by disabilities and movements impairments, such as elderly, blind people, etc., are those who will benefit most from new technological advancements in the benefit of their well being.

However, when more advanced interfaces, content and services are available for all types of individuals, these applications will be adopted and used by other groups as well.
Nevertheless, still today there is a strong barrier on the utilization of those systems due the lack of suitable interfaces, contents, and services completely adapted for all kind of people, regardless of their limitations and their capacity.

This concept is gathered by the initiative of "Design for All" promoted by the European Commission.The objective is to create products and services to meet the needs of users through accessible, barrier free and inclusive design [39].

C. Home automation and intelligent environment. This category includes technological services and products that can be utilized in the home environment, in some cases to support independent living for older and disabled people (see also assisting technologies section for this specific application). Potential applications consist of videoconferencing, robotics and mobile technology.

Note that areas B. and C. are tightly intertwined with assistive technologies.

II.2. State of the art

II.2.1. Future wireless diagnostic and disease management systems

The monitoring technology of medical parameters such as heart rate, blood pressure or oxygen saturation of blood (SpO2) at rest is well established, while getting reliable measurements and diagnosis is very difficult under mobile conditions for people moving around and performing their normal daily activities. This is particularly the case for non-invasive methods, where monitoring techniques are very sensitive to different artefacts, such as those appearing when the person is freely moving around, walking for instance.

Recent advances in low-power integrated circuits, wireless communications and physiological sensors promote the development of tiny, lightweight, ultra-low-power monitoring devices that can be used in a wide spectrum of applications. A body-centric network, so-called WBAN-Wireless Body Area Network, can be formed by integrating these devices on a human body (or its proximity). WBAN, with sensors consuming extremely low power, is used to monitor patients. WBAN can use ZigBee[1], Bluetooth[2] or Ultra Wideband radio technologies [40].

A short description of the existing e-health pervasive services/applications is following:

I. Mobile applications to monitor and transmit to a data base cardiovascular and hemodynamic parameters.

- Description
  Mobile application for:
  - Heart Rate Monitor.
  - Finger Ring SpO2 Monitor.
  - Stress Monitoring.
  - Multi-parameter HOLTER.
  - Pulse transit time for assessing arterial BP variations.
  - Electrical measurements of heart activity with dry electrodes.

[1] www.zigbee.org
[2] www.bluetooth.org

The self-monitoring devices applied for personal health combine smart phones to send accurate measurement results to health care professionals in almost real time regardless of the location. An example is the use of pulse oximeters to measure blood oxygen saturation (%SpO2) and heart rate to determine the tendency to sleep apnea.
The personal treatment can be monitored and quickly adapted to a change in health status.

- Utilisation
  The doctor has prescribed a patient to take e.g. blood pressure, use a weighing scale or a glucometer and other measurements at home regularly for some time period. Smart phones can collect measurement results automatically and wirelessly from the measuring devices and seamlessly transfer the collected data to the doctor for further analysis.
- Components
  Sensors for medical data acquisition, smart phones.
- Characteristics
  Results from measurement devices are forwarded by using mobile networks like GPRS and 3G to the doctor.
- Requirements
  Available where GPRS and 3G networks are available.
- Traffic
  Demand for low bandwidth network.
- Entities
  Healthcare professionals, social security organizations, health ministry.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Depend on the biosignals that are monitored and the health case. Could be real time for BP or ECG monitoring or non real time for sleep apnea monitoring or Holter measurements.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  UL, constant or variable (Annex A).

II. Mobile applications to monitor and transmit to a data base Human activity parameters.

- Description
  Mobile applications for:
  - Measuring running efficiency.
  - Fall detection.
  - Smart monitor of human motion.

  Integrated sensors within mobile devices e.g. 3D accelerometer, integrated sensors built into clothes combined with suitable algorithms can be used to detect falling automatically, for personal wellbeing and to monitor the actual person muscle activity and heart rate automatically.
- Utilisation
  These applications can monitor patient exercise, daily activities and fitness levels very easily and accurately. A possible case could be to assist the elderly to seek less care from the health care providers. For example falls are one of the leading causes of fatal and nonfatal injuries to older people. Exploiting these applications could provide elderly citizens more security to cope in their daily lives since they feel that they are not alone if something happened and medical help will be come when needed.
- Components
  Data.

- Characteristics
  Results from measurement devices are forwarded by using mobile networks like GPRS and 3G to the caring personnel.
- Requirements
  Available where GPRS and 3G networks are available.
- Traffic
  Demand for low bandwidth network.
- Entities
  Professional healthcare/wellbeing personnel, social insurance organizations, caring personnel.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Depend on the case that is being monitored. Could be real time for fall detection or non real time for exercise monitoring.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  UL, constant or variable (Annex A).

III. Mobile applications to monitor and transmit to a data base other human vital signs and images.

- Description
  Mobile applications for:
  - Electrical measurement of skin hydration and perspiration.
  - Using smart phones as medical image viewers for teleradiology and teleneurosurgery.
  - Mobile device control using muscle activity.
  - Capsule Endoscopy: miniature ingestible capsule to record images through the digestive tract [40].
- Utilisation
  Allow medical personnel to view on their mobile phones medical images (tele-radiology) as a secondary consultation tool.
  The main reason to use EMG (electromyography) applications in health care area is to rehabilitate muscles in patients with some kind of slight paralysis.
  Furthermore smart phone applications can constantly monitor blood oxygen saturation, heart rate, muscle activity (EMG), location (GPS), altitude, speed, air pressure, temperature giving optimal results for exercise and health.
  Wireless capsule endoscopy consists of a pill-sized unit including a miniature camera swallowed by patients which take pictures automatically and transmit these digital images through a wireless link.
- Components
  Video complying with H.323, photos, data. Problem with device screen resolutions.
- Characteristics
  Need for broadband channels e.g. 256 kbps if images are involved.
- Requirements
  Where 3G/GPRS infrastructure exists or short-range communication.
- Traffic
  The traffic will depend on usage eg, the images are expected to increase traffic.
- Entities
  Hospitals, doctors on duty, health ministry.

Technical Characteristics

- Time dependency
  Non-time-based.

- Delivery requirements
  Real time and non real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Both for UL and DL, constant or variable (Annex A).

Furthermore the development of software and hardware platforms of nanorobots is a technological breakthrough that can enable real time in vivo prognosis for application in a variety of biomedical problems [41]. The research and development of nanorobots with embedded nanobiosensors and actuators is considered a new possibility to provide new medical devices for doctors [42], [43]. These medical nano-robot approaches can be used as drug delivery systems, for Laparoscopic Cancer Surgery [45], or to control contagious epidemic diseases [41], [44]. The use of smart cell phone with RF has been proposed as an effective approach for control upload, helping to interface nanorobots communication and energy supply.

A brief description of European and national projects and their contributions to the topic are presented in Annex A.

II.2.2. Hospital consultation and emergency scenarios

Traditional wireless telemedicine services use WLANs, 2G, 2.5G, and 3G wireless networks for patient monitoring and diagnostic purposes [46], [47], [36]. However, application of these technologies in real scenarios are limited due to mobility and/or transmission speed constraints, resulting in an unacceptable quality for the considered service, which often requires transmission of multimedia data.

Examples are the wireless telemedicine project from University of Maryland, developed for ischemic stroke [48], [49], allowing a video transmission rate of around eight frames per minute over GSM; the British *Lancashire* Ambulance project, demonstrating transmission of vital signals over one cell phone line and slow-scan images over another line at a frame rate of 15 pictures per minute [50]; the European Union's Ambulance and its successive projects [51], [52], showing transmission of patients' biosignals or image sequences using available GSM phone lines with image transmission rate of one image (size of 2.5–3 kB) every 3–5 seconds and a percentage of ECG transmission interruption of 27%. The aforementioned emergency telemedicine projects exploited the possibility of transmitting patient information through commercial wireless links, although their usefulness to emergency medicine was limited due to their poor performance.

Regardless of such poor performance, due to the narrowband and dynamic behaviour of the wireless link on one hand and to the bandwidth hungry multimedia data on the other, none of the example projects developed effective solutions for optimizing the use of the limited wireless link. One of the first examples of use of tailored solutions for system optimization is presented in [53] where transmission over a 3G network for a mobile teletrauma system is demonstrated and, in order to alleviate the limited and fluctuating bandwidth barriers of the wireless cellular link, the system adapts to network conditions through media transformations, data prioritization, and application-level congestion control methods.

Tele-ultrasound systems for remote diagnosis have been proposed in the last ten years given the need to allow tele-consultation when the access of the medical specialist to the sonographer is not possible. The first example of wireless robotic tele-ultrasonography consists in the OTELO (mObile-Tele-Echography using an ultra-Light rObot) project, a European IST funded project that developed a fully integrated end-to-end mobile tele-echography system for population groups not served locally, either temporarily or permanently, by medical ultrasound experts [36]. It comprises a fully portable teleoperated robot allowing a specialist sonographer to perform a real-time robotised tele-echography to remote patients. OTELO is a remotely controlled system designed to achieve reliable ultrasound imaging at an isolated site, distant from a specialist clinician, also when a wireline connection is not available. The quality of received real-time medical video sequences after transmission was acceptable, although the currently available wireless technologies (2.5G, 3G) did not allow sufficient bandwidth for good quality video transmission. Further studies reported in [37], [54] show the improvements achievable through the exploitation of cross-layer design over WLAN/3G systems.

More recently, some projects and demonstrations are undergoing on multimedia telemedical application through WiMAX systems. A relevant list follows.

WEIRD (EU FP6)

The goal of the European IST project WEIRD [55] is the realisation of IEEE 802.16/WiMAX based testbeds, including novel applications running on top of a WiMAX-based end-to-end architecture. The testbeds are based on real use case scenarios, including tele-medicine and tele-hospitalization. Broadband access for medical personnel requiring high resolution medical information in nomadic emergency camps and high resolution video and data streaming from medical instruments are considered.

Mobile Healthcare Services (Taiwan)

The goal of the "Mobile Healthcare Services" project in Taiwan [56] is to support emergency medical assistance and patient care services wherever required outside of a medical facility. With the assistance of high-bandwidth wireless communications (WiMAX), healthcare personnel in the field will be able to connect to critical medical resources, exchange important files and arrange treatment, saving crucial minutes in the early treatment of patients. The network has been launched at the Taipei Medical University Hospital, Tri-Service General Hospital and Taipei City-Wan Fang Hospital. The "Mobile Healthcare Services" project is part of the M-Taiwan initiative supported by Taiwan's Ministry of Economic Affairs (MoEA). The Taiwanese government has emphasized the importance of mobile access throughout the country, placing Taiwan at the forefront of mobile broadband development.

Australian Grand-prix demonstration

In Australia, with the help of Intel Australia and Airspan Networks, the organizers of the Australian Grand Prix deployed a WiMAX network to improve communication flow between the on-site trauma unit and medical specialists at the Alfred Hospital three kilometres away [57]. Auto racing events require a medical team capable of attending the steady stream of injuries incurred by the drivers, mechanics and other personnel throughout the competition. The trackside trauma facility was provided with a high-speed wireless connection, linking the on-site medical staff with their counterparts at the Alfred Hospital three kilometres away. The WiMAX network eliminated the need for the 20-minute trips previously required to manually transport radiology images, test results and other medical information. Wireless web cameras installed at the remote site allowed medical staff in the field to run real-time video consultations and patient reviews with their colleagues in the hospital. The main challenges included the definition of a secure, dependable and yet cost-effective solution that would only take two to three days to deploy for the temporary Emergency Medical Centre for the Grand Prix. For the Wireless ICU, the key challenge was testing and trialling a large range of communication devices and medical equipment such as ventilators and other life support machines to ensure that there was no interference from the wireless systems deployed.

Table II.2 reports a summary of WiMAX based demonstration projects for hospital consultation and emergency applications.

Other relevant projects (see Annex A for further details) are listed as follows.

OTELO – mObile Tele-Echography using an ultra-Light rObot

OTELO (mObile- Tele-Echography using an ultra-Light rObot) is a European IST project that developed a fully integrated end-to-end mobile tele-echography system for population groups that are not served locally, either temporarily or permanently, by medical ultrasound experts. It comprised a fully portable teleoperated robot allowing a specialist sonographer to perform a real-time robotized tele-echography to remote patients [36]. OTELO is a remotely controlled system designed to achieve reliable ultrasound imaging at an isolated site, distant from a specialist clinician. This Tele-echography system is composed of the following:

- An “expert” site where the medical expert interacts with a dedicated patented pseudo-haptic fictive probe instrumented to control the positioning of the remote robot and emulates an ultrasound probe that medical experts are used to handle, thus providing a better ergonomy.
- The communication media.
- A “patient” site made up of the 6 degrees of freedom (Dof) light weight robotic system and its control unit.

Further details on this system are described in [36], [1].

Table II.2 – Summary of WiMAX based telemedicine demonstration projects (extracted from [38]).

	Country	Service	Data type	Wireless platform	Real-time/Duplex
WEIRD (EU) [15]	Europe (telemedical testbed in Italy)	Streaming from medical instruments	High resolution video and data	IEEE 802.16-2004	Real-time, DL / UL
F1 medical care at Australian Grand prix [17]	Australia	Hospital consultation	Radiology images	IEEE 802.16-2004	Small delay, Uplink
Mobile Healthcare Services [16]	Taiwan	Emergency medical assistance and patient care services wherever it is required outside of a medical facility	Patient's medical records, biosignals, high-quality diagnostic images and audio-visual information	IEEE 802.16e	Real-Time, Duplex

EMERGE - Emergency Monitoring and Prevention (FP6)

EMERGE intends to model the typical behaviour of elderly people with medical risks following an integrated approach that uses ambient and unobtrusive sensors, in order to detect deviations from typical behaviour, reason on acute disorders, and prevent emergencies.

DICOEMS (FP6)

DICOEMS is a portable system to support the management of medical emergencies. It aims to bring together on-the-spot care providers and networks of experts, enabling more effective decision support and risk management in primary diagnosis, pre-transfer arrangements and treatment of critical situations.

The need for remote management of medical emergencies arises in a number of situations. DICOEMS focuses its efforts on accidents and natural disasters. Under such stressed and time critical conditions, the care provider (a medical doctor, nurse, paramedical personnel etc.) who is in charge of the patient needs a user-friendly utility to:

- Acquire critical medical data (such as vital signs) to assess the medical condition.
- Offer appropriate first-aid.
- Communicate the findings and patient status to a network of health experts – no matter where they are physically located - and closely cooperate under their guidance for the effective management of the emergency.
- Provide information about the geographic location of the emergency.

DIORAMA (US)

The goal of DIORAMA, "Dynamic Information Collection and Resource Tracking Architecture for Disaster Management", is to improve the identification and management of response assets in a mass-casualty incident, as well as to help coordinate the initial response. DIORAMA will provide a real-time scalable decision support framework built on rapid information collection and accurate resource tracking functionalities. This system makes use of Radio Frequency Identification (RFID) tags and Global Positioning System (GPS) devices to identify the location and status of the patients, responders, and emergency transport vehicles involved in mass casualty incidents. Emergency response vehicles will have communication servers that will collect location and status information from these tags and transmit it to an Incident Commander at a remote location via satellite links. The combination of these components will result in the creation of a mobile, scalable tool that can be rapidly deployed at a disaster scene to enable an offsite commander to visualize the location and condition of the casualties as well as the available resources. This information will improve the coordination of the response to better match supply (care providers, ambulances, medical equipment) with demand (number of patients, level of acuity). The system could also aid in patient tracking as they transit through the disaster response system to definitive care in a receiving medical facility.

Med-on-@ix (EU)

The research project Med-on-@ix is a research project in the German rescue service and explores the use of current telecommunication technology in the emergency rescue. The key aim within the project is to create a teleemergency medical center, which holds highly qualified emergency personnel. From the place of emergency data, readings and live videos are directly transmitted to the teleambulance headquarters. The concepts are based on uniform quality standards and medical guidelines. In this way, an emergency medical can care on site before the arrival of the emergency physician, for example in rural hard to reach areas. On the other hand - in cases where the manual skills of an emergency physician on site are less detailed in a special treatment - well-trained paramedics can instruct the on-site physician by dint of the communication in the treatment of patients, or to efficiently support the tactical mission.

Example services in the area are listed below, together with their relevant characteristics:

I. Mobile Videoconferencing.

- Description
  The purpose is to allow exchange of data between doctors (D2D) and to allow interaction between a patient and its doctor (D2P).
- Utilisation
  In rural and remote settings where fixed telecom infrastructures are lacking, for example in environments such as in developing countries. Also for patients at home, on the road and away from their homes to communicate in real time with their carers or physicians in medical emergencies or on the road consultations.
- Components
  Video, Audio, Text, Photos.
- Characteristics
  Requirements in terms of the network performance, e.g., maximum transfer delay.
- Requirements
  The telecommunication network already exists and emerging but the software infrastructure will need to be developed.
- Traffic
  The traffic will depend on usage which in turn is dependent on health needs, location and health professionals' qualification and experience.
- Entities
  Developing Countries, Health Ministry, Public and Private Healthcare Providers, Medical Emergency Services Organization, Military, Social/Home care providers.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Symmetric or asymmetric.
- Bit rate
  Several kbps.

II. Mobile Robotic Tele-ultrasonography.

- Description
  End-to-end mobile tele-echography system [36], [37] to perform real-time robotised tele-echography to remote patients.
- Utilisation
  For population groups that are not served locally, either temporarily or permanently, by medical ultrasound experts.
- Components
  - Expert site: dedicated pseudo-haptic fictive probe instrumented to control the positioning of the remote robot and emulates an ultrasound probe that medical experts are used to handle - better ergonomy.
  - Communication media: wired and wireless links.
  - Patient site: 6 degrees of freedom lightweight robotic system and its control unit.

- Requirements
  Real-time end-to-end communication.
- Entities
  Developing Countries, Health Ministry, Public and Private Healthcare Providers, Medical Emergency Services Organization, Military, Social/Home care providers.

Technical Characteristics

- Delivery requirements
  Real time.
- Symmetry of the connection
  Uplink (from patient site) more demanding due to medical video transmission.
- Bit rate
  Minimum 210 kbps patient-to-expert, 16kbps expert-to-patient.
- Maximum transfer delay
  300 ms.

III. Real-time transmission of medical data from an ambulance.

- Description
  The purpose is to allow the transmition real-time of a patient's medical data from the ambulance to the hospital.
- Utilisation
  Emergency.
- Components
  - ECG and other vital signals.
  - Ultrasound (images and video): if the ambulance is equipped with a portable ultrasound device, an ultrasonography can be performed on the patient on the way to the hospital, in order to check possible internal injuries or heart problems, and the acquired video sequence can be sent to the hospital via a mobile broadband platform (such as WiMAX).
  - A video conference can also be set-up.
- Requirements
  - Low-delay.
  - High bit rate if ultrasound data involved.
- Entities
  Hospitals and Medical Emergency Services Organization.

Technical Characteristics

- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric (ambulance to hospital) if video conference not considered.
- Bit rate
  Several kbps. The bit-rate is high in particular if medical video / ambient video is transmitted and a video conference is set-up.
- Maximum transfer delay
  - <1 s if no video conference.
  - <0.3 s if video conference.

IV. Access to hospital database from ambulances.

- Description
  The purpose is to transmit a patient's medical data stored in hospitals' databases from the hospital to the ambulance.

- Utilisation
  Emergency access to patient's clinical data.
- Components
  - ECG and other medical examinations results.
  - CT scans.
  - MRI images.
  - Ultrasound (images and video).
- Requirements
  - Low-delay.
  - High bit rate if MRI/CTscan/ultrasound data is involved.
- Entities
  Hospitals and Medical Emergency Services Organization.

Technical Characteristics

- Delivery requirements
  Low-delay.
- Symmetry of the connection
  Asymmetric (hospital to ambulance). Only request of data from ambulance to hospital.
- Bit rate
  Several kbps. The bit-rate is high in particular if medical video.
- Maximum transfer delay
  < 3 seconds.

V. Medical consultation when the specialist is on the move.

- Description
  A medical doctor may be travelling and his expertise may be urgently required. In this case, patient's data can be immediately transferred to the specialist's PDA enabling an immediate first diagnosis.
- Utilisation
  Urgent medical consultation.
- Components
  - ECG and other medical examinations results.
  - CT scans.
  - MRI images.
  - Ultrasound (images and video).
- Requirements
  - Low-delay.
  - High bit rate if MRI/CTscan/ultrasound data is involved.
- Entities
  Hospitals.

Technical Characteristics

- Delivery requirements
  - High mobility.
  - Low-delay.
  - Reception through low-complexity devices.

- Symmetry of the connection
  Asymmetric (hospital to medical doctor).
- Bit rate
  Several kbps. The bit-rate is high in particular for medical video/MRI/CTscan.
- Maximum transfer delay
  Depends on urgency of consultation. Typically few seconds.

II.2.3. Assistive technologies

A short description of the existing assistive services/applications is as follows:

I. Mobile applications to provide personalized multimodal interfaces for mobile devices in order to ease people with visual, auditority, cognitive or motor skills impairments access to them. These mobile applications include Screen Readers / Magnifiers, software for blind and partially sighted users to magnify text and images and to communicate with braille embossers as well as to enable speech enabled services (SES) and their implementation by means of Distributed Speech Recognition (DSR) [34]. The concept of speech enabled services (SES) and their implementation by means of Distributed Speech Recognition (DSR) is based upon the standards for DSR developed by the European Telecommunications Standards Institute [59]–[62].

- Name
  Distributed Speech Recognition (DSR).
- Description
  Client/server architecture with recognition mainly carried out by a remote server. Recognition features are extracted at the client side, compressed and transmitted to the server, where recognition is performed. Advantages over an embedded speech recognition system:
  - Use of simple clients.
  - It frees the user of upgrading and maintenance tasks.
  - It allows easy language portability.
  - Smaller bit-rate.
  - Increased robustness.
- Utilisation
  These services will be a requirement for impaired people. Speech enabled services will be a requirement for some types of users such as blind people or ageing people with sight difficulties. Due to the type of disability, an oral interface is the best way to interact with the application.
- Components
  Speech.
- Characteristics
  - Maximum transfer delay: 250 ms.
  - Robust to high loss rate swith short burst length. More sensible to long bursts lengths.
- Requirements
  A mobile device with the DSR client implemented.
- Traffic
  It has low bit-rate requirements.
- Entities
  Blind organizations, ageing people with sight difficulties.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.

- Symmetry of the connection
  Asymmetric.
- Bit rate
  Low bit rate, constant.
- Maximum transfer delay
  250 ms.

II. Mobile applications to provide information about location and positioning through technologies like Global Positioning System (GPS), Wifi or Bluetooth.

- Name
  Navigation/orientation and positioning services.
- Description
  Client/server architecture with recognition mainly carried out by a remote server. Advantages over an embedded indoor and outdoor localization system:
  - Use of simple clients.
  - Smaller bit-rate.
- Utilisation
  These services will be a requirement for some types of users such as blind people or ageing people with sight difficulties.
- Components
  Location.
- Characteristics
  Maximum transfer delay: 1 s.
- Requirements
  A mobile device with the GPS client implemented.
- Traffic
  It has low bit-rate requirements.
- Entities
  Blind organizations, people with sight difficulties.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Low bit rate, constant.
- Maximum transfer delay
  1 s.

III. Mobile applications to record the physical activity of its user.

- Name
  Biometric identification services.
- Description
  Motion as an important modulator of vital organic functions such as respiration, heart cycle, blood–oxygen saturation and blood pressure can allow important information about human health. Thus the daily activity data can be monitored by the physiological data sensors and used to identify potential psychological or physiological disorders.
  Advantages over an embedded biometric identification system:
  - Use of simple clients.

  - Smaller bit-rate.

- Utilisation
  These services will be a requirement for some types of users such as chronic disease people.
- Components
  Motion.
- Characteristics
  Maximum transfer delay: 250 ms.
- Requirements
  A mobile device with the DSR client implemented.
- Traffic
  It has low bit-rate requirements.
- Entities
  Chronic patients, elderly, patients with dementia.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Low bit rate, constant.
- Maximum transfer delay
  250 ms.

Brief description of European and national projects and their contributions in the topic is presented in Annex A.

II.2.4. Well being and personalisation

Personalisation of information and communications technologies for well being systems and services has already been extensively investigated from various viewpoints.

A. Fitness.
Physical activity has been linked to positive health outcomes [63] and general well-being [64]. In recent years, the use of mobile devices in wellness and fitness has gained increasing amount of attention, including both research and commercial development. A short description of the existing fitness services/applications follows:

I. Fitness and nutrition software applications.

- Description
  Mobile application for:
  - Managing fitness.
  - Managing diet and nutrition.
- Utilisation
  Products for managing fitness often consist of two separate pieces of software. The main version of the software runs on a computer and a smaller piece of software is installed on a mobile device. Diet & Exercise Assistant [65] and My Sport Training [66] are examples of such products that provide a wealth of information, planning tools and graphical reporting on a computer and also let you take essential information along on a handheld. Same products are the Personal Trainer for Series 60 [67] that can calculate and track calories consumption and Wellness Diary [68] and PmEB mobile phone applications which are also targeted for the weight management, and help the users to monitor and record different factors related to their lifestyle such as the food intake and physical activity for tracking their energy balance [69], [70]. NutriData [71] is another example of

application running on handhelds that features an extensive and detailed database of ingredients of food and beverage items. Finally Consolvo et al. [72] present a mobile phone application, where the users get the information not only of their own step count and progress towards a set goal, but the corresponding situation of their friends as well.

- Components
  Data.
- Characteristics
  Needs data from measurement devices.
- Traffic
  Demand for low bandwidth network when updates are taking place.
- Entities
  Professional wellbeing personnel.

II. Mobile technology for physical activity.

- Description
  Mobile applications to:
  - Monitor fitness-related activities.
- Utilisation
  Common off-the-shelf mobile devices that are targeted to fitness purposes include several sensors for measuring physiological parameters in a human body, i.e., heart rate meter, 3-axis accelerometer for step counter and energy consumption, and bio-resistance meter for fat percentage, body water content and galvanic skin response. These sensors are integrated within mobile phones, MP3 players and wrist-watches or are integrated in standalone mobile devices. Some examples are following:
  - Mobile phones:
    Nokia 5500 mobile phone, which has an integrated step counter, includes a training diary and several tests of the user's physical condition [73].
    Samsung YP-60V [74] fitness-enhanced MP3 player features a heart rate monitor, calorie counter and stop watch.
  - Stand alone devices:
    Heart rate monitors, wristop computers, cycling computers and other sports and outdoors devices, such as those manufactured by Cardiosport [75], Oregon Scientific [76], Polar [77] and Actismile [78], are meant for a variety of outdoors activities. They can measure and display information about the ongoing exercise and follow-up reports are typically generated on a computer.
- Components
  Data.
- Characteristics
  Results from measurement devices can be forwarded by using mobile networks like GPRS to the data base.
- Requirements
  Available where GPRS networks exist.
- Traffic
  Demand high capacity wireless networks systems are needed to deliver real time information.
- Entities
  Professional wellbeing and caring personnel.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Depend on the case that is being monitored. Could be real-time for fall detection or non real-time for exercise monitoring.

- Symmetry of the connection
  Asymmetric.
- Bit rate
  Constant or variable.

B. Personalised applications.
A short description of the existing assistive services/applications is following:

I. Automatic Character Size Changing System [79].
System to provide an automatic character size changing system for automatically changing the size of characters in a sentence, such as e-mail and content of a web site displayed in a terminal.

- Description
  The automatic character size changing system has a sentence reading part for reading a sentence, the number of total reference dots calculating part for calculating the number of total reference dots by counting how may characters are included in the read sentence, a dot counting part for counting the number of dots used to actually display characters in the sentence, a determination part for determining whether to change the display of the characters of the read sentence on the basis of the number of total reference dots and the number of counted dots, and a display change processing part for displaying the sentence on a display device of a terminal after applying prescribed display change to the read sentence when the determination part determines to change the display.
- Utilisation
  This service will be used for partially blind people or elderly people.
- Components
  Text.
- Requirements
  A mobile device.

II. Client/server rendering of network transcoded sign language content [80].
A method and system is provided for communicating a interpreted sign-language communication in a communication system having a plurality of nodes including at least a source node, a destination node, and a network node

- Description
  To facilitate communicating the interpreted sign-language communication, the network node receives from the source node non-sign-language content. The network node stores sign-language-interpreted content in a network queue for retrieval by the destination node. The sign-language-interpreted content defines at least one sign-language translation of the non-sign-language content. When the destination node retrieves and displays the sign-language-interpreted content, a user of the destination node, such as a hearing-impaired individual, can receive communications from the source node that originate in a form other than sign-language format.
- Utilisation
  This service will be used for deaf people or elderly people.
- Components
  Sign language, text.
- Requirements
  A mobile device or PC.
- Traffic
  It has low bit-rate requirements.

III. Hosted Voice Recognition System for Wireless Devices [81].
Methods, systems, and software for converting the audio input of a user of a hand-held client device or mobile phone into a textual representation by means of a backend server accessed by the device through a communications network.

- Description
  The text is then inserted into or used by an application of the client device to send a text message, instant message, email, or to insert a request into a web-based application or service. In one embodiment, the method includes the steps of initializing or launching the application on the device; recording and transmitting the recorded audio message from the client device to the backend server

through a client-server communication protocol; converting the transmitted audio message into the textual representation in the backend server; and sending the converted text message back to the client device or forwarding it on to an alternate destination directly from the server.

- Utilisation
  Blind people, elderly, people with movement disabilities.
- Components
  Voice, Text.
- Requirements
  A mobile device.

IV. Mobile Phone Using Optical Pointing Device to input letters [82].
An optically pointed letter-inputting portable terminal having a display <screen, a signal receiving and transmitting device and input buttons is provided.

- Description
  The portable terminal includes an optical pointing device mounted to a specified position of the portable terminal and used as a letter input means. The optical pointing device includes a light source for irradiating a light beam to be used in writing letters on a floor surface as a light pointing object. The display screen is adapted to directly display the letters written on the floor surface.
- Utilisation
  Partially blind people, elderly people, children.
- Components
  Optical light, Text.
- Requirements
  An optical pointing device including a light source, and a display screen adapted to directly display the letters.

V. Reading-Aloud Apparatus and Program Therefore [83].
To provide a reading-aloud apparatus capable of deciding, without depending on user's memory, as to whether the user has ever listened to the web-contents, when the user is listening to the voice of a voice browser reading aloud the web-contents, and to provide a program therefore.

- Description
  The reading-aloud apparatus which converts a part to be read out in the contents into voice to read it aloud comprises a storage device control means that makes a storage device store the read information, showing that when the reading-out object part has been read aloud, the read part which is the read-out object part read-aloud in the above has been read aloud; and a reading-aloud means that reads aloud the above read part, when reading it aloud, by a method of presenting it in sounds different from those when an unread part is read aloud.
- Utilisation
  Blind people, elderly people.
- Components
  Audio.
- Requirements
  PC, mobile device.

Brief description of European and national projects and their contributions in the topic is presented in Annex A.

C. Home automation and intelligent environment.
Home automation and the intelligent environment have been important issues throughout the last two decades. Many solutions have been reported and implemented. Home automation and intelligent environment technologies include enhanced video assistance, using broadband [84] communications and video telephony, interconnection and communication of home appliances as well as mobile handheld devices.

I. Mobile applications for home automation and intelligent environment.

- Description
  Mobile applications for:
  - Videoconference.

  - Location tracking.
  - Control of home appliances.

- Utilisation
  Mobile phones which are being integrated within a home automation and intelligent environment allow videoconference and location tracking and can control home appliances (heating systems, lighting systems, washing machines, refrigerators), multimedia players. The positioning feature can use GPS or AGPS, which is a faster version of GPS, assisted by a network server and which requires much less battery power to run on a mobile phone. The control feature allows the homeowner to monitor and control his house appliances via his mobile phone set by sending commands in the form of SMS messages and receiving the appliances status as well. A GSM modem in house provides the communication media between the homeowner and the mobile phone by means of SMS messages.
- Components
  Video complying with H.323, GPS. Problem with device screen resolutions.
- Characteristics
  Need for GPRS, 3G.
- Requirements
  Where 3G/GPRS infrastructure exists.
- Traffic
  Demand for high capacity wireless networks systems are needed to deliver real time information and videoconference application.
- Entities
  Caring personnel, social environment.

Technical Characteristics

- Time dependency
  Non-time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Both for UL and DL, constant or variable.

Brief description of European and national projects and their contributions in the topic is presented in Annex A.

II.3. Future challenges

II.3.1. Future wireless diagnostic and disease management systems

The European Commission has recently published a pan-European survey on electronic services in healthcare (eHealth). Results have been presented in [58]. The survey involved almost 7,000 General Practitioners in the 3rd quarter of 2007. The report highlights where doctors could make better use of ICT.

According to the results, telemonitoring, which allows doctors to monitor a patient's illness or manage chronic diseases remotely, is still far from being widely applied in Europe and is only used in Sweden (where 9% of doctors provide telemonitoring services), the Netherlands and Iceland (both about 3%). Doctors not using ICT cite a lack of training and technical support as major barriers and note the quality provided by the systems available is quite low.

Pervasive healthcare systems and applications set demanding requirements regarding energy, size, cost, mobility, connectivity, and coverage. The technological advances of the last few years in mobile communications, location-aware and context-aware computing have enabled the introduction of pervasive healthcare applications, which implement healthcare platforms to work on personal digital assistants (PDAs) and smart phones. These systems are very critical, as they deal with a person's health, and therefore they raise high standards regarding reliability, scalability, privacy-enhancing, interoperability, and configurability, among other things.

Furthermore, the use of such pervasive healthcare systems raises several other challenges.

Considering the fact that healthcare systems are intended to be used by beginner or moderately computer literate users, it is of high importance to build a user-friendly platform reducing complexity through better design. Thus usability issues such as user friendliness, HCI and ergonomics to increase the functionality that users need is an important factor in the design of such systems. To enable the ease of use of such systems there is a need to make wireless diagnostic and disease management systems more intelligent, using trends from the artificial intelligence discipline. Machine learning smart-phone systems using advanced sensors that gather data about the physical world, such as motion, temperature or visible light, together with machine learning algorithms which analyzes the sensor data to enhance the healthcare services are recommended.

Personal data security and location privacy are considered to be the most important future challenges. However enhancement of the main functionalities in terms of speed and data compression are also considered important.

Related to challenges within the field of IT security aspects one of the main challenges in this key area relies in the trustworthiness of the gathered physiological parameter information. To obtain reliable and trustworthy information the system has to consider both the integrity of the transmitted data between the sensor and the doctor's reporting unit via diverse entities (end-to-end integrity protection) and the validation that sensors and reporting unit are executed in a trustworthy and not manipulated state. The later point means that both entities consistently are able to attest mutually that they behave in the expected way. Those demands can be enforced by hardware and software, e.g. by Trusted Computing technologies. This challenge does only consider attack or manipulation attempts on the transmission path or the entities itself (sensor and reporting unit). The manipulation of the sensor's environment to (intentionally) falsify recorded sensor data has to be tackled by a second challenge that considers plausibility checks on the sensor data.

Another challenge related to IT security aspects is the privacy and confidentiality of the patient's health status data. It has to be ensured, that a manageable access control management system is in place that ensures that only authorized persons (e.g., doctors, relatives, clinic personnel, etc.) are allowed to access the data and ensures that the data is protected to achieve confidentiality. The authorization should be managed by the data owner that is supposed to be the patient himself. Dedicated authentication and logging mechanisms have to support the access control enforcement. The challenge in this approach is that access control architecture has to consider both, the decentralized storage of data at a medical practice and the comprehensive access control mechanisms and enforcement that concern all parties that could have access to that data. That means, even if data is locally stored in a medical practice, the access control system has to approve data usage according the current access permissions. That also implies that access rights have to be revocable within the data life-cycle.

II.3.2. Hospital consultation and emergency scenarios

Future services include:

- Citizen or patient to carer (C2P)/ (C2C) communications and interactions.
- Health care providers tele-consultation and communication.
- Battlefield medical emergency telemedicine services.
- Disasters medical emergency services.
- Rural healthcare delivery.

Most of the cited services require the transmission of demanding (medical) multimedia data over wireless links.

The main challenge in this area is secure delivery of medical quality (multimedia) data over wireless channels [38], [85], [86].

Wireless transmission of multimedia medical data is a challenging application area due in particular to the high quality requirements of medical video, the bandwidth limitation/error prone characteristic of the wireless channels and real-time requirements of most of the services in this area.

In order to keep the required quality, lossless compression techniques are usually considered when medical video sequences are involved, resulting in huge amounts for transmission. When transmission is over band limited, error prone channels, lossless compression is not possible and a compromise should be made between compression fidelity and protection and resilience from channel errors and packet loss. The quality level achieved in a low-bandwidth system is in some cases acceptable, although due to the high compression ratios and to the effects of the wireless channel, such systems are of interest for a first diagnosis and in emergency scenarios, and a second diagnosis is usually required.

The most recent broadband wireless access technologies, including WiMAX, HSxPA, ev-DO, LTE, allow a broader bandwidth, which provides the means to make multimedia telemedical applications reliable, by maintaining good quality levels. The proper exploitation of such novel technologies and the development of tailored tools for medical video compression and transmission over these systems is one of the main challenges in the area. The trend towards even more bandwidth demanding 3D medical digital imaging adds interest to such a challenge.

Future developments will also see an increased use of satellites, particularly in situations such as natural disasters and emergencies, and where the existing infrastructure is poor or non-existent. Thanks to the specific properties of satellites, including the ability to oversee and monitor large parts of the continent, they are likely to play an important role in a future unified European system of eHealth.

Legal and regulatory issues need to be addressed in the near future, since there are still uncertainties about liability of healthcare services providers.

Security and privacy issues and their integration/interaction with the whole transmission system is another important challenge in the area. From the perspective of IT security the main challenges in this key area relies in the issues of confidentiality, integrity and availability of data within a system that has the two major goals the protection of the medical condition of patients and the data protection of patient's data records. This key area requires that data is sent to / from hospitals or emergency specialists in case of an abnormal medical condition. The challenge in this key area is to provide a balanced approach between privacy, data sharing and data administration. A comprehensive model of a role-based access and its deployment is an organisational and technical challenge in the medical sector with its significant number of attendees like hospital personnel, doctors or care assistants and its different players like relatives, hospitals, nursing services and registered doctors.

Privacy issues are in tension with other important demands in the environment of emergency medicine. Here, for example, the rapid availability of required information and the general availability of the service are essential to protection of the medical condition of patients and their lives. Therefore, it is necessary to anchor the privacy requirements per se fundamentally in the design and architecture development.

II.3.3. Assistive technologies

The main challenge for assistive technologies is offering independence and autonomy to senior citizens and people with disabilities. In order to achieve this, efforts should be focused on research projects about:

- Locating services and guiding people with heterogeneous disabilities at places like museums, airports and shopping malls.
- Developing customized and accurate platforms to exchange homogeneous data among different devices, services and healthcare personnel.
- Developing easy to use, highly reliable, unobtrusive, low power and transparent technologies and devices in order to gain seniors' confidence. The implementation of stress detectors and face recognition applications utilising emotion recognition techniques is expected to meet the expectations and cognitive capabilities of the end users.

It will be necessary to consider ethical issues in this application domain to ensure adequate respect for the individual end user's rights, such as self-determined private life and others.

The use case within the key area of assistive technologies induces different security challenges. First, secured multimodal user interfaces have to fulfil the usability aspects of the user as well as that they do not enlarge the attack footprint of the user system itself. The later aspect means that the analysis and filtering of multimodal inputs should not be usable for attack techniques, which is definitely a current challenge in IT security research. Second, potential challenges in this field of activity refer to the secured record, storage, transfer and usage of physical activity data of the patient. This applies to the vital parameters and the geographical position of the patient, that have to be handled securely in the recording device itself, its operating system architecture, software components and evaluation services.

II.3.4. Well being and personalisation

Well being and personalization have been recognised as important features for improving mobile services. But although these technologies are expected to be applied in other fields such as the occupational health and corporate wellness and new service concepts like the health couch or the self controlled stress monitoring system have been developed, these concepts and solutions are still far from being settled. Potential frustrations are among the weight of devices, the duration of batterylife, security and privacy as well as the accuracy of measurements. Contributions to innovation that will boost these services are expected in areas such as intelligent agents, ambient intelligence, smart shirt sensory architecture and wearable sensors for activity monitoring, and in-home and domotic sensors.

More specifically, until recently personalisation has focused on social requirements, and this is popular among teenagers. However, personalisation to facilitate daily lives for the well being of all kinds of people has great potential for growth. There are a lot of services and devices personalized to the different disabilities and impairments of the people. Researches face multiple kinds of impairments, so even if people are provided with an adapted device, they only have access to a limited set of services. Therefore, the challenge now is not to invent new devices but to make any service adaptive to the conditions of the users and the device there are using, not the contrary. In this way, we would start to taking about equality and design for all.

The advantage of personalization in this key area is given, but currently users are becoming increasingly privacy-conscious and less willing to disclose personal data. Privacy-preserving personalization is a huge challenge in research, including the goals and methods of user modelling and personalization with privacy constraints imposed by individual preferences, conventions and laws. Privacy in this context it has to include, that an information or privacy setting should be changed if the setting could be sussed by others by observing the effects. That refers to analyse a huge number of dependencies that have to be met to preserve patient’s confidentiality demands.

III. Transport

III.1. Description

III.1.1. Vision

Mobile and wireless technologies can contribute to the sustainable development of cities and facilitate national and international transportation. New approaches for reducing traffic congestion and shortening travel times are under development through the creation of Intelligent Transport Systems (ITSs). At the same time, users' desire to obtain as a wide range of services whilst they travel to leverage their time continues to grow. Examples of such services include: location based services, context-aware services, spare time applications, transportation-based services including passenger information, etc.

In this chapter we explore future trends for mobile and wireless technologies to enhance the users experience when travelling. As key research lines we consider:

1. Urban and road traffic management.
2. Efficient trip management.
3. Communication services and new applications for Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communications.
4. The mobile office.
5. Security, Trust and Privacy.

III.1.2. Urban and road traffic control

Our first line of research is urban and road traffic control. There are a wide range of projects at both European and national level which focus on various applications and services in the transport industry and primarily intelligent transport systems. They include: advanced vehicle control systems, travel information and traffic management systems, public transport applications, digital mapping solutions, smart cards and communications technologies that enable the various components and applications to interact. Many of these applications are focusing on integrating vehicle movement with the road and wider transport environment.

Many of these applications and services must also be understood in the context in which they take place and the related impact they may have on policies for mobility, transport and the environment.

III.1.3. Efficient trip management

Our second line of research is to review how mobility can be enhanced via applications and services which focus on creating efficient travel. Providing efficient and cost effective public transport is considered a key objective of national transport policy in order to:

- Cope with ever increasing mobility demands.
- Manage increasing energy prices as well as environmental pollution.

Today the traveller using public transport is faced with several public information challenges. For example these include which tram to take if tram A is delayed or which alternative bus route would be best or where should the traveller park their car to change to a bus. One potentially important advance would be to utilize "pervasive computing" technologies to enable users to better organize their travelling needs. However, for this to succeed an overall multi-modal travelling solution is required.

III.1.4. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications

The V2V communication capabilities offer the ability to detect traffic problems through the dynamic exchange of position and speed information among nearby vehicles. V2V-V2I communication technologies can improve traffic management through real-time exchange of data among vehicles and with road infrastructure. Once a particular road condition requiring traffic engineering is detected, V2V and V2I communications will be used to route and disseminate the information to the vehicles approaching the problematic area.

Wireless vehicular cooperative systems are an attractive solution to improve road traffic management, thereby contributing to the European goal of safer, cleaner, and more efficient and sustainable traffic solutions. The use of V2V (Vehicular to Vehicular) and V2I (Vehicular to Infrastructure) communication technologies can help reduce road fatalities and also provide more efficient and adaptive traffic management that contributes to reducing energy and environmental costs while improving our lives.

According to the EU i2010 Intelligent Car Initiative launched in 2006 at the eSafety forum, intelligent systems embedded in car or in road infrastructure needs to address the following issues:

- Congestion
- Costs amount to 50 billion €/ year.
- 10% of the Road network is affected daily by traffic jams.
- Energy Efficiency & Emissions
- Road transport consumed 83% of the energy consumed by the whole transport sector and 85% of the total CO2 transport emissions.
- Safety
- The cost of over 40,000 fatalities and 1.4 million accidents in the EU represent 2% of the EU GDP. Human error is involved in almost 93% of accidents.

III.1.5. The mobile office

The final research area is the concept of the mobile office. Mobile users wish to use their devices in multiple locations and for different reasons to access the information they require at any time. Furthermore, this will be amplified over the coming years as personal mobility increases, access to a range of networks proliferate and “mobile workers” will continue to desire access to their working environment everywhere with the same tools and applications they would have in their office.

Our working environment is in a process of transition, due to the forces of globalisation and competition, location has diminished in importance. Mobility adds to the flexibility of knowledge workers, but this flexibility could be constrained in the future due to concerns about sustainable development. Thus, new working environments across organisational boundaries have become important, if not imperative, and are enabled by user-friendly information and communication technologies and new ways of working.

Focusing on transport systems, as the most dynamic context where users will need to access information, we present the current state of the art and the future challenges in the ***“mobile office field”,*** whereby the “mobile office” concept is making information available, accessible, secure and transparent to transport users. Thus, working while on the move (in transport) will make use of different communication, virtual, and ambient intelligent technologies that in an integrated way, and through new applications and services, will allow users to feel in their own personal office.

Therefore, the present strategic vision will centre its attention on the following topics:

1. Workers on the move.
2. New applications and services that allow access to the right information, at the right time, applying ambient intelligent and context aware technologies.

3. Innovative, user-friendly and mobile-capable security for collaboration while meeting needs for integrity, authenticity and privacy.
4. Knowledge management in media-rich working environments, including mobility and multimodality.
5. Uninterrupted communication through heterogeneous networks.

III.1.6. Security, Trust and Privacy

Mobile systems and their infrastructures are an essential part of the transportation domain and security aspects such as trust and privacy can be viewed as an essential part of any system. User acceptance of new applications in this area is often linked directly to the quality of the underlying security mechanisms. The main challenge is to provide security, trust and privacy in such a manner that it enhances the user's experience and the quality of the application without annoying the user or hindering him in his usual workflow. Security should be perceived like the air that we breathe – unrecognized when present and crucial when missing.

The main security challenge within the transportation domain is to cope with the diversity of domain system and infrastructure constraints. We have to deal with various devices moving within and through different networks and infrastructure types. Different devices with different abilities concerning CPU power and communication bandwidth and throughput must be secured to a specific level in order to guarantee security as a steady companion whilst moving. Keeping the "bad guys" out and protecting the users against malicious attackers and protecting the users' privacy while moving through physically unsecure or hostile environments, turns out to be harder to achieve than in any other domain.

There are already projects that cover security, trust and privacy aspects of the transportation domain, mainly situated in the automotive area, covering topics such as the secure and trustworthy communication within a vehicle, between vehicles, and between vehicles and infrastructures. Within these topics various applications are analysed and protected against threats that are encountered in current research.

III.2. State of the art

In this section we present a brief description of several projects and their contributions to this area. An extended description of the projects can be found in Annex B.

III.2.1. Urban and road traffic management

Annex B lists a very wide selection of projects some of which have completed over the past 5 years and others which are still running. The examples are taken from the European Commission (EC), the UK, Germany, Finland and Hong Kong.

In this section we first examine several services with regard to urban and road traffic control, and then we present several projects within the field.

III.2.1.1. Services related

Advanced Driver Assistance Systems

- Description
  There are a variety of functions such as driver assistance, safety enhancement, information provision and automated transport. This set of services includes Adaptive Cruise Control (ACC) features.
- Utilisation
  Driver support systems are relevant and contribute to traffic management in the urban environment with regard to traffic flow and traffic safety.

- Components
  The types of technologies required for this service include: onboard sensors and GPS.
- Characteristics
  Unknown.
- Requirements
  This service requires new technology solutions both in vehicles and in the surrounding environment.
- Traffic
  Unknown at this point what impact this service would have on any network.
- Entities
  Governments, transport firms and possibly in future individual citizens may have an interest.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Symmetric or asymmetric.
- Bit rate
  Maximum transfer delay.

Ramp metering on European motorways

- Description
  The service provided is a solution to monitor the use of "on and off" ramps on European motorways using the latest technologies to facilitate increased traffic flow.
- Utilisation
  Ramp monitoring should allow for improved safety and more efficient traffic flow and can be applied individually to one ramp which may have heavy usage or across several ramps.
- Components
  This requires telematic solutions amongst other things such as some form of detectors (sensors) on the ramp.
- Characteristics
  Unknown.
- Requirements
  Network requirements are unknown at this time.
- Traffic
  Unknown.
- Entities
  Government transport departments would be interested in this service.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Symmetric or asymmetric.
- Bit rate
  Maximum transfer delay.

Individual automated vehicles (cybercars)

- Description
  Small automated vehicles form part of the public transport system complementing mass transport and non-motorised transport.
- Utilisation
  This service can provide passenger transport solutions and potentially also be used for door to door freight delivery or garbage collection.
- Components
  The types of technologies required for this service include mobile network, sensors, magnets.
- Characteristics
  Unknown.
- Requirements
  This service requires new vehicles, hardware and software solutions and interfaces for communication with mobile phones.
- Traffic
  Unknown at this point what impact this service would have on any network.
- Entities
  Governments or private firms wishing to provide a cybernetic transport solution to customers.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Symmetric or asymmetric.
- Bit rate
  Maximum transfer delay.

Integration of information while travelling

- Description
  Integration of information provided as a mobile service while travelling. The information includes navigation in a city environment and other location information.
- Utilisation
  The service offers dynamic route planning, continuous information broadcasting on weather, route guidance, traffic information etc.) and messaging.
- Components
  The types of technologies required for this service include a PDA or mobile phone to access the location based services, GPRS, satellite broadcast.
- Characteristics
  Unknown.
- Traffic
  Unknown at this point what impact this service would have on any network.
- Entities
  All types of travellers.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Symmetric or asymmetric.

- Bit rate
  Maximum transfer delay.

Intelligent in - vehicle terminals

- Description
  Creation of an intelligent in-vehicle terminal to be used by various transport services.
- Utilisation
  The terminals are able to provide communications to a range of types of transport services and modes of transport (bus, taxi) using a range of communications networks (GSM, Private radio networks).
- Components
  The types of technologies required for this service include an in-vehicle terminal, wireless network connectivity, location devices, in-vehicle software services.
- Characteristics
  Unknown.
- Traffic
  Unknown at this point what impact this service would have on any network.
- Entities
  Actors in the area of public transport and related services including: authorities, public transport operators.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Symmetric or asymmetric.
- Bit rate
  Maximum transfer delay.

Integrated location based services on highways

- Description
  Location based services that draw on a person in a vehicle, the info in the vehicle itself and a wireless network.
- Utilisation
  Provision of location based services in the area of e-safety.
- Components
  The types of technologies required for this service include smart, realtime maps, UMTS 3G technology, positioning systems, intelligent agent technology, 2D/3D spatial tools and speech recognition/voice interfaces.
- Characteristics
  Unknown.
- Traffic
  Unknown at this point what impact this service would have on any network.
- Entities
  European drivers, bicyclists, pedestrians.

Technical Characteristics

- Time dependency
  Time-based or non-time-based.
- Delivery requirements
  Real time.

- Symmetry of the connection
  Symmetric or asymmetric.

III.2.1.2. Related projects

CRUISE

CRUISE [87] is a 32 member EU network of excellence. The main objective of CRUISE is to plan and coordinate open research activities on communication and application aspects of wireless sensor networking in Europe. It brings together a diverse group of partners from academic and independent research and development (R&D) organisations, each with an international reputation and expertise in specific areas of wireless sensor networking. These partners will integrate their expertise and knowledge gained from projects to build a strong team that will jointly work for the creation of a State-of-the-Art Knowledge Base, and make this base available to the general public. Joint work will consist of information collection, comparison, validation and dissemination. CRUISE will focus its research toward the solution of specific theoretical and technological problems that will enable the building of sensor network applications that can significantly benefit the European society.

P-Innovations, Automatic Vehicle Guidance System, Tampere, Finland

Perhaps one of the biggest problems with parking a vehicle in a car park, be it a multi-storey or open air facility, is the human element. Many companies are now trying to provide sophisticated guidance systems, which not only tell the driver where to park but can also keep tabs on the vehicle while it is in the car park.

In mid-2007, the P-Innovations [88] research project, led by the VTT Technical Research Centre of Finland started a pilot scheme to investigate automatic vehicle recognition and dynamic guidance in a single parking structure.

The project was started in a car park in Tampere and has used RFID (radio frequency identification) and optical number plate recognition. The combination of these two technologies has allowed floor-specific vehicle amount calculation and also vehicle parking guidance. This project represents the first time in Europe that a parking application has used passive long-range RFID remote identification for vehicle identification.

Hong Kong Intelligent Transport System (ITS)

The Hong Kong ITS project [89] will have four key platforms to address the traffic congestion problem. The functions of the ITS project include traffic management, monitoring, data analysis and control activities. The project will bring in effective traffic management through a Traffic Control and Surveillance System (TCSS) tracking all the major highways, road tunnels, and selected trunk roads.

The Area Traffic Control (ATC) system will be used for monitoring urban roads. CCTV systems and sensors will be used for collecting traffic information and the useful information about the traffic and routes will be disseminated to commuters through public media, road signs and land controllers.

The important ITS solutions include the implementation of the Transport Information System (TIS), extension of ATC, installation of TCSS and setting up the Traffic Management and Information Centre (TMIC). The other key features of the Hong Kong ITS project include the journey time indication system, and red light and speed enforcement cameras.

Dynamic signposts with integrated congestion information

A dWiSta system [90] was planned and installed as a pilot project in the Leipzig region at three federal motorway interchanges and eight motorway junctions. The acceptance of such information-based signposts was to be investigated, in particular with regard to their use at motorway junctions, and their effect was to be evaluated from a traffic control and economic point of view. An example of a cost-benefit analysis for the installation and operation of dWiSta at a motorway junction in the Leipzig region showed a high benefit ratio depending on the frequency of events, the traffic load and the detour factors. The results of the investigation consist of specific recommendations concerning the further implementation of dWiSta in the Leipzig region and of generally applicable usage criteria for dWiSta at federal motorway junctions.

Use of new technologies for traffic information and guidance systems

The provision of modern information technology to control traffic has added a new dimension to road traffic engineering in recent years. The current level of development regarding telematics in traffic is characterised by attempts to prove the functionality of numerous technical elements and sub-systems. There has recently been rapid development of private traffic information services which are largely based on mobile radio systems. Analysis of the current developments and demonstrations of their potential for contributing to an integrated traffic management system is necessary from the perspective of traffic science, which has to deal with the traffic engineering strategies for the operation of new guidance systems. The aim of the project [91] was to develop solid concepts for the use of new technologies in different scenarios.

EU project on infrastructure and safety: In-Safety

Although new telematic applications are known to enhance traffic safety, specific results concerning infrastructure-aided systems - especially in conjunction with conventional traffic safety measures - are not yet available. This project [92] is meant to investigate how conventional traffic safety measures can be aided through a use of new technologies like driver assistance systems. For this purpose, the Federal Highway Research Institute develops and rates implementation scenarios (road maps) comprising a combination of innovative and conventional traffic safety measures. Based on cost-benefit analyses, the recommended road maps are to support public authorities in rating investments in new telematic systems.

Updates of technical delivery conditions for route control stations (TLS)

Traffic guidance implemented by means of alternating traffic signs and directions on interstate roads [93] is being continued as part of a program by the Federal Ministry of Traffic, Construction and Housing lasting from 2002 to 2007. In this process, it is necessary to update the TLS bodies of rules relevant to system configuration in terms of additionally established applications, technological advancements and accompanying developments in standards. This primarily means an integration of faster data transfer facilities and various communication media such as fibreglass or copper cables and radio links. In addition to opening TLS to promising future technologies, these measures will streamline interaction between traffic and road engineering systems in tunnels so as to improve identification and management of disruptions.

Stadtinfo Cologne Traffic and Parking Data System

PartnersStadtinfo Köln (City Info Cologne) [94] is a research project financed by the German Federal Ministry of Research that centres around the collection of various traffic data to be distributed to diverse platforms including the Internet, portable devices such as PDAs and mobile telephones, in-car navigation systems and variable message signs throughout the city. The project was implemented over a four-year period from 1998 to October 2002 by 15 partners in co-operation with the city of Cologne at a cost of €16.1 million.

Traffic Management Centre (VMZ Berlin)

The objective of the Berlin Traffic Management Centre [95] (known as VMZ Berlin in Germany) has been to record and evaluate the traffic situation in Berlin. Specifically, the aim was to integrate all Berlin transport into an efficient city traffic management system. This has included individual and public passenger transportation as well as commercial transportation.

The data gathered has been used to generate comprehensive traffic information and aid informed management decisions to improve the traffic situation in Berlin.

EuroMetropolis

This initiative [96] combines the topics of traffic information, travel management and networking (e.g., linking cars with the home and office). The initiative also supports the development of the needed infrastructure:

- Traffic information: The goal is to provide reliable traffic information throughout Europe. Combined with dynamic, customised navigation services, this results in safer, more efficient traffic flow and a more pleasant and relaxed journey for the driver.
- Travel management: In future, points of interest (POI) will be continually updated during the journey to reflect the time of day and the location. Depending on the purpose of the journey, the driver can select particular POIs and have these transmitted to the vehicle. This turns the navigation system into nothing less than a personal travel companion.
- Networking: In a networked world, vehicles will also be able to communicate with home, office and other locations. The goal is to give people access to their personal data, music and information, irrespective of where they happen to be.

INVENT

The research initiative INVENT (Intelligent Traffic and User-oriented Technology) [97] is advancing the development of intelligent vehicle systems that will provide the required information and alert drivers to hazardous situations.

The German Federal Ministry for Research and Education is supporting the research cooperation of 23 partners in INVENT. The research initiative focuses on three main themes, each involving a number of projects: "Driver Assistance and Active safety," "Traffic Management 2010" and "Traffic Management in Transport and Logistics."

Cell Phone Radar (CPR) - Investigation for Transport Applications

Cell phone radar (CPR) [98] is a low-cost passive method of detecting and tracking moving objects (vehicles, people, animals etc.). In its simplest form CPR uses the radio transmissions being made by mobile telephone base stations to 'illuminate' objects in its 'cell'. The objective of this research is to investigate the CPR concept to explore how it could fulfil DfT policy objectives, in the area of road transport. Of particular interest is the ability of CPR to monitor traffic flow for traffic management purposes, especially in adverse weather conditions.

Wireless communication to road users for Urban Traffic Management

Urban traffic congestion results in delays to travellers and increases in urban pollution. It also disrupts the provision of efficient public transport services resulting in more travellers opting to use their own vehicle.

UTMC-14 [99] was one of a series of Urban Traffic Management and Control projects, part of the ongoing development of the UTMC Technical Specifications.

The overall aim of this project was to develop and demonstrate a specification for roadside to vehicle communications, and for fixed link wireless communications for traffic management systems. Based on current and future requirements for wireless communications, the project defined technical guidance that was then tested at a demonstration site.

This project addressed the full current range of wireless communications technologies, from 5.8 GHz for short range vehicle links to VHF and point-to-point microwave.

Pedestrian Detection Techniques

This project [100] is studying the performance of new pedestrian detectors which are starting to become available. With more advanced detectors it should be possible to realise more sophisticated traffic control in order to give a fairer allocation of time to pedestrians at traffic signals and pedestrian crossings.

New types of imaging systems are becoming available, using CCTV, infrared and laser technologies. Automatic number-plate readers are being deployed in access-control and in data collection of journey times and journey movements. The project will provide advice on how these systems perform in different circumstances, and provide an understanding of their performance limitations under varying environmental and traffic conditions.

Probe Vehicle Information for Traffic Management and Road Network Operations (PROBE-IT)

The aim of the project [101] was the development of a fully working system for the transmission of position-related information from a dynamic database to in-vehicle systems.

The overall objective was to demonstrate an end-to-end process of information transfer utilising emerging commercially-available, wireless communications technology. The process was developed in three phases: non-dynamic data flow; dynamic data flow and floating vehicle application.

Virtual Vehicle Information Displays

The amount of on-board information that is available to drivers is dramatically increasing. There is a danger that drivers, who should be devoting more attention to the driving task, will be bombarded by large volumes of un-prioritised information.

The aim of this project [102] was to create a system that will allow the realistic design, testing and evaluation of both the form and function of multiple automotive information systems for both commercial and private vehicles.

The original objective of VIVID was to create a Virtual Reality prototyping environment to assess the different methods of integrating the information sources available to drivers such as mobile phones and in-car navigation technologies.

Autonomous Driving: Cybercars

The objective of the CyberCars [103] project is to develop and experiment with new transportation techniques for the cities of tomorrow. These techniques are all based on the concept of individual automated vehicles which run on city streets or in private grounds as an alternative to the use of private cars and as a complement to public mass transportation and non-motorized travel.

Various communication schemes have been used and are now operational on various systems: GSM and GPRS mostly for communicating with the users through their mobile phones, and Wi-Fi (IEEE 802.11) for the communication between vehicles and infrastructure. High bandwidth communication is needed in case of transfer of images, for example for remote control of the vehicles.

HIGHWAY

HIGHWAY [104] is to offer higher safety and location-based value added services where interactions between the person in control, the vehicle and the information infrastructure are addressed in an integrated way. HIGHWAY, through the combination of smart real-time maps, UMTS 3G mobile technology, positioning systems and intelligent agent technology, 2D/3D spatial tools and speech synthesis/voice recognition interfaces will provide European car drivers/bikers/pedestrians/etc. with e- safety services and at the point of need interaction with multimedia (text, audio, images, real-time video, voice/graphics) and value-added location-based services.

Satcoms in support of transport on European Roads (SISTER)

The SISTER - "Satcoms in Support of Transport on European Roads" – project [105] will promote the integration of satellite and terrestrial communication with Galileo, the European satellite navigation system. The project's goal is to enable mass-market take-up by road transport applications.

Satellite navigation services have already proved their value in a large range of road transport applications. Many of these applications require one or two-way communications services in order to function. In many cases to date, terrestrial communication systems such as GSM and GPRS have been employed. However, there are numerous circumstances in which these technologies may not be sufficient to meet the communications requirements.

VII and SafeTrip-21

SafeTrip-21 [106] builds upon research into the use of information, navigation, and communications technologies to prevent accidents and alleviate congestion by providing drivers with real-time safety warnings, traffic and transit information, and advanced navigational tools. SafeTrip-21 will accelerate testing and deployment of these capabilities.

Sevecom

SeVeCom (Secure Vehicular Communication) [107] is an EU-funded project that focuses on providing a full definition and implementation of security requirements for vehicular communications.

The Sevecom vision is that future vehicular communication and inter-vehicular communication infrastructures will be widely deployed in order to bring the promise of improved road safety and optimised road traffic.
Sevecom addresses security of the future vehicle communication networks, including both the security and privacy of inter-vehicular communication and of the vehicle-infrastructure communication. Its objective is to define the security architecture of such networks, as well as to propose a roadmap for integration of security functions in these networks.

Car-2-Car Communication Consortium

The mission and the objectives of the CAR 2 CAR Communication Consortium [108] are:

- To create and establish an open European industry standard for CAR 2 CAR communication systems based on wireless LAN components and to guarantee European-wide inter-vehicle operability.
- To enable the development of active safety applications by specifying, prototyping and demonstrating the CAR 2 CAR system.

- To promote the allocation of a royalty free European wide exclusive frequency band for CAR 2 CAR applications.
- To push the harmonisation of CAR 2 CAR Communication standards worldwide.
- To develop realistic deployment strategies and business models to speed-up the market penetration.

Communication Vehicle Infrastructure Systems (CVIS)

Intelligent Co-operative Systems [109] are the next big challenge in automotive electronics and ITS. Intelligent Co-operative Systems that are based on vehicle-to-vehicle and vehicle (V2V) and Vehicle to Infrastructure (V2I) communications hold the promise of great improvements both in the efficiency of the transport systems and in the safety of all road users.

Indeed intelligent Co-operative Systems increase the "time horizon", the quality and reliability of information available to the drivers about their immediate environment, the other vehicles and road users, enabling improved driving conditions leading to enhanced safety and mobility efficiency.

Similarly, Co-operative Systems offer increased information about the vehicles, their location and the road conditions to the road operators and infrastructure, allowing optimized and safer use of the available road network, and better response to incidents and hazards.

Monitoring and Intervention for the TRAnsportation of dangerous goods (MITRA)

The objective of the MITRA project was to prototype a new system for monitoring the transportation of dangerous goods in Europe based on regional responsibilities. This concept, based on systems used in air traffic control, aims to provide civil security centres with real-time knowledge of the position and contents of dangerous vehicles circulating in their area of responsibility, and in the event of an incident, to issue warnings, alerts and crisis management information, to permit intervention teams to react immediately with maximum safety. The European Commission under the FP6 programme funded the project.

Data Services for Transport and Mobility Users (DSTM)

The DSTM will provide complete solutions for European multi-user and multi-modal (sea, road and rail) positioning, remote monitoring & control services.

The DSTM service solution is devised to address basically the European Carrier Companies and the National, Regional or Local Service Providers operating in the transport environment. It can be used to implement service solutions for all categories of users involved in the transport field (e.g., producers, warehouse managers, etc.).

The main goal of the DSTM project is primarily to provide users in the transport and mobility field, with a basic "intercommunication" service between the already available fixed/mobile, terrestrial/satellite data communication (and positioning) technologies. Furthermore, the selected open-architecture platform will allow the set-up and provision of new and added value services tailored to European transport sector needs (e.g., freight and fleet management, security, web applications, etc.).

III.2.2. Efficient trip management

Looking at current solutions, e.g., in Germany and other European countries, the situation is as follows:

- For trams or buses paper and electronic timetables exist – typically these can also be found on the Internet. No information about the present situation (e.g., positioning of trams) is available in a widespread fashion.
- For trains, timetables – in paper and on the Internet, enhanced by up to date travel information including delays, are provided. Some initial applications (Java clients) to make this information available to people on the move are provided, but access and information management is difficult. Integrated passenger information systems are not yet readily available.
- In cars, a navigation system and the FM radio (with its corresponding information e.g., via TMC) is available. However there is no interoperability between the above two types of information.
- For pedestrians, navigation services are starting to be offered, mainly driven by Nokia.
- For businesses, transport of goods and traceability related issues exist.

What is not available is an integrated, context aware, easy to use solution which would provide the required information, easily for the traveller. This requires the development of a comprehensive, integrated communications system and service platforms which is the vision of multi-modal transport. In addition almost no safety services are offered.

Currently we do not know of projects in the topic area. There are quite a few projects about Car2x. The infrastructure envisaged here, would be an excellent facilitator for launching some of the services envisaged. Additional services, like safety or multi-modal traffic would be well appreciated, but this does not appear to be part of the current R&D focus.

Several projects have or are still working on the service platform and algorithms:

SPICE (Service Platform for Innovative Communication Environment) is addressing the still unsolved problem of designing, developing and putting into operation efficient and innovative mobile service creation/execution platforms for networks beyond 3G [110].

The S4ALL project can be summarized as follows [111]:

People are used to being able to contact anyone, anywhere, at anytime. However, the challenge of enabling mass-market-scale ubiquitous services and applications remains. MobiLife Integrated Project in IST-FP6 (September 2004 - December 2006) [112] was to bring advances in mobile applications and services within the reach of users in their everyday life by innovating and deploying new applications and services based on the evolving capabilities of the 3G systems and beyond. The project addressed with a strong user-centric view problems related to different end-user devices, available communication networks, interaction modes, applications and services. The MobiLife consortium consisted of application owners (mostly SMEs), manufacturers, operators, solution providers and academia. MobiLife was part of the Wireless World Initiative, which comprises several projects for IST.

Project Railnet [113] is a strategic partnership between Deutsche Bahn (DB) and T-Mobile Deutschland to provide wireless Internet access aboard high-speed trains in Germany. The technical solution connects passenger laptops, PDAs, and mobile phones to the nearest wireless hotspot located on a train, which, in turn, connects to T-Mobile Deutschland's broadband mobile network. In addition, each train is equipped with a central server that automatically connects with the WLAN as the train arrives at each station. This data is then relayed to a central communication system to update, for example, travel information to customers waiting further down the line.

SMILE project [114] compiles the results and experience of European cities and towns in designing projects and measures according to the needs of specific target groups and presents successful models on how to involve citizens. Sustainable Mobility is about creating incentives for citizens to choose more sustainable modes of transport such as walking, cycling and public transport.

SMILE gathers experience on how to best include public transport in sustainable mobility initiatives and draws up recommendations for both local authorities and public transport operators.

The COMPOSE project [115] aims to define the specifications and demonstrate an innovative mobile service package for travellers based on the full integration of the mobile Pre-Trip (3D navigation in city environment) and On-Trip (in-car location based & satellite broadcast/multicast and last mile) service components. COMPOSE offers the full coverage of mobile users needs during the pre-trip and on-trip phases through a single access point for continuous information broadcasting (weather forecast, news & sport, cultural & entertainment information) and on demand information (messages, points of interest, route guidance, dynamic traffic information).

Trans-European Trunked Radio Based Specialised Network Linked Services (TETRA Link)

The objective of the project is to develop TETRA-based, modular and expandable communication products that address long-standing, pressing surveillance needs in the public transport and the emergency service markets. These products are:

- Automatic Vehicle Location (AVL) system.
- Public Transport Surveillance (PTS) system.
- Urban Forest Surveillance (UFS) system.
- Ambulance based Image and Patient Data (IPD) communication system.

Cold chain monitoring and traceability services (Cold-Trace)

Cold-Trace (www.cold-trace.com) offers a wide range of services for monitoring traceability of the cold chain using mobile communications. They consist of a management tool on board trucks that collects and processes information from a set of sensors distributed throughout the vehicle, and provides a software application that allows drivers to manage the administrative tasks performed during a trip. Information is transmitted to the central office using mobile communications based on GPRS/3G.

Cold-Trace's objective is to demonstrate and test the feasibility of these services on a wide-scale basis in different contexts and countries before deployment across Europe. Pilot sites are to be set up at three European transportation companies in Spain, Ireland and Sweden.

Dangerous Goods Transportation Routing, Monitoring and Enforcement

GOOD ROUTE (www.goodroute-eu.org) aims to develop a cooperative system for the monitoring and routing of vehicles transporting dangerous goods. The system uses dynamic real time data to minimise risks to the public, whilst generating the most cost efficient solution for all actors involved in the logistic chain.

III.2.3. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications

Mobile Ad-Hoc Networks (MANET) technology has been evolving over the last two decades. While initially only for military use, like communications in the battlefield, there has been a transition of the technology to civilian and commercial use. This evolution is studied in [116]. New standards, like IEEE 1609 and 802.11p, are being developing for VANETs (Vehicular Ad-Hoc Networks) as well as the adaptation of MANET technology to street vehicles like cars. Thus far these new standards have not taken off and so different solutions have been proposed.

The Drive-thru Internet [117] project investigates the usability of IEEE 802.11 technology for providing network access to mobile users in moving vehicles using hot spots along the road. The vehicle driving close to these hot spots will obtain WLAN access for some relatively short period of time. Measurements of a prototype can be seen in [118]. In [119] another prototype is presented, this time for communications between motorbikes in movement to support social interaction among motorcyclists. In [120] research in the performance of a WLAN in different vehicular traffic and mobility scenarios is undertaken. They observed that network throughput and the quality of the wireless communication channel, measured on IEEE 802.11b compliant equipment, degrades with increasingly stressful communication scenarios.

Given the C2C scenario, in [121] a cooperative strategy for content delivery and sharing in future vehicular networks is proposed. A ”communication efficient” swarming protocol is used, it leverages the inherent broadcast nature of the wireless medium, and a piece-selection strategy that takes proximity into account in decisions to exchange pieces. Also an analytical model is developed to characterize the performance of the strategy.
A very important issue in C2C communications, due to its wireless nature, is security. An extended analysis is completed in [122], where they address the security issues of these networks. They provide a detailed threat analysis and devise appropriate security architecture, and also describe some major design decisions still to be made. Finally they provide a set of security protocols, and show that they protect privacy and analyze their robustness and efficiency. References [123]-[128] provide a deep explanation within the topics of C2C and C2I communications.

We break the projects down into six categories as follows:

- Communications systems.
- Standardization and Harmonisation.
- Secure communications.
- Satellite communications.
- Field trials in the application areas.
- Driver assistance.

Category 1 Communications systems

1. **ASV3** [129] – ASV3 was the third phase of the Japanese Advanced Safety Vehicle project. Inter-vehicle communication type systems were developed that allow vehicles to exchange information on their position and behavior using the latest wireless communication technologies to keep drivers informed of their own vehicle's separation from surrounding vehicles. In 2005, verification tests were conducted on test roads.
2. **Carlink** [130] – The aim of this project is to develop an intelligent wireless traffic service platform between cars supported by wireless transceivers beside the road. The primary applications are real-time local weather data, urban transport traffic management, and urban information broadcasting.
3. **CICAS** [131] – The Cooperative intersection collision avoidance systems (CICAS) project has a focus on optimizing the combination of autonomous-vehicle, autonomous-infrastructure and cooperative communication systems. CICAS has the potential to warn drivers about likely violations of traffic lights and to help them maneuver through cross traffic.
4. **COM2React** [132] – COM2REACT will establish and test a scalable, cooperative, multi-level road transport concept for local, short-term traffic control by Vehicle-to-Vehicle (V2V) communication and Vehicle-to-Centre (V2C) communication. This will facilitate improvements in the flow of information acquired by moving vehicles and in its quality and reliability, thereby enhancing road efficiency and traffic safety on urban, intercity arterials and rural roads.
5. **COOPERS** [133] – The aim of COOPERS is to define, develop and test new safety related services, equipment and applications using two way communication between road infrastructure and vehicles from a traffic management perspective. COOPERS will build upon existing equipment and infrastructure as far as possible to incorporate bi-directional infrastructure-vehicle links as an open standardized wireless communication technology.
6. **CVIS** [134] – The CVIS project aims to design, develop and test the technologies needed to allow cars to communicate and network directly with the roadside infrastructure. CVIS will build on the ISO "CALM" standards to develop a world "first": a standardized networking terminal capable of connecting continuously and seamlessly using a wide range of communication media - including mobile cellular and wireless local area networks, short-range microwave (DSRC) or infra-red.
7. **EPFL Vehicular Networks** [135] – Vehicular Networks (also known as VANETs) are a cornerstone of the envisioned Intelligent Transportation Systems (ITS). This project, driven by the University Of Lausanne (CH), aims at bringing vehicular ad hoc networks to their full potential.
8. **Fleetnet** [136] – FleetNet aimed at the development and demonstration of a wireless ad hoc network for inter-vehicle communications. Key design requirements for FleetNet were the capability to distribute locally relevant data where generated and needed and to satisfy the vehicle drivers' and passengers' needs for location-dependent information and services.
9. **GST** [137] – Aim of GST (Global System for Telematics) was the creation of an open and standardized end-to-end architecture for automotive telematics services. The purpose was to create an environment in which innovative telematics services could be developed and delivered cost-effectively and hence could increase the range of economic telematics services available to manufacturers and consumers.
10. **VSC** [138] – The Vehicle Safety Communications (VSC) Project is a program to identify vehicle safety applications enhanced or enabled by external communications, determine their respective communications requirements, evaluate emerging 5.9 GHz DSRC vehicle communications technology and influence proposed DSRC communications protocols to meet the needs of vehicle safety applications.
11. **SMART-NETS** (Signal MAnagement in Real Time for Urban Traffic NETworkS) [139] – addresses urban traffic management via the use of new generation signal control strategy TUC (Traffic-responsive Urban Control) that employs advanced automatic control methodologies to avoid the drawbacks of conventional UTC systems.

Category 2: Standardization & Harmonization

1. **Car2Car Communication Consortium** [140] – The CAR 2 CAR Communication Consortium has a strong focus on the standardization of interfaces and protocols of wireless communications between vehicles and their environment. The Consortium also promotes the allocation of a European frequency band for C2C. Due to the strong involvement of several vehicle manufacturers, the interoperability between vehicles of different manufacturers is another main target.
2. **COMeSafety** [141] – The COMeSafety Project supports the eSafety Forum with respect to all issues related to vehicle-to-vehicle and vehicle-to-infrastructure communications as the basis for cooperative

intelligent road transport systems. Consolidated results and interests are submitted to the European and worldwide standardization bodies. Especially the European frequency allocation process is being actively supported.

3. **EASIS** [142] – EASIS stands for Electronic Architecture and System Engineering for Integrated Safety Systems. The EASIS approach is to develop a modular scalable electronic architecture and a standardized system engineering approach for integrated safety systems and to provide enabling technologies for the introduction of integrated safety systems.
4. **Inter vehicle communication for highway safety messages** [143] – The project works on a MAC Protocol (MAC: media access control) for Inter-Vehicle Communication, Highway Safety Messaging and Secure Safety Messaging. There is only very limited information available on this project.
5. **GeoNet** [144] – aims at developing a reference set of implementation specifications of a geographic addressing and routing (geo-networking) protocols for vehicle to vehicle and vehicle to infrastructure communication systems, ensuring the support for IPv6.

Category 3: Secure Communication

1. **Network on wheels (NOW)** [145] – The main objectives of NOW were to solve technical key questions on the communication protocols and data security for C2C communications and to submit the results to the standardization activities of the Car2Car Communication Consortium.
2. **SeVeCom** [146] – SeVeCom (Secure Vehicular Communication) addresses the security of the future vehicle communication networks, including both the security and privacy of inter-vehicular communication and of the vehicle-infrastructure communication. Its objective is to define the security architecture of such networks, as well as to propose a roadmap for integration of security functions in these networks.
3. **INTRO** (Intelligent roads) project [147] – was created to address the problems of road safety and capacity by combining sensing technologies and local databases with real-time networking technologies. INTRO places a strong emphasis on the complementing role of sensing technologies with regard to new wireless vehicular cooperative systems and into data fusion mechanisms (infrastructure or car based) to improve real time safety and performance indicators estimation and prediction.

Category 4: Satellite Communication

1. **MAESTRO** [148] – The MAESTRO project consortium is proceeding towards the development of the innovative Satellite Digital Multimedia Broadcast (SDMB) concept, which will pave the way for an effective Satellite and Terrestrial network convergence. The MAESTRO project approach is to take advantage of the natural assets of satellite systems and ensure that the SDMB system achieves the highest possible degree of interoperability with terrestrial 2G and 3G mobile infrastructures in order to encourage multimedia usage adoption in Europe and contribute to the successful deployment of 3G.
2. **Mobile Ku Band Demonstrator** [149] – The project aim was to develop a demonstrator for vehicular reception of file based content in the Ku-band frequency range using a small aperture satellite antenna of the size of a compact disc. An international team from research and industry developed the required communication modems, the content playout platform, the caching strategies and algorithms, the in-car application but also the aggregated and with additional meta information enriched multimedia content. The final demonstrator was tested in different environments such as rural, urban and highway and at different latitudes.
3. **SISTER** [150] – The SISTER project (Satcoms In Support of Transport on European Roads) promotes the integration of satellite and terrestrial communications with Galileo to enable mass market take-up by transport applications. The goal is to make road transport more intelligent with satellite communications.

Category 5: Field Trials

1. **AHSRA** [151] – The purpose of AHSRA was to develop the Advanced Cruise-Assist Highway Systems (AHS), with the aim achieve significant improvements in road traffic safety and efficiency by applying information technology (IT) to road infrastructure. Field Operation Tests of AHS were conducted over the two years 2002 and 2003. Evaluation of the benefits for the driver and of system safety and reliability were carried out in the face of traffic on actual roads.
2. **SIM-TD** [152] – SIM-TD stands for "Sichere Intelligente Mobilität Testfeld Deutschland" (safe intelligent mobility testfield Germany). The project is still in an early phase. It plans to create the basis for large-scale field-trials in the region around of Frankfurt/Main.

3. **Smartway** [153] – Smartway is the Japanese lead project in the domain of ITS and is being promoted as part of the effort to realize the world's safest road traffic society. Smartway benefits from the infrastructure of VICS (vehicle information and communication system) and ETC (electronic toll collection), which are already operational.
4. **Vehicle Infrastructure Integration (VII)** [154] – The VII program is a multi-faceted, multi-disciplinary program. Its ultimate rollout and deployment will insert various ITS technologies into the transportation infrastructure and integrate ITS communications and sensors in vehicles. The fundamental building blocks of the VII concept are coordinated deployments of communication technologies in all vehicles by the automotive industry, and on all major U.S. roadways by the transportation public sector.
5. **iTETRIS** [155] – is aimed at producing the necessary building blocks and interfaces to conduct large-scale tests in open source integrated wireless and traffic emulation platforms to propose and optimize innovative V2V and V2I communication capabilities to improve road traffic management.
6. **PRE-DRIVE** [156] – aims at developing a detailed system specification and a working and functionally verified prototype for inter-vehicle and vehicle-to-infrastructure communication that is robust enough to be used in future field operational tests of cooperative systems.

Category 6: Driver Assistance

1. **Cartalk 2000** [157] – The European Project Cartalk 2000 focused on new driver assistance systems based upon inter-vehicle communication. The main objectives were the development of co-operative driver assistance systems and the development of a self-organizing ad-hoc radio network as a communication basis with the aim of preparing a future standard.
2. **Heavy Route** [158] – The Heavy Route project dealt with the development of a concept and architecture for a scheme to support, manage, and guide heavy goods vehicles in Europe. It grouped several sub-projects aiming at improving navigation, fleet management and logistics.
3. **HIGHWAY** [159] – The HIGHWAY project offers higher safety and location-based value added services where interactions between the person in control, the vehicle and the information infrastructure are addressed in an integrated way. Within the HIGHWAY integrated safety scenario, the role of digital maps will be central.
4. **PATH** [160] – The core of the PATH program is its collection of research projects within California. PATH's mission is to apply advanced technology to increase highway capacity and safety, and to reduce traffic congestion, air pollution, and energy consumption.
5. **Roncalli** [161] – The objective of RONCALLI was to create an information platform for traffic relevant information. This information, arising from different sources, is prepared and can be accessed for every single road user, especially based on his/her current situation. Special significance was ascribed to the topics road safety, customer-friendliness and reliability of information.
6. **Safespot** [162] – The SAFESPOT project aims to understand how intelligent vehicles and intelligent roads can cooperate to produce a breakthrough for road safety. The goal is to prevent road accidents developing a "Safety Margin Assistant" that detects in advance potentially dangerous situations and extends "in space and time" drivers' awareness of the surrounding environment.
7. **Willwarn** [163] – The WILLWARN subproject is developing, integrating and validating a safety application that warns the driver whenever a safety-related critical situation is occurring beyond the driver's field of view. This includes the development of on-board hazard detection, in-car warning management, and decentralized warning distribution by vehicle-to-vehicle communication on a road network.

III.2.4. The mobile office

FP5 eWORK

FP5 brought together in a single IST Key Action (KA II: New Methods of Work and Electronic Commerce) all research related to helping individuals improve the quality of their working lives and to helping companies operate more efficiently in trading goods and services. The aim was to develop Information Society Technologies enabling European workers and companies, in particular SMEs, to increase their competitiveness in the global market place, whilst at the same time improving the quality of the individual's working life. The term eWork took a step onwards from previous notions of telework. While telework in the traditional sense is mostly focussing on individual changes of work location, most prominently at home, eWork also included remote work in shared office premises, such as call-centres and (other) remote back offices. In addition to traditional telework, eWork was understood to cover tele-collaboration as well, i.e. tele-mediated work forms carried out by workers located in traditional office environments, as in the case of virtual teams which stretch across the boundaries of single organisations (eCollaboration).

FP6 New Working Environments

Related FP6 research aims at improving understanding of the changes and new opportunities in ways of working and doing business, together with the development of new technologies, methods and services – for the workplace and for support of teamwork, within and across the boundaries of organisations. Following the developments of mobile communication technology, the research on telework and eWork got extended to mobile work environments. Location mobility, linked to the possibilities of increased connectivity anytime, anywhere, has been the first focus of emerging research. The growing technological capabilities steered a discussion on further aspects of mobility, including virtual mobility, operational and interactional mobility. Consequently, the aspect of networking and collaboration grew more important.

FP7 Collaborative (Working) Environments

The research clustering done in FP6 by integrating the IPs with horizontal actions has reinforced the research agenda for FP7. The area of collaborative working environments is explicitly mentioned in the FP decision under the subheading of applications for business and industry, which highlights the orientation of the work.

CASCOM: Context-Aware Business Application Service Co-ordination in Mobile Computing Environments [164].

The main objective of the project is to implement, validate, and trial a value-added supportive infrastructure for Semantic Web based business application services across mobile and fixed networks.

The main expected outcomes of the CASCOM coordination framework include:

- Innovative research results and techniques for context-aware, agent-based business application service coordination and secure provision in open P2P service environments.
- Implemented context-aware agents using these techniques, and basic co-ordination infrastructure services.
- Service coordination architecture and specifications, and guidelines for using (a) and (b) to develop various context-aware business application services in nomadic computing environments.
- Prototypically implemented CASCOM service coordination demonstrator for selected health care use case scenario.

EU-DOMAIN: Enabling users for - distance-working and organizational mobility using ambient intelligence service networks [165].

The vision of the eu-DOMAIN project were to develop a Europe-wide, mobile, ambient intelligence services platform that integrates users into intelligent surroundings and support new methods of collaborative working with seamless delivery-on-demand of services from content repositories to people, machines and devices.

eu-DOMAIN enables mobile ambient intelligence awareness by allowing the user to integrate his virtual user profile into any location thereby providing context aware decision support combined with delegation of work.

MOBILE-IN: Harmonised services over heterogeneous mobile, IN and WLAN Infrastructures [166].

The main objective of the MobileIN project was to define and develop a novel set of advanced, future-proof, personalised harmonised services for the mobile user and worker by taking full advantage of heterogeneous service infrastructures (Intelligent Network Services, Mobile Network Services, VoIP Services). The project built on operators' needs to preserve and enhance existing services infrastructures (IN, CAMEL, LBS), which is already a major source of income, integrated with new, emerging ones (IP, VoIP, SIP etc.) that will provide operators and 3 RD party application developers with access to unrealised revenue streams.

MobiLife: Advances in mobile applications and services within the reach of users in their everyday life [167].

People are used to being able to contact anyone, anywhere, at anytime. However, the challenge of enabling mass-market-scale ubiquitous services and applications remains. MobiLife Integrated Project in IST-FP6 was to bring advances in mobile applications and services within the reach of users in their everyday life by innovating and deploying new applications and services based on the evolving capabilities of the 3G systems and beyond. The project addressed with a strong user-centric view problematic related to different end-user devices, available communication networks, interaction modes, applications and services.

III.2.5. Security, Trust and Privacy

EVITA

Background
Future automotive safety applications based on vehicle-to-vehicle and vehicle-to-infrastructure communication have been identified as a means for decreasing the number of fatal traffic accidents. Examples of such applications are local danger warnings and electronic emergency brakes. While these functionalities inspire a new era of traffic safety, new security requirements need to be considered in order to prevent attacks on these systems. Examples of such threats are forced malfunctioning of safety-critical components or the interference with the traffic flow by means of fake messages [168].

Objectives
Secure and trustworthy intra-vehicular communication is the basis for trustworthy communication among cars or between cars and the infrastructure. Therefore, the objective of the EVITA project is to design, verify, and prototype architecture for automotive on-board networks where security-relevant components are protected against tampering and sensitive data are protected against compromise when transferred inside a vehicle.
By focusing on the protection of the intra-vehicle communication EVITA complements other e-safety related projects that focus on the protection of the vehicle-to-X communication [168].

Applications and Services
Future Applications that are secured within the EVITA project are the following [169]:

- Active brake (Safety reaction).
- Local Danger Warning.
- Traffic Information.
- eTolling.
- eCall.
- Remote Car Control.
- Point of Interest.
- Remote Diagnosis.
- Integration of nomadic devices.

The EVITA project is concerned specifically with on-board networks within individual vehicles, rather than the wider ITS systems. In future road transport scenarios, breaches in the security of vehicle information or functions could lead to possible issues for stakeholders in four main areas [170]:

- Privacy – unwanted/unauthorized acquisition of data relating to vehicle/driver activity, vehicle/driver identity data, or vehicle/sub-system design and implementation.
- Financial – unwanted/unauthorized commercial transactions, or access to vehicle.
- Operational – unwanted/unauthorized interference with on-board vehicle systems or Car2X communications that may impact on the operational performance of vehicles and/or ITS systems (without affecting physical safety).
- Safety – unwanted/unauthorized interference with on-board vehicle systems or Car2X communications that may impact on the safe operation of vehicles and/or ITS systems.

SeVeCom

Background
SeVeCom (Secure Vehicular Communication) is an EU-funded project that focuses on providing a full definition and implementation of security requirements for vehicular communications.

Objectives
The Sevecom vision is that future vehicular communication and inter-vehicular communication infrastructures will be widely deployed in order to bring the promise of improved road safety and optimised road traffic.
Sevecom addresses security of the future vehicle communication networks, including both the security and privacy of inter-vehicular communication and of the vehicle-infrastructure communication. Its objective is to define the security architecture of such networks, as well as to propose a roadmap for integration of security functions in these networks [171].

Applications and Services
With the goal of enhancing the immunity of future road safety applications against a wide range of security threats, Sevecom focuses on communications specific to road traffic. Three major aspects will be examined [171]:

- Threats, such as bogus information, denial of service or identity cheating.
- Requirements, like authentication, availability, and privacy.
- Operational Properties, including network scale, privacy, cost and trust.

NoW

Background
Network on Wheels was founded by Daimler AG, BMW AG, Volkswagen AG, Fraunhofer Institute for Open Communication Systems, NEC Deutschland GmbH and Siemens AG in 2004. Siemens left the consortium in 2006. Their part was taken over by IMST GmbH and embedded wireless GmbH. NoW is a German research project which is supported by Federal Ministry of Education and Research. Besides the partners the Universities of Mannheim, Karlsruhe and Munich and the Carmeq GmbH co-operate within NOW [172].

Objectives
The main objectives are to solve technical key questions on the communication protocols and data security for car-to-car communications and to submit the results to the standardization activities of the Car2Car Communication Consortium, which is an initiative of major European car manufacturers and suppliers. Furthermore, a test bed for functional tests and demonstrations is implemented which will be developed further on toward a reference system for the Car2Car Communication Consortium specifications [172].

Applications and Services
The communications protocols developed in NOW: Network on wheels will support active safety applications as well as infotainment applications and will thus provide an open communication platform for a broad spectrum of applications. This is of particular importance regarding the market introduction of car-to-car communication systems [172].

PRE-DRIVE C2X

The European project PRE-DRIVE C2X prepares a large scale field trial for vehicular communication technology. Based on the European COMeSafety architecture for a vehicle to x communication system, the project develops a detailed specification for such a system and a functionally verified prototype. The prototype will be robust enough to be used in future field operational tests. The aims are to connect vehicle to vehicle and vehicle to infrastructure communication, to establish a pan European architecture framework for cooperative systems, to ensure interoperability of all different applications of vehicle to vehicle and vehicle to infrastructure communications for safety and mobility, to perform consistent a priori estimations of the impact on traffic safety and mobility of cooperative systems, to pave the road for the forthcoming field operational tests on cooperative systems and to identify the key enabling and disabling factors to plan future market introduction of vehicular communication [173].

PRECIOSA

Background
The PRECIOSA (Privacy Enabled Capability in Co-operative Systems and Safety Applications) project is part of the eSafety initiative, the Information Society Technologies initiative, and the Seventh Framework Programme of the European Commission.

Objectives
Privacy in ITS Applications Research and development in the field of Intelligent Transport Systems (ITS) currently focuses on the next generation of technology in transportation. Co-operative Systems are the key technology for collaboration between individual travellers, the operators of transport systems, and service providers, all equipped

with state-of-the-art technology. By introducing Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I) and Vehicle to X (V2X) communication, new potentials and challenges open up for improving safe and "green" mobility [174].

INTRO

Intelligent Roads (INTRO) is a research project supported by the European Commission with the aim of developing innovative methods for increased capacity and safety of the road network. This combines sensing technologies and local databases with real-time networking technologies.
The project is being conducted by the Forum of European National Highway Research Laboratories (FEHRL) institutes together with partners from the ITS and research sector.
Three main strands of research are being conducted [175].

sim^{TD}

Background
The sim^{TD} research project is shaping tomorrow's safe and intelligent mobility through researching and testing car-to-X communication and its applications. The project started in September 2008 and will run for four years. sim^{TD} will put the results of previous research projects into practice. For this purpose realistic traffic scenarios will be addressed in a large-scale test field infrastructure around the Hessian city of Frankfurt. The project will also pave the way for the political, economic and technological framework to successfully set up car-to-car and car-to-infrastructure networking [176].

Objectives
sim^{TD} is pursuing the following principle objectives [176]:

- Increased road safety and improved efficiency of the existing traffic system through the use of car-to-x communication.
- Definition and validation of a roll-out scenario for the identified functions and applications for scientific questions through practice-oriented experiments and field operational tests.
- Consolidation of car-to-x functions from the categories of traffic efficiency, driving and safety as well as value-added services.
- Definition, analysis, specification and documentation of those functions that are to be developed and tested, as well as of the resulting requirements for the overall system for selected functions and tests within sub-project 1.
- Development of test and validation metrics and methods in each phase of the overall system development in order to allow measurement and evaluation of the results.
- Consolidation and harmonisation of requirements from the standpoint of feasibility and performance as well as their compatibility of requirements within the sub-projects.
- Verification of functions and requirements within the context of individual milestones.

Based on the results of a parallel security analysis of the sim^{TD} system architecture specified and results of preliminary projects such as NoW, SeVeCom, etc., a security architecture for the sim^{TD} system is specified according to the principle "security by design". Then the security architecture is specified in more detail for the sim^{TD} subsystems, implemeted and tested during the project. Thus, the sim^{TD} security architecture has to protect both the C2X communication system including its infrastructure and the system required for the field trial itself.

Applications and Services
During a systematic and methodically sound process, the consortium partners selected the following functions in the categories traffic, driving and safety as well as value-added services. As a first major result, the following functions were selected for implementation [176]:

1. **Traffic –** Functions:
   1.1. Monitoring of traffic situation and complementary information/basic functions.
   1.2. Traffic (flow) information and navigation.
   1.3. Traffic management.
2. **Driving and safety –** Functions:
   2.1. Local danger alert.

2.2. Driving assistance.

3. **Additional services –** Functions:

3.1. Internet access and local information services.

The security requirements the sim^{TD} security architecture has to cope with are the following for example:

- Authenticity, integrity (and confidentiality if required by function) of C2X messages.
- Authenticity of message originator.
- Authenticity, integrity (and confidentiality if required by function) of measured data.
- Integrity, confidentiality and completeness of logging data.
- Authorisation of access to data.
- Plausibilty of data/messages.
- Authentication and authorisation of drivers.
- Confidentiality of personal data.
- Privacy of the test drivers.
- Integrity of software used.

Pervasive Computing: Trends and Impacts

Background

The dissemination and use of modern ICTs are considered to be preconditions today for dynamic economic growth and future viability in global competition. At the same time, the processes of change triggered, enabled and accelerated by ICT are enormous. The new technologies have an ever-expanding ripple effect on the economy, public administration, science, scholarship and private life. They exert influence on social and individual life. The development of mobile telephony and Internet technology during the past ten years exemplifies the transformative potential of ICT [177].

Digital information and services are going mobile and can be called up from any location. A trend toward pervasive computing is emerging - that is, the ubiquitous and invisible use, creation, processing, transmission and storage of information. The "computerisation of the world" is being accelerated by technological and economic developments. Everyday objects are becoming "smart objects", which are linked together into networks, react to their environment, and interact with their users [177].

Objectives

The study investigates the central trends in pervasive computing and considers them from technical, economic and social perspectives. It emphasises the level of analysis that is located between individual case studies and the global, comprehensive picture, and that can be mapped onto the application areas of pervasive computing. The study bundles the specialised knowledge of German and international experts who were asked for their assessment of pervasive computing in interviews and an online survey [177].

The study's findings underscore the fundamental potential of pervasive computing. They also show, however, that different application areas and sectors will profit from this potential at different speeds and with qualitative idiosyncrasies. In addition, the study makes clear that pervasive computing not only poses technical problems, it also comprises serious social, economic and judicial challenges that require active solutions and management [177].

Applications and Services

The exchange of information between large numbers of smart objects is a central property of pervasive computing. Smart objects differ considerably from other objects in terms of their input/output capabilities, sensory interfaces and application processes. Pervasive computing processes are, for the most part, designed to run as inconspicuously and situationally dependent – and therefore semi-automatically – as possible. It is thus essential that information be exchanged between authorised persons and/or objects only. Data and information must be allocated clearly and protected from manipulation and espionage. The secure identification of and communication between objects and persons in pervasive computing is therefore of vital importance. Equally important is the protection of users in the event of smart object failure or malfunction. As the first pervasive computing systems are introduced, technical issues in security, safety and privacy will fast become decisive [177].

Identifying persons and objects is both an application of pervasive computing (e.g., digital IDs) and a central internal operation required to make pervasive computing services safe and reliable. Because different technical approaches will be used to identify objects and persons, it is essential that we prove able to distinguish between the two. The first scenario provided here considers the identification of objects. The second scenario examines the identification of individuals via biometric universal identification. Both scenarios rely on technology in use currently. These include the Trusted Platform Module (TPM) for object identification and the ICAOStandard for biometric identification systems. The third pervasive computing scenario involves the interaction between vehicles and telematics systems. It was chosen because several experts responding to the online survey regard this field to be one of the earliest applications of pervasive computing. This scenario takes a visionary look into the future and draws upon the findings of current research projects [177].

In this study, security issues are identified in the following three main categries:

- Security: e.g., identity theft, unauthorised access, denial of service, introducing rogue signalling/data messages, generation/modification/replay of correct messages, eavesdropping, introducing malware.
- Safety: e.g., manipulation/cheating of sensors, overstimulation leading to overreactions/mistakes of the driver, incorrect intervention of the system, introducing of syntactically incorrect messages, introduced/inherent malware.
- Privacy: e.g., unwanted/unauthorised acquisition of data relating to vehicle/driver activity, vehicle/driver identity data, or vehicle/driver position.

III.3. Future challenges

In this section, first we address the current and future challenges in three main areas:

- Legal, regulatory and institutional challenges or barriers.
- Social, economic and cultural challenges.
- Technical challenges or barriers.

For more detail please look at Annex B for project examples.

Legal, regulatory and institutional challenges

Should there be legislation which requires mandatory implementation of certain advanced driver assistance technologies? There are also judicial and civil liberties issues that arise with regard to intelligent speed adaptation and there could be great pressure put on manufacturers with regard to services such as adaptive cruise control and the need for supplementary systems including those for collision warnings. In order to achieve benefits with regard to traffic flow and more throughput of traffic may require some level of coordination between manufacturers and government.

There appears to be no existing framework for regulating the inter-vehicle or vehicle-to-environment communications in a holistic way. Although C2C2E communication is widely discussed at the technological and standardization level, regulatory issues have no increased awareness in the community. It is possible that a regulatory framework for C2C2E might be derived from recent regulation existing in the automotive industry, satellite communications and communications in general. A specialized framework has to be created to ensure the economical and technical success as well as the security and safety of such applications. Prior to introducing a specific framework the effectiveness of the C2C2E technology has to be proved first. C2C2E is a technology with strong networks effect whereby the benefit of the technology increases as the number of users grows. Therefore for C2C2E, a certain penetration level in the field is required before the effects can be unambiguously shown. Until this time regulation on the basis of expected safety and traffic flow improvements is not possible before certain penetration is reached.

Certification guidelines are needed across a wide range of areas including safety issues which are very important for all forms of cybernetic transport systems.

Issues with regard to personal privacy and protection of privacy arise across many of the services and applications. How are these best dealt with?

Some studies were undertaken prior to current developments in the area of spectrum management and policy. Therefore current and future plans for spectrum use may have an impact on certain applications and service developments.

Social, economic and cultural challenges

There are a range of questions which arise with regard to social, economic and cultural challenges. Are customers going to be interested in buying vehicles with adaptive driver assistance systems or fitting them out on their own vehicles? Which commercial firms would benefit from these services such as bus firms, trucking firms etc.? Do the safety benefits outweigh the costs of implementation? Is it possible that users would become over-reliant on these types of systems so that manufacturers would need to introduce greater safety margins? There also appears to be a cost issue with regard to development of some of the equipment required. If, at present, the volumes of equipment are not large enough, then the cost of production is too great.

The main social or user issues relating to the individual automated vehicle project were around how these vehicles would operate in a shared environment (with other traditional vehicles) as opposed to a constrained environment such as a campus or private business park.

The consumer market may not yet be ready for some of the location information services and further education may need to take place. The study also identified that the price for the service could be the determining factor of take up followed by other barriers including:

- Equipment that was "technically immature" – too big, heavy and complex.
- Too much information going to the end customer which is not personalised.

Technical challenges

The main technical challenges raised with regard to adaptive driver assistance systems including issues of reliability in the cruise control and stop and go systems due to the complexity of the system with the driver and the driver's environment. There are also issues with regard to training of personnel to use these systems if implemented in a business environment (say by a bus firm).

The main technical challenges found on looking at cybernetic transport systems were to do with human-machine interfaces, fleet management, energy management and remote operation. High bandwidth telecommunications are also required for this system to operate. The interface for the human-machine communication is based on a mobile phone or PDA with specific programming on the device. High speed wireless networks should provide the ability to have browser type access. Finally these interfaces need to be compatible with other information systems that provide advice for customers while travelling. Finally challenges with regard to remote operation were mainly around the environment in which the vehicle was operating. If in a busy city centre then pedestrians, bicycles and other moving travel were difficult and unpredictable.

The main technical challenges associated with the location based service solution using satellite and PDA's fell into three main areas:

- TCP/IP protocols were not optimised due to the constraints of satellite communications. This caused long round trip delays which could hinder operation and introduce vulnerabilities.
- The bandwidth of the 2 way communications service was limited which could then have an impact on the speed and quality of service to end users.
- The size of the mobile user terminal employed to access the in-car broadcast/multicast service was quite big and test users confirmed they would want something smaller.

C2C2E applications have to perform the creation and delivery of value added services to mobile users using multiple communication technologies and paradigms. Mobile users can be classified into the following main categories:

- Pedestrian.
- Public transportation users.
- Vehicular users in both urban and non-urban areas.
- Transportation fleets.

The specificities of each user category raise important challenges for the communication infrastructure as well as for service creation, deployment and management.

One of the first important technological elements under investigation is related to service platforms supporting C2C2E services and applications. A service platform can be defined in this specific context as a mean to provide wireless networking capabilities to users in moving vehicles and mobile users.
A service platform in the context of C2C2E has to deal with a variety of technological challenges including cost effectiveness and attractiveness. The targeted solutions must cope with the special properties of communication traffic. Potential users must see a need for the service to attract car manufacturers to embed C2C2E solutions in their cars.

At the architectural level the software has to act as an abstract layer that hides the specificities of the network infrastructure. This system could be based on a Service Oriented Architecture (SOA) allowing reuse and composition, to share modules between applications, permanence of used technologies, flexibility according to new features and business challenge, openness and interoperability between platforms and environments, distribution for remote access and centralization, independence of modules as well as performance, especially scalability.

To what extent will further improvements in wireless technologies (WiMAX, LTE etc.), sensors such as RFIDs and devices have an impact on the challenges and barriers identified in this section?

III.3.1. Road and urban traffic control

To fully exploit the benefits of such dissemination schemes, research needs to be conducted to design and optimize new dynamic, self-configuring and real-time traffic management schemes to redistribute traffic flows to ensure minimum journey times, fuel consumption and pollution. Routing and data distribution policies suited to the wireless vehicular environment operational characteristics need to be designed and optimized. It is also of great importance to investigate the adequate combination of V2V and V2I technologies to ensure the continuous and cost-efficient operation of traffic management solutions based on wireless vehicular cooperative solutions.

While V2V traffic management solutions can represent a cost-effective solution that allows running decentralized and self-autonomous policies, it does not support the monitoring and participation of road traffic authorities in the traffic management and its performance would heavily depend on the actual implementation degree of V2V communication capabilities in cars. Despite the potential long-term benefits of wireless vehicular communications, their incorporation in cars will be done gradually. In this case, the use of V2I solutions, although with higher costs, can represent a valuable solution to ensure the potential of wireless vehicular communications systems to improve road traffic management is not heavily influenced by the degree of in-car V2V implementation. In this case, V2I communication systems would not only represent a gateway for road traffic authorities but can also act as routing or relaying nodes while V2V communication capabilities are gradually introduced. The understanding of the mobility patterns to be able to define or study what V2V and V2I penetration "threshold" (amount of equipped vehicles, city wireless/cellular coverage) should be reached to enable efficient communication-enhanced traffic management.

The requirement for future standards in the ITS field is to be able to provide multiple services, over multiple platforms, that will work in different countries (as vehicles can easily cross borders), while maintaining a simple-to-use interface that requires minimum intervention from the driver. The safety requirements associated with fast-moving vehicles make this challenge all the more rigorous.

Families of standards already exist, notably:

- Dedicated Short-Range Communications (DSRC), which are mainly used for electronic toll collection.
- 802.11p/WAVE (Wireless Access for a Vehicular Environments), in the popular IEEE 802 family of wireless standards, where work is ongoing on to provide support in the 5.9 GHz band which has been allocated for ITS in the USA and is under consideration in Europe and Australia; and a 5.8 GHz allocation in Japan.
- Cooperative research projects, such as the EU projects CVIS, SAFESPOT, COOPERS, and commercial projects being progressed by ERTICO (European Road Telematics Implementation and Coordination Organization). Other organizations, such as the Car-to-Car Communications Consortium (C2C-CC), which is a vehicle manufacturers' consortium (initially European only), are working mainly on short range communications for driver advisory warning, and eventually collision avoidance, and are preparing requirements for standards, based on the results of their research and development work.

However, systems in use in different parts of the world remain incompatible and fragmented, particularly for 5 GHz systems for which North America, Europe and Japan have different implementations using different frequencies. This problem is being addressed within ITU-R.

In addition to some challenges on the technological level, the focus of interest of the C2C2E community is now strongly addressing standardization issues. With more and more players becoming active in ITS, the interest of developing a global standard for C2C2E is increasing. A very promising initiative is CALM, which tries to bundle many existing terrestrial communication standards, and additionally, to take satellite communication into consideration. With the support of Europe and Japan, CALM has a good basis for becoming a reference C2C2E standard if it is able to cope with the multiple issues it wants to address.

There is a risk that the technologies currently already deployed in the field (Japan, US) will prevail, not necessarily because they are the best but simply because they are already there. This would then consolidate a fragmented ITS environment, and make it problematic for alternative technologies to create a global standard to achieve a breakthrough in the market. This would also be a major challenge for satellite communication in C2C2E, especially without a standard covering a hybrid communication system.

The car manufacturers have also realized that, in order to be able to jump onto the ITS bandwagon, and not to leave the field to manufacturers of nomadic devices, they have to provide the interfaces and prepare vehicle architecture standards being able to support C2C2E applications.

III.3.2. Efficient trip management

In order to achieve the vision of a world where services are made available to all citizens everywhere, at any time, in any condition and by anyone, new technologies for service creation, customization, deployment and provisioning are needed.

Requirements for services:

- Services for increasing the safety of pedestrians in the traffic.
- Services for providing the right information required (e.g., free parking places).
- The right information (context aware, potentially with context prediction) at your fingertip.
- “Easy” service creation for end users, or service providers in a personalized, context aware fashion.
- The right service architecture including algorithms for context awareness/ prediction.
- Tools for semantically enhanced service creation.
- The right set of APIs.
- Smart user interfaces.
- Multimodality of travel information services.

III.3.3. Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications

To guarantee efficient traffic data distribution within vehicular networks, the routing, broadcasting and dissemination communication protocols have to incorporate reliable transmission policies, such as congestion control or back fire algorithms. These schemes will ensure the efficient use of wireless channel resources, maximizing not only the transmission reliability but also the channel occupancy and consequently the system capacity. The developed routing and dissemination protocols have to work also when there is a low connectivity due to factors such as: low vehicles density, low V2V communication capabilities penetration rate, bad radio propagation conditions, etc.

Wireless communications for vehicular applications have not yet reached the “one size fits all” or “one technology fits all” solution. Standards at all layers and their integration are still lacking. Regardless of the selected technology, there are always three competing factors:

- Cost (e.g., equipment cost, usage cost: airtime, flat fee, data volume …).

- Quality of Service (e.g., bandwidth, latency, scalability, …).
- Availability (e.g., coverage area, indoors, outdoors, …).

Communication technologies have considerably progressed, but intense field trials are still needed to achieve requirements in a vehicular environment (high mobility), such as reliability, timeliness, bandwidth, priority, latency, scalability, etc.

Introduction and wide-scale deployment of such technologies have to be faced accordingly by companies, government and road operators, since a minimum market penetration of equipped vehicles and infrastructures is required for applications to work.

Self organizing wireless networks (or Mobile Ad hoc Networks) are providing an innovative way for users to build networks at will. This user driven network, created 'on the fly', dynamically adjusts to conditions as nodes join or leave the network. Such a network can operate in a standalone fashion.

In contrast, the traditional cellular networks such as GSM/GPRS and UMTS networks lie in the category of infrastructure network, deployable by the network operator. The services offered on these networks are managed by the operator who is fully controlling the deployed infrastructure, with no management flexibility for the end-users.

Recently, a third paradigm has emerged called Wireless Mesh Networks which lays half way between the ad-hoc and infrastructure networking domains. Wireless Mesh Networks is an emerging two-tier architecture based on wireless multi-hop transmission. Wireless mesh network technology is believed to be a key technology for next generation wireless networks, showing rapid progress and inspiring numerous applications. The persistent driving force in the development of wireless mesh networks comes from their envisioned advantages including extended coverage, robustness, self-configuration, easy maintenance and low cost.

In spite of the high attention and the massive efforts on research and development, wireless mesh networks have not yet witnessed mass market deployment. However, it is fundamental to consider this technology as a part of the global communication puzzle constituted of various communication technologies that have to coordinate among them to provide the best available services to the end-users.

The objective of Mesh Networking is to facilitate the deployment of value added services to mobile users using a self-organized multi-technologies network infrastructure. This latter is based on the use of the mesh network paradigms along with its integration with other network technologies (ad hoc/ fixed/cellular/satellite). This mainly requires the following:

- As for the communication building blocs, a hybrid (ad hoc/mesh/fixed/cellular/satellite) communication system has to be designed (hybrid routing, QoS and capacity planning, mobility and multi-homing, network selection, etc.) to allow efficient data exchange between the elements of the overall system. This infrastructure should be managed efficiently. The management of such a dynamic infrastructure has to be as autonomic as possible with a minimum human intervention. Thus, the autonomic management of such hybrid communication systems will also be considered.
- From the service point of view, the requirement is the creation of an abstract level that separates the application providers from the infrastructure.
- Broadcasting constitutes one of the fundamental low-level network operations which serves as the basis of higher level applications (such as routing), in mobile ad hoc networks (MANETs). In MANETs, the limited radio range of the nodes, as well as node mobility, causes the unattainability of some nodes at a given time and a highly fluctuating topology. This is the reason why some researchers are focusing on optimizing the behaviour of these algorithms, e.g., maximizing the number of nodes reached, and minimizing both the time required and the network overload.

III.3.4. The mobile office

Designing applications and services which appeal to *"mobile workers"* and cater for distinct usage environments mean that adaptation needs to be built into the system. In the coming age of ambient intelligence, context awareness will become a necessity rather than a nice feature to have. A "one-size-fits-all" approach will not resolve the problems of heterogenic users, devices, services and environments. For services and applications content, for instance, workers will be able to select and mix service/content components, and even create their own services. Furthermore, the availability for a multitude of devices to play content and deliver services requires open interfaces and standards for communications and rendering.

In terms of access, mobile workers are expected to retrieve all kind of digital content and interact with it while being on the move. In terms of collaboration, technologies need to leverage the increasing computing power, data capacity and connectivity of surrounding services, and exploit a distributed concept. Besides, virtual reality and conferencing facilities will enable a more natural and effective team collaboration in the "virtual workplace", and also empower virtual communities to create user-generate services and applications. While cost, and ecological impact of virtual collaboration is obvious, their potential advantages of convenience and practicality are less apparent. Consequently, research needs to focus on creating sophisticated environments, where all the human senses are engaged and where communication via technological means preservers (and maybe augment) the richness and subtle characteristics of human to human communications. This means, for example, that integrating sensors within the transport systems for those using the "mobile office" would help to deliver a better service by obtaining intelligent information from the environment. It would also make the most of resources currently available in the best suitable way.

What happens when the mobile worker hits a technical problem? The virtual team can be expanded by a remote support person. This remote support person needs access to all the information the worker has gathered (e.g., text, images, live-video), as well as special domain knowledge data related to the problem. Remote support scenarios are particularly demanding as they call for a co-ordinated use of communication and mobile access. By offering a uniform framework in which mobile communication and access to information and services can be offered in a synchronized and aligned manner, the future challenges will strongly contribute to mobile ad hoc solution of problems.

Moreover, within the context of mobile office, multimodal interfaces need to be exploited and improved. Speech recognition, tangible user interfaces and emotional user interaction all need to be combined and adapted to provide a suitable working space to the mobile workers.

One of the core pieces of research that needs to be stressed in the field of transport – mobile office, is exploiting new emerging communication technologies (Zigbee, RFID, etc.). It is vital to improve the current state of the art, interoperability, communication continuity, and handoff approaches (in an environment where the communication is not always available) in homogeneous and heterogeneous networks (UMTS, WiFi, etc.), that will be key for providing transparency to the user.

Furthermore, trends of users wishing to access information during their journey (say on a train), implies many people concentrated in one area all requiring a lot of information. The challenge is that the required bandwidth may not be available creating delays and poor quality of service.

Many of the proposed services require the secure distribution of multimedia data or resources amongst a group of users. These users may be on many different networks, using many different devices, belonging to many different organisations with different security solutions. Applying security in such a heterogeneous environment requires new solutions for managing security while at the same time providing the users the possibility to control their identity, personal information, etc.

III.3.5. Security, Trust and Privacy

In this section, we address the current and future security challenges in the following three main areas:

- Technical challenges or barriers.
- Legal, regulatory and institutional challenges or barriers.
- Social, economic and cultural challenges or barriers.

Technical challenges or barriers

Technical challenges are in this context as diverse as the applications that one can think of. From the security point of view guaranteeing the anonymity of users, the trust into the information, the availability of services and the scalability of security applications are important long-term considerations that have to be taken into account.

Privacy as key concern of the user of such systems also remains as a top challenge, as information about the user is measured, transferred stored and distributed in some cases even without knowledge of the user. Enabling the user to stay in control of his personal data is therefore a technical challenge, as the information has to be

handled with, in order to provide certain applications. Therefore, successful deployments of these applications should cover the span between these two interests.
Additionally, interoperability between old and new technologies can be viewed as a hurdle that has to be cleared. In early deployments secured applications, entities and infrastructural elements have to cope with unsecured traditional technologies in some case allowing communication with them or access from or to them, which may lead to an endangerement for the whole security process.

Finally, interoperability between different new, innovative solutions can also be viewed as an unsolved challenge. As new ideas for new applications arise, researchers and industry leaders have to envisage that their solutions will in some case have to communicate with each other. Therefore, techniques must be found that guarantee an unbroken chain of security, independent from technical implementation. One facet of this barrier is for example the distibrution of keys for secure communication between operators, system- and parts- manufacturers or service providers.

Legal, regulatory and institutional challenges or barriers

The differences between national laws can be considered as a major challenge concerning secured applications. Security mechanisms are often linked with export restrictions, which already is a concern for traditional applications that are marketed internationally. Considering applications using these functions whilst travelling through different regions of the world lets this concern weigh even more.

Furthermore, legal aspects like the interest of a nation can be a big challenge either, when for example one nation has big interest in the protection of its citizens' privacy while another nation wants to stay in control of their citizens and collect as much data as possible about them. Another example is, in one nation it could be determined by law that user information that needs to be exchanged between network elements has to be anonymised while in another nation it could be determined by law that anonymous services are forbidden. If applications that move through different countries using such services these legal aspects can be viewed as a barrier, with which must be dealt with in some way.

Social, economic and cultural challenges or barriers

One of the main economic challenges for secure applications in the transportation domain is obviously the expense factor of deployment of security. As mentioned earlier, security stays unrecognised when implemented in a good manner. Therefore, the higher the cost for securing ones applications, the larger the hurdle.

Furthermore, new infrastructures for e.g. communication have to be established and maintained and decisions have to be made on how the security is provided. If for instance one innovative system manufacturer (e.g., a car manufacturer) decides to integrate applications with certain security functions, but infrastructure maintainers decide not to consider these security functions, then the system could be cut off, which of course is undesirable. Researchers should therefore keep an eye on providing hybrid techniques or standardising functions and applications as possible, in order to avoid these challenges.

III.3.6. A Global Perspective for a Transport Scenario

This is a scenario for 2025+ in which the role of mobile and wireless solutions and indeed the Future Internet are in full play enabling forward thinking governments to meet their transport policy goals through innovative technical solutions. The visions of Intelligent Transport Systems (ITSs) which were only just coming into play ten years ago are now a reality. For example cooperative systems which facilitate vehicle to vehicle (V2V), vehicle to infrastructure (V2I) and infrastructure to infrastructure (I2I) communication are in place and growing. Road safety has greatly improved with the successful introduction of driver assistance systems. Navigation and tracking systems for monitoring business deliveries have been introduced overcoming initial privacy concerns. Success has meant that the scale of deployment of ITS across Europe is widespread enabling the greatest benefit for all citizens. Standards have been harmonised for ITS implementation with the particular focus on cooperative systems.

In the next sections we provide one scenario of the possible future for land transport which relates to the key research areas of the SAA and concerning the topics:

1. Government policy and regulation.
2. Industry structure and technology.
3. Socio-cultural aspects.

4. Economic and environmental aspects.

1. Government policy and regulation

There has been a European legal framework put in place to facilitate trans-national aspects of intelligent transport and member states have implemented their own strategies and action plans. The European principles on safe and efficient in-vehicle information and communications systems were employed as an input to a wider regulatory framework for safety issues.

Government assistance in the form of both light and strong regulations have been successful in overcoming issues such as concerns on personal privacy and data protection concerns, financial interventions in the form of structural funds, grants, etc. and setting policy at national, regional and local levels where appropriate, all of which tie together both European and national government transport policies. Liability issues were a great challenge to overcome and in particular those related to ITS applications and in-vehicle safety systems. However, legal specifications with regard to issues such as product liability were developed and tested by the end of the timeframe.

Consensus building, dissemination and coordinated deployment across the EU has facilitated a synchronised approach. Common methods were employed by governments at national, regional and local levels in urban, sub-urban and inter-urban levels while recognising the differing needs of countries. Governments at all levels worked with all the stakeholders in the value chain to ensure the integration of the many vehicle management and monitoring systems which led to reduced congestion.

2. Industry structure and technology

ICTs have been a key enabler in the development of Intelligent Transport Systems and more effective and efficient use of road infrastructure. Intelligence (sensors) has been embedded into cars, buses, taxi's, freight vehicles, roads and related systems such as traffic signals and full on board assistance to motorists has arrived. All forms of real time data on performance and traffic monitoring is provided to the drivers of vehicles and to the wider industry. Industry is able to turn the data into useful management information and vehicles use the data directly as required through sophisticated data collection and analysis processes.

These solutions have enabled multi-modal transport and the sharing of information and applications across a journey. Inter-modal transfers have improved efficiency for businesses such as freight logistics firms. The interoperability of a combination of products and applications from various suppliers, manufacturers, telecoms providers and road operators is now fully functioning. The collection, processing and management of data and turning that data into useful information for all road users takes place automatically.

The availability and immediacy of personalised information has grown for all users of transport systems. This has been in part as a result of ITS which provided a wide range of real time information services to consumers. The integration of the location based information with bus, train and aircraft services has ensured that consumers have vastly better information to hand to plan and enact their journeys. This in turn has cut down on lost time, wasteful carbon emissions and traveller frustration.

Cooperative systems were successfully promoted by the industry which have included cooperative driving and anti-collision and warning systems that have improved road safety. This success has included harmonised specifications for various forms of cooperative systems (V2V, V2I and I2I).

Some safety applications will make high demands on quality of service parameters of the communications network and low latency. Others such as a warning to reduce speed for a bend in the road will not be so demanding given the nature of the application.

The human machine interface (HMI) design of systems has been created to fit both driver and vehicle. For examples various modes of informing the driver have been introduced (haptic, acoustic and visual for example).

3. Socio-cultural aspects

Society's attitudes to personal travel and personal mobility and freedom of movement have grown in strength. This has put increased pressure on society to use intelligent transport solutions and accept the potential further intrusion of monitoring that may be a by-product of the system. For example acceptance of wireless sensor networks in a personal context has led to further acceptance of wireless sensor networks and applications in the wider environment. In addition, mobile devices are now fully context aware and able to provide multi-modal (train, road, rail, bus, plane) applications to customers. For example, a rail customer is alerted that his train will arrive late so his electronic calendar (also alerted) automatically sends an update to alert the person he was meeting to the delay. The device also looks at various alternative travel options should the delay worsen and provides maps, directions and timings.

Awareness and understanding of the benefits of intelligent vehicles and related cooperative systems has influenced users purchasing decisions both during the choice of a new vehicle as well as considering retrofitting equipment to current vehicles. Awareness rising was undertaken across the range of related stakeholders including the public sector, manufacturers, auto makers, etc.

User friendly human-machine interface solutions have been developed which enable drivers to easily access the technology without putting themselves or other road drivers at risk. Reliability of the technology is quite high so that users do not feel they are putting themselves at risk by relying on cooperative systems.

Privacy issues have begun to be overcome with regard to users accepting a higher level of "surveillance" in their day to day lives. This "surveillance" comes from the use and acceptance of satellite and cellular positioning, identification of things through RFID and "condition monitoring" (people or things) via sensors.

4. Economic and environmental aspects

In this world economic growth has rebounded dramatically from the financial and economic depression and stagnation of 2008 and 2009. Countries which suffered during high levels of borrowing and high GDP to debt ratio's in 2009 and 2010 have since taken tough action so that by 2025 + there is sufficient capital to invest in the infrastructure and services required to enable this scenario to unfold.

Issues regarding the end customers' willingness to pay for systems on personal or business vehicles have been overcome through economies of scale and scope for manufactures and better public information provided on actual costs. In addition, operating costs have come down to reasonable levels to make the applications practical for most users.

Positive environmental benefits such as lower carbon emissions have arisen from the better management of road traffic and lessening of congestion through the use of intelligent transport systems.

InTable III. 1 a summary of applications and services, their required technologies and related end user issues is illustred.

Table III. 1 – Summary of applications and services required technologies and related end user issues.

Services and Applications	Technologies	End User Issues
Advanced Vehicle Control systems Travel Information Traffic Management Information Public Transport Applications Digital Mapping solutions Smart Card solutions Metering and toll collection applications Context aware applications such as city navigation Location based services	PDA/Laptop Mobile Phone GPRS Intelligent vehicle terminals RFIDs, sensors Fixed, mobile, wireless, satellite comms networks In-vehicle software Smart, realtime maps Intelligent agent technology Speech recognition and voice interfaces In-car navigation systems Telematics Harmonised spectrum	**Technical issues** quality of service from devices in vehicles and from the networks providing connectivity avalilability of high bandwidth connectivity for some applications creation of standards for C2C comms interoperability with existing systems systems which facilitate multi-modal transport heterogenous devices able to communicate with each other **Human issues** safety issues arising from drivers given too much non-structured information trust and confidence in data security and safety liability issues should something go wrong **Organisational/Administrative** Links with national and international transport policy and law Economics of scale and scope for building equipment

IV. Environment

IV.1. Description

IV.1.1. Vision

The environment is a constant consideration in our lives, including the development of technologies and their associated impact on the environment. Therefore the main vision when addressing the environment as a topic area is described in the following statement:

"We live surrounded by natural and man made hazards that, with advances in technology, can be monitored, in order to provide the necessary alerts; but this technological evolution also translates into greater implications for our natural resources, requiring efficient technical solutions, so that we can live in a cleaner and safer environment."

We focus our research on four domains where mobile and wireless communications can have a positive impact on our environment and lives:

- Monitoring.
- Alarms.
- Efficient resources management.
- Technology waste.

IV.1.2. Monitoring

Our plannet is constantly changing, and one of the major issues that exist is how to be able to predict events that may impact on the people's lives. Through the monitoring of some environmental parameters, it is possible to study their behaviour and evolution, enabling to take the necessary measures to prevent catastrophes. There are parameters strictly of natural origin (e.g., geographic) and others were society and people may contribute significantly or even be the sole responsible for (e.g., radiation, pollution).

The impact of using ICTs in this area is huge. The ability to collect data and disseminate information, allowing a wider knowledge data base and efficient means of monitorization of people's quality of live is of extreme importance. ICTs can be used in different applications and several Projects that have been conducted state so, some examples are presented in Section IV.2.

IV.1.3. Alarms

When considering the environment one of the major issues that we have is how quickly it can change around us. These changes can be quite harmfull to the people that are affected by such changes. So it is important to have means of sounding alarms to the changes that are occurring, in order to take the necessary measures to decrease the impact of these events in the populations and regions.

There are several areas were the usage of a sensor networks in order to monitor and give alarms an event is extremely helpfull, for instance, to detect floods, fires, vulcanos eruption at the surface, and many others. Some applications have already been approached by several European projects and their requirements and limitations are focused in Section IV.2.

IV.1.4. Efficient resources management

Now days, one of the major issues that we are facing regarding the environment are the limitations that we have in terms of the natural resources usage. The natural sources of energy (e.g., oil) and also the impact that its exploration has on the planet and economy is becoming an unavoidable and very important topic. As such, the different applications that can contribute to have a more efficient management of the planets natural resources are on the spotlight. There are several projects that aim at contributing to an efficient resource management, not only directly related with energy, but other areas as well, e.g., through the use of ICT redce the risk of natural disasters and improve the capacity of response to such events.

In Section IV.2., some projects regarding this area are presented, as well as some of their main conclusions and requirements.

IV.1.5. Technology waste

Our society is more and more a consumption society, a disposable consumption society that produces large quantities of waste. A large quantity of this waste is coming from the technology usage, e.g., PCs and mobile phones. So, when considering the environment it is inevitable to consider the impact that the amount of waste produced has on the planet, and some questions arise:

- Where does the waste go?
- Is it possible to reduce the waste by recycling? How can it be best recycled?
- How can ICT help reduce the technology waste that surrounds us, on earth and event around the planet?

These are some of the concerns that must be given consideration in the near future.

IV.2. State of the art

In this section a brief description of some projects and their contributions in the four domains is given (a more detailed description can be found in Annex C).

In FP5 the Key action 1 – Systems & Services for the Citizen (1998-2002) [178] consisted of 5 themes, including one on environment that had 3 clusters, two of which focused on the four domains considered. The Intelligent Systems for Risk & Disaster Management cluster focused on generating more accurate and earlier prediction of natural disasters by improving the information dissemination process and through better planning of long-term cross-border strategies. Within this cluster other goals were to:

- Minimise health risks and fatal injuries from natural disasters.
- Reduce costs and financial losses through coordinated emergency procedures and information exchanges, and, ultimately.
- Limit environmental damage.

The Intelligent Environmental Monitoring and Management Systems cluster aimed to concentrate on providing and/or integrating environmental monitoring and management tools, such as decision support systems, intelligent data capture networks, innovative real-time information systems and novel sensors. The challenges were addressed under three headings:

- Air and noise: real-time predictions of air quality and levels of noise.
- Water: sustainable management of inland, coastal and marine waters is critical.
- Natural resources: intelligent exploitation of natural resources via optimised monitoring, rationalisation of costs and sustainable development solutions.

In FP6 (2002-2006) [179] research focused on ICT for environmental risk management, including both environmental monitoring via open information architectures and sensor networks as well as ICT-enabled management of emergencies, and natural and man-made disasters via early warning, alert and rapidly deployable telecommunications.

In FP7 Challenge 6 - ICT for Mobility, Environmental Sustainability and Energy Efficiency (2007-2013) [180] there is the opportunity to broaden the scope of challenges to be addressed, beyond environmental and disaster management themes (FP6). In this respect, future Research & Development on ICT for energy efficiency and on other emerging fields, such as the interactions between environment and health, is envisaged.

Also in FP7 Environment there is a concern with the waste, e.g., on the use of new technologies for waste sorting and waste prevention (from an industrial networking and zero-waste entrepreneurship point of view) [181].

There are also several reports (e.g., [182], [183]) focusing on the reduction of a carbon footprint through the use of ICTs.

Analysing the different projects illustrates where the four domains overlap or complement each other when the applications are assessed. For example technology enables monitoring of the water levels and activation of an alarm if the reference level is surpassed, that makes the service requirements a mix of the alarm and the monitoring domains.

Also, many projects focus on the way information is disseminated (e.g., OSIRIS) and transmitted (e.g., INTERACT). These projects aim to provide frameworks, methods (e.g., FORMIDABLE) and decision support systems (e.g., FORFAIT) in order to support the environmental authorities and help make the information comprehensive to the different actors.

Taking into account the projects' contributions, a summary of some applications for the 4 domains is presented.

IV.2.1. Monitoring

Marine environmental response data management and acquisition [188].

- Description
  A seamless, minimum intervention link to allow end users working in the marine environmental emergency domain, to access and use large distributed datasets of environmental parameters (a web-enabled neutral formats for environmental data transmission and exchange).
- Utilisation
  For cataloguing, storing/referencing and accessing of environmental datasets, providing the user with the ablity to search for, choose, purchase and download data subsets for their specific and immediate data requirements.
- Components
  Requires environmental datasets.
- Characteristics
  Unknown.
- Requirements
  No new infrastructure is required.
- Traffic
  Unknown.
- Entities
  End users who provide services to the citizen, e.g., in dupport of maritime emergencies (maritime pollution, search and rescue).

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Near Real time.
- Symmetry of the connection
  Asymmetric.

- Bit rate
  Unknown.
- Maximum transfer delay
  Unknown.

Robot for volcano exploration [189].

- Description
  An automatic robotic system to explore and perform measurements in a volcanic environment, integrated in the volcanic surveillance system to be used when the approach to active vents becomes too dangerous for human live but information is vital for a correct forecast of dangerous eruptions.
- Utilisation
  In order to minimize the risk for volcanologists who are involved in work close to volcanic vents during eruptive phenomena. Observations and measurements of the variables relating to volcanic activity are of greatest interest during paroxismal phases of eruptions, which unfortunately are also the time of greatest risk for humans.
- Components
  Requires the use of sensors (integration of a variety of sensors for robust localisation and environment reconstruction, an effective user interface) and GPS.
- Characteristics
  Unknown.
- Requirements
  No new network requirements.
- Traffic
  Unknown.
- Entities
  Civil Protection authorities.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Unknown.
- Maximum transfer delay
  Unknown.

User-centric collaborative decision support network for water and air quality management [190]

- Description
  An innovative collaborative decision support network for exchange of location-based environmental and health services between all stakeholders, for enhanced capacity to assess population exposure and health risks and better management of the concerned ecosystems. It will include health indicators as integral part of the environmental management. It aims at research and development of an architecture and technical solution for integration of services.
- Utilisation
  Integration of services, linking water, air and health domains, providing information through a user centric decision support network, filling the existing gap between environmental management and the health management systems.
- Components
  Developing of a generic ICT solution that combines service-oriented-architecture (SOA) and user-centric approach (peer-to-peer network, P2P) by fusion of location-based environmental and health data, information and modelling services. This collaborative peer-to-peer network, as an integral

part of the Single Information Space for the Environment in Europe, is to be validated through test cases on fresh surface water and outdoor air quality in the Netherlands, Portugal and Italy..

- Characteristics
  Unknown.
- Requirements
  Unknown.
- Traffic
  Unknown.
- Entities
  Environmental protection agencies, health institutions and service providers, policy makers, citizens in general and environmental communities in Europe.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Unknown.
- Maximum transfer delay
  Unknown.

Distributed information acquisition and decision-making for environmental management (DIADEM) [191]

The Prime Objective of the Diadem project is to create an ICT system for collaborative decision making that effectively supports the protection of the population and the environment against chemical hazards in industrial areas.

This is achieved by combining:

- Advanced gas detection and monitoring approaches supporting enhanced situation awareness.
- Methods and tools facilitating collaborative decision making in involving many emergency management professionals.
- Advanced human machine interfaces supporting efficient exploitation of human cognitive capabilities.
- A service oriented framework which facilitates large scale collaborative decision making processes involving professionals from multiple, geographically distributed organizations.

The resulting systems will contribute to safer and healthier environment in industrialized areas in different, complementary ways:

- Mitigation of consequences of catastrophic chemical incidents through quick and reliable gas detection, monitoring and extremely efficient decision making processes.
- Prevention of catastrophic chemical incidents and reduction of chemical pollution through planning based on collaboration of many experts and efficient use of advanced tools.
- Prevention of chemical air pollution in industrial areas. By being able to quickly detect and discover the sources of pollution, the environmental protection agencies will able to enforce stringent regulations upon the industry.

Advanced spatial analysis tools for on-site environmental monitoring and management (HYDROSYS) [192]

The HYDROSYS consortium addresses the need to take a closer look at environmental processes as a response to the continuously increasing pressure on our ecosystem. HYDROSYS extends current practice by enabling on-site data collection and visualization, supporting new ways of observing environmental processes.

It aims at providing a system infrastructure to support teams of users in on-site monitoring events analysing natural resources. The project introduces the concept of event-driven campaigns with handheld devices, potentially supported by an unmanned aerial vehicle (UAV). In these campaigns, users can setup and retrieve data from mobile sensorstations, the UAV and external sources (sensor network) generating dense information on a small area. The sensor network system gathers and stores sensor data, and processes simulations based on physical process models. To obtain rich data sets from a specific location, additionally, remotely controlled cameras are deployed, mounted on sensorstations and below the UAV. Users can analyse the environment using cell phones and handheld computers, supported by advanced user interface techniques. The system is validated in two application areas, dealing with pollution caused by storm water, and permafrost melting.

IV.2.2. Alarms

Volcano Early Warning Systems [185].

- Description
  A software package designed to recognize the early signs of reactivation of magmatic activity within the crust that might lead to a volcanic eruption at the surface.
- Utilisation
  Used as an early-warning system, including the basis for hazard assessment, vulnerability and risk studies as well as for and emergency planning. In addition, the new information system incorporates educational information accessible to the public in order to generate awareness.
- Components
  Require monitored geodetic, seismic and geochemical data that together with satellite images are transferred and unified in a coherent way to allow integration into a geo-spatial information system (GIS). In case of reactivation, implementation of real-time monitoring into the early-warning system would then permit volcanic eruption prediction (long-term) or forecast (short-term).
- Characteristics
  Unknown.
- Requirements
  No new infrastructure is required.
- Traffic
  Unknown.
- Entities
  National councils and civil protection agencies.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Unknown.
- Maximum transfer delay
  Unknown.

Anti-Pollution System [186].

- Description
  An airborne Synthetic Aperture Radar (SAR) remote sensing system, dedicated to oil-spill.
- Utilisation
  To address maritime oil-spill pollution monitoring in an emergency situation as well as in routine surveillance mode; to support operational clean-up actions, through sensor information integration,

efficient man-machine interface and decision aids, developing detection, estimation and tracking functions.

- Components
  Requires data from aircraft and satellite sensors.
- Characteristics
  Unknown.
- Requirements
  No new infrastructure is required.
- Traffic
  Unknown.
- Entities
  National councils, civil protection agencies and anti-pollution operators.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Unknown.
- Maximum transfer delay
  Unknown.

Climbing robot [187].

- Description
  A low-cost climbing robot to convey sensors to remote parts of large structures, with robotic methods of attaching sensors to the structure, advanced sensors for surface inspection using visual, acoustic, magnetic and radar sensing techniques and a user interface supporting robot navigation, data acquisition and display, and analytical facilities.
- Utilisation
  For structural risk assessment to remove the need for human climbers, who are scarce and expensive, and not well-suited for carrying out objective, repeatable inspection protocols.
- Components
  Requires the use of sensors using visual, acoustic, magnetic and radar sensing techniques.
- Characteristics
  Unknown.
- Requirements
  No new network requirements.
- Traffic
  Unknown.
- Entities
  Operators of large infrastructures.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.

- Bit rate
  Unknown.
- Maximum transfer delay
  Unknown.

CLuster Initiative for Flood and Fire emergencies (CLIFF)

CLIFF [184] aimed at improving on-going disaster management applications as well as simplifying the development of new systems by increasing and optimising the contribution of the earth observation data, by paving the way towards the standardisation of the various components. Its key output was a set of documents providing a framework for the standardisation of critical components for the disaster management activities. There was a review and analysis studies of flood and fire projects taking into account the application specific issues (e.g., data flow, models), meteo, and service aspects (e.g., telecommunications, user interfaces). For each of the topics best case practices were identified as well as remaining weaknesses.

IV.2.3. Eficient resource management

Virtualisation and managing the energy consumption of household appliances [196]

- Description
  To foster a harmonised technology for managing in real time the energy consumption of appliances at home, interworking this information to communication devices over the home network and virtualising it. To provide a generalised method for managing the power consumption of devices that are, either powered on or in stand-by state. Especially for the second category of devices, the project will conceive autonomous, self-programmable mechanisms for stand-by state detection and power off, using all-device-fit, harmonised, own-developed interfaces
- Utilisation
  Make the managing of energy consumption available to users through home communication networks in the form of standalone or network operator services.
- Components
  Require an harmonisation of technology.
- Characteristics
  Unknown.
- Requirements
  Some domestic appliances may require new technology.
- Traffic
  Unknown.
- Entities
  Unknown.

Technical Characteristics

- Time dependency
  Time-based.
- Delivery requirements
  Real time.
- Symmetry of the connection
  Asymmetric.
- Bit rate
  Unknown.
- Maximum transfer delay
  Unknown.

European ICT environmental sustainability research [193]

It aims to promote and extend the European exchange of knowledge and information on environmental issues for a sustainable environmental development based on a well-established network.

The overall idea of the Support Action includes the following activities:

- To identify relevant application areas for ICT for a sustainable development.
- To expand the existing network with experts from EU27+.
- To organise two enlarged EnviroInfo conferences.

Finalizing with recommendation and a roadmap for inter-/transdisciplinary research to strengthen the European research area in the field of ICT for environmental sustainability.

Friendly Operational Risk Management through Interoperable Decision Aid Based on Local Environment [194]

The main objective was to propose a European standard methodology for natural hazards management and to develop an interoperable support system prototype which integrates the resulting guidelines. It aims to address the general lack of co-ordination and poorly unified approach to emergency management scenarios, having to include flexibility and simplicity to ensure efficient intervention and immediate relief to the affected citizens.

Forest fire risk and hazard assessment [195]

It set out to develop and demonstrate a decision support system to assit planners, regulators and industry in optimising the management of forest fire risks, on a holistic, integrated and traceable basis. Its objectives are to contribute to the protection of national resources and improvements in health and safety s applicable to forest fires, and to integrate established emerging technologies, including electronic data gathering, in order to design and build a decision support system for use as a tool in planning, educational, regulatory and business contexts.

IV.2.4. Technology waste

Regarding technology waste there aren't ICT Projects, since there isn't a specific ICT call, but there are some Environment projects that focus on the use of new technologies for waste sorting and waste prevention (e.g., SORT IT [197], ISSOWAMA [198]).

Towards zero waste in industrial networks (ZEROWIN) [199]

The project will define a common vision on zero-waste entrepreneurship. The mythos Individual Producer Responsibility will be investigated if it can become the all-healing-solution in electronics industry as well as how this concept can be applied to other industrial sectors. The knowledge on new technological developments, waste prevention methodologies and strategies, and adaptation of existing software tools supporting waste prevention, will be formalised into an innovative production model for resource-use optimisation and waste prevention. This work will enable 9 industrial case studies to implement this approach.

Development and application of standardized methodology for the PROspective SUstaInability assessment of TEchnologies (PROSUITE) [200]

The main goal of PROSUITE is to develop a framework methodology, operational methods and tools for the sustainability assessment of current and future technologies over their life cycle, applicable to different stages of maturity. The project will apply the methodology for four technology cases with close consultation of the stakeholders involved, which includes cases from biorefineries, nanotechnology, information technologies, and carbon storage and sequestration. It will create a solid research basis for technology characterization, including the identification of decisive technology features, basic engineering modules for estimations of material flows and energy use, and learning curves.

The use of various multicriteria assessment methods (economic, environmental and social) will be explored to aggregate across indicators. The methods developed will be part of a decision support system, which will be output as open source modular software.

IV.3. Future challenges

In this section some of the current and future challenges of applications and services considering the development of new and emerging technologies that support the environmental agenda are addressed. The areas for consideration include:

- Legal, regulatory and institutional challenges or barriers.
- Social economic and cultural challenges.
- Technical challenges or barriers.

Considering the four key areas – Alarms Monitoring, Efficient resource management and Technology waste – there are events and phenomena raising awareness for new needs and requirements. These key areas are increasingly important, given global drivers such as public safety and sustainable growth. All the solutions require investment and must show results which are measurable and economically viable in the long term. The mix of solutions can potentially address a large commercial market on a global scale. The drivers for the various solutions derive their specifications from risks caused by natural phenomena (volcanic activity, earthquakes), those caused by human activity (production methods, handling of waste, choice of materials and components) or an unforeseen hazardous deviation causing a serious risk to human life (chemicals used in food substances, issues with safety in public places).

IV.3.1. Alarms & Monitoring

Alarms per se are currently isolated systems, triggered by set limit values. They provide a warning signal once a risk has already been identified. Future opportunities lie in combining monitoring and alarm solutions. Furthermore, gathering data from distributed sources and processing the inputs over the network, will reduce the need for components of a single terminal. Lifespans will also be extended in the future, as solutions and applications are increasingly becoming software driven, such as:

- Recognition and prevention using learning systems (pervasive computing, data mining, neural network applications able to process and analyse data).
- Linking servers through robust and reliable transmission channels to multiple kinds of terminals (such as, positioning-enabled terminals receiving warnings based on direct satellite signal, also A-GPS, mobile network station, DVB-H, WLAN/Wi-Fi, and short range sensors and transmitters connected to a remote server storing and packing the data for later use).

Globally distributed and interconnected systems could transfer an alarm at one location to a pre-warning signal in the surrounding areas and countries, such as forest fires or other sources of hazardous or harmful chemicals spreading over wind or water. The challenge lies in setting standards and conventions surpassing national and language boundaries, but also political and legal issues. Product reliability, other legal issues as well as prevention of malicious attacks and viruses are also major considerations for such critical systems.

An example that focuses on some of the issues regarding these topics is presented below.

Remote and wireless monitoring of various environmental sectors in relation to the use of Meteor Burst Communications

Remote monitoring is a well established area both in the communications sector and the utilities and environment sectors. Wireless communications serves as the platform for the delivery of services with new dependencies beginning to emerge due to the over dependence on public cellular operators. This has meant new innovative methods are introduced to ensure these dependencies can be mitigated. In the last 10 years GSM technology throughout Europe has been able to serve the needs of businesses for monitoring of environmental and control systems. It is only when rural/remote monitoring becomes a requirement that other networks and systems are used.

Meteor Burst Technology is in sporadic use across the world. In Europe the UK has adopted this technology for remote monitoring of environmental systems.

Legal, regulatory and institutional challenges

The authorisation of the communications solution chosen for water quality and air quality monitoring is left to the utilities and environmental sector to decide. Usually the most cost effective approach would be the most preferred solution. However there are some factors which contribute to the decision for a less cost effective but more practical solution, such as:

- Remoteness of deployment.
- Specialist monitoring equipment used.

Meteor Burst is a technology predominantly deployed within the UK and the US that is used to monitor different types of applications with environmental monitoring a large proportion of its use. The technology operates within an internationally recognised spectrum band allocated for fixed and mobile by the ITU in region 1 at 46/47 MHz and 49 MHz. This spectrum is a licensed band within the UK but is only occupied by one main user who operates nationwide. Other European countries use this spectrum for many different applications such as short range devices, radiolocation systems and amateur radio enthusiasts which presents some distinct difficulties for expansion across Europe.

Any foreseeable challenges may emerge in the regulatory spectrum area. This is where regulators are identifying spectrum that now has a value use and apportioning set fees to the spectrum. This incentive pricing structure encourages efficient use of spectrum which, it can be suggested meteor burst technology does not offer.

Two key challenges surrounding this technology are mainly its low density of usage and difficulty to become more widespread which thus negates any possibility of economies of scale, enjoyed by more popular technologies such as GSM and GPRS. It is possible regulators may wish to see more of an efficient use by meteor burst technology operators which could be a challenging prospect to overcome. However, the probability is quite low due to the very limited alternative uses that could offer any improvement in value.

There is very little in the way of legal and regulatory challenges to overcome in this niche sector. This is mainly due to the limiting factors present when deploying the system. The system offers a simple cost effective solution whose main barriers reside on more of the commercial and technical issues rather than the legal, regulatory or institutional issues.

Social, economic and cultural challenges

Meteor Burst technology has a limited user base and small target market. However, it is considered to be a cost effective solution compared to other wireless technologies. The technology offers a unique proposition that can be fulfilled by alternative technologies such as GSM, GPRS or satellite. Meteor burst is not able to compete with these technologies on a technical level but there are some benefits to using it, namely:

- Long range communications.
- Very good coverage area in remote regions.
- Cheap to maintain, service and operate.

The benefits are only realised in very rural hard to cover areas of the country where most cellular or even broadcasting coverage is not served. This attractive coverage footprint although relatively cheap to deploy in contrast with more traditional fixed or mobile applications can only offer, small quantities of bandwidth for data logging or control applications. It is therefore mainly found in industries where this application is most suitable like environmental, water treatment and system processing.

The main economic challenges are cost of deployment and widespread deployment of equipment. The cost to build the meteor burst equipment remains high due to low density of usage for the niche market base. In addition, the discrete components are proving to be difficult to obtain as technology advances. This may hinder further development of the technology.

The technology does successfully serve a societal purpose and that is to assist with environmental monitoring. The challenge however is it’s not a very modern or up to date technology and could be considered old technology. The general perception is that it is very much fit for purpose and does not serve a wider more popular remit.

The technology would require some major investment for further development that would help reduce costs of components and the improvement of the integrated system design.

Technical challenges

The types of deployments for meteor burst can be restrictive due to the low frequency band of operation and the large type antennas that must be used for longer range use. In addition, for the long distant signal hops the propagation parameters rely on the meteor trails to maintain the link and these meteor trails are unpredictable and can mean the longer distance hops can be unreliable and intermittent. In more recent times more advanced technologies have provided a useful cost effective alternative where coverage allows. Unreliability of the communications link can mean delays in the system which can often mean the requirement to back up information locally.

Meteor Burst does not support high data rate applications and therefore does not cope well in real time related environments. This further limits the type of applications that the technology can be used for.

Another technical challenge with meteor burst technology is the susceptibility to interference from noisy, heavy plant machinery. It is this environment where electromagnetic compatibility of large equipment can cause interference into the meteor signal reception.

Further development of the technology may assist with overcoming the technical challenges in addition to incorporating modern style compression and processing techniques which may prove to be more spectrally efficient.

Meteor Burst Technology (MBT) is deployed in some niche areas that may prove useful on a wider European scale. For example, in the United States MBT is used by government agencies for the collection of weather data. In Alaska the Alaskan Meteor Burst Communications Systems is used to collect data for the National Weather Service from automated weather stations as well as occasional data from other US government agencies. This type of system could be worthwhile from a wider European perspective where more remote regions could use this system for very wide area remote data collection.

IV.3.2. Efficient resources management & Technology waste

Efficient resource management is measurable through assessing the ecological footprint and life cycle management. For example there are increasing amounts of hazardous waste resulting from manufacturing processes and discarding devices such as mobile phones. The proactive solution focuses on designing for ecological sustainability taking into account battery life and reusable materials.

Mobile devices and desktop or laptop computers are increasingly software-driven. Thin mobile clients, with software radio features and network-based applications, will allow for a longer life span and versatility.

One of the main issues regarding environmental monitoring is to provide guidelines that facilitate critical information availability, as well as the way the information is computed, transmitted and delivered. Usability and reliability play a key role in new solution design and implementation. It is also important to increase the collaboration between environmental organizations, the public sector and industry in order to focus on the most imminent risks, allowing the technology to improve the security of the professionals involved and the way it affects their lives and work.

Given the current focus on energy production and consumption (e.g., oil), there is great concern to improve and find new and more efficient ways of producing energy and produce/recycle electronic components in an environmentally friendly way. The ecological or carbon footprint has been created as a tool for allocating the environmental impact of products and services. This serves not just for national fiscal (e.g., tax) purposes, but also for consumer awareness and criteria for public sector and large corporation purchase and partnership policies.

The "green" topic is surely one of the main focuses on applications and services in the next 10 – 15 years, and the topic of energy efficiency one that provides great challenges ahead, as such, a more extensive approach on this topic is given below.

Energy Efficiency

A statement that it is generally accepted is that Energy Efficiency is one of the key issues to be considered when addressing global warming and climate changes. It is, in fact, the key factor for a sustainable economy. This statement is indeed shared and recognized by all major stakeholders, including the European Union (EU), which clearly include Energy Efficiency in its main targets for 2020:

- Reducing carbon emissions by 20%.
- Increasing the share of renewables in energy consumption to 20%.
- Saving 20% of the EU's energy consumption.

The achievement of these goals depends on the answer that all economy sectors are willing to provide, requiring in many cases a profound transformation of the current situation and trends. Due to its great impact in the economy and in society in general, the ICT sector is well positioned to assume a leading role on promoting energy efficiency across all energy-use sectors. Despite ICT sector being responsible for about 2% of carbon emissions, it can contribute to cutbacks of about 15% by enabling technological improvements in other sectors,[183] and [201].

This role is acknowledged by all major stakeholders, for instance:

- "Information and communication technologies (ICTs) have a major role in improving environmental performance and addressing climate change across all sectors of the economy" – *High-level OECD Conference ICTs, THE ENVIRONMENT AND CLIMATE CHANGE, Conference Summary*.
- "…On top of all these multiple crises, we have the most pressing issue and urgent issue of climate change. We talked a lot about climate change yesterday, and this information and communications technology can bring great tools. …" – *UN Secretary-General speech, attending ITU TELECOM WORLD 2009*.

In the context of this general acceptance, the EU has published a recommendation "on mobilising Information and Communication Technologies to facilitate the transition to an energy-efficient, low carbon economy", [202]. This recommendation aims at promoting the cooperation of the ICT with other sectors in order to ease the transition to an energy-efficient, low carbon economy. The mandate is clear, the ICT sector should:

- Be committed on promoting a measurable and verifiable reduction in carbon emissions of its own processes.
- In close cooperation with the buildings and construction sector, identify solutions to improve energy efficiency of new and existing buildings and constructions.
- In close cooperation with the transport and logistics sector, identify ICT solutions to improve the environmental and energy performance of their services.

As identified in the EU recommendation, and in several other studies ([183] and [201]), buildings and construction, transport and logistic, together with power transmission and distribution are the sectors were ICTs can deliver greater improvements. Quantifying this untapped potential, recent studies estimate that ICTs can be exploited to reduce energy consumption of buildings in the EU by up to 17% and to reduce carbon emissions in transport logistics by up to 27%, [183] and [203].

In this context, it is evident that eMobility, as an ETP, must take the lead and promote cooperation with other ICT ETPs (ARTEMIS [204]; ENIAC [205]; ISI [206]; NEM [207]; NESSI [208]; Photonics 21 [209]) and also with other sectors ETPs.

An identification of identify how this cooperation can be achieved and to highlight some mobile and wireless communication applications that can be developed is presented, being organized in order to emphasize the dual contribution that ICTs can provide:

- The enabling role, which stands for the reduction of the amount of energy required to provide a service.
- The quantifying role, which stands for the quantitative basis that ICT can provide in order to support decision making processes and strategies.

Enabling Energy Efficiency in Power Transmission and Distribution

When discussing energy efficiency in the power transmission and distribution sector, the focus should be on the implementation of the so-called smart grids. A smart grid is defined as a set of tools designed to improve efficiency, reduce the need for excess capacity and allow two-way real time information exchange within power distribution networks. Two main topics must be considered, [201]:

- Energy production with focus on distributed energy resources: the actual grid is based on a centralized energy generation. However, the growing importance of renewable energy systems will require a paradigm shift. A future grid, with ICT-based optimization, should support the integration of renewables and distributed generation.

- Advanced metering infrastructure – smart metering: current energy networks do not allow an effective communication between providers and customers. Future grids must provide this two-way information exchange in order to allow all parties (energy suppliers, network operators and end-use customers) to better manage their energy consumption and costs. The use of ICT-powered smart meters will allow the deployment of this functionality.

The transition from the existing infrastructure to a smart grid must take into account the above described topics, using the tools and solutions that ICT sector can provide.

The ETP SmartGrids [210] was created to facilitate this transition. It aims at increasing the efficiency, safety and reliability of European electricity transmission and distribution systems, and removing obstacles to the large-scale integration of distributed and renewable energy sources. A strict cooperation between this ETP and eMobility platform is then essential to identify possible applications of mobile and wireless communication technologies.

To provide some examples of applications and services that can be developed and disseminated, below are outlined two types of applications, one illustrating the enabling role and other the quantifying role of the ICT sector:

- Advanced Telecommunications to allow Distributed Energy Production – Typically, information is gathered only in the high-voltage grid and parts of the medium voltage grid. However, the focus on energy efficiency is changing this scenario. Connecting all relevant nodes to collect information on grid conditions is becoming increasingly important. Such a network will provide valuable information that can enable decision-making mechanisms to reduce grid losses in all areas, and to optimize the integration of renewable generation sources. The deployment of this network will beneficiate from the flexibility that wireless communication technologies can deliver, which allow data collection even in the most remote sites.
- Advanced Metering Infrastructure (AMI) – Replacing traditional mechanical electrical meters with "smart meters", allowing customers to choose variable-rate pricing, can have a long-term positive impact. Based on the real cost of energy they are consuming at a specific moment, consumers can change their energy demands to low-price time periods. This load shifting can contribute for the reduction of demand peaks. The use of smart meters enables the development of demand-response programs. For instance, it is possible to send electronic messages to consumers during periods of peak energy use to have non-essential appliances turned off.

Enabling Energy Efficiency in the Buildings and Construction Sector

As a major industrial sector, and being one of the greatest energy consumers, the Buildings and Construction sector must promote an efficient use of energy over all its segments. The requirement of energy efficiency must be present in the design, construction and operation of buildings.

An analysis of the available data shows that about 80 % of the energy consumed during the entire life-cycle of a building is consumed during its service life, [211] (the remaining 20 % are for materials, construction and demolition). It is then apparent that the first priority should be the promotion of efficient buildings, with reduced energy demand during all stages of its lifetime, and if possible, integrating a distributed network of CO2-free energy producers. These goals must be achieved not only for new buildings, but also for the existing ones. The challenge is, of course, different: while for the formers the focus should be on promoting eco design processes, where energy efficiency is considered from the beginning, for the latter the difficulty is on finding the best solutions to retrofit existing structures and systems to a higher level of energy efficiency.
Whatever the market that is being considered (new or existing buildings), the energy consumption of a building is mainly related to, [201]:

- Heating, ventilation and air conditioning (HVAC): from a technical point of view, there are two types of HVAC systems that must be considered. The Passive system approach, which intention is to minimize thermal losses by implementing several design and construction techniques, and the Active system approach, based on the installation of HVAC equipment in conjunction with a sensor-based control system.
- Lighting systems: the effort for the reduction of energy consumption due to lighting must be considered from two different perspectives. One is the development of new light sources, and the other is the development/enhancement of lighting control systems to regulate the lighting system in response to some external signal (manual contact, occupancy, timer, light level …).

Despite the ICT sector cannot save much energy by its own, it can deliver several solutions and tools to enhance the above described systems. For instance, the development of new HVAC equipment, together with the deployment of ICT-based solutions, can further increase the effectiveness of the overall system.

In this context, it is possible to outline two important functionalities that mobile and wireless communication technologies are able to provide:

- Connectivity: several components of the building infrastructure can be connected wirelessly, enabling automatic reactions to changing conditions. The nature of wireless systems also provides an adequate flexibility to deal with changes in the building infrastructure.
- Transparency: in fact, this functionality corresponds to the quantifying role. It stands for the possibility of remotely transmit useful sensor data to the system administrator or user. This information can be used in any decision-making process to optimize energy use.

The ECTP (European Construction Technology Platform), [212], is the ETP dedicated to investigate the major challenges that the Buildings and Construction sector faces in terms of society, sustainability and technological development. The goal is to develop research and innovation strategies to meet these challenges. A number of focus areas has been identified, being one of them the 'Processes & ICT', which covers items related to processes optimisation, extended products and future services for home, buildings, underground constructions and networks, and the appropriate development and deployment of ICT to support these items. The mere existence of this focus area reveals that the Building and Construction sector recognizes the ICT sector as an enabler of processes and systems optimization. Thus, cooperation between ECTP and eMobility will lead to the:

- Development and deployment of new applications to enable energy efficiency.
- Development of reliable and transparent means to quantify and track energy and cost savings over time.
- Development of open standards for interoperability between different technologies and systems.

There are already several applications and solutions available on the market addressing some of these topics. An example of the type of applications that can be developed is described by a typical ICT-enhanced application to enable energy efficient buildings (temperature monitoring and heating control of a HVAC system). An efficient HVAC control system must connect all components of the system (e.g., indoor and outdoor sensors, radiators, air conditioners, ventilators) in a network, in order to exchange data and to have an adequate set-up of the system (condition dependent). The role of ICT is obvious; the network can be implemented using wireless technologies, which increase the flexibility of the system.

Enabling Energy Efficiency in the Transport and Logistics Sector

With the advent of globalization and global economic growth, the Transport and Logistics sector has assumed a central role. In fact, there is an increasing need for global goods transport that must be met by this sector. Moreover, manufacturing is in several cases a distributed process over several locations, relying on the Transport sector to move parts to the final place of assembly.

However, and despite its importance, several processes of the Transport and Logistics sector (including packaging, transport, storage, consumer purchasing and waste) are inherently inefficient. For instance:

- The use of back-loading is not common. Vehicles capacity on the return journey is many times wasted.
- Cooperation between competitor companies is currently not possible (e.g., major supermarkets do not cooperate in order to promote a shared supply chain).

There is then a vast potential for optimization that can be implemented with the help of ICT based applications. From all the challenges that Transport and Logistics are facing today, the ones that can greatly beneficiate with the contribution of the ICT sector are, [213]:

- Traffic and freighter management.
- Energy-efficient driving and stimulation of behavioural changes.
- Controlling power train fuel efficiency.
- Co-modality.

In order to address these issues, eMobility can cooperate with the three ETPs that are currently working on several aspects of the Transport and Logistics sector: ACARE (Advisory Council for Aeronautics Research in Europe), [214]; ERRAC (European Rail Research Advisory Council), [215]; ERTRAC (European Road Transport Research Advisory Council), [216]. All of them consider energy efficiency as a priority research topic.

An example of an application that can be developed with the contribution of mobile and wireless technologies is efficiency tracking, meaning the association of data recorders installed on each vehicle with wireless transmission devices creates an information system capable of providing real time information. This information can be used by:

- The driver, in order to track vehicle's efficiency and adapt behaviour.
- The operations centre, in order to allow real time route optimization and to track efficiency against business performance.

Energy efficiency aspects in relation to Smart Meters and environmental monitoring

Legal, regulatory and institutional challenges

Presently there are European directives that have been developed to provide a framework for sustainability and energy efficiency. Does the framework go far enough to ensure that energy efficiency and sustainability penetrates fully into society and becomes more integrated?

The legal and regulatory barriers for the deployment of smart meters are very much dependent on the status of regulation in the different Member States. For example, a fully de-regulated country such as Germany, where open, competitive markets have developed is able to adopt new efficient methods for improving energy efficiency and reducing carbon footprints. However, in France there appears to be one, nationally owned electricity company supplying the nation. In this case there is less motivation to move towards a common European approach as there is no competition to motivate innovation.

Will greater government intervention or regulation lead to the deployment of smart meters? In most cases explicit governmental policy goals to promote smart grids/meter implementation should lead to the deployment of smart meters more rapidly. Indeed, it is evident from countries like Italy that mandating the implementation of smart meters can be a significant factor to rapid deployment.

Legal policy will most likely relate to the accuracy and preciseness of the procedure for taking readings and the ability to modify the data in the information transfer chain. The protection of consumers and businesses is vital with any change to collection of data from the premises. The legal framework currently does not encompass sufficient protection for consumers so this is a future issue to be addressed.

Are there open standards for devices including standard interfaces with different suppliers' equipment? There is still some debate in the industry regarding what spectrum the remote meter readers should use. This basic conundrum can only be resolved by in-depth analysis and understanding the costs and benefits to make an informed decision, which informs part of the overall business case. However, regulatory intervention could either offer a particular frequency band for use or leave it for the market to decide. This uncertainty may prove to be more of a barrier to mass deployment.

Social, economic and cultural challenges

Innovative and new technologies generally spark interest by the general public and if there is an associated improvement to the environment then interest is deepened amongst potential users. There are challenges, however, when introducing new technologies as some social groups such as the elderly may not necessarily appreciate or understand the benefits.

Traditional meter reading methods have been regarded as an imprecise way of collecting data for gas and electricity readings. Therefore, the introduction of a process that will not only become more accurate in the reading, thus saving money and time but also in the method the data is collected. This change would be acceptable should the benefits outweigh the costs.

A significant factor for many of those adopting remote meter reading and enabling energy efficiency is cost. Governments' objectives for nationwide deployment in countries like the UK, France and Germany, with a combined number of household at nearly 80 million, will mean huge costs. Any proposed project would require significant project management, time and resources for an effective national roll out of smart meters.

There is also the challenge of maturity of equipment. Current work by equipment manufacturers has demonstrated an innovative method for remotely collecting data. The equipment now seen in domestic and business premises is all approved and standardised in line with the International Organisation of Legal Metrology (OIML) and the Measuring Instruments Directive (MID). The challenge, therefore lies with the manufacturers and vendors to ensure up to date equipment is released to market early. They will also need to create strategies for upgrades and swap outs of equipment which will mean have a significant timeline for technology advancements to be realised.

Technical challenges

In liberalised energy and utility metering markets there is a risk that some smart meters may not be interoperable with domestic supply systems. It will be important that the basic functionalities are in place in order for any smart metering equipment to be installed into the customers' existing supply systems.

In addition, as more advanced countries start to deploy the technologies that emerge, the countries which have a slower deployment rate will be able to take advantage of the new technologies. This will cause a disparity between countries and compound the challenges of interoperability.

Decisions on the communication between the smart meters and the meter readers are proving to be the biggest challenge. One particular transmission medium used at the moment is within the short range device domain or the Industrial, Scientific and Measurement bands such as 900 MHz band. This frequency band is exempt from licensing in some countries and therefore can suffer from interference. In addition it is likely there will be millions of deployments for smart meter devices and there may be a requirement for additional coordination to avoid these circumstances.

V. Future Internet

V.1. Description

Future Internet is a concept involving several technology areas that is receiving a great deal of attention in the research world. A number of projects have started in this area, and most of these projects are focussed on understanding what the Future Internet will be. There is no clear vision, as yet, with regard to what such network of the future will allow and which capabilities will offer.

Personalisation, context-awareness, Internet of Things, Internet of Media and also Internet of the people as evolution of Web 2.0, are often mentioned in relation to the capabilities the new Internet will have. While the potential and the key technologies of such network are not clearly addressed yet, there is also an emerging need to understand what the users would like to achieve with such networks. Understanding the requirements for future applications and services may, in turn, drive research in the right technological direction, where business potential exists, so that technology advancements may translate into business innovation.

At the same time, from a bottom-up approach, as the technology evolves and next generation of Internet becomes better defined and closer to reality, new opportunities for applications arise. Applications and services are the drivers for the development of the Future Internet. Applications and services have requirements that the Future Internet should fulfil. Higher transmission rates, seamless connectivity, better reliability, higher security are just a few features that we expect Future Internet contribute.

"The opportunities in the Future Internet are huge and the threats are real. … The Internet space where we will reside in the future, provides us with a unique opportunity to overcome:

- Our competitiveness deficit, be it in technological or service aspects.
- Fragmentation and the absence of a fully developed Single Market for services.
- The lack of critical mass resulting from an inefficient use of resources.

From the primitive networks of today, a new Internet will emerge where the economy of tomorrow will be invented. Employment and innovation opportunities will be plenty in Internet-enabled sectors such as manufacturing, energy, transportation, healthcare, education, and entertainment, where pervasive and massively-distributed and networked resources (sensors, actuators, communication devices, databases, etc.), will generate new economic and societal value chains."

Future Internet 2020: Call for Action by a high-level visionary Panel

In this chapter we have imagined possible future applications and have sketched a few scenarios relevant to different aspects of daily life. These scenarios have features that go beyond the capabilities of the current networks and of the current Internet. For each scenario we take a look at why they are not currently feasible and what kind of capabilities are required from Future Internet to make these applications reality.

V.2. Home and communities

One of the main goals of developing new technologies is to ease the life of people. Home and interaction with fellow citizens are important aspects of everyones life. The Future Internet could be used to help in automating a great deal of the home maintenance, due to a combination of high speed connectivity and intelligent home maintenance system, a "majordomo".

Scenarios

Build a garden in the backyard
Joe is at work, and remembers that he wanted to ask someone for the best way to build a garden in the backyard of his house, which right now is just a patch of ground. He connects to the maintenance system of his house and asks the majordomo to take care of it. The system, using the cameras installed around the house for

surveillance, takes some pictures of the backyard. Then looks up in the different available guides on the Internet for professional gardeners, select the 5 most recommended by customers and other possible references; maybe sends messages to Joe's friends on his behalf, asking for recommended gardeners. Then he sends a message to the 5 selected gardeners, sending the pictures taken and an estimation of the area, address of the house, etc. and asking for budgets estimations, time planning, options and solutions to build a garden on the backyard. When Joe is back, the majordomo has a list of budget estimations and other information sent by the different gardeners, who had recommended them, the available choices, etc. If Joe is on a business trip, Joe could select the appropriate gardener, make the initial payment, and the majordomo would take care of sending the gardener appropriate security tokens or other authentication information to be able to get in the house during Joe's absence. The majordomo would grant access to the gardener and will keep Joe updated on the progress, sending daily pictures showing how the works are going.

Solving electrical issues

Joe is at work. The majordomo at home is taking care of the usual aspects of home maintenance, like searching for the best offer on some online grocery stores looking for some food that is missing at home, doing the payments and ordering the deliveries, when it detects an electrical failure on the upper floor of the house. The majordomo makes a system check and identifies possible causes based on knowledge of house facilities and sensor information. It then notifies Joe, and if Joe consents, it will take care of the problem. The majordomo will send available information on the system, the symptoms (lack of electricity in the backyard), the information gathered from the sensors, and following a similar process as in the preceeding case, will contact a set of selected electricians to ask for a budget and planning estimation. If the problem is not big, once Joe gives the authorization to proceed, the majordomo will then carry on with the selected offer, proceed again as in the previous use case, and when Joe's back at home, the problem has been already solved. As an alternative flow, the maintenance system could detect a leak on the heating system circuit. After checking the different cameras from within the house, it detects a radiator leaking liquid on the floor (either automatically or with assistance from Joe, who is checking the webcams once he received the warning to see if a leak was apparent). The majordomo will take pictures of the leak from one of the cameras from within the house, and send it to the insurance company, who quickly evaluate the circumstance and send someone to fix the problem. Joe, who is abroad, will make the necessary authorizations so that the insurance company and the majordomo can exchange relevant information on the problem, and the needed security measures to let the plumbers and the insurance people get in the house.

Future Communities

Jill is fixing her computer and solves some generic problem on hardrive installation. She records the solutions with the mobile phone camera and stores it. Later on Jack is installing his hardrive and finds out that his friend Jill has solved the problem he has. He downloads the solution from Jills mobile and follows up the process. However Jack realises he do not have correct type of screw driver. He connects to the local social network of computer enthusiastics and asks if anyone have such screwdriver. Jim living nearby sees Jacks requests and goes for help.

Key technological aspects

In order to support the detailed level of automation and obtain the desired sensoring and control abilities over the house, more sources of information is required than is available as of today. Sensors and actuators providing such information should be interconnected so that the applications controlling home can get the information they need promptly and seamlessly. The sensors and actuators may vary greatly on their capabilities and cost. Some of them may have powerful processors inside while others could be implemented with just few thousand logical gates. Furthermore, some of the sensors will likely have limited power source, like battery. For such a simple devices with restricted power, it is not feasible to implement all the Future Internet connectivity capabilities. Thus a small device connectivity solution that is simple and requires little power while being compatible with rest of the Future Internet protocols would be of importance. Furthermore simple authentication and integrity solutions are needed that the information sources can support.

Due the interactivity and the evolution of virtual communities, more of the service consumers will also participate in the service producing e.g. consumers turn to be Prosumers "consumers active in a product's development and production". Since users can play an active role in content production and organization, the traditional client-server model is not adequate any longer. For future Internet new application level communication models are thus required. Monitoring of user actions in the network can be used to enhance the users future experiences.

In order to find the correct sensors, sources of information by either automated systems or by user, the service discovery and selection processes have to be enhanced. Automated systems require more knowledge about the information sources in order to determine which of the hundreds if not thousands of sources it should use. People using services need more help for finding and selecting the service fulfilling their need from the multitude of possibilities that will exist in future internet. Also, currently there is no easy way to find new user produced content. How can someone know that a given video reproducing an important event has been uploaded to the network somewhere? If a user just uploads some content without giving any information about it, the current search technologies cannot find it. For such, we need an idea or a concept based search. Automation of indexing and adding the metadata about the content is also required to not put too much burden on the prosumers. As important than finding the information is also ability to identify its source. Knowing the source can help information user to determine how reliable and authentic the fetched data is e.g. whether the scandalous image of pop star is real of fake. Protection of the copyrights of prosumers will also require the knowledge of content creator and the time when that was done.

Future Ad-Hoc Communities can be viewed as social networks based on Peer-to-Peer (P2P), Peer-to-Multi-Peer (P2MP) or Multi-Peer-to-Multi-Peer (MP2MP) approaches, allowing real-time sharing of information, such as position, photos, videos and files. These Communities are created on demand, by a user or by a set of users, to fulfil a specific need or purpose. The complexity of such applications lies in the end users devices, which must have the computing capabilities to instantly create services with information and content that can be used by remote peers. The key factor that distinguishes Ad-hoc Communities from the existing Social Networks is the fact that users do not need to join any common third-party service. Instead, they just need to run a service created by other(s) peer(s) of the Community. In these communities it is also possible that users can become service and network providers for others in the community. User can open up their internet connectivity to others via variety of connectivity technologies or allow ad-hoc routing of packets via their devices.

V.3. On the road- Interacting with changing environment

Scenarios

Around the city

John is walking in the city. His new intelligent wear is connected to the Internet and ready to provide multi-modal information to him, when required. Today John is looking for a bicycle repair man. He turns on his microphone and says: "Where is the nearest bicycle repair shop?". The request is turned into text format and transmitted to Internet search machine that returns the location of several bicycle repair companies. The results are shown in his data glasses and John can select one of them after which he will start to get a guiding voice through his headset. Textual information is added over the object and buildings that John sees through his data glasses when he walks across the town. When crossing streets he will get warning about cars nearby. Suddenly his glasses will point to a red dot on his left and at the same time his left hand data glove provides slight pressure, indicating danger to his left. There is a woman walking her dog and John is very allergic to dogs, so he changes his walking route a bit to avoid problems. While walking, John makes a phone call to his friend and thus the guidance to the bicycle repair shop will change to visual mode, showing arrows for John to find his way. As John finally enters into the store, his jacket will turn of it's internal warming and starts cooling cycle so that John is not going to sweat while in the store.

After visit at the store John goes visit his grandmother Anita, who has bad knees and hearing problems. Anita is living by herself in her apartment thanks to the new applications which will help her overcome her disabilities. During the conversation with John, Anita will get textual cues on her glasses to help her follow what John is saying to her. When John suggest they go for nearby café, Anita will see an image cup filled freshly brewed coffee. John´s mobile guidance system realises Anita is with him and suggests a route to café, where John and Anita will not have to climb any stairs. While Anita and John both get the same directions towards café, they will get them in different form, due to their different physical capabilities. During their walk they walk by advertisement board, that notices new people within its vicinity. Advertisement board changes its content based on the interests it fetches from the mobile anonymous profiles of John and Anita. John's electronic newspaper will notify John that the local hockey game has ended and the results and in-depth analysis of the game can be now read from the paper.

Key technological aspects
The seamless interaction with multitude of objects requires enhancements for current service discovery, selection and authentication mechanisms. When intelligent clothing can react and prepare for changes in weather, it acquires the upcoming changes to context through future internet. The discovery of sensors and other information providers should be automated and done proactively. There is a clear need for intelligent and automated information source selection procedures. Routing messages from mobile device to mobile device should be dynamic and more efficient so that messages used for local communications do not have to go through long discovery process. The decisions should be done rather locally than through some centralised servers on the

other side of the world. Since the behaviour of different objects such as intelligent wear, is reliable of the outside information sources, the security, authenticity and reliability of such a data is in ever more important role. Reading a fake context information from rogue sensor can hurt significantly an industry that provide solutions like spikes coming out from shoes when a road becomes slippery, material changing to less breathable but more waterproof when it starts to rain, jackets that warm up outside and cool down, when a person walks into the store, clothing that changes colours to fit into the current environment and fashion view of given culture. Similarly augmenting reality requires knowledge about the real environment so that the augmentation is accurate and useful. The equipment used for interacting with and gathering information from the environment must be light, non intrusive, and discrete enough for people to wear it at all times. The connectivity should be efficient enough to support even rich media flow, with non perceivable latency, so that accurate and current information about environment can be provided. Personalisation of interactions within environment requires mechanisms that separate the identity from the preferences, so that customers privacy can be protected.

V.4. The next step to automation

Future Internet will encompass scenarios where technologies, devices and wireless broadband connectivity will allow compelling services and enhanced assistance in our everyday lives, freeing us, for example, from tedious tasks such as the search for a parking place or enduring a traffic jam. The development of future internet will open up new possibilities on applications relying on remote operations that can help different aspects of peoples lives.

Scenarios

Park the car and pick me up at 07:00 PM
Joe is driving to a meeting. He arrived at the meeting point downtown, but has no time to find a parking place. Joe calls to a remote-chauffeur service, asking for a — park me service and a — pick me up at 19:00. After agreeing the price and payment methods, Joe leaves the car and heads to the meeting place, whilst the remote chauffeur service gets control of the car. The remote driver, that can be a real person or an automated driver, looks for a parking place and leaves the car on the available place there, and afterwards, he will attend his next customer. 15 minutes before 19:00, the remote driver gains control again of the car, pays the parking fee on behalf of Joe, and heads towards the building entrance where Joe will appear to get the car. After Joe gets in, the remote driver disconnects and access permissions are automatically dropped for the service.

Drive me home
Joe has many papers to review when driving home. Instead of driving himself, he extends the "park me" and "pick me up" service with the "drive me home" service. The remote driver will get control of the car and take Joe home, while he is in the back seat reading some documents he has to comment on before nine p.m. On arrival, Joe may dismiss the remote driver service for the day, or perhaps he decides to ask the remote driver to take the car to a garage, so that they can make the revision of the 10.000 miles. The day after, when Joe gets up, the car is already at the front door, the revision is made, and the cost has been charged to his credit card.

Remote robotics
A bag is noticed at the bus station of the medium sized city and it contains a bomb. Jack, the head of police in the town, is shocked as there is no-one with proper bomb defusing skills within an hour drive. Fortunately town police is wired in and they have remotely controllable robots. John contacts the bomb squad of the capital and requests help. The experts from the capital connect to the robot whose id was given by Jack. The experts take control of the robot and defuse the bomb. The same system is used at the local hospital to allow experts help on rare operations which normally wouldn't be done in such small city hospital. In the meanwhile the local paperfactory gets new hardware installed. The installation process is controlled from abroad by the company that sold the new machine.

Key technological aspects
With regard to the first two scenarios it has to be noted that on one side they appear to be the most futuristic (even beyond the current understanding of the Internet of the Future) while on the other hand a number of features are already provided today in modern cars in order to help drivers to drive safely. However a totally automated system would have very significant user-acceptance issues to be solved, including the issue whether a local, integrated within the car, control system would be more easily accepted. A system such as the one depicted in the scenarios would require a total reliability of the sensing system as well as the telecommunication and control system and as such is probably not feasible.

A very reliable connection has to be in place between the car and the remote driver, be it human or automatic. High resolution video, audio, and sensor information has to be sent via a wireless connection with no delay to the

remote driver, so that he/she can really have the control of the car. Likewise, the connection from the driver to the car has to be extremely reliable, with virtually no latency and absolutely fail proof.
The car has to be prepared in order to be remotely driven. It will take as well appropriate safety measures in case the wireless connectivity breaks, or the car—feels the remote driver is doing something unsafe.
Security must be in place as well, in order to grant that only the remote driver service is entitled to gain control of the car, only under owner's authorization and under the hours and terms of the hired service.
Wireless payment systems must exist, with appropriate security measures, in order to make possible for the remote driver service to pay parking fees on behalf of the owner.

In remote robotics it is important that the connection to the robot is reliable and with minimal latency so that the operation is smooth. Errors in commands send to remote robot can cause danger situations. Transmission of HD quality video for remote surgery requires high throughput requires fast and reliable connectivity (for HD and 3D image transmission). As there is lot of sensitive data transmitted, securing it all without losing the performance of a system will be a challenge. If adversary is able to affect on the robots that will install the heavy duty machinery in factory, the damages can be significant. Without proper security this is real threat.

V.5. New media experiences

The Internet of the Future will also be an Internet of Media. New approaches to search and retrieval of content will be developed, content and experiences will be geo-located and associated to a social context. The two scenarios presented below have been presented at Digibiz 2009[1] and are reported here to illustrate the future "internet of media".

Ann, the movie-lover
Ann is a very sociable person and well educated in using online services (although she is not a techie). Outside working hours you will find her sitting at some fashion bar drinking an exotic cocktail with a friend, or posting on Facebook, or answering questions on LinkedIn.

At the same time she really loves a quiet evening at home enjoying one of her favourite movies, just by herself, or with a few selected friends sharing similar interests, which she also finds fun.

<u>Today</u>

Ann really loves movies and anything that is in any way movie related, from music soundtracks to actor biographies and the like. She has a collection of them on DVDs, either bought or recorded from the TV or downloaded over the Internet. The funny thing is that when you open the case of one of her DVDs, there are a bunch of notes and half glued Post-ITs that fall out.

These are things like: "This movie is a remake, I should find out what the original was and who was playing in it. Lisa would know. ASK!!!", or "There was a kind of controversial book about the film director. GET IT and READ IT", or "The scene of the girl walking alone on the Champs Elysées, really moving. Julia would have loved it. Next time invite her and enjoy together", or "This movie does not seem that funny anymore, probably last time I watched it, I was in a better company, or in a better mood".

It is always something personal: a reminder to check on the sound track, a to-do note, a reminder to call that friend who knows everything about that actor.

<u>Tomorrow</u>

Ann is even fonder of movies but she is now able to personalize every media experience in an online inter-linked stream of memory flashbacks and plans for the future. She has a different way of keeping all of this together.

Ann's media dashboard interaction features drive her to expand beyond simple playing: she can post a comment, store it for future memory, share it with friends or possibly let it be public for everyone; get the answer to her questions from Lisa, or Julia and probably also order that controversial book from a partner affiliate online bookstore. When she decides to watch again a movie, her history of watching that movie can be retrieved and the new experience will be added. All of this experience is visualized as a media living "add-on", a starting point

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[1] L. Galli, R. Guarneri, J. Huhtamaki "VERTIGO: Find, Enjoy and Share Media Trails across Physical and Social Contexts" DigiBiz 2009, LNICST 21, pp. 64–73, 2009. © Institute for Computer Science, Social-Informatics and Telecommunications Engineering 2009.

for further experiences. When she decides she wants to watch a new "noir", she can get opinions from the "noir-lovers 24/24 7/7" group in the movies' social network and make a selection based on this advise. She can see, and visualize the "not-to-miss" movie of the week – on the basis of trusted opinions – and plan to watch it on TV. She can also check if her friends are watching the same program, or invite some of them to do so and share the experience.

Markus, the traveler
Markus is a long time independent traveller; he is a heavy music listener (having been himself active in playing with a college group) and avid reader of books and magazines. Now in his late forties, he just feels a bit frustrated by the complexity of pursuing his interests online, being not being in the habit of moving from one service or social network to another, building profiles, installing and updating new software and the like. He is a bit more confident with cell phones though: he likes to fiddle around with them and has enough money to buy the good ones, even if he is not so much into the technical details.

<u>Today</u>

Markus is on vacation in the US, wandering around the Golden Gate Bridge in San Francisco. A wave of memories wells up in him: a key scene from a Hitchcock-classic, VERTIGO, was shot at this particular location and, of course, he forgot to include the soundtrack in his iPod playlist when he left the hotel in the morning (actually, he only has a CD-version of the soundtrack in his CD shelf). It occurs to him that that the bridge has starred in quite a few movies. He tries to figure out where to look for some more information now that he is has a brand new smart phone, with data access even in the US thanks to that roaming option he has subscribed before leaving. The difficulty is where to look for the information. Wikipedia entries are difficult to read on the small screen; moreover, it should only be possible to listen to that track. This way, he would be sure to remember the movie!

<u>Tomorrow</u>

A few years later Markus is back on the West Coast. As he is on location, the map on his smart phone entices him with icons pointing to multimedia "trails" found in this location. A dynamically composed playlist appears in his player including the main theme of VERTIGO as well as versions of other Hitchcock themes by Laika & the Cosmonauts, a long time favourite of Markus, and by Los Angeles Philharmonic conducted by Esa-Pekka Salonen, a fellow Finn. Also images and movie scenes appear in the playlist. He shuffles it until he notes one piece that reminds him of that famous movie he was pondering about the other day: the bridge is also featuring in the opening scene of The Maltese Falcon! He is able to post an extract to the media social network he is finally able to master, with an impromptu comment. What a better place to comment on a movie than its real stage! Media outdoors can be even more fun than at home – but certainly he is going to enjoy the full movie on his HDTV set when he returns home (perhaps with some more comments from friends).

Key technological aspects
The scenarios stress in particular the capability to link content to contexts to persons to groups of interests.
The main challenges brought by the scenarios are:

- A novel media search and retrieval paradigm to overcome the limitations of the existing separate domains.
- The enabling of a new paradigm to access and manipulate media content, managing heterogenous sources, representing it in visually rich, dynamic configurations and adapting it to always changing individual and social profiles and to contexts.

The scenarios, in particular the first, calls for a total blurring of the boundary between linear fruition of content and interactivity, while keeping the content integrity and moving the interaction requirements that will come from the user to areas related to his personal experiences and interests, including social networks.

In addition to high computational capabilities to be able to process such amount of data and information, a key technology to be further developed is that of metadata, both annotation and processing: an automated processing of the metadata, in the creation phase, will increase the efficiency of content annotation, thus reducing the user's cognitive burden. Metadata will have to be defined in a more detailed level, for example as attached to a particular scene or event or as attached to an object on screen. Moreover, metadata will include information on the user experience, including user's feelings caused by a piece of music or a movie etcetera. Such information will be offered to the external world with different degrees of visibility, which in turn implies strong requirements on privacy and security, including the aspects of user interface to manage privacy.

Another important aspect is the media service platform. The infrastructure of today is very scattered for the content creators, application developers and multimedia consumers. In particular, there are many proprietary platforms that are deployed in mobile services, broadcast (terrestrial and satellite) and IPTV (cable or fixed telecommunication network), with the further specialization coming from the country where the platforms are deployed. The Internet of the Future may offer such unifying platform providing standardisation efforts will take place in order to enable easy design and implementation of media-handling value chains whose devices interoperate because they are all based on a standard set of technologies accessible from standard APIs.

V.6. Others

From reality to virtual reality
Future Internet will enable immersion and virtuality providing true Multisensory & Immersive Experiences (MIE) that can be used in many application fields, from gaming to telemedicine and e-health.

It is a fact that today we are experiencing fast development of new technologies based on sensory perception. This, together with the increasing trend to customize no matter which aspect of our lives, open the way to new attractive and innovative services.

It is expected that users will demand more and more immersive and multisensory entertainment, requiring 3D video, holography, surround, different senses information, with the proper devices and interfaces. But not only this, let's imagine educational initiatives, physical training, eInclusion, eHealth, all of them as part of a complete portfolio of MIE.

Going a bit further, let's think about new possibilities for these technologies, such as customization and creation of personal environments with unlimited complexity and simulation of most real physical aspects, virtual trips, virtual reality, new gesture based interfaces, neuronal interfaces, BCI, or, why not, connectivity with implants and new nanotechnology based capabilities, enabling realistic simulations of senses and transmission of feelings and sensations (hunger, happiness, sadness, thirst, emotion, surprise) not only to people but to any machine.

Smart cities
The Internet of the Future will be pervasive. The level of pervasiveness of ICT technologies (sensors, identification–capable devices, actuators, wireless communications) will offer means to potentially monitor and control in real–time many fundamental aspects of life. Typical applications can be found in the urban environment. Examples are:

- Control traffic lights and car navigators' suggested routes in real–time to optimize traffic flows and reduce air pollution based on the current traffic situation and users' needs.
- Control public and private electrical appliances to fulfil user–driven goals but trying to minimize environmental impact and cost by accounting for fluctuations in energy markets and in availability of distributed renewable energy sources.
- Build "information torrents" by displaying relevant information to users passing by accounting for their preferences, interests and social networks.

Cities of the future will be characterized by the complex intertwine of a number of systems, having the common feature of having a presence in the digital world. Given the sheer size of the resulting "system of systems", decisions will need to be taken in a distributed, yet coordinated, way.

Mobile 3D Internet
The development of 3D web-based graphics and interactive 3D scenes opens a new range of possibilities for the enrichment of mobile internet services and applications. Moreover, and going a step further on the 3D concept, the integration of 3D like applications with Personal Area Networks (PANs) and Wireless Sensor Networks (WSNs) can greatly enrich users' experience. In fact, provided that it is possible to adequately control local PANs and WSNs, the user surrounding environment can be adjusted or modified.

Interactive Context Aware Games
Games based on the user context, i.e., a user can play around in his environment and the games adapt itself (e.g., user hides behind something). This can greatly improve the user perception and involvement within the game. This is a trend that can already be seen today. These context aware games take the user inside the game, as it is the user who plays the game directly without any keyboard or gamepad. The actions for the game should be done by the user itself and the game takes that information into account and reacts accordingly, i.e., if the user jumps, hides, lies down, moves, etc.

Resources on Demand
Resources on demand are a new concept of information delivery to users. The network can have information regarding users profiles, i.e., how the user is moving, where he is heading and so on. Based on this information, the network can provide resources to users in some kind of "optimal" way. This can be used when the user is connected just to a low speed/expensive access network, but the network knows that the user will be covered by a faster/cheaper access network. The network can warn the user about this fact and automatically send the requested data to the 2nd network. Then, when the user gets there, he/she downloads the requested data.

Resilient connectivity
Resilient connectivity is a way of providing connectivity to the user, even if using multi-hop connection via other users' terminals, and so on. The terminal and the network must be smart enough to switch between access networks to maintain communication, or even using multi-hop connections via other users' terminal (rewarding other users for the resources usage).

Some sort of context prediction can further enhance users' experience. In fact, being able to predict the future context of a user or device can be useful to enhance services or the way they are being provided.

Business
The Future Internet should be a place where professional and customer deal with part of the business in an automated manner, where automated systems interconnect to each other, and are able to offer their services, receive requests and perform basic initial estimations and offers, and even close deals, without having to interact with their owners, provided that they have put the necessary authorizations in place.

Context Aware Mobile Web
Users' experience when accessing Internet services and applications can be greatly improved if some degree of context-awareness is taken into account. Context-awareness can be viewed from two different perspectives:

- A physical one, where context stands for the user situation in terms of the surrounding environment (location, types of available networks, etc.).
- A social one, where context is related to the user profile (activities he/she is engaged in, information on his/her friends and colleagues, etc.).

The key factor beyond context awareness is that services can be tailored in accordance with the user's physical and social context.

Real Time Translation
Future Internet enabling seamless communication. Let's imagine a final scenario in which any communication, with no human intervention, is automatically translated depending on sender and receiver and their profiles, preferences or context information.

We are thinking of a method for translating speech and text in real time, no matter which language it is or the type of communication. Language translation is made without human intervention.

Languages to be translated include non verbal ones, Braille, thought, telepathy and maybe others.

VI. Enabling Technologies

VI.1. Description

VI.1.1. Vision

In recent years, we have witnessed rapid advances in enabling technologies for mobile and ubiquitous computing, such as the increasing pervasive computing paradigm, embedded sensor technologies and a wide range of wired and wireless protocols. *Context-aware computing* is emerging as the next computing paradigm in which infrastructure and services are seamlessly available anywhere, anytime and in any format. In order to engineer context-aware computing systems, it is of high importance to understand, apprehend, and define the constituent components of context from an engineering perspective, as well as, from a model-theoretic perspective. It is therefore important to consider the issues and research challenges in context aware applications and settings, as well as cross layer design issues in wireless networks. Focusing on the cross layer adaptation, and the most important parameters and constrains that should be taken into consideration when attempting cross layer adaptation in wireless networks that involves different protocols in the protocol stack.

Also, challenging issues have emerged in the deployment of mobile services over heterogeneous networks using different wireless access technologies. In this context, it is essential to optimize handover and interworking mechanisms to be able to maintain service continuity and quality of applications running in mobile devices.

A common denominator of the three issues context-awareness, cross-layer design and service continuity is the aspect of achieving a comprehensive level of security, privacy and trust. New privacy threads emerging from context-aware applications require further research in identity management techniques, and raise new challenges such as semantically modelling security requirements and establishing an appropriate and consistent level of security across different network layers, contexts, and services in dynamic environments. As security can be considered as a key enabler ensuring user acceptance and compliance with legal requirements it becomes critical to develop appropriate security concepts for future self-adapting infrastructures ranging from the network to the application layer.

VI.1.2. Context-aware applications and systems

The term *context* refers to any information that can be used to characterize the situation of an entity. An entity is a person, place or object that is considered relevant to the integration between a user and an application, including the user and the application themselves, e.g., context can be information related to location, speed, proximity to access points or other mobile devices. However, context encompasses more than just the user's location, because other things of interest are also mobile and changing. Context includes lighting, noise level, network connectivity, communication costs, communication bandwidth, and even the social situation (e.g., if you are in a meeting).

Context-aware computing applications respond to changes in the environment in an intelligent manner in order to enhance the computer experience of the user. Context-aware applications tend to be enhanced mobile applications for the following reasons:

- User context changes frequently subject to the user's mobility behaviour.
- The need for context-aware behaviour is greater in a mobile environment. Context-aware applications have to take into account user location, network resources, and device capabilities.

Applications should exhibit certain capabilities in order to be characterized as *context-aware*. Specifically, a *Context-Aware Application* (CAA) has to take into consideration a set of characteristics related to *context modelling* (knowledge representation) and *context management* (fusing, inference / reasoning and adaptation).

VI.1.2.1. Context modeling

Context Representation: Contextual information (context) has to be represented according to specific knowledge representation models, e.g., ontological modelling, semantic graphs, fuzzy sets-based representation, inference rules, in order for a CAA to support (i) information abstraction (taxonomies / ontologies) (ii) inference (deduction) (iii) reasoning (context classification, clustering, data mining techniques for context pattern recognition, consistency) and (iv) expressivity in interpreting the user context (e.g., first order logic, fuzzy logic). A hierarchical (ontological) model refers to graph-based knowledge representation covering the range from the most abstract to the most specific context along with enhanced semantics (specialization relations, mereological dependencies, compatibility and mutual exclusion relations). A fuzzy-set based model can accommodate the vagueness inherent in sensor-based context capturing.

Context Inference / Reasoning: Context can be elaborated with reasoning mechanisms. Context inference is a process for inferring *new* context, previously unidentified on the basis of a-priori known context (historical context). Reasoning tasks check context consistency, deduce high-level context or classify context. Such tasks can be realized through logical schemes like first-order predicates and description logics.

Context Quality: Context can come from heterogeneous context sources, such as, sensors and software services. A mechanism for maintaining predefined sets of *quality* indicators is very important. Such indicators may be *resolution*, *accuracy*, *reliability of measure*, *belief of evidence*, *repeatability*, *frequency*, and, *staleness* of context. Any function over such indicators leads to the determination of context validity which becomes a special important metric as soon as security-relevant decisions are made based on context data.

Context Query Model: A reference query model needs a high-level mechanism for posing queries. Complex context retrieval tasks (e.g., queries as *list all persons in the same conference hall whose presentation is at the same time with mine*) must be transparent to end-users.

VI.1.2.2. Context management

Context Acquisition: A mechanism to obtain context from diverse sources. Context acquisition could be dealt with (hardware) sensors delivering contextual information that conforms to a low-level context model.

Context Fusion: A mechanism that provides a basis for merging correlated contextual information. Fusion engines could provide a model for high-level context from aggregated / composite low-level context, e.g., environmental and position sensor-readings could refer to the current user situation in a Pervasive Computing Environment. Context fusion incorporates context estimation through data identification techniques (e.g., unsupervised learning, clustering, outliers detection).

Context Discovery: A mechanism to locate and access context sources, in terms of serving context requests (e.g., discovering the appropriate, or approximate, context pertinent to an entity).

Context Adaptation: A CAA should be capable of adapting its behaviour according to user context and current situation; it is trained to automatically adapt its configuration in response to a contextual change. Unsupervised and supervised machine learning could result in context-aware adaptive control mechanisms for context-aware applications, like adaptive fuzzy control, supervisory control, supporting self-organization, self-healing, self-optimization, and self-protection.

Context Diffusion: Contextual information acquired through networking between sensors and higher-level devices can be propagated in order to increase the range of context availability and reliability. Context sharing among CAAs provides each CAA through knowledge diffusion for achieving common goals. Missing or erroneous context is substituted by collaborative CAAs, thus, increasing their robustness. Finally, a CAA generates up-to-date contextual information, which can be exploited by other neighboring applications as long as information dissemination algorithms are adopted (e.g., epidemical spreading). Context diffusion leads to collaborative context-awareness supporting distributed intelligence tasks, e.g., autonomic and distributed decision-making.

VI.1.3. Cross layer design for wireless networks

As wireless communications and networking fast occupy centre stage in research and development activity in the area of communication networks, the suitability of the layered protocol architecture is coming under close scrutiny from the research community. Although layered protocol architectures have served well for wired networks, they are not suitable for wireless networks. To illustrate this point, researchers usually present what they call a cross-layer design proposal. Thus, there have been a large number of cross-layer design proposals in the literature (Raisinghani 2004). Generally speaking, cross-layer design refers to protocol design done by actively exploiting the dependence between protocol layers to obtain performance gains. This is unlike layering, where the protocols at the different layers are designed independently.

When, looking at the OSI model from a different angle and from some distance we can vision it as a system. In an organized system, the various system elements should develop a high level of cooperation through knowledge sharing so that the system as a whole can perform its tasks in a more effective and efficient way. Therefore, we could increase any system's performance if we developed such mechanisms that could increase the level of cooperation and communication amongst the various elements. Here is where the whole concept of cross-layer adaptation is encapsulated; to design those mechanisms without altering the layered model.

VI.1.4. Service continuity and quality over heterogeneous networks

In recent years challenging troubles have emerged in the deployment of mobile services over current heterogeneous networks due to the changing nature of new wireless access technologies. In this context it is essential to assure an efficient handover between different radio access technologies and to provide a correct performance of mobile applications.

In the area of Services Enabling Technologies the identification of available standards and proposals enabling permanently connected applications and remote device management will make it possible to tackle new issues present in the deployment of mobile applications over converged wireless networks.

VI.2. State of the art

VI.2.1. Context-aware applications and systems

VI.2.1.1. Research on context modeling

Significant research efforts have been devoted to capturing, classifying and inferring context. The work in [217] presents a context model based on Dynamic Bayesian Network for inferring context. Moreover, the authors in [218] use propositional calculus for representing situations through logic atoms and connectives to infer situation. In addition, the model in [219] deals with situation inference through data fusion techniques. Such model adopts probabilistic classification for labelling unknown situations. The context model in [220] represents context as a vector in a multidimensional space, where each dimension represents a contextual ingredient. Any subspace comprises the situation space, in which certain ingredients assume values in arbitrarily segmented intervals. The work in [221] represents context through fuzzy sets where values are derived from multi-sensor environments. Principal and Independent Component Analysis are used for detecting dimensions of context that are not explicitly available, thus, resulting in context inference. In [222], ingredients are modelled through fuzzy sets. Such sets constitute the input for a fuzzy controller, which provides control signals for a context-aware application. Moreover, context and situation recognition based on fuzzy sets is discussed in [223]. The reported fuzzy decision tree in [224], which is an extension of classical decision tree, incorporates a fuzzy-set based approach for inferring high-level context. Finally, the model in [225] represents knowledge about the user context (state), which refers to the sequence of activities performed in a pervasive computing environment. Such sequence and the corresponding state transitions typically constitute the so-called user behaviour thus clusters of similar user behaviours can be formed. The model in [225] represents and infers the current user state and reasons about user behaviours through approximate reasoning and fuzzy clustering techniques is proposed.

Related work for context fusion is reported in the model in [226]. Specifically, such context fusion model represents, determines and reasons about the current user's situation. The discussed engine is based on Dynamic Bayesian Networks and Fuzzy Logic deals with the reliability of sources (e.g., sensors readings) and approximate contextual reasoning.

Related work on context adaptation and situation awareness is referred to [227] and [228]. Specifically, situation awareness is a more holistic variant of context adaptation where situations are regarded as logically aggregated contexts. One important problem that arises in such systems, studied in [227], is the imperfect observations (e.g., sensor readings) that lead to the estimation of the current context of the user. Hence, the knowledge upon which the context / situation aware paradigm is built is rather vague. To deal with this shortcoming, the models in [227] and [228] make use of Fuzzy Logic theory with the purpose of determining (inferring) and reasoning about the current situation of the involved user. Such models enable a CAA to assume actions autonomously according to previous user reactions and current situation. The captured, imperfect contextual information is matched against pre-developed ontologies in order to approximately infer the current situation of the user. Evidently, the CAA is able to adapt to context changes and comply with the user preferences thus eliminating user involvement.

VI.2.1.2. Research on context-aware applications

The work described in [229] focuses on a communication scheme for retrieving contextual information through autonomous sensors without centralized control. These sensors called Smart-Its, are aware of their sensing capabilities and can report them to their neighbors, if necessary. The idea of introducing an interoperable data format, describing sensor-features among Smart-Its, is based on the Smart Context-Aware Packets (sCAPs). Such protocol may be considered as a document-based approach for collecting sensor-features sharing some similarities with Context-Aware Packets (CAP). The sCAP is gradually filled with sensed information on its way through the environment. Each Smart-It that receives a sCAP contributes to the required sensor-features and forwards it to another Smart-It in its neighbourhood. Combining the features stored in the sCAP allows each Smart-It to make assumptions about the current context. Based on this knowledge, it can forward this sCAP to an *appropriate* sensor for further processing.

Intelligent architectures that support multi-granular context descriptions (i.e., different context representations) are required, in order to model complex contextual information. The sensor devices range in complexity, as discussed in [230], from *simple* binary on-off reporting modules to sensors that can decide whenever a person is engaged in a certain activity at a specific location. Merino [230] is an architecture for constructing context into layers. Merino consists of five elements: sensors, smart sensors, smart environment-agents, repository, and, the user model. In the lowest level, sensors are mechanisms, both hardware and software, able to interrogate both the physical and computational environment. Smart sensors, forming the first layer of the context abstraction, are responsible for filtering and aggregating the raw sensors data into structures that are available through the repository interface. Such interface is a space where smart environment-agents can make use of the processed data, and, thus, provide a richer context. Smart environment-agents constitute the second layer of that context abstraction. These agents may be classified in two categories: *rich context agents* and *performance enhancers*. The former agent category accesses the contextual information from the repository in order to reformulate it to higher-level contextual information (called *rich-context*). Smart agents produce rich context that may be provided in varying levels of granularity. Moreover, the user model is managed by a Smart Personal Assistant, which has access to the repository, in order to customize and configure the user needs.

The Context-Aware Packets Enabling Ubiquitous Services (CAPEUS) [231] system *discovers*, *selects* and *executes* services, with regard to the current user context. CAPEUS adopts the *situation composition* and *conceptual graph* context models. The discussed system adopts a standard document format, the discussed CAP, in order to describe service needs and constraints on a logical level. The CAP is initiated by the user and placed in the network, where it is evaluated. Service needs are expressed by context constraints, which describe the *situation* and *circumstances* under which the user intends to use a service. The CAP document is organized into three parts: *Context Constraints*, *Scripting*, and *Data*. Context Constraints take into account user's service needs. A Context Constraint is further analyzed into three entities: the *Abstract*, the *Relation*, and the *Event* entity. The former relates to the service peer, sensor, or, person. The Relation entity describes dependencies related to the service selection. Events, which are represented by logical conditions, report situations *detected* by sensors, thus forming a *trigger*. The scripting part represents simple scripts to be executed during service invocation, whilst the data section is the prerequisite data to be processed by the service.

The Web Architectures for Services Platforms (WASP) [232] is a project dealing with the definition of a service platform, which supports the development and the deployment of context-aware integrated speech and data applications, based on Web Services technology, on top of 3G mobile networks. The contextual information in this system is modelled by conceptual graphs describing ontologies of context-aware services. Such platform provides services to *Context Providers*, which communicate through the *Context Interpreter* module. The latter gathers context and makes it available to the rest of the platform. The platform consists of a set of *Repositories*, which support the *Monitor* component with knowledge related to the elements involved in WASP. Repositories collect information from the Context Interpreter (e.g., user preferences and constraints) and make use of the services of the Service Providers. The Monitor component is responsible for managing application subscription by using a WASP Subscription Language (WSL) and by gathering information from both Repositories and Context Interpreters.

The system presented in [233], addresses such issues by developing an agent-oriented architecture**,** the Context Broker Architecture (CoBrA). CoBrA is considered as a large-scale implementing paradigm, which models its contextual information through semantic graphs (e.g., ontologies). Such graphs describe user profiles, user preferences, and device capabilities. CoBrA aims to *assist* devices, services and agents to become context-aware in smart spaces (e.g., an intelligent meeting room). Such an infrastructure requires the following functionality:

1. A collection of ontologies for modelling contextual information (i.e., Context Conceptual Modelling methodology).
2. A shared model for the current context.
3. A declarative policy language that users and devices may use for defining constraints on their sharable resource (e.g., personal agenda).

CoBrA uses languages from the Semantic Web for defining contextual ontologies providing not only a semantically richer context representation, but, also, making use of the ability of reasoning and sharing knowledge. CoBrA provides a resource-rich agent, called *context broker*, to manage and maintain the shared context into consistency. A context broker is associated with a certain smart spaces environment. It may be considered as an aggregation of other brokers representing *smaller* parts of the original smart space environment. Such hierarchical approach, with the support of shared ontologies, is capable of avoiding the bottlenecks associated with a single centralized broker. The Context broker can, also, infer contextual information that cannot be easily acquired from sensors. Furthermore, it can detect and resolve inconsistent knowledge that often emerges as a result from imperfect context sensing. Moreover, CoBrA provides a policy language that allows users to *control* the provision of their contextual information. A context broker acquires contextual information from heterogeneous sources and fuses such information into a coherent model that is, then, shared among computing entities inside the environment.

The My Campus system [234] is an agent-based environment for context-aware mobile services. It revolves around a growing collection of customizable agents capable of automatically discovering and accessing Internet and Intranet services. The scalability of such architecture is attributed to the use of ontologies describing contextual information (e.g., user preferences and constraints). Moreover, agents focus on context-sensitive message filtering, message routing, and, context sensitive reminding. More *sophisticated* agents incorporate planning and automated Web Service access functionality.

One of the most important concepts in the mobile computing context is that of *location*. Architectures, like ParcTab [235] process the location information through suitable spatial models (e.g., the Geometric Model WGS84 [236]). RAUM [237] system develops context-aware applications based on the contextual information retrieved by the user location. The system supports context generated by an appropriate spatial model (i.e., Context Conceptual Modeling methodology). Such context model is based on conceptual graphs representing hierarchies of symbolic locations. Spatial contextual information (location symbolic model) is based on the relative location of entities (e.g., users) rather than on their identity. RAUM is a spatial-aware communication model, in which, two entities are considered contextually relevant (i.e., the relative location information is the compatibility relation between those entities) through their locations rather than their network identifiers. Such model consists of two main parts: the Location Representation Model (LRM), and the Communication Model (CM). The LRM defines how location is represented, stored, and communicated in the RAUM architecture, whilst the CM defines how location information is used in the communication among the RAUM entities. The RAUM – LRM adopts a tree presentation for location selection. Such logical representation consists of three general layers:

- A tree-root.
- The semantic sub-layers.
- A location expressed in three-dimensional Cartesian coordinates.

Further specialization of the third layer into sub-sections enables a more fine-grained differentiation of locations.

The ITEA LOMS[1] project (LOcal Mobile Services) has established a framework and methodology for easy creation of context-aware mobile services. Some LOMS enabling services are:

- An ontology-based context awareness service [238].
- A context-dependent charging service for service features and content [239].

[1] http://www.loms-itea.org

- Heterogeneous indoor and outdoor positioning services [240].

Several approaches have been proposed to model and simulate *mono-epidemical* spreading in networks. Therefore, considerable research related to epidemic-based information dissemination in ad-hoc networks has been studied in [241]. The work in [242] presented a model, which analyses the epidemical spreading in random graphs. The authors in [243] studied epidemical spreading in complex networks and the authors in [244] proposed a model for spreading in arbitrary network topologies. The architecture in [245] uses the mobility of users only for transferring files among networks. Additionally, the architecture discussed in [246] proposed an approach for collaborative context dissemination among groups of nodes. Such architecture takes into account the *reliability* of contextual information in the dissemination process. Finally, the analytical Markov model in [247] and [248] refers to a *multi-epidemical* dissemination scheme for context diffusion. Specifically, short-range communications facilitate the spreading of contextual information throughout a network of ad-hoc topology. The multi-epidemical model greatly resembles the spreading of a set of epidemics in the biological perspective. Such abstraction allows a CAA to design and implement information spreading schemes with increased efficiency. The pieces of context are represented through a contextual hierarchy induced by semantic dependencies. Low-level information is captured from sensors and further processed to obtain more specific, higher-level context. This is also reflected in the epidemical framework through the ideas of virus transmutation (reflecting to the idea of multi-epidemical).

VI.2.2. Security, Privacy and Trust

There are some projects like the FP6-funded projects Hydra [249] and Amigo [250] deal with leveraging semantic models for context-enabled platforms for distributed systems. Amigo, a service-based middleware for Ambient Intelligence applications has stressed the benefit of an increased interoperability which is achieved by the usage of semantic models. This concept is continued by the project Hydra - a middleware and development tool for context-aware applications. Hydra follows the principle of service-oriented architectures (SOA) and makes extensive use of ontologies for describing devices, services, as well as security- and quality of service properties. The security architecture of Hydra provides context-based addressing and aims at pulling all persistent information to the secured middleware layer [251], thereby realising "virtual identities" (VID) in the middleware layer which allow a privacy-preserving interaction across different contexts. This privacy-preserving concept of virtual identities has been coined by projects like DAIDALOS before and is now mainly continued by projects concerned with Identity Management (IdM), as discussed below.

The aspect of self-adapting middleware has been worked out by the European project MUSIC which aims at developing tools and a middleware architecture for self-adaptive, mobile applications. MUSIC mainly focuses on the aspect of context-awareness and self-adaptability and integrates some security aspects like context-specific access control and privacy when sharing context data [252].

In [253] it has further been shown how on the basis of models and architectures as developed within Hydra and MUSIC self-protecting systems can be realised that adapt their security mechanisms to the current context.

Context-awareness does not only play a major role in the scope of pervasive systems and intelligent environments – also on-line communities are fostering a mobile usage and integrate more and more context-sensitive features. Although this opens new ways of social on-line interaction, new privacy challenges arise and need to be addressed in order to increase user acceptance. The problem of privacy in context-sensitive on-line communities is aimed at by the EU FP7-funded project PICOS. The project plans to analyse the privacy requirements and information flows in context-sensitive social networks and to develop services to support stakeholders in achieving an optimal trade-off between privacy and service value.

VI.2.3. Cross layer design for wireless networks

The issue of cross layer design and optimization for wireless networks has occupied various researchers across the globe. Here are some indicative examples: In Van der Schaar, 2005 the need of a cross-layer optimization is examined and an adaptation framework is proposed amongst the APP, the MAC and the Physical (PHY) layers. In Shakkottai, 2003 the issue of cross-layer design in wireless networks is addressed. The focus is on the way that higher layers share knowledge of the PHY and MAC layers conditions in order to provide efficient methods to allocate network resources over the Internet. Signalling issues between the layers for cross-layer optimization over wireless networks are examined in Wang, 2003. The authors propose a new signalling framework in which signalling can be done between two non-neighbouring layers, through light-weighted messages and the use of a message control mechanism to avoid message dissemination overflow. Finally, Carneiro, 2004 outlines the need for new cross-layer architecture to address known problems of mobility, packet losses and delay that are

observed in wireless networks. The main idea of a cross-layer manager is discussed in which all layers send notification messages to the manager who is responsible for intra layer co-ordination.
The cross layered architecture available to the literature can be divided to the following categories [254]:

- Creation of new interfaces [255]: Several cross-layer designs require creation of new interfaces between the layers. The new interfaces are used for information sharing between the layers at runtime.
- Merging of adjacent layers [256]: Another way to do cross-layer design is to design two or more adjacent layers together such that the service provided by the new layer is the union of the services provided by the constituent layers.
- Design coupling without new interfaces [257]: Another category of cross-layer design involves coupling two or more layers at design time without creating any extra interfaces for information sharing at runtime.
- Vertical calibration across layers [258]: Adjusting parameters that span across layers.

USA, EU and Korea have already identified the importance of cross layer design for transmission over wireless networks and have funded some R&D projects:

- EC IST project PHOENIX. PHOENIX focuses on cross layer adaptation only among some layers (more particularly the application and physical layers, demonstrating the realistic feasibility of a network-aware joint source and channel coding approach) like the other state of the art initiatives in the area.
- EC IST project OPTIMIX. OPTIMIX extends such approach by jointly addressing all the layers in the protocol stack and the case of transmission to multiple users.
- EC IST Project UNITE. The target of UNITE project is to investigate, design and evaluate cross-layer and cross-system interactions for current and future generation of wireless systems in term of both radio and protocols.
- USA NSF funded project "Cross-Layer Design of Ad-hoc Wireless Networks for Real-Time Media" (Grant CCR-0325639) which focuses on interfaces among various layers.
- Korea ETRI funded project "Cross Layer QoS control and management over heterogeneous network" which focuses on algorithms which can control and manage the QoS using cross layer concept.

VI.2.4. Service continuity and quality over heterogeneous networks

In the area described in the introduction the following proposals have been identified:

- 3GPP Generic Access Network (GAN), also know as Unlicensed Mobile Access (UMA) [259].
- IEEE Draft Standard for local and metropolitan area networks: Media Independent Handover (MIH) services [260].
- 3GPP System to Wireles Local Area Network (WLAN) interworking [261].
- OMA Mobile Device Management [262].

3GPP Generic Access Network (GAN)

- Name
  Generic Access Network.
- Description
  Generic Access Network (GAN) is a technology which was developed to provide access to cellular networks through unlicensed radio access technologies such as WiFi.
- Utilisation
  Environmental, transport and health applications can take advantage of this technology to achieve global connectivity along cellular networks using WiFi access.
- Components
  New elements, such as the Generic Access Network Controller (GANC), need to be added to the current architecture of cellular networks.

- Characteristics
    - GAN allows mobile devices to connect to GSM/UMTS services through WLAN.
    - When no WiFi connection is available, the mobile phone automatically switches from broadband to cellular network in a seamless manner.
    - GAN capable terminals employ 3GPP specific protocols to correspond with the UMA AP.
- Requirements
  Protocols specified in [259] need to be implemented in user and control plane protocol architectures.
- Traffic
  Available services:
    - Telephony.
    - Emergency calls.
    - Short message services.
    - General packet radio services.
    - Location services.
    - Multimedia messaging services.
    - Supplementary services like caller ID, voicemail, three-way conference calls.
- Entities
    - GAN service must be provided by network operators.
    - Device manufacturers should include the functionalities specified in [259] in mobile devices.

IEEE 802.21 Media Independent Handover

- Name
  IEEE 802.21 Media Independent Handover.
- Description
  The IEEE 802.21 Media Independent Handover standard provides link layer intelligence in devices to optimize handovers between heterogeneous radio access technologies.
- Utilisation
    - IEEE 802.21 is primarily intended for Vertical Handovers between different radio access technologies and can also be used for Homogeneous Handovers between the same radio access technology.
    - IEEE 802.21 helps with handover initiation, network selection and interface activation and provides components to other handover standards.
    - This technology allows maintaining service continuity of applications running in mobile devices on different access technologies.
- Components
  The MIH function is a logical entity which resides in the mobile node as well as on the network side. IEEE 802.21 enables co-operative handover decision making between clients and the network. The mobile client is capable of using network information stored by the network infrastructure, such as available networks, neighbor maps and network services.
- Characteristics
  MIH is a more generalist solution than UMA, since it provides an independent interface between radio access technologies and upper layers.
- Requirements
  IEEE 802.21 introduces a Media Independent Handover (MIH) function between layer-2 and the upper layers protocol stack available in mobile devices.
- Traffic
  Available services in the network where the device is connected.

- Entities
  Network support should be provided by network operators.
  Device manufacturers should include MIH implementation in new devices.

3GPP system to Wireless Local Area Network (WLAN) interworking

- Name
  3GPP system to Wireless Local Area Network (WLAN) Interworking.
- Description
  3GPP TS 23.234 [260] specifies the system description for interworking between 3GPP systems and Wireless Local Area Networks (WLANs). This specification is not limited to WLAN technologies. It is also valid for other IP based Access Networks that support the same capabilities towards the interworking system as WLAN does. The intent of 3GPP–WLAN Interworking is to extend 3GPP services and functionality to the WLAN access environment.
- Utilisation
  The 3GPP–WLAN Interworking System provides bearer services allowing a 3GPP subscriber to use a WLAN to access 3GPP packet switched based services. Other Access Network Technologies are not described in this technical specification but are not excluded.
- Components
  New elements such as WLAN Access Gateway and Packed Data Gateway (PDG) need to be added to the current architecture of cellular networks.
- Characteristics
  - 3GPP-WLAN interworking concentrates on the interfaces between 3GPP elements and the interface between the 3GPP system and the WLAN. 3GPP-WLAN interworking will be independent of the underlying WLAN Radio Technology.
  - The User Equipment employs IEEE and IETF protocols to correspond with the WLAN AP.
- Requirements
  - A WLAN UE is the User Equipment using a UICC card utilized by a 3GPP subscriber to access the WLAN AN (Access Network) for 3GPP interworking purposes. The WLAN UE may be capable of WLAN access only, or it may be capable of both WLAN and 3GPP radio access. Some WLAN UEs may be capable of simultaneous access to both WLAN and 3GPP radio access.
  - Network operators should provide this new functionality.
- Traffic
  This specification defines a 3GPP system architecture and procedures to do the following:
  - Provide Access, Authentication and Authorisation (AAA) services to the 3GPP-WLAN Interworking System based on subscription.
  - Provide access to the locally connected IP network (e.g., the Internet) if allowed by subscription.
  - Provide WLAN UEs (User Equipment) with IP bearer capability to the operator's network and PS (Packet Switched) Services, if allowed by subscription.
  - Provide WLAN UEs with IP bearer capability to access IMS Emergency calls for both UICC (Universal Integrated Circuit Card) and UICC-less cases.

  The interworking architecture will provide IP connectivity to be able to support all 3GPP PS based services. 3GPP PS based services which use more than IP connectivity (e.g., SMS, MMS, MBMS) could require additional entities and interfaces not specified in [260].
- Entities
  - Networks should support this new functionality.
  - Device manufacturers should include the functionality specified in [260] for WLAN user equipment in new devices.

OMA Mobile Device Management

- Name
  OMA Mobile Device Management.

- Description

  The goal of the Device Management Working Group is to specify protocols and mechanisms that enable the management of mobile devices, including the necessary configuration to access services and software management on mobile devices.

  In general terms, device management consists of three parts:

  - Protocol and mechanism: The protocol used between a management server and a mobile device.
  - Data model: The data made available for remote manipulation, for example browser and mail settings.
  - Policy: The policy decides who can manipulate a particular parameter, or update a particular object in the device.

- Utilisation

  The Device Management Working Group defines management protocols and mechanisms that enable robust management during the entire life cycle of the device and its applications over a variety of bearers.

- Components

  A management authority is an entity that has the right to perform a specific DM function on a device or manipulate a given data element or parameter. For example, the network operator, handset manufacturer, enterprise, or device owner may be the authority or share authority for managing the device.

- Characteristics

  OMA DM Protocols are explicitly bearer independent and agnostic to underlying transport between the device and the server.

- Requirements

  - Management authority.
  - Device must offer support for OMA DM Technology.

- Traffic

  Any kind of application.

- Entities

  Management authority.

VI.2.4.1. Identity management

Another challenge in the field of service continuity and convergence is providing secure services in environments of changing network protocols. In order to allow for trustworthy services across different protocols, network- or operator-based authentication schemes need to be replaced by cross-protocol identity management (IdM) techniques allowing users to manage multiple representations of their identity (so-called "virtual identities") and use those different identities in different contexts. These challenges are targeted by the SWIFT project, funded by the seventh European framework programme. SWIFT focuses at a cross-layer integration of mechanisms for Identity Management (IdM), privacy, trust and security, based on the work of previous projects like DAIDALOS II [250]. It thus aims at applying IdM mechanisms to the network layer, thereby allowing for enhancing privacy at this layer, on the one hand, while opening new business models to network operators and service providers on the other hand. One of the planned results of SWIFT is to provide a frameworks and an API that can be used for accessing identity information independent from the networks and services used.

A recently formed ETSI Industry Specification Group ISG INS intends to utilize existing activities of ongoing R&D projects on Identity Management (IdM) to enable a pre-standardization consensus on Identity Management protocols and architectures, in particular related to networks and services taking the Future Internet perspective into consideration, the above mentioned projects and their results play a significant role there.

In the sixth European framework programme FP6, the PRIME [263] project was mainly concerned with developing a privacy-enhancing Identity Management system. The project mainly targeted at allowing citizens to control their personal information in online transactions and to execute their legal rights in case of privacy breaches. The work started in PRIME is continued in the successor project, PrimeLife [264], which is part of the seventh European Framework Programme. PrimeLife is mainly concerned with developing privacy-preserving techniques in order to counteract the trend towards the creating of life-long trails of personal data such as user preferences, healthcare and employment data. For this, the project researches access control mechanisms, cryptographic techniques and privacy metrics upon which Privacy-Enhancing Technologies (PET) will be developed and provided in form of open-source components.

A similar challenge is tackled by the TAS³ Integrated Project [265]. Also TAS³ is concerned long-living personal data, especially from the healthcare and employment domain and the questions of possible privacy breaches and the need for trustworthy services. In contrast to PrimeLife, TAS³ aims mainly at developing guidelines, checklists and sample policies for trustworthy business workflows dealing with such critical data.

VI.3. Future challenges

VI.3.1. Context-aware applications and systems

Context-aware computing is a mobile computing paradigm in which applications can discover and take advantage of contextual information (such as user location, time of day, nearby people and devices, and user activity). Since it was proposed about a decade ago, many researchers have studied this topic and built several context-aware services / applications to demonstrate the usefulness of this new technology.

Context-aware applications (or the system infrastructure to support them), however, have been widely available to everyday users. Research on context-aware systems and applications looks in depth at the types of context used and models of context information, at systems that support collecting and disseminating context, and at applications that adapt to the changing context. Specifically, context-aware computing will enable a framework in which users to easily develop local applications for context-aware services. The several research challenges are:

- Context discovery: mobile applications require on the fly discovery of devices and resources in an ad-hoc network with the ability to check whether these devices provide the required capabilities, such as specific input-output facilities.
- Context state capture and transfer: for seamless service relocation, the state of a mobile application should be preserved while the user is moving from one system to another to ensure that contextual information is not lost during transfer.
- Context adaptation: the mobile application should be deployable on different hardware platforms, ranging from desktop systems to mobile handheld devices. This should be possible without any modification or manual reconfiguration of the service by the user while at the same time it must be ensured that abstract and platform-independent security requirements are appropriately enforced by platform-specific mechanisms.

We also need more generic methodologies to develop self-adaptive context-aware services. An open research challenge is to create a language to define the adaptation capabilities of a context-aware service. This language should separated functionality and adaptation concerns. Another open research question is the guarantee of system consistency after adaptation. Indeed, when a service is adapted its functionality must remain unchanged. This challenge is directly linked to context monitoring. Context monitoring is already used to find relevant context-aware services. However, in order to ensure that such services remain relevant, context has to be monitored also during service provision. As the user context usually contains personal data such as the user location, recording context naturally leads to privacy problems. Recording context-data on the user personal device can be a possible solution, but we have to keep in mind the resource-constrained nature of such devices.

Moreover, research and development activities in the field of autonomous agents and multi-agent systems can be adopted in context-aware computing. The aim is to identify key concepts and applications, and to indicate how they relate to one-another. Some historical context to the field of agent-based computing is studied, but contemporary research directions have to be investigated.

Moreover, recently, there are many efforts to build ubiquitous computing applications in many areas such as home, office, and mobile. However, it tends to make ubiquitous system not based on scenario, but technology. Targeted applications at home such as u-media, u-healthcare and u-control can be supported by context-aware home applications. From such applications, one can abstract technologies and system architecture required to be developed. System architectures that can easily accommodate context-aware information and support new applications are of high importance.

Furthermore, context-aware middleware encompasses uniform abstractions and reliable services for common operations, supports for most of the tasks involved in dealing with context, and thus simplifying the development of context-aware applications. Several key issues of a middleware for context-aware ubiquitous computing range from design considerations of a unified sensing framework, formal modelling and representation of the real world and pluggable reasoning engines for high-level contexts to context delivery-runtime service composition mechanisms. Past experience indicates that a comprehensive approach throughout the system layers results in a flexible and reusable context-aware middleware architecture.

In this flexible and reusable context-aware middleware architecture, value is generated on all system layers, i.e., content, service and network. Not everything can be paid via the traffic charges collected by a network operator, as additional charges from different players apply, in particular for third-party service and content providers. Generic charging models that build a basis for a flexible revenue sharing scheme have to be investigated. These models should be able to at least partially take the context, under which context-aware applications are used, into account. It is a matter of research to identify those contextual elements that are suitable for context-dependent charging and billing.

One key aspect here is to keep a transparent pricing to the end users and ensure viable business models for all involved players. Context-dependent charging and billing has therefore also to be further investigated for reliable third party payment operations able to satisfy all involved parties. Corresponding enabling technologies should allow context-aware advice of charge and charging operations. Important features to investigate further are [266]:

1. Context-aware charging of service usage in real-time.
2. Providing Advice of Charge to mobile users *before* the actual service usage to increase confidence.
3. Interaction of context-dependent charging and billing with user profile settings (charging limits, thresholds), especially under real-time aspects.

In addition, as the human-computer interface becomes more pervasive and intimate, it will need to explicitly draw upon cognitive science as a basis for understanding what people are capable of doing. User experience and situation should be integrated into the computer system design process. Situation and context awareness can be used to reduce the amount of explicit input a person is required to give a computer. Contextual information of what and where the user task is, what the user knows, and what the system capabilities are, can greatly simplify the user scenario. Such use of contextual models in computers can also reduce the teaching needed for the user to accomplish tasks. Approaches to a framework for design of human-computer interaction based on contextual information are challenges in context-aware computing.

While context-awareness simplifies human-computer interaction and even fosters a completely new way of apparently omnipresent and omniscient, yet almost invisible computing, new security challenges arise. On the one hand these challenges are caused by new applications that become possible with the advent of context-aware middleware technologies. Context-aware applications such as intelligent homes, offices and eHealth-environments deal with a massive amount of sensor data describing the user's behaviour and his environment as well as critical personal data such as patient records, activity history and personal preferences. This data is required in order to deliver the type situation-adapted behaviour that is expected from context-aware applications. But it is also obvious that this bears serious risks like omni-surveillance of users or a roaring trade with personal information that can be used to blackmail users, but at least a significant breach of privacy. Therefore, one major future challenge in the field of security in context-aware systems is to research identity management techniques that are tailored to context-aware systems and privacy-preserving context-fusion mechanisms that ensure trustworthiness of context data while sticking to the paradigm of minimal disclosure of private data.

On the other hand, traditional security technologies cannot be directly applied to the context-aware and pervasive software environments: public key infrastructures (PKI) are not well-suited for the type of dynamic ad-hoc connectivity in open environments which is typical for context-aware applications. Further, in CAAs devices roaming between different networks, protocols and domains are the rule rather than the exception and the traditional distinction of "trusted" and "untrusted" networks whose interaction is controlled by perimeter firewalls does not apply anymore. Rather, the new paradigm is to separate security requirements from the actual platforms and to work towards self-protecting systems that automatically re-configure themselves. Such systems will automatically enforce abstract security requirements (which have been stated in the form of policies,for example) by appropriate security mechanisms that are tailored to the specific platforms currently in use. The challenge here is thus to decouple security implementations from specifications and to develop self-protecting infrastructures, e.g. making use of technologies from the field of artificial intelligence like reasoners, planning engines, optimisation algorithms and (fuzzy) rule engines.

VI.3.2. Cross layer design for wireless networks

Cross layer adaptation is a very challenging process due to the numerous parameters involved in the whole procedure. This section outlines the most important parameters and constrains that should be taken into consideration when attempting cross layer adaptation in wireless networks that involves different protocols in the overall protocol stack.

VI.3.2.1. Network elements involved in the adaptation process.

During transmission three entities can be distinguished that take part in the information exchange procedure: the sender, the core network elements (links, routers) and the receiver. There has been a detailed discussion whether or not all three elements should be involved in an adaptation scheme, targeting at improving the QoS offered to the end user. The most challenging and maybe the most beneficial approach would be the participation of all three elements in the optimization mechanism. However, even in the same network domain someone has to decide whether or not both the sender and the receiver should participate in the adaptation process.

VI.3.2.2. Layers involved in the cross layer adaptation (Inter-layer optimization)

Most of the available bibliography focuses on a jointly PHY and MAC layers adaptation. This bibliography (Choudhury, 2004, Verikouris, 2005 and Chen, 2004) has proven that PHY and MAC layers are very important especially in wireless networks and must be taken into account during cross layer adaptation and optimization. Moreover, the APP layer has been used in several cross layer adaptation schemes (Radha, 2001 and Ahmed, 2005). While the above mentioned layers (PHY, MAC and APP) have been extensively researched in cross layer adaptation schemes there has been little work done in the whole protocol stack. The transport/session layer can play important role in cross layer adaptation for wireless networks, as a number of adopting mechanisms in this layer have been extensively evaluated in wired networks, revealing adaptation opportunities in wireless networks. Although, the network layer can not be used straightforward for cross layer adaptation it can be used for indirectly cross layer adaptation through QoS schemes implemented at the network layer.

VI.3.2.3. Parameters involved in cross layer adaptation (Intra-layer optimization)

Each layer offers a number of different parameters through which adaptation can be achieved. The optimization of each layer parameters includes the selection of the applicable parameters which could lead to better results. At this point, we should mention that the adaptation of a parameter in one layer may and most likely, will influence the parameters in other layers. Therefore, the adaptation of the parameters in each layer should be done by taking into account the above mentioned assumption. Table VI.1 shows the various parameters that can be involved in cross layer adaptation.

Table VI.1 – Parameters for cross layer adaptation in wireless networks.

Layer	**Parameters a**
PHY	Signal modulation
MAC	ARQ, FEC, QoS (802.11e)
Network	QoS (Diffserv, IntServ), IPv6
Transport / Session	Adaptive Transmission Rates (TFRC, DCCP, other mechanisms)
Application	Encoding parameters

VI.3.2.4. Adaptation strategy

Another important issue is how the adaptation strategy could be realized. There are various approaches in this field as following:

- Bottom-up approach: In this approach the lower layers (PHY and MAC) provide the upper layers with optimal services by reducing the transmission errors.
- Top-down approach: In this approach the APP layer informs the lower layers for the importance of each data packet and the lower layers treat each data set with a different way, based on QoS criteria. The higher layer protocols optimize the parameters and the strategies of the next lower layer.
- MAC-centric approach: In this approach the APP layer passes its traffic information and requirements to the MAC layer that decides which APP layer packets/flows should be transmitted and at what QoS level.
- Integrated approach: This approach is the most challenging because the adaptation strategy is decided jointly by all the layers.

The above cross-layer approaches exhibit different advantages and drawbacks for wireless transmission, and the best solution depends on the application requirements, used protocols, algorithms at the various layers, complexity and limitations.

VI.3.2.5. Devices constraints

The decision on the above mention design issues must be done under the following constrains:

- Device constrains: Mobile devices have many limitations when compared to desktop systems. These include display limitations, CPU resources and power consumption.
- Network constrains: Network constrains include available bandwidth, delay, RTT and QoS support.
- Application constrains: Application constrains include maximum and acceptable delay, maximum and acceptable delay jitter (especially for interactive applications), maximum and acceptable packet loss ratio and finally bandwidth constrains.

In conclusion, the main objective of the optimization process is the optimal selection of the above described parameters in order to provide the best experience to the end user by taking into account the above described constrains.

VI.3.2.6. Future trends

Nowadays we are moving from the static connectivity of the wired networks to the "anytime anywhere mobile applications". In addition we are facing important increase in the usage of wireless access networks either in the form of PAN (Personal Area Networks, e.g., Bluetooth), LAN (Local Area Networks, e.g., IEEE 802.11) and MAN (Metropolitan Area Networks, e.g., IEEE 802.16) or in the form of current 3G and future 4G mobile networks and important increase of mobile multimedia applications like voice over IP, Video on Demand, videoconference, Media streaming, etc. Cross layer design will facilitate the above important changes by providing a unify scheme which will allow the incessant usage of networked media by adapting the media transmission to the specifically needs of the wireless networks and the mobile terminal (e.g., laptop, PDA, mobile phone). In addition, cross layer adaptation will allow smooth operation of mobile multimedia applications during the transition form one wireless network technology to other.

VI.3.3. Service continuity and quality over heterogeneous networks

Service continuity is key in the deployment of new services, such as remote health monitoring.

In order to support a seamless mobility between different radio access technologies and provide service continuity, technologies introduced in the previous section need to be adopted.

For the successful deployment of new services in the context of heterogeneous wireless networks, three main challenges have been identified:

- Seamless handover between different radio access technologies in order to provide permanently connected applications.
- Interoperability between different available solutions for seamless mobility.

- Remote monitoring and management of mobile applications to enable remote configuration in mobile devices, retrieval of management information and detection of events and alarms generated on the client side.

VI.3.4. Identity Management

Future challenges in the field of Identity Management mainly arise from converging heterogeneous networks and service platforms. In future open environments, identity representations from many identity providers must be brought together in order to achieve a seamless and valuable service experience to the user. Therefore, further research on interoperability of identities and open platforms for integrating various identity providers into a universal IdM system has to be undertaken.

Another aspect of identity management is that of growing privacy concerns caused by a trend towards live-long personal data and the rapidly increasing usage of on-line social networks. As such platforms tend to integrate mobility and context-awareness features, the collections of personal data do not only grow in size but also in value – i.e. from the viewpoint of privacy, the risk of data loss is getting less and less acceptable. Future challenges therefore relate to combining Identity Management techniques with privacy-preserving methods and the paradigm of user-centrism so that users stay in control of their private data while moving across different networks, service types and contexts.

VI.3.5. Matrix Serv. & Apps. vs. Techs., End User Issues

[259], [260], [261] technologies make it possible to improve service accessibility and usability, since services can be accessed from different radio access technologies, and also from a wide range of devices, from mobile devices to laptops.

On the other hand, OMA DM provides a complete set of protocols to improve performance and reliability of applications running on customer devices. OMA DM makes it possible to perform a wide range of over-the-air management tasks on user terminals.

The main tasks available are the following:

- Connectivity Management.
- Device Capabilities Management.
- Diagnostics and Monitoring Management.
- Firmware and Software updates.
- Software Component Management.

Table VI.2 summarises the advantages of applying these technologies to the deployment of future services.

Table VI.2 – Advantages of applying a certain technology to the deployment of future services.

	Service accessibility	Service usability	Service reliability	Service availability
3GPP GAN	X	X		
IEEE 802.21 MIH	X	X		
3GPP WLAN interw	X	X		
OMA DR		X	X	X

VI.3.6. Examples of enabling technologies for healthcare applications

The most recent wireless broadband standards will support highly demanding telemedical applications, also through the exploitation of the emerging concepts described below [38].

VI.3.6.1. Context awareness

The concept of context awareness has been cited for some time, but only recently have technologies (e.g. wireless technologies, mobile tools, sensors, wearable equipment, handheld computers) become available to support the development of relevant applications.

In the healthcare area [267], context awareness technology has been used for health awareness purposes.

Applications include the determination of critical heart conditions, including seizures. A wireless device that is attached to the patient's body can automatically send the necessary information to a receiver (for example a monitoring unit in a hospital), that can take immediate action in case of a serious situation. At this moment the application is primarily foreseen in post-care situations, although the next goal would be to use the data for prevention purposes.

A patient status monitoring module that collects patient data and determines the patient status has to be considered in order to utilize context data for system adaptation. The patient status can be determined through a number of health sensors (e.g. heart rate and body temperature sensors) and corresponding vital signals.

Several research topics can be envisaged in this emerging area: information about the context (e.g., patient state, location) can in fact be exploited for system optimization.

As an example, the operation of compression of medical multimedia signals can be performed according to the patient status, e.g., higher compression can be considered if the patient is in a non-critical status, whereas in critical conditions detailed information need to be transmitted, at the expenses e.g. of redundancy for security purposes.

Joint compression and coding of different medical signals (e.g., cardiac ultrasonography with ECG and respiratory pattern) and compression taking context into account can be performed; similarly detection of portions of interest (in space and time) in a medical video sequence can be performed with the support of context information (collected e.g. through medical sensors).

Data protection, scheduling and security can be also adapted to the context (location and status of the patient).

Examples of exploitation of context information in the healthcare area include [268].

VI.3.6.2. Content awareness

Video compression and transmission systems have mostly developed without taking the content of the transmitted information into account. In recent years, approaches of joint source and channel coding have taken into account some information about the content of the source [269], such as source sensitivity information (the sensitivity of the different bits representing the source to channel errors) in order to perform unequal error protection or the source a-priori information (e.g., statistical information about the source such as the prevalence of bits equal to one or equal to zero in its binary representation).

In the case of telemedical applications, specific application requirements are present, as well as specific characteristics of the transmitted data. The characteristics of medical video sequences, both in terms of statistics and semantic, can be taken into account to envisage medical video specific error resilient tools. In particular, regions of interest (ROI) can be considered for the compression and protection strategy.

As a simple example, the region of interest can be compressed without loss of data and/or can be highly protected through error correcting codes or prioritization techniques when transmitted.

The suitable tools of the recent video coding standards (e.g., the possibility to identify video objects in MPEG-4) can be exploited in order to select and separately manage the regions of interest.

The concept of content-awareness is tightly linked to the need to enable an acceptable perceptual quality of the service.

Transmission systems are classically developed with the target of maximizing the data throughput. However, in particular for multimedia data transmission, the final target is the maximization of end-to-end quality [85], [269]. Such quality is usually expressed through a single quality index, representing the distortion between the received and the transmitted signals. However, such metrics (as MSE, PSNR) often fail in actually representing the quality perceived by the user and objective metrics well representing the perceived quality have been developed [270]. Such metrics are based on the knowledge of the human visual system (HVS) and are often derived after extensive subjective quality assessment tests (mean opinion score, MOS).

Such novel quality metrics do not always represent a correct index in the case of medical images, since the content of the image/video sequence is not considered in the quality assessment procedure.

An example of content-aware and quality-driven optimization of wireless telemedical applications is reported in [85].

VI.3.6.3. Cross-layer design

Example applications of cross layer design in specific telemedical applications are reported in [54], [37], [85]. Cross layer design allows the joint exploitation of side information from all the OSI protocol layers to perform system optimization. Context information can also be included in such a framework, providing systems which are aware of the environment and of all the blocks of the transmission system itself and that can exploit the relevant information for the system design and for optimization of the end-to-end quality.

VII. Conclusions

*e*Mobility aims to reinforce Europe's leadership in Mobile and Wireless Communications (M&WCs), which have created unprecedented possibilities for people to communicate and have become a key driver of economic growth. Within the activities of *e*Mobility, the Working Group on Leading-Edge Applications is creating a report, which addresses non-technological aspects related to services and applications in M&WCs, i.e., the current SAA (Strategic Applications Agenda).

The SAA focuses on several areas:

- Health and Inclusion.
- Transport.
- Environment.
- Future internet.
- Enabling Technologies.

For each area a vision and core topics are defined, a compilation of the state of the art has been made and future challenges assessed. The contributions have been gathered through workshops and research.

On Health and Inclusion the main challenges identified are:

- The barrier that comes from doctors not using ICT citing a lack of training and technical support.
- The quality (e.g., medical data) provided by the available systems.
- The demanding requirements regarding energy, size, cost, mobility, connectivity, and coverage for pervasive healthcare systems and applications.
- The need for enhancement of the main functionalities in terms of speed, data compression.
- The requirement for high quality medical video, bandwidth limitation/error prone characteristics of the wireless channels and real-time requirements of most of the services.
- The need to address legal and regulatory issues.
- The integration/interaction of the security (e.g., of data) and privacy (e.g., location) issues with the whole transmission system.
- The need for high standards with regard to reliability, scalability, privacy-enhancing, interoperability, and configurability.
- The need to build user-friendly platforms thereby diminishing complexity through better design.
- To develop research projects on customized and accurate platforms to exchange homogeneous data among different devices, services and healthcare personnel.
- To initiate research projects which focus on easy to use, highly reliable, unobtrusive, low power, transparent technologies and devices in order to gain the users confidence. The implementation of stress detectors and face recognition applications utilising emotion recognition techniques is expected to meet the expectations and cognitive capabilities of the end users.
- To make any service adaptive to the conditions of the user and the device there are using, not the contrary. In this way, equality and design for all would be met.

On Transport the main challenges identified are:

- The need for certification guidelines across a wide range of areas including safety issues.
- The issues surrounding personal privacy and protection of privacy.
- How individual automated vehicles would operate in a shared environment (with other traditional vehicles) as opposed to a constrained environment such as a campus or private business park.
- Reliability in cruise control and stop and go systems due to the complexity of the system with the driver and the driver’s environment.

- Training of personnel to use adaptive driver assistance systems if implemented in a business environment (say by a bus firm).
- Services that increase the safety of pedestrians in traffic.
- Services that provide the right information as required (e.g., free parking places).
- To have the right information (context aware, potentially with context prediction) at your fingertips.
- To have "easy" service creation for end users, or service providers in a personalized, context aware fashion.
- To have the right service architecture including algorithms for context awareness/ prediction.
- To have tools for semantically enhanced service creation.
- To have the right set of APIs.
- To have smart user interfaces.
- To have multimodality of travel information services.
- To guarantee efficient traffic data distribution within vehicular networks, the routing, broadcasting and dissemination communication protocols have to incorporate reliable transmission policies, such as congestion control or back fire algorithms.
- Wireless communications for vehicular applications have not yet reached the "one size fits all" or "one technology fits all" solution. Standards at all layers and their integration are still lacking.
- Cost (e.g., equipment cost, usage cost: airtime, flat fee, data volume, etc.).
- Quality of Service (e.g., bandwidth, latency, scalability, etc.).
- Availability (e.g., coverage area, indoors, outdoors, etc.).
- Wireless mesh networks have not yet witnessed mass market deployment. However, it is fundamental to consider this technology as a part of the global communication puzzle.
- The requirement for future standards in the ITS field to be able to provide multiple services, over multiple different platforms, that will work in different countries (as vehicles can easily cross borders), while maintaining a simple-to-use interface that requires minimum intervention from the driver.
- Multimodal interfaces need to be exploited and improved.
- Exploiting new emerging communication technologies (Zigbee, RFID, etc.). It is vital to improve the current state of the art, interoperability, communication continuity, and handoff approaches (in an environment where the communication is not always available) in homogeneous and heterogeneous networks (UMTS, WiFi, etc.), that will be key for providing transparency to the user.
- Applying security in such a heterogeneous environment requires new solutions for managing security while at the same time providing the users the possibility to control their identity, personal information, etc.

On Environment the main challenges identified are:

- Requirement-driven solutions which have a commercial and economic justification and can be provided at best on a global scale.
- Setting standards and conventions surpassing national and language boundaries, and also political and legal issues.
- Product reliability and other legal issues as well as prevention of malicious attacks and viruses.
- To provide guidelines that facilitate the increased availability of critical information, as well as the way the critical information is computed, transmitted and delivered.
- New solutions that design and implement usability and reliability.
- To increase the collaboration between environmental organizations, public sector and industry.

On Future Internet the main challenges identified are:

- The need to understand what the users would like to achieve.
- To understand the requirements for future applications and services.

- To drive research in the right technological direction, so that technology advancements may translate into business innovation.

On Enabling Technologies the main challenges identified are:

- To have service continuity in order to facilitate the deployment of new services.
- To support seamless mobility between different radio access technologies and provide service continuity.
- To support seamless handover between different radio access technologies in order to provide permanently connected applications.
- To have interoperability between different available solutions for seamless mobility.
- To have remote monitoring and management of mobile applications to enable remote configuration in mobile devices, retrieval of management information and detection of events and alarms generated on the client side.

An issue common to all the areas is trust concerning W&MCs, as well as security and privacy of data, whose perception varies.

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[3] Imagine a world where cars don't crash, where congestion is drastically reduced and where your car is energy efficient and pollutes less.
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The eSafety initiative brings together the European Commission, public authorities, industry and other stakeholders in a drive to accelerate the development, deployment and use of eSafety systems. The main aim is to contribute to the European Commission's 2001 goal of halving the number of fatalities on Europe's roads by 2010.
Established in early 2003 by the Commission in close co-operation with the industry, industrial associations and public sector stakeholders, the eSafety Forum is a joint platform involving all road safety stakeholders. Its general objective is to promote and monitor the implementation of the recommendations identified by the eSafety Working Group and to support the development, deployment and use of eSafety systems.

Annex A (Health and Inclusion)

Point of care diagnostics systems

1. VitaBIT

Background and Objectives

Launched in July 2007 the VitaBIT project (http://www.vitabit.org) deals with the central question of how patient care can be made efficient with high quality characteristics and cost-saving. Technological, scientific, and social partners teamed up with the goal of providing outpatient care by dint of an open IT platform. The platform is designed to ensure communication and the secure exchange of information between all parties involved in the care process. By dint of a nursing service as a pilot test in outpatient nursing care the operability of the IT platform in everyday life and their profitability shall be proven.

Legal, regulatory and institutional issues

Supplier

The nursing care centre is supported on administrative work in planning and coordination of staff and communication with agencies such as hospitals, physicians, food service, relatives, etc. With the open platform, the entire patient information is centrally collected and made available to all interested parties everywhere and taking into account high data security.

Cultural and social issues

Supplier

By dint of the mobile phone the nurse has the opportunity to retrieve the tour schedule and all the data of the patients she cares that day. With a digital pen, the nurse documents the course of work carried out. At the end of the day, all the data of the digital pen is transferred to the central database and are assigned to the electronic health record and health account for charging. The use of wireless instruments with an interface to mobile solution makes it possible that the vital signs can be digitally recorded and thus evaluated. With a corresponding logic, it is then possible to identify major discrepancies in the recorded vital signs and send automatically, for example, the candidate's doctor a notification. The employees will be relieved on the spot - the bureaucracy is minimized and the staffs have more time to take care of and for the needs of patients.

Technical issues

Supplier

A special security component for the authorization of access to sensitive care and patient data is used in each terminal. To ensure optimal expandability and maintenance of the system even after the individual extensions and adaptations to be able to VitaBIT based on a plugin architecture. The plugins can be integrated using standard Web services interfaces. VitaBIT provides interfaces for the care planning software available, so that the nursing can continue to use the familiar environment.

Participants

http://vitabit.org/2/index.php?id=partner

FZI Forschungszentrum Informatik
CAS Software AG
PTV AG, Sozial- und Diakoniestation Weinstadt e.V.
WIBU-SYSTEMS AG

2. Wealthy

Background and Objectives

The main goal of WEALTHY project (www.wealthy-ist.com) is to integrate computing techniques, smart sensors, portable devices and telecommunications, together with local intelligence and a decision support system and set up a wearable healthcare system that will improve patient or user autonomy and safety.

Demand

Patients in the near future will use 'smart' fabrics to keep them healthy. Potential users could be soldiers under extreme conditions in the field, athletes, personnel in high-risk jobs like firefighting, or the sick and vulnerable, will all benefit from the health data these clothes can provide. The system can also be used as part of treatment, for example monitoring people undergoing physical therapy and rehabilitation. Sleep apneas, where people stop breathing in their sleep, is another application, or for people who drive long distances.

Commercial and economic issues

Supplier

WEALTHY project will send prototypes of its smart clothing to selected stores around Europe, in part to acquire vital data from users.

Technical issues

Supplier

WEALTHY building blocks are:

4. cost-effective, non-invasive system based on wearable and wireless instrumented garments, which are able to detect user specific physiological signals;
5. intelligent system for data representation and alert functions for creating intelligent feedback and deliver information to a target professional;
6. electronic devices for signals transmission by using 3G wireless network allowing monitor the patient ""anywhere"";
7. advance telecommunication protocols and services;
8. effective and user-friendly data format.

The WEALTHY project integrated temperature sensors in the armpit and shoulder of their garment to register core and skin temperature.

Participants

http://www.wealthy-ist.com/index.php?action=show_consortium

3. MyHeart

Background and Objectives

MyHeart (www.hitech-projects.com/euprojects/myheart/home.html) is an integrated project under Philips Research Aachen leadership for fighting Cardiovascular Diseases (CVD) by prevention and early diagnosis. The major goal of the project is to demonstrate technical solutions and a system suitable for supporting citizens to fight major risk factors of Cardiovascular Diseases (CVD) and help avoid heart attack and other acute events by personalized monitoring, guidelines and feedback.

Demand

So far the results have not yet yielded in systems for practical use.

Commercial and economic issues

Demand

Chronic cardiovascular diseases, which currently affect more than 20% of Europe's population is one of the world's biggest killers.

Technical issues

Supplier

The approach is to integrate system solutions into functional clothes with integrated textile sensors, combined with feedback devices, able to interact with the user as well as with professional services.

The MyHeart approach for solving the key challenges is based on the development of:

- products & services to effectively improve preventive life-style as functional intelligent biomedical clothes for preventive care application tailored to specific user groups and on-body electronics
- solutions for disease (self-) management
- safety & security by ubiquitous access to primary care

Participants

http://www.hitech-projects.com/euprojects/myheart/consortium.html

4. Nisan

Background and Objectives

The Nisan project (www.afcon-inc.com/Templates/showpage.asp?TMID=84&FID=739 &PID=2855) copes with diagnosing and caring for patients with blood coagulation conditions. Combining new and existing technologies, Nisan aims to build a platform for medical home tests and to create a sensor for non-invasive blood coagulation assessment. With Nisan, the patient will carry out the test at home and transfer data to the doctor either via the Internet or cell phone. The doctor will diagnose the data and send a prescription through the same technology.

5. Mobihealth / HealthService24

Background and Objectives

The MobiHealth system (www.mobihealth.org) allows patients to be fully mobile whilst undergoing health monitoring.
The patients wear a lightweight monitoring system - the MobiHealth BAN (Body Area Network) - which is customized to their individual health needs. Mobihealth showed the feasibility of using GPRS or UMTS mobile communications for cardiology applications.

HealthService24 (www.healthservice24.com) aimed to exploit in a pre commercial eTEn project the results of the MobilHealth project at supporting patients, health professionals, mobility and increasing patients' quality of life.

Commercial and economic issues

Supplier

The experience and the prototype developed have been exploited in a pre commercial eTEn project called Health Service 24.

Ericsson Mobile Health (EMH) comprises a wireless and light-weight system which monitors objective and subjective body values anytime and anywhere and gives feedback to the patient in real time. Used in the field of COPD, cardiac patients and pregnant women that demonstrate the benefits and advantages of using a solution based on mobile systems, feedback and interactivity in personal care.

The system offers a viable mobile healthcare service that permits healthcare professionals to remotely assess, diagnose and treat patients, while allowing the patients to be free to continue with life's daily activities. The solution is based on sensor devices that measures patient's vital parameters and are connected to a Body Area Network (BAN) that transmits the data wirelessly to a remote healthcare organisation where the professionals monitor, diagnose and provide advice to the patients in real time. The EMH solution is ready for the market and Ericsson GmbH in under final commercial negotiations inside and outside Europe.

Technical issues

Supplier

The architecture is based on Java. MobiHealth targeted the introduction of new mobile value added services in the area of health, based on 2.5 and 3 G technologies with the integration of sensors and actuators, to a wireless Body Area Network. The MobiHealth BAN system also targeted fast and reliable remote assistance in case of accidents, enabling paramedics to send reliable vital constants data as well as audio and video from the accident site to a health care centre.

Participants

http://www.mobihealth.org/

6. MOTOHEALTH

Background and Objectives

The MOTOHEALTH project (www.motorola.com/mediacenter/news/detail.jsp?globalObjectId=5241_5237_23) using Motorola's MOTOHEALTH solution monitors patients with chronic diseases such as diabetes, COPD, asthma and obesity, and others.

MOTOHEALTH is an integrated solution which uses Motorola's cell phones (Motorola A1000) to help older citizens manage their chronic conditions and increase their independence, while potentially reducing healthcare costs. This Project consists in the monitoring of 100 people with chronic diseases through a mobile phone with the very latest technology, which will collect, through sensors, the patients' bodily information and send the data to the Clínic Hospital of Barcelona to be checked by its doctors

Participants

The Clinic Hospital of Barcelona, the Telecommunication Engineering College of the Polytechnic University of Madrid (ETSIT-UPM) and Amena.

7. PIPS

Background and Objectives

By using all the latest ICT devices (Mobile phones, PDAs), PIPS (www.pips.eu.org/background.html) helps the individual by providing all the information needed at the point of decision (home, supermarket, restaurant, gym) in order to make informed decisions and thus helping him/her to follow GP's therapeutical and nutritional instructions for maintaining a healthy lifestyle.

Legal, Regulatory and institutional issues

Supplier

The Trust infrastructure that has been proposed claimed that guarantees the privacy and the protection of information and fulfills all the legal and ethical implications that such flows could create.

Cultural and social issues

Supplier

High risk for patient safety. Aging of the population. Demand for high-quality services, for everyone, everywhere. Need to effectively react to public health crisis.

Commercial and economic issues

Supplier

Medical devices, mobile phones, PDAs, interactive TV, broadband connections are used to monitor and transmit user's vital signs.

Technical issues

Supplier

PIPS developed & deployed an integrated system using multy-device User-Interfaces, enabling ubiquitous access.

Participants

http://www.pips.eu.org/partner.html

8. HeartCycle (FP7)

Background and Objectives

HeartCycle will provide a closed-loop disease management solution being able to serve both Heart Failure (HF) patients and Chronic Heart Disease (CHD) patients, including possible co-morbidities hypertension, diabetes and arrhythmias. This will be achieved by multi-parametric monitoring and analysis of vital signs and other measurements. The system will contain:

- A patient loop interacting directly with the patient to support the daily treatment. It will show the health development, including treatment adherence and effectiveness. Being motivated, compliance will increase, and health will improve.
- A professional loop involving medical professionals, e.g. alerting to revisit the
- care plan. The patient loop is connected with hospital information systems, to
- ensure optimal and personalised care.

Europe's health system is undergoing radical changes due to an aging population. It's moving from reactive towards preventative care, and from hospital care to care at home. Tomorrow's patients will become more empowered to take their health into their own hands. New ICT is required to enable this paradigm shift.
HeartCycle, coordinated by Philips, includes experts on textiles, ICT, decision support and user interaction.

HeartCycle aims to improve the quality of life for patients with coronary heart disease or heart failure by monitoring their condition and involving them in the daily management of their disease as well as by developing mechanisms to automatically report relevant monitoring data back to clinicians so that they can prescribe personalized therapies and lifestyle recommendations.
To this end, HeartCycle will develop:

- An integrated care system for cardiovascular disease management linking health status monitoring, motivation and treatment assistance at home with the professional care platform.
- A closed-loop treatment system, empowering the patient, and giving motivating feedback to show the importance of working with the treatment program.
- A tool for Health status Assessment for Patients at Home by integrating easy to use sensors for vital body sign measurement and feature extraction algorithms.
- Methods that provide accurate daily measurements related to medication and lifestyle effectiveness. This information will be integrated into the decision support system to warn the professional of unfavourable trends, and possible problems, enabling appropriate updating of the patient care plan. The system will also give feedback to the patient to inform him of his health progression, and enable a more optimal lifestyle management.
- A personalised complete care system, integrating care at home with professional care in the hospital. The HeartCycle system consists of two loops. An inner home-based loop directly interacts with the patient in his daily life, giving feedback, motivation and help, and an outer loop involves medical professionals, maintaining a personalised care plan for optimal therapy.

Technical issues

Proposed technologies to be used in this project:

Sensors
New sensors: Cuff-less blood pressure, wearable SpO2, inductive impedance, electronic acupuncture system, Further sensor development: Contact-less ECG, Arrays of electret foils, Motion-compensation in ECG, Cardiac performance monitor (bio-imped.)

Decision Support System
Patient and professional DSS; Dynamic learning capabilities; Personalised DSS; Traceability; Upgradeability (for incorporating new guidelines); Models for predicting the short-term and longterm effects of lifestyle and medication; Models for obtaining an objective indicator of patient compliance

Patient platform
Dynamic context awareness in a User Interaction Workflow
Sensor network middleware for sensors abstraction
Medication compliance coaching

Professional platform
Management of chronic care plans (MyHeart: Warning system)
Light workflow engine available for light devices with very high expressivity and easy to modify on execution

Participants

Philips Research Aachen
Philips Electronics Nederlans
Fundacion Vodafone Espana
Empirica, Germany
Gesellschaft für Kommunikations – und Technologieforschung mbH, Germany
CSEM, Suisse
Aristotle Univ. of Thesaloniki
Polytechnic University Milano, Italy
Polytechnic University Madrid, Spain

ETSI Telecomunicación, Madrid, Spain
University of Hull
T-Systems ITC Iberia
ITACA, Spain
Universidad Politecnica de Valencia
VTT, Finland
RWTH Aachen University
Clinic Hospital San Carlos, Madrid, Spain

9. Doc@home

Background and Objectives

doc@HOME is an integrated telehealth solution for the remote management of patients with a range of Long Term Conditions (also known as Chronic Diseases). It is the means for the collection and analysis of essential patient related data, permitting effective management through efficient interaction between clinicians and patients at home.

The doc@HOME service is designed to provide a systematic approach to the management of chronic disease in the home and other locations remote from the clinicians office. Patient/Clinician interaction is typically via the Docobo HealthHub, a fit for purpose, robust, handheld data collection unit which connects through a standard telephone line at the patients home to secure server. Healthcare Professional interaction with the doc@HOME service is via secure Web access using standard browsers, enabling patient management at a range of locations.

Legal, Regulatory and institutional issues

Supplier

The Trust infrastructure that has been proposed guarantees the privacy and the protection of information and fulfills all the legal and ethical implications that such flows could create.

Cultural and social issues

For the delivery of public healthcare, remote health management provides the cost effective way to manage burdens on public services caused by an increasing proportion of chronically ill and elderly people requiring healthcare.

Point- of- care motivator for improvement in lifestyle and wellbeing leads to increased values and enhanced Quality of Life Enhances patient choice, prompts 'expert' patient self- care and empowerment and increases satisfaction through delivery of high quality and timely care. Reduced demand on clinics and home visits with ultimate reduction in acute hospital presentations. Increased acceptance and adoption of preventative care regimes within 'wellbeing' programmes, for example smoking cessation and weight reduction. Improved understanding of health related issues resulting in motivated and condition-aware patients contributing to their own care. Easier and more flexible access to healthcare services and support.

Commercial and economic issues

doc@HOME, is presented as cost effective, offering a range of solutions that satisfy operational need. The service is compliant with current standards and infrastructure set- up cost is insignificant, obsolescence and depreciation is eliminated and repair logistics considerations are not necessary Pilot evaluation studies can be conducted on any scale.

Compliance to Standards

doc@HOME uses open database standards and as such compatibility with emergent Electronic Patient Record systems at local, national and European level is assured. It offers the highest standard of interoperability and is fully compliant European and International standards. European Medical Device Directive compliant EN13485 accredited Interfaces to Electronic Patient Record Systems

Supplier

Specifically designed medical devices, mobile phones, PDAs, interactive used to monitor and transmit user’s vital signs.

Participants

DOCOBO

Hospital consultation and emergency

10. OTELO (FP5)

http://www.bourges.univ-orleans.fr/otelo/

Background and Objectives

The OTELO project aims at designing a system that guarantees a reliable echographic diagnosis in an isolated site away from an expert MD located at the expert clinical site (University Hospital, ultrasound expert centre...).

This should be performed knowing that there is only a non ultrasound specialist present at the isolated site also called the patient site, or in rescue vehicle and that the wireless transmission system is the only link between the two sites.

The OTELO project proposes the study and development of a fully integrated end-to-end mobile tele-echography system for population groups that are not served locally, either temporarily or permanently, by medical ultrasound experts.

The project offers an alternative to medical centers that lack ultrasound specialists.

OTELO is a portable ultrasound probe holder robotic system, associated with new mobile communications technologies (ISDN, Fixed and mobile satellites solutions, 3G technologies). It reproduces the expert's hand movements performed during an ultrasound examination. Although being positioned on the patient's skin by non-specialised staff on the remote site, the patient system brings, in real time, acceptable image quality back to the expert site where force feedback control is combined with virtual reality for the rendering of the distant environment.

Participants

UNIVERSITE d'ORLEANS - LVR - Bourges - France
KELL S.r.l.- Roma - Italy
SINTERS - Toulouse - France
CENTER for RESEARCH and TECHNOLOGY HELLAS - Thermi - Greece
CORPORACIO SANITARIA CLINIC - Barcelona - Spain
KINGSTON UNIVERSITY - London - United Kingdom
ELSACOM S.p.A. - Roma - Italy
UNIVERSITE de TOURS - CHU Trousseau - Tours - France
EBIT Sanità S.p.A. - Genova - Italy

11. WEIRD (FP6)

Background and Objectives

The goal of the European IST project WEIRD [55] is the realisation of IEEE 802.16/WiMAX based testbeds, including novel applications running on top of a WiMAX-based end-to-end architecture. The testbeds are based on real use case scenarios, including tele-medicine and tele-hospitalization. Broadband access for medical personnel requiring high resolution medical information in nomadic emergency camps and high resolution video and data streaming from medical instruments are considered.

Technical aspects

The features that the WEIRD system aims to validate include: QoS, resource and access management, authentication authorization and accounting (AAA) and security, environmental awareness and full mobility support. Therefore, the focus was on state of the art of next generation networking improvement and analysis and enhancement of the WiMAX specific layers.

www.ist-weird.eu

Participants

ElsagDatamat
CRAT - University of Rome
Alcatel
Wind Telecomunicazioni S.p.A.
CPR - Consorzio Pisa Ricerche
PT Inovação
UoC - University of Coimbra
VTT
Italtel SpA
DAS Photonics
INGV - Osservatorio Vesuviano
Orange Romania SA
UPB - Universitatea Politehnica din Bucuresti
Associazione OASI Maria SS. ONLUS
Icelandic Metereological Office
Socrate Medical

12. EMERGE - Emergency Monitoring and Prevention (FP6)

Background and Objectives

The goal of EMERGE is to improve emergency assistance through early detection and proactive prevention, as well as unobtrusive sensing. As a consequence, quality of life for elderly people will increase and costs for emergency medical services (EMS) can be leveraged for the elderly as well as for society. The main innovation of EMERGE is to provide a model for recurring behaviours and experiences of elderly people following a holistic approach in order to detect deviations from their typical behaviour and to reason on acute disorders in their health condition.

http://www.emerge-project.eu/index.html

Cultural and social issues

Demand

So far the results have not yet yielded in systems for practical use, and they usually are limited to user warnings.[1]

Technical issues

Current emergency assistance devices (EAD) are limited regarding the following qualities:

[1] http://www.sparc-eu.net/sparc/Background and Objectives.php

- Adaptivity. They do not consider the current circumstances of the assisted persons, which results either in false or late indications.
- Adaptability. They do not support easy and cheap adaptation to the current circumstances, e.g., by adding additional or improved sensing and assistance devices.
- Interoperability. These solutions are typically proprietary and closed, and offer no means to interoperate with other systems. The results are higher costs, unexploited synergies, lower precision, and lower support in emergencies.

Participants

Fraunhofer IESE
Siemens Corporate Technology Westpfalz Klinikum
e-ISOTIS Bay Zoltan Art of Technology
European Microsoft Innovation Center
National Research Centre Demokritos
Medical University of Graz

13. DICOEMS (FP6)

Background and Objectives

DICOEMS is a portable system to support the management of medical emergencies. It aims to bring together on-the-spot care providers and networks of experts, enabling more effective decision support and risk management in primary diagnosis, pre-transfer arrangements and treatment of critical situations.

The need for remote management of medical emergencies arises in a number of situations. **DICOEMS** focuses its efforts on accidents and natural disasters. Under such stressed and time critical conditions, the care provider (a medical doctor, nurse, paramedical personnel etc.) who is in charge of the patient needs a user-friendly utility to:

- acquire critical medical data (such as vital signs) to assess the medical condition;
- offer appropriate first-aid;
- communicate the findings and patient status to a network of health experts – no matter where they are physically located - and closely cooperate under their guidance for the effective management of the emergency;
- provide information about the geographic location of the emergency.

http://www.dicoems.com/

Project description

DICOEMS allows the care provider to request on-demand, real-time, accurate information and receive precious guidance in the management of the incident Health experts are offered a valuable set of tools and resources enabling their early participation in the handling of medical emergencies, thus contributing significantly to reducing risk and making informed decisions promptly.

The **DICOEMS** collaboration environment is scientifically and technologically powered by the strong synergy of Grid computing, XML,Web services and intelligent agents.

As far as the collaboration grid is concerned, the project deals with:

- Planning and developing an effective methodology for routing and managing collaboration requests among the peer grid nodes (i.e. the mobile workstations).
- Hosting a collaboration session between the involved peers, with focus on shared care.
- Provision of synchronous and asynchronous multimedia- based interactive services over the collaborative session.

- Selection of the most appropriate health experts available, depending on the nature of the incident, based on their professional profile and expertise as well as other aspects, such as proximity, on-duty schedules and duty range.
- Design and integration of GPS functionality, to enrich the collaboration grid with precise geographic information about the incident location and the proximity of appropriate medical support and resources.
- Provision of critical information concerning the availability of compatible blood resources and specialised medication and equipment.
- Support of a policy-based collaboration environment that integrates roles, relationships, user privileges, access-control policies, coordination of user actions, sharing of data, delegation of responsibility and enforcement of security, with focus on the actual roles of peers.
- Implementation of a mechanism for delivering alerts to health experts, based on the severity of the medical incident.

Participants

Synergia 2000 s.p.a. (IT)
Association medicale europeenne (BE)
Lito hospital for women s.a. (GR)
Fraternita di misericordia Milano (IT)
SSM computer systems limited (CY)
Guy' s and St.Thomas' hospital national health service trust (UK)
Information management group (UK)
Azienda ospedaliera ospedale san Gerardo (IT)

14. DIORAMA (US)

Background and objectives

The goal of DIORAMA, "Dynamic Information Collection and Resource Tracking Architecture for **Disaster Management**", is to improve the identification and management of response assets in a mass-casualty incident, as well as to help coordinate the initial response. DIORAMA will provide a real-time scalable decision support framework built on rapid information collection and accurate resource tracking functionalities. This system makes use of Radio Frequency Identification (RFID) tags and Global Positioning System (GPS) devices to identify the location and status of the patients, responders, and emergency transport vehicles involved in mass casualty incidents. Emergency response vehicles will have communication servers that will collect location and status information from these tags and transmit it to an Incident Commander at a remote location via satellite links. The combination of these components will result in the creation of a mobile, scalable tool that can be rapidly deployed at a disaster scene to enable an offsite commander to visualize the location and condition of the casualties as well as the available resources. This information will improve the coordination of the response to better match supply (care providers, ambulances, medical equipment) with demand (number of patients, level of acuity). The system could also aid in patient tracking as they transit through the disaster response system to definitive care in a receiving medical facility.

Participants

University of Massachusetts
Harvard Medical School
Beth Israel Deaconess Medical Center

Website not yet available
See for some information: http://www.ieee.org.uk/events.html.

15. Med-on-@ix

Background and Objectives

The research project Med-on-@ix (http://www.medonaix.de) is a research project in the German rescue service and explores the use of current telecommunication technology in the emergency rescue. The key aim within the project is to create a teleemergency medical center, which holds highly qualified emergency personnel. From the place of emergency data, readings and live videos are directly transmitted to the teleambulance headquarters. The concepts are based on uniform quality standards and medical guidelines.
In this way, an emergency medical can care on site before the arrival of the emergency physician, for example in rural hard to reach areas. On the other hand - in cases where the manual skills of an emergency physician on site are less detailed in a special treatment - well-trained paramedics can instruct the on-site physician by dint of the communication in the treatment of patients, or to efficiently support the tactical mission.

Legal, regulatory and institutional issues

Supplier

The project Med-on-ix @ obtained two legal opinions, which have been extensively answered the relevant legal issues and problems. The experts were Prof. Dr. iur. Cats Christian Meier (Institute of Legal Medicine, University of Cologne) and Prof. Dr. Karsten Fehn (specialist in medical law, University of Cologne).
The evaluation of the project carried out -@ix, included the following topics privacy, principles of personal service, prohibition of remote treatment, liability issues / criminal responsibility and telemedicine: delegation of medical activities.

Technical issues

Supplier

The following solutions are developed in the project: Medial devices that facilitate remote vita parameter transmission, a teleemergency medical services headquarter in which experienced emergency physicians are in constant contact with the rescue team on site, and a special emergency vehicle which includes GSM, UMTS, WLAN and TETRA connections for secure transmission of relevant data.

Participants

http://www.medonaix.de/index.php?id=3

Department of Anesthesiology at the University Hospital Aachen
Center for Learning and Knowledge Management/Dep. of Information Management in Mechanical Engineering (ZLW / IMA)
P3 communications
Philips Healthcare
Research Institute for Operations Management (Forschungsinstitut für Rationalisierung; FIR)
Institut für Unternehmenskybernetik e.V.
Fire department Aachen

Assistive technologies

16. HEARCOM. Hearing in the communication society (FP6)

Background and Objectives

The project (www.hearcom.org) will relate to the mechanisms that influence communication problems as well as the development of methods for screening, rehabilitation, and evaluation.

The focus of HEARCOM is on:

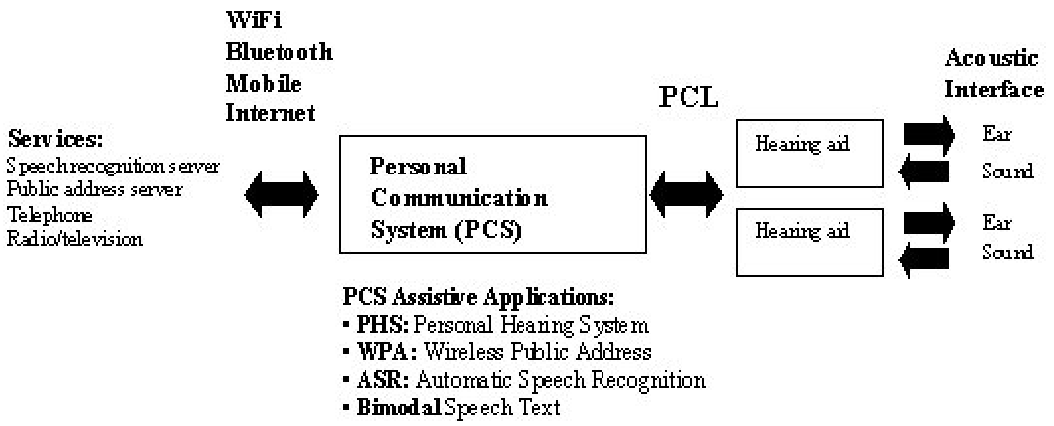
- The development of innovative assistive personal communication technology based on wireless communication links and assistive applications integrated in mainstream technologies
- The development of Internet services that assist individuals and professionals in the improvement and compensation of communication problems.

Demand

Focusing on sound and speech, many people experience severe limitations in their activities, caused either by hearing loss or by poor environmental conditions. The HEARCOM project aims at full participation in the modern communication society by reducing the limitations in auditory communication.

Technical issues

Supplier



Assistive Applications :

Personal Communication System (PCS) to support assistive communications on a handheld device.

Personal Hearing System (PHS) integrated in a mainstream based handheld device allowing interaction with other assistive services and providing advanced audio signal processing for use with hearing devices..

Wireless Public Address (WPA) that relays auditive and textual information from local public announcements to the PCS using a local area wireless network.

Automated Speech Recognition (ASR) for use on a PCS to assist hearing impaired persons for communication tasks.

Bimodal Communication: The presentation of textual information to improve communication in adverse conditions.

Participants

http://www.hearcom.org/about/partners.html

17. ENABLED. Enhanced network accessibility for the blind and visually impaired. (FP6)

Background and Objectives

The ENABLED project (www.enabledweb.org), has therefore allocated its effort to two specific tasks:

9. Developing technologies that create accessible graphical content on broadband multimedia networks, primarily concerning indoor and outdoor maps;
10. Developing "ubiquitous" tools that enable easy access to the map information, and interfaces that are adaptable and interoperable no matter where the users are and what equipment they are using.

To achieve these objectives, research and development work will be focused on three supporting tools:

11. an annotation tool for audio and haptic map representations;
12. adaptable interfaces for exploration of maps and route-planning;
13. a navigation aid provided through wireless networks.

With the aim of providing ubiquitous access to map information and network-based services, the project is developing a navigation system that provides guidance for visually impaired pedestrians in both indoor and outdoor settings.

The outcome of this project will directly benefit visually impaired people as the technologies developed will be deployed onto a commercial mobile navigation aid.

Cultural and social issues

Supplier

The design and development will be focused on: "Developing multi-modal interfaces and applications to enable Mobile computing for partially sighted people".

Demand

The small display found in most mobile phones can even sometimes be a problem to a sighted people. By combining mobile phones, PDAs and portable computers, applications and services is possible to enhance blind people's quality of life. Currently, mobile devices are not really accessible to blind people because of their graphics-dominated displays.

Multimodal interfaces can be developed for mobile devices which already have audio capability. Haptic interfaces for mobile devices are still uncommon because of the cost and power issues.

In this project, low-cost and low power consumption haptic interfaces will be developed to present information in abstract form. Context-awareness and adaptable interfaces are currently being actively studied.

Commercial and economic issues

Demand

For blind people, the use of mobile solutions will have one of the most beneficial impacts.

Technical issues

Supplier

The objective of ENABLED is to design and develop an integrated set of solutions to enable partially sighted people to gain a better understanding of their environment.

This will be achieved by designing multi-modal interfaces that will run on mobile devices (for example PDAs). Of paramount importance will be the integration of wireless technologies (GPS, Bluetooth and 802.11) that provide location based information to the user at any time and place.

Applications will be developed to demonstrate and study the added value of location based and wireless technology to the needs of partially sighted people.

Participants

http://www.enabledweb.org/partners.htm#partners

18. EASY LINE+. Low cost advanced white goods for a longer independent life of elderly people (FP6)

Background and Objectives

EASY LINE+ project (www.easylineplus.com) will develop prototypes near to market of advanced white goods in order to support elderly persons with or without disabilities to live a longer independent life, which will compensate for their loss of physical and/or cognitive abilities.

The project foresees that integrated RFID, Neural Networks and human-machine interface (HMI) technologies will combine to build a system that can capture data of the home environment and can control any white goods appliance in the home.

HMI devices that can be used to managing the system: the mobile devices (PDAs, smart phones, wearable devices, ultra-mobile PCs, touch screens, etc.) which means the user can carry them around the house and be able to monitor the house appliances wherever he or she is. After a study of the state-of-art in the actual market about the technical specifications of potential clients, it was decided that the best option could be a touch screen device with a dock, middle way between a tablet PC and a PDA; something similar to Nokia N800.

Cultural and social issues

Demand

Easy Line + Project focuses on the population of age 65 and higher (elderly people and very elderly people), which currently represents a 15.7% of the EU25 and with the forecast of being more than a 30% by 2030. Roughly speaking, 42% of them carry out home tasks, and 70% deal with some degree of disabilities.

Old age affects the functioning of sensory organs, information processing capacity, reduces speed and increases variance in the timing of precise movements, increases the "thinking time" necessary to interpret complex display scenarios, makes it difficult to do two things at once, reduces the ability to maintain attention over long periods of time, etc. Consequently, domestic appliances that usually have been a big help in their independent daily life, owing to their new functional limitations, now become barriers to it.

The results of the project are aimed at contributing to solve a crucial social problem: the e-inclusion of elderly people, by developing ICT systems that are easy to use by any people.

Participants

http://www.easylineplus.com/pb/wp_f13d37e9/wp_f13d37e9.html

19. SENSACTION-AAL. Sensing and ACTION to support mobility in ambient assisted living (FP6)

Background and Objectives

The ultimate goal of the project (www.sensaction-aal.eu) is to assist older people in maintaining independent mobility and daily life activities and prevent injuries by introducing smart body fixed sensor based technology that allow medical professionals to initiate interventions in the home environment.

To achieve this goal, the SENSACTION-AAL project will design, test and release a next-generation, smart, wireless on-body system which enables:

14. monitoring of activities of daily living and
15. simultaneous real-time active control of physical performance using principles such as sensory augmentation and biofeedback.

Cultural and social issues

Supplier

Ultimately, this project could have important influences on the quality of life of European citizens. These new systems will empower persons with disabilities and aging citizens to play a major role in society and will help them to augment their autonomy and realize their potential.

Technical issues

Supplier

SENSACTION-AAL will develop an ICT-based solution which is highly usable and can support the elderly people in their preferred environment. The key challenge is to develop an integrated system that brings together the different components involved (network cells; communication protocols; embedded real-time algorithms for actuator control; signal processing algorithms; data warehousing, web-based data access).

Participants

http://www.sensaction-aal.eu/index.php?option=com_content&task=view&id=18&Itemid=38

20. OLDES. Older People's e-services at home (FP6)

Background and Objectives

- OLDES (www.oldes.eu), aims to plan and develop a technological, cheap and easy to use platform for tele-assistance and tele-company, thanks to the joint work of 11 EU partners.
- OLDES will plan and implement an innovative technological platform, with low cost and easy use able to provide a wider range of services to an higher number of elderly.
- OLDES objectives are:
- To develop a cost optimized technical solution;
- To define the profile of "elderly people";

To define a standardized procedure for tele-care interaction;

- To develop a programme for results evaluation and impact assessment.

The aim of OLDES project is to offer new technological solutions to improve the quality of life of older people in their homes. Thanks to an advanced and innovative technological platform, OLDES will provide user entertainment services, through easy-to access thematic channels and special interest forums supported by animators, and health care facilities based on established Internet and Tele-care communication standards.

The technological platform (driven by a cost-effectiveness technical choice) has been developed on the basis of the requirements of potential end users: elderly, municipalities, local health authority, professionals and so on) and on architectural constraints. OLDES is a typical multi-agency project, whose architecture is flexible and open to third-party services, new modules or components.

The system will be developed and tested at two different locations: Italy, where the user entertainment feature will be tested over a group of 100 elderly (including 10 suffering with cardio diseases) in their homes in conjunction with health system and Czech Republic, where the communication feature will be used in conjunction with the health monitoring linking a hospital with a group of 10 diabetics patients living at home.

Cultural and social issues

In the OLDES vision, many elderly people can be supported in their own homes by means of networked connections and services, contributing greatly to the quality and the cost-effectiveness of their care, and to their independence and wellbeing.

Demand

The number of elderly in the EU is dramatically increasing and the related burden in term of public expense getting higher and higher - these are the two main reasons motivating the OLDES project. Today more and more old people are living alone, in many cases with no families helping them nor enough money to afford private carers.

Technical issues

OLDES platform will be based on a low cost PC (named INK) corresponding to Negroponte's paradigm of a 100 euro devices. It will provide user entertainment services through easy to access thematic channels and interest forum supported by an animator and health care facilities based on established Internet and tele-care communication standards. The software used will be open sources and the communication standards the existing ones (VoIP), while the communication layer will be Bluetooth or Zigbee. All standards will be kept open in order to be able to add and provide other services in the future. OLDES is a typical multi-agency project, whose architecture is flexible and open to third-party services, new modules or components.

Supplier

The system will include wireless ambient (ex kitchen scale) and medical sensors (ex ECG, Blood Pressure) linked via a contact centre to social services and health care providers to provide tele-medicine, tele-assistance, tele-entertainment and tele-company services. OLDES will also cover the definition, implementation and evaluation of a Knowledge Management (KM) program, an advanced user profiling system that will enhance the communication between all the stakeholders of the system.

Participants

ENEA, project coordinator - Italy
CUP 2000 – Italy
Alma Mater Studiorum University of Bologna – Italy
University of Newcastle upon Tyne – United Kingdom
CETIC – Belgium
Czech Technical University in Prague– Czech Republic
INK Media – Canada
Agentscape – Germany
Municipality of Bologna – Italy
Azienda Unità Sanitaria Locale di Bologna – Italy
Charles University in Prague – Czech Republic

21. ASK-IT. Ambient intelligence system of agents for knowledge-based and integrated services for mobility impaired users (FP6)

Background and Objectives

ASK-IT integrated project (www.ask-it.org) aims to establish Ambient Intelligence (Ami) in semantic wed enabled services, to support and promote the mobility of the Mobility Impaired people, enabling the provision of personalised, self-configurable, intuitive and context-related applications and services and facilitating knowledge and content organisation and processing. Within it, MIpeople related infomobility content is collected, interfaced and managed in SP1 (Content for All), encompassing transport, tourism and leisure, personal support services, work, business and education, social relations and community building related content.

Cultural and social issues

Demand

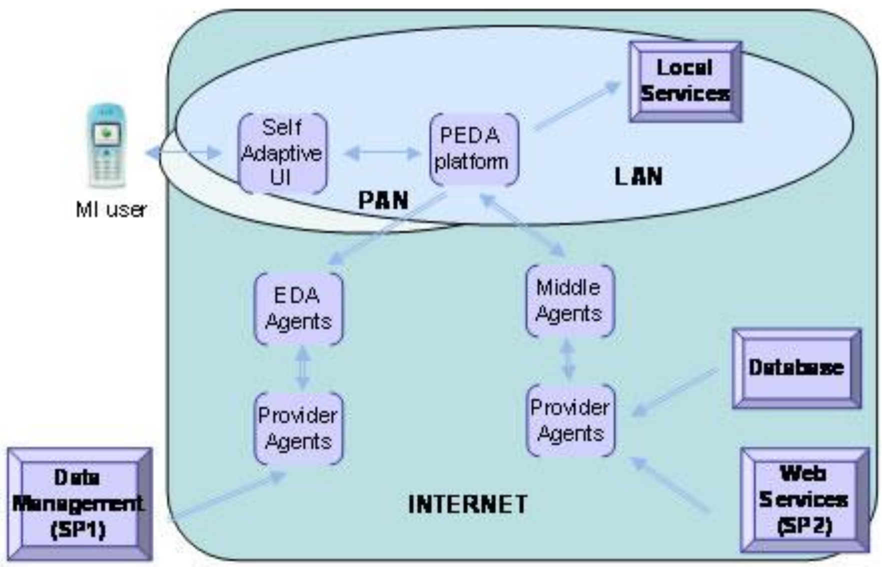
Mobility Impaired (MI) people have a wide variety of functional limitations, from different types of physical impairments to activity limitations. ICT systems following the "design for all" and adequate content are required, so as to take advantage of both internet and mobile-based services.

Technical issues

Supplier

To offer the content, a number of advanced tools are developed, such as enhanced accuracy localisation, accessible inter-modal route guidance modules and interfaces to eCommerce / ePayment, health and emergency management, driver support, computer accessibility, eWorking, eLearning systems and assistive devices.

The general architecture of the ASK- IT system is depicted in the following figure:



The major objectives of the project are to:

- develop an open and modular service platform and advanced key services

- connect the new services to emerging ITS applications; e.g. EDGE, UMTS, and the combination of ATM and high speed wireless LANs through the provision of a mobile ad hoc network which will manage connectivity and ensure the most appropriate communications carrier is used for a particular service in a particular location.;
- develop a n iPDA, based on intelligent mobile phones and PDAs, able to configure itself according to the specific needs of the person;
- develop the appropriate gateway of this device to key assistive technologies (such as domotics, emergency management, driver support aids, computer accessibility, 3D walkthroughs and accessibility planning tools, etc.) and web services;

Participants

http://www.ask-it.org/consortium.php

22. MAPPED. Mobilisation and Accessibility Planning for People with Disabilities (FP6)

http://services.txt.it/MAPPED/

Background and Objectives

MAPPED is clustered with ASK-IT (Ambient Intelligence System of Agents for Knowledge-based and Integrated services for Mobility Impaired Users), an Integrated Project that aims to develop an Ambient Intelligence (AmI) space for the integration of functions and services for Mobility Impaired (MI) people across various environments, enabling the provision of personalised, self-configurable, intuitive and context related applications and services and facilitating knowledge and content organization and processing.

The MAPPED project aims to provide disabled users with the ability to plan excursions from any point to any other point, at any time, using public transport, their own vehicle, walking, or using a wheelchair, taking into consideration all their accessibility needs. In addition to this, MAPPED aims to provide the users with location-based services tailored to their accessibility needs.

Legal, Regulatory and institutional issues

Supplier

The project certifies that it conforms to EU legislation such as:

- The Charter of Fundamental Rights of the EU
- Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data

It also certifies that the proposed research has no clinical, medicinal, biotechnological or genetical content.

Technical issues

Supplier

MAPPED will incorporate

16. a multi-modal route planner that allows for disability specific routing information and reservation of accessibility services
17. Geographically indexed accessibility information
18. disabled friendly mobile user interfaces

Demand

Many disabled users are prevented from accessing functionally and socially important activities such as shopping, visiting public parks, theatres etc. because of a lack of real-time accessibility knowledge.

Participants

http://services.txt.it/MAPPED/partners.html

23. CAALYX. Complete ambient assisting living experiment (FP6)

Background and Objectives

The main objective of the project (www.caalyx.eu) is to develop a wearable light device able to measure specific vital signs of the elder or ill person, to detect falls and to communicate autonomously in real time with his/her caregiver in case of an emergency, wherever they are. The emergency information can be directed to the personal caretaker and/or the 112 Emergency Service.

The emergency information will provide the geographic position and health information of the elder in a sensible way for the caretaker or emergency service. The incorporation of largely non-intrusive new sensors for fall detection and highly sensitive positioning is expected to address many of the elderly concerns about adopting technology. The monitoring device for the caretaker can range from a mobile phone and/or a more complex system so that an integrated caretaking service can be created to look after groups of elders.

Specifically, CAALYX' objectives are:

- To identify which vital signs and patterns are more relevant to determine probable critical states of an elder's health.
- To develop an electronic device able to measure vital signs and to detect falls of the aged person at the domestic environment and outside. This gadget will have a geolocation system so that the monitoring system may be able to know the elder's position in case of emergency (especially outdoors).
- To allow for the secure monitoring of individuals organised into groups managed by a caretaker who will decide whether to promote raised events to the emergency service (112).
- To create social tele-assistance services that can be easily operated by users.

Cultural and social issues

Demand

Europe faces a social change, which is brought about by the unprecedented demographic change: the share of elderly people to the entire population is steadily growing, while the share of the youngest, especially the working population is shrinking. Ambient Assisted Living (AAL), as a specific user-oriented type of "Ambient Intelligence", may greatly help in this situation.

Technical issues

Supplier

To be able to offer users proper help using voice an data records during emergencies wherever they might be (including incidents in which patients are unconscious or unable to adequately describe their location for any reason), a service would ideally require both detailed information about user's current medical status and details of user's current location, e.g., in order to send a suitably equipped emergency team to the patient, and that's exactly what it is developed in CAALYX.

Participants

http://caalyx.eu/index.php?option=com_contact&Itemid=3

24. I2HOME. Intuitive interaction for everyone with home appliances based on industry standards (FP6)

Background and Objectives

The I2HOME project (www.i2home.org/desktopdefault.aspx?lang=en-us):

- By following a design for all / adaptive design approach.
- By using adaptive and multimodal access devices such as cell phones, PDAs, TVs. The goal will be to make use of universal remote controls that can be interacted with by natural language and adaptable interaction devices. By setting on top of mainstream consumer electronic devices and standards virtually all devices will become accessible at once.
- By providing intuitive user interfaces with task guidance, short cuts and other types of support not available in today's built-in device interfaces.

will:

- make the digital home accessible to all.
- create an open market for adaptable user interfaces for the digital home.
- develop a technology to the task of empowering citizens to play a full role in society.

Commercial and economic issues

Supplier

The final beneficiaries of I2HOME system are:

- people with disabilities;
- older persons;
- people with little or no technical affinity.

Market Sector

Possible and already identified market sectors for I2HOME are:

- Home Appliances and Home Automation
- Industrial Production
- Health Care
- Education
- Automotive Industry

Demand

Despite recent advancements in information and communication technologies and growing sales numbers, industry has been rather reluctant to standardise access technologies and to implement them in a Design for All approach. The design and the implementation of appliances, mobile phones and remote controls are driven by the ambition to satisfy users that are already engaged in modern technologies. Thus many people with disabilities, in particular persons with cognitive disabilities and older persons, are excluded from using modern technologies, at home and in the public.

Technical issues

Supplier

I2HOME is build upon a new series of industry standards (ANSI/INCITS 389ff) for interfacing networked appliances by means of a Universal Remote Console (URC). It uses an architecture with a Universal Control Hub (UCH) as core component that communicates to networked (off-the-shelf) home appliances and consumer electronics devices through industry networking protocols. The UCH provides intelligent and adaptable interfaces that are particularly targeted to persons with cognitive disabilities and older persons. The user interfaces will be designed according to the results of a broad requirements analysis and will include multimodal communication and activity management. In an incremental process, we will conduct large evaluations of the project intermediate results in controlled laboratory environments as well as in day-care centres.

In this architecture a hub component provides a connection point between end user devices (URCs) and home appliances. This means that anybody can write user interfaces for the control of networked home appliances from any vendor. Also, home appliances that implement the URC standards are ready for more advanced user interaction mechanisms of the future, such as activity-oriented user interfaces and natural language interaction.

The proposed solution is based on an innovative architecture that secures the communication between virtually any kind of controller device (cell phones, PDA's, TVs and their remote controls, PCs, assistive technology devices, etc.) and any controlled device (stoves, fridges, microwave ovens, lights, doors, washing machines, dryers, telephones, TVs, video recorders, stereos, etc.).

Participants

http://www.i2home.org/Participants/Germany/tabid/74/Default.aspx

25. COMET. Converged messaging technology (FP6)

Background and Objectives

The overall goal of the COMET project (www.comet-consortium.org) is to realise the potential of a converged messaging service beyond 3G by creating the global enabling technology for easy-to-activate and easy-to-use converged messaging services, allowing users to navigate and control all their messages Anytime, Anyplace, regardless of the access network and the type of device they are using.

Legal, Regulatory and institutional issues

Supplier

By achieving its overall goal, the COMET project will contribute directly to the achievement of the priorities of critical importance as set out by the Commission with respect to the future of the Information Society. These priority areas include: Content and services; eInclusion and citizenship; Interoperability; and Trust and dependability.

Cultural and social issues

Supplier

The benefits to the end-user will include: easy-to-access and easy-to-use mobile message services. Thereby attracting groups of users currently excluded by the ' digital divide', such as the elderly, disabled, low-income and IT-illiterate in the community; increased reach-ability, due to inter-working with legacy domains it will be possible to communicate with more peers; and single view and easy-to-use (intuitive) navigation of all messages stored in the network(s), regardless of the device, network and bearer that the user chooses at a given point in time.

Technical issues

Supplier

To reach this goal a consortium of European organisations of excellence has been established to research and create applicable standards, enabling technology and services to create an Internet Protocol Multimedia Subsystem (IMS) messaging technology framework in a concerted range of sub-projects including standardisation, software R&D, user-agent R&D, platform R&D, integration, validation, software publication and dissemination

Participants

www.comet-consortium.org

26. VITAL. Vital assistance for the elderly (FP6).

Background and Objectives

The objective of the VITAL project (www.eptron.es/projects/vital) will be to develop a set of technologies, platforms and applications with the aim to provide remote assistance to elderly users. The VITAL insight presents a new concept of remote assistance that differs from traditional schemes in the sense that it is concerned not only with elementary subsistence needs but also with the aim to significantly increase the quality of life of the average elderly user. VITAL will intend to put in practice, inside an integrated environment, the concept of Total Assistance; understood as assistance anytime, anywhere, using any terminal and for any type of service. Using existing infrastructures and domestic terminals, VITAL is designed to deliver advice, assistance, information, education, entertainment and inter-personal communication to the users.

Technical issues

Supplier

VITAL key innovations will require research work in three basic fields: advanced user interfaces over readily available domestic terminals that are specifically designed for the elderly (i.e. TV and mobiles), intelligent systems able to offer personalised information and services in an active way and speech understanding technologies with the aim to provide natural speech dialogue with the machine and automatic summarising capabilities.

For this purpose, VITAL will address several state of the art research topics in the IST today: anywhere / anytime computing, intelligent agents technology, true personalisation, active systems, natural speech processing, mobile and iTV applications, location sensing, advanced video services.

Participants

http://www.eptron.es/projects/vital/partners.html

27. HERMES. Cognitive care and guidance for active aging (FP7)

Background and Objectives

HERMES (www.fp7-hermes.eu) provides an innovative integrated approach to cognitive care covering the domain of cognitive support and training. This is achieved through an advanced, integrated, assistive technology that combines the functional skills of the older person to reduce age-related decline of cognitive capabilities and assist the user where necessary. Based on intelligent audio and visual processing and reasoning, the project results in a combination of a home-based and mobile device to support the user's cognitive state and prevent cognitive decline.

HERMES also assesses the Mobility support to address the needs of the user outside of the house with cognitive support when and where needed.

Technical issues

Supplier

The proposed solution deals with 7 logical blocks:

- Sensing infrastructure
- Visual Processing
- Audio Processing
- Low-level Information Fusion
- Context Modelling
- Indexing, Annotation and Knowledge Conceptualization
- Semantic data summarization and meta data processing

Participants

http://www.fp7-hermes.eu/index.php?option=com_content&view=article&id=52&Itemid=57

28. OASIS. Open architecture for accessible services integration and standardisation (FP7)

Background and Objectives

OASIS (www.oasis-fp6.org) introduces an innovative, Ontology-driven, Open Reference Architecture and Platform, which will enable and facilitate interoperability, seamless connectivity and sharing of content between different services and ontologies in all application domains relevant to applications for the elderly and beyond.

Through this new Architecture, over 12 different types of services are connected with the OASIS Platform for the benefit of the elderly, covering user needs and wants in terms of Independent Living Applications (nutritional advisor, activity coach, brain and skills trainers, social communities platform, health monitoring and environmental control), Autonomous Mobility and Smart Workplaces Applications (elderly-friendly transport information services, elderly-friendly route guidance, personal mobility services, mobile devices, biometric authentication interface and multi-modal dialogue mitigation and other smart workplace applications). Applications are all integrated as a unified, dynamic service batch, managed by the OASIS Service Centre and supporting all types of mobile devices (tablet PC, PDA, smartphone, automotive device, ITV, infokiosk) and all types of environments (living labs, sheltered homes, private homes, two car demonstrators, public transport, DSRT, etc.) in 4 Pilot sites Europewide.

Participants

http://www.oasis-fp6.org/consortium.htm

29. mCIUDAD (National, Spain)

Background and Objectives

m: Ciudad (www.mciudad.org/index_ing.htm) is a Strategic and Singular Project born under the umbrella of the Technological Platform of Wireless and Mobile Communications (eMOV), the Spanish national mirror of the eMOBILITY European Technology Platform. m: Ciudad's main goal is to conduct technological research in wireless communications, allowing mobility/pervasiveness of urban services that are currently delivered by third parties. In summary, m: Ciudad proposes a paradigm shift from the Internet model to the Ubiquity model, where contents, information and services are provided through any channel, to any device, in a customized and secure way.

The Project work is structured in two axes:

- The business vision, by the investigation on the market demands of mobile services. This vision is introduced in the project through a set of scenarios, which establishes the general requirements of mobile services and the main trends that will characterize these services in the future in terms of proximity, confidence, security or ambient intelligence.
- The Technology vision, starting from the capacities and competitive position of the industrial and academic members of the consortium. This vision allows for the definition of the road map of key-technologies like location, positioning, sensor networks, interaction systems, security and pervasive connectivity.

Participants

http://www.mciudad.org/mCiudad-flier-EN06.pdf

30. AUBADE

Background and Objectives

The core scientific and technological objective of COGKNOW (www.cogknow.eu) is to achieve a breakthrough in the development of a successful, user-validated cognitive prosthetic device with associated services for people with mild dementia. We are addressing this core objective by focusing on scientific and technological objectives for the device, including:

- Remotely configurable reminding functionality
- Communication and interaction functionality
- Supportive technology for performing activities of daily living (ADLs), e.g., via voice prompts
- Anomaly detection and emergency contact.

In order to achieve our aim of helping people with mild dementia to have greater actual and perceived autonomy and improved quality of life, we wish to help sufferers navigate through their day. Through cognitive reinforcement, our aim is to assist people to remember, maintain social contact, perform daily life activities and enhance their feelings of safety.

Cultural and social issues

Demand

The of the project is to breakthrough with research that addresses the needs of those with *dementia*, particularly those with mild dementia in Europe. At about 2% of the elderly population, this comes to around 1,900,000 people.

Participants

http://www.cogknow.eu/partners

31. URUS. Ubiquitous Networking Robotics in Urban Settings(FP6)

http://haydn.upc.es/groups/urus/

Background and Objectives

The *URUS* project will be focused in designing a cognitive network robot architecture that integrates cooperating urban robots, intelligent sensors, intelligent devices and communications. Among the specific technology that will be developed in the project, there will be: navigation coordination; cooperative perception; cooperative map building; task negotiation; human robot interaction; and wireless communication strategies between users (mobile phones), the environment (cameras), and the robots. Moreover, a **specific objective** is to extend the localization of human beings fusing information from typical communication systems (mobile phones, embedded and mobile sensors) and detecting hand human movements; improve the communication recovery with robots and humans; and establish a common wireless interactive language and protocol for the communication between humans (by means of mobile phone), robots and ubiquitous sensors

Cultural and social issues

Demand

European cities are becoming difficult places to live due to noise, pollution and security. Moreover, the average age of people living in European cities is growing and in a short period of time there will be an important community of elderly people. City Halls are becoming conscious of this problem and are studying solutions, for example by reducing the free car circulation areas. Free car areas imply a revolution in the planning of urban settings, for example, by imposing new means for transportation of goods, security issues, etc. In this project we want to analyze and test the idea of incorporating a network of robots (robots, intelligent sensors, devices and communications) in order to improve life quality in such urban areas.

Well being and personalization

32. Delivering Inclusive Access for Disabled or Elderly Members of the community (DIADEM). FP6 project

Objectives

The goal of this project is to provide an adaptable web browser interface, to enable people who suffer a reduction of cognitive skills, to remain active and independent members of society. This will be achieved by developing an Expert System (ES) that, monitors the user, adapting and personalising the computer interface to enable people to interact with web based forms. This system will be located on the user's PC and will ensure that the many services available over the Internet are open and accessible to as many people as possible, whilst providing privacy and security. The technology will also be extended into the work place enabling people to be in more control of their working environment and their working life.

Description

Plug-in to a web browser that monitors the ability of the user to interact with the system and dynamically offers personalisation of the interface to optimise assistance to that specific user. All the service provider needs to do is use the Web Services standard and provide some fixed meta-level data about the dialogue structure.

Utilization

The project focuses on the problem of accessing services online where the user needs to fill in a form on the screen

Entities

RTD developers and Public Authorities.

Web

DIADEM PROJECT. http://www.project-diadem.eu/.

33. Mobility for All – The Use of Ambient Intelligence in Addressing the Mobility Needs of People with Impairments (ASK-IT). FP6 Project

Objectives

The project aims at establish Ambient Intelligence (AmI) in semantic web enabled services, to support and promote the mobility of Mobility Impaired people, enabling the provision of personalised, self-configurable, intuitive and context-related applications and services and facilitating knowledge and content organisation and processing.

Description

This project targeted the following objectives:

- **Content for all:** Content gathering, interfacing, modelling and integration into a dynamic, open and flexible Data Management Module. It is not narrowed to stand alone transportation tasks, but also does not over-extend to all possible MI related services. The gathered and interfaced content is absolutely needed to provide ASK-IT services and may be well extended in the future to cover new services or emerging new content, with the use of commonly defined content models and ontologies and a semantics-based integration.
- **Tools for all:** Tools developed cover a wide area, focusing on new tools for seamless and adequate accessible route guidance and intuitive user interfaces, but also interfacing all the MI environments and everyday tools, such as driver support, domotics, home health care, computer accessibility, assistive devices and services e-procurement. The selected tools match well the gathered content within SP1 as well as the priority areas of interest of MI people. Thus, they can support a truly holistic service, without unnecessary development of specific modules for niche markets (i.e. particular aids for blind, deaf or wheelchair users that may not be viable). By streamlining research in few focus areas and still interfacing and adapting several existing modules and tools, the integrated ASK-IT service delivery is facilitated at minimum additional cost.
- **Ambient Intelligence Framework:** Ambient Intelligence is achieved by introducing personalisation to the content management (intuitive semantics), search functionality (intelligent agents for service provision), as well as the usability (self configured UI). It tailors the service to the user's preferences, needs and habits as well as to the context of use. It then introduces this intelligence to the body, personal, local and wide area networks, and the integrated, secure service platform. Thus, the

intelligence is diffused on all aspects of service provision; else the unintelligent parts (i.e. content, functionality or interface) would cancel and limit the benefits of the intelligent ones. On the other hand, intelligent sensors are not developed, but interfaced from other research initiatives (such as SENSATION IP), to limit the work to the required for the service provision and result to a low-cost, modular, s/w-based system.

Accessible Europe: Accessibility is demonstrated by integration and installation of ASK-IT in 7 interrelated European sites, where significant accessibility content and infrastructure exists (to minimise efforts) but with many different IST technologies and sociological characteristics (to demonstrate interoperability). Furthermore, intercity Pilots between these sites guarantee the seamless service delivery across Europe. The selected sites offer a good balance between full European coverage and avoidance of unnecessary duplication of efforts and are all jointly managed and coordinated by a single Authority (POLIS), to safeguard unanimity in application and evaluation. The scenarios tested in these Pilots cover together all selected use cases of SP1, but do not attempt to address all possible parameters combinations nor to be based on local-centric approaches.

Utilization

The ASK-IT project is working with the design for all principal. ASK-IT aims to develop services for a broad range of people with impairments and has identified 10 User Groups:

19. Lower limb impairment;
20. Wheelchair users;
21. Upper limb impairment;
22. Upper body impairment;
23. Physiological impairment;
24. Psychological impairment;
25. Cognitive impairment;
26. Vision impairment;
27. Hearing impairment;
28. Communication producing and receiving difficulties.

Entities

SMEs, Telecom Operators, R&D Companies, Universities, Research Centres, and Foundations.

Web

ASK-IT PROJECT. http://www.ask-it.org/.

34. E-library Voice AppLication for eUropean Blind, Elderly and Sight-impaired (e-Values). FP6 Project

Objectives

The eVALUES project is aimed at providing to sight impaired people, in particular blind and elderly, but also other kind of people with disabilities and barriers to read, a trans-European service -based on internet- which opens to them the extraordinary possibility of reading and having access to written information (access to textual content) by means of computer-generated synthetic voice (Text-to-Speech), using a PC and/or a portable handheld PDA, and other specific mobile devices for disabled, enabling mobility.

Description

The concept of the service is the one of an internet e-document service (Internet Blind and Sight Impaired Bibliographic Center) through which a blind or sight impaired can select any book or document on-line and download to hear it with an advanced conversion from Text to Speech, with the additional possibility of accessing and downloading the document file into a common PDA or mobility specialised PDA device for enabling the blind to hear the document wherever and at any time.

Utilization

It is used by blind people.

Entities

R&D companies, Blind People Association.

Web

http://evalues.moviquity.com/index.asp

35. IWell

Objectives

The aim of iWell is to take information and communication technology and solutions that were originally developed for production, logistics and construction sectors and turn them into well-being applications.

Description

In iWell the focus is on solutions that can promote healthy and balanced living.Targets to be achieved and the challenges the program involves among the others the technology and service products for the working age population and the research on well-being technology.

Utilization

IWell's technology is especially well-suited to the ageing population, the disabled and those suffering from long-term illnesses as it gives them a better chance of living independently. However, the working age population will also be able to monitor and improve its health with the resulting applications.

Entities

R&D companies.

Web

http://akseli.tekes.fi/opencms/opencms/OhjelmaPortaali/ohjelmat/iWell/en/etusivu.html

36. OASIS (Open architecture for Accessible Services Integration and Standardization). FP7 Project

Objectives

OASIS is an Integrated Project with the scope to revolutionise the interoperability, quality, breadth and usability of services for all daily activities of **older people**. More specifically, OASIS targets to utilise ICT and other key technologies in order to provide holistic services to older people to support their physical and psychological independence, stimulate their social or psychological engagement and foster their emotional well being. In doing so, OASIS thus addresses key areas of their activities encompassing: independent living and socialising, autonomous mobility, and flexible work-ability.

Description

OASIS introduces an innovative, Ontology-driven, Open Reference Architecture and Platform, which will enable and facilitate interoperability, seamless connectivity and sharing of content between different services and ontologies in all application domains relevant to applications for the elderly and beyond. The OASIS platform is open, modular, holistic, easy to use and standards abiding. It includes a set of novel tools for content/services connection and management, for user interfaces creation and adaptation and for service personalization and integration. Through this new Architecture, over 12 different types of services are connected with the OASIS Platform for the benefit of the elderly, covering user needs and wants in terms of Independent Living Applications (nutritional advisor, activity coach, brain and skills trainers, social communities platform, health monitoring and environmental control), Autonomous Mobility and Smart Workplaces Applications (elderly-friendly transport information services, elderly-friendly route guidance, personal mobility services and smart workplace applications). Applications are all integrated as a unified, dynamic service batch, managed by the OASIS Service Centre and supporting all types of mobile devices (tablet PC, PDA, smartphone, automotive device, ITV, infokiosk, ...) and all types of environments (living labs, sheltered homes, private homes, two car demonstrators, public transport, DSRT, etc.).

Utilization

It is used by elderly people.

Entities

The OASIS Consortium is composed of 33 Partners from 11 countries. Large Industries, SMEs, Universities, Research Centers, Non-Profit Organizations, Public Organizations and Healthcare Centers are all represented.

Web

http://www.oasis-project.eu/

37. INHOME. An Intelligent Interactive Services Environment for Assisted Living at Home. FP7 Project

Objectives

The goal of the **INHOME project** is to provide the means for improving the quality of life of elderly people at home, by developing generic technologies for managing their domestic ambient environment, comprised of white goods, entertainment equipment and home automation systems with the aim to increase their autonomy and safety.

Description

The key issue of the **INHOME** project is to enhance the ESTIA in-home network architecture so as for the later to be able of integrating management functions not only for home equipment but also healthcare devices and to enhance ESTIA services execution environment to allow user-defined services composition and execution and repair.

Utilization

It is used by elderly people.

Entities

www.ist-inhome.eu/inhome/The_Consortium.php

Web

http://www.ist-inhome.eu/inhome/Home.php

38. Amigo- Ambient Intelligence for the Networked Home Environment. FP6 project.

Objectives

Amigo project aims to overcome the obstacles to widespread acceptance of home ICT applications. The project will develop open, standardized, interoperable middleware and attractive user services, thus improving end-user usability and attractiveness. The project will show the end-user usability and attractiveness of such a home system by creating and demonstrating prototype applications improving everyday life, addressing all vital user aspects: home care and safety, home information and entertainment, and extension of the home environment by means of ambience sharing for advanced personal communication. The Amigo project will further support interoperability between equipment and services within the networked home environment by using standard technology when possible and by making the basic middleware (components and infrastructure) and basic user services available as open source software together with architectural rules for everyone to use.

Description

The project develops applications in different domains to show the potential for end-users and the benefits of the service oriented-middleware architecture for application developers. These applications are: "Home Care and Safety", "Home Information and Entertainment", and the "Extended Home Environment" – in which multiple homes are connected. A major goal is to provide end-users with services that enable them to share activities and experiences in an easy and personalized way. They can socialize and visit from their personal environment, for example, their home, with friends and relatives, or other social parties who are at other locations. It is, for example, possible for parents who are on a business trip to still share daily activities with their children at home, to tell them their bedtime stories, to watch TV together, to look at pictures or to play a game with them. That is, they can share their presence independent of location and devices, using TV with PC, TV with hotel-TV, or mobile with TV, etc.

Utilization

All citizens.

Entities

Fifteen of Europe's leading companies and research establishments in mobile and home networking, software development, consumer electronics and domestic appliances have joined together in Amigo – an integrated project that will realize the full potential of home networking to improve people's lives.

Web

http://www.hitech-projects.com/euprojects/amigo/

Bandwidth requirements of medical data [11]

Digital device	Data rate required
Digital BP	<10 kb/s
Digital thermometer	<10 kb/s
Digital audio stethoscope and integrated electrocardiogram	<10 kb/s
Ultrasound, cardiology, radiology	256 Kb (image size)
Magnetic resonance image	384 Kb (image size)
Scanned x-ray	1.8 Mb (image size)

Biomedical measurements	Bandwidth (Hz)	Information rate (B/s)
ECG	0.01-250	15.000
Heart sound	5-2000	120.000
Heart rate	0.4-5	600
EEG	0.5-70	4.200
EMG	0-10.000	600.000
Respiratory rate	0.1-10	800
Temperature of body	0-1	80

Note: the reported data rates are indicative, since medical signals can be digitised and compressed with different compression rates, depending of the required quality.

Annex B (Transport)

1. New generation sensorial systems: STARDUST

Background and Objectives

The objective of STARDUST project is to assess the extent to which ADAS (Advanced Driver Assistance Systems) and AVG (Automated Vehicle Guidance) systems can contribute to a sustainable urban development not only in terms of direct impacts on traffic conditions and environment but also in terms of impacts on social life, economic viability, safety, etc.

ADAS/AVG systems can be designed to have variety of functions (e.g. driver assistance, safety enhancement, information provision and automated transport) and use different technologies (e.g. vehicle based, infrastructure based or co-operative).

The STARDUST project has revealed that driver support systems have a substantial potential in the urban environment regarding traffic flow and traffic safety. However, there is a need for more research on urban following processes and traffic flow mechanisms such as:

- influence on capacity (smoothing and increasing the flow)
- reliability of the systems under different traffic conditions and surroundings
- adaptation and interaction to the traffic environment
- effects of coupling between different systems
- safety (looking at the driver behaviour and traffic processes, long term database for incidents)
- user acceptance and understanding of new technologies.

From the road keeper and governmental point of view there is a need for more research to understanding the traffic management: opportunities and how best handle and regulation to avoid inappropriate technologies.

The ADAS/AVG technologies assessed in STARDUST were: Intelligent Speed Adaptation (ISA - safety improvements – sensors, GPS); Adaptive Cruise Control (ACC - Driver Comfort - sensors); Stop&GO (Driver Comfort; on-board sensors); Lane Keeping (increase road capacity without widening road profile – vision systems, sensors); Cybercars.

http://www.trg.soton.ac.uk/stardust/
http://www.adase2.net/

Legal, Regulatory and institutional issues

Supplier

- To move forward and reach a level of use that will have a major influence on traffic flow and safety some concerns have to be dealt with. These were identified to include:
- Legislation (mandatory or not)
- Infrastructure investments
- Combination with other applications
- Robustness of the systems in different traffic situations
- Liability issues
- Market needs (user acceptance, training, long term effect, maintenance)
To make a substantial step forward in the rate of deployment, it will be necessary for governments to consider making some of the systems mandatory.
- ISA system: Liability for database information and system performance.

- Stop & Go system: juridical and civil liability issues. Stop & Go is unable to detect bicycles or pedestrians, or negotiate roundabouts, and there is a risk of foreseeable misuse. For obvious reasons, the use of Stop&Go in an urban environment would only amplify these limitations. It is questionable whether the level of warnings and training necessary to allow manufacturers to discharge their duty could be achieved for a fully automated system without introducing supplementary systems as collision warning systems.
- ACC system: juridical and civil liability issues

Cultural and social issues

Supplier

- Lane Keeping system: Progress in research and technology and the lack of willingness from the decision makers are two other high barriers to implementation. Another interesting point to note is that the bus operators seem reluctant to the implementation of Lane Keeping, which is however thought to have positive impacts on bus driving.
-

Demand

- Driver's willingness to buy and use the system. Governmental willingness to implement and enforce speeding
- Safety benefits of ADAS may be significantly reduced, or cancelled out altogether, by unexpected behavioural responses to the technologies, e.g. system over-reliance and safety margin compensation.
- MS and nomad devices may induce dangerous levels of workload and distraction
- Potential conflicts between different independent systems interacting with the driver further increase the risk for mental overload and unexpected behavioural effects
- There is not a completely positive attitude towards Stop&Go systems and opinions are also less favourable for Lane Keeping systems.
- Some systems such as ACC and Stop&Go can provide wider network benefits with regard to traffic flow and more throughput of traffic – but may as well provide disbenefits if not coordinated between manufacturers and government. The disbenefits and obstacles to deployment could be related both to liability issues and to how the systems actually are implemented and utilized in practice.

Commercial and economic issues

Demand

- ISA system: cost is a barrier
- Lane Keeping system: cost is biggest barrier

Technical issues

Supplier

- ISA system: reliability issues
- ISA system: Technical challenge in creating the speed limit database
- Stop & Go system: reliability issues
- ACC system: reliability issues
- ACC system: Technical collaboration is necessary to ensure a common functionality between different brands.
- Difficulty is the number and complexity of interactions between the driver, the system and the external environment. This is particularly true in relation to Stop&Go

Demand

- Training: manual training has limitations and compulsory training is costly and difficult to enforce.

Participants

Final Report can be found: http://www.trg.soton.ac.uk/stardust/reports.htm.

2. EURAMP

Background and Objectives

The major objective of the EURAMP project is to advance, promote and harmonise ramp metering control measures in European motorways in the aim of improving safety and increasing efficiency of traffic flow. Each on-ramp is fully equipped with loop detectors and traffic signals. This major objective is pursued within EURAMP via a number of multifaceted actions and sub-objectives:

- Advancement of methodological issues, with particular focus on traffic flow safety, to secure a European technological leadership in the area.
- Consolidation, harmonisation and advancement of ramp metering practice in Europe.
- Demonstration of new developments in European sites and paving the way for a new generation of extended (network-wide) ramp metering installations.
- Co-operation of ramp metering with signal control and further heterogeneous control measures for maximum synergy in terms of traffic flow efficiency and safety.

What is ramp metering?

Depending on the layout of the on-ramp there can be one or two lanes of queuing traffic. In general, when the signal turns green one car in each lane is allowed to go. However, some ramp metering locations operate a "two cars per green" policy.

In a *fixed-time* ramp metering strategy, the traffic signal settings for the metered ramp are calculated offline based on previously-collected data on traffic demands at that location. There will be different signal settings for different times of day and for different types of day (weekday, weekend, holiday).

In a *reactive* ramp metering strategy, the signal settings are calculated based on real-time traffic data from detectors on the ramp and on the highway upstream and downstream of the ramp. According to the precise strategy adopted, this detector data is processed to produce the signal timings at the ramp, which are therefore reactive to changing traffic conditions. *Predictive* ramp metering strategies go one step further by using real-time traffic measurements along with appropriate estimation and prediction algorithms. Predictive strategies therefore take control actions in real-time to deal with anticipated problems.

Ramp metering can either be applied in isolation to an individual on-ramp (*local* strategy) or a *co-ordinated* strategy could apply to several ramps.

This solution requires 'various levels of modern technology/telematics'.

Results

The results have the potential of moving rapidly from the research to the prototyping stage.

A number of EU cities, including Paris, have adopted on-ramp metering.

http://www.euramp.org/

Technical issues

Demand

- The storage capacity of on-ramps is a key constraint

- Need to be able to hold several hundred cars on nine or 10 ramps to get maximum return for the effort. Once the ramp fills up, the system must cut out, or on-ramp queues will feed into city streets. It is a constraint, but it is not an expensive one to overcome. New ramps can be designed for greater capacity, existing ones can be widened.

http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89232

3. F-MAN (Fleet MANager)

Background and Objectives

The problem F-MAN is addressing is that rail cargo operators still tend to orientate their strategy in a national framework and on train- (not wagon-) oriented operation. This has a consequence: no yield and cost control of international wagon operation exist. F-Man is concentrating on the development of tools for asset management on those several hundred thousand international cargo wagons. IT tools, including GPS, mobile messaging and Internet based applications, will be developed and used to ensure the traceability and the access to wagon information.

The objective of F-Man is to provide the RCO-fleet manager with innovative tools to control his international wagon fleet, and to enhance the productivity of wagons. On this basis, the following tools will be developed:

- The On-Board Terminal will collect wagon position and status information and send it to the Operation Center, according to pre-defined events criteria (Event Messaging);
- The Operation Centre will forecast the Expected Time of Arrival using Artificial Intelligence models;
- The Internet-based bid and offer module (F-MAN pool) will reduce the empty returns;
- The status-oriented maintenance module will improve the availability of wagons;
- A Decision support system based on financial and commercial criteria will be developed to assist the future Fleet Manager to control his fleet of wagons.

http://www.civil.ntua.gr/f-man/

Results

The project was a success. A prototype has been developed and successfully tested during six months with various freight wagons on European corridors. The prototype is currently undergoing the necessary adaptations to make it into a commercial application.

Commercial and economic issues

Supplier

During the lifecycle of the project the Consortium had to face heavy problems concerning the withdrawal of two Partners: Trenitalia S.p.A. and Tecnosistemi S.p.A. – TLC Engineering & Services, which were present within the partnership at the beginning. The problem arose early and successfully solved by new Partner, Sigma Conseil, and the presence of SNCF as leader of the ROG. Project was delayed for three months.

4. Autonomous Driving: Cybercars

Background and Objectives

The objective of the CyberCars project is to develop and experiment with new transportation techniques for the cities of tomorrow. These techniques are all based on the concept of individual automated vehicles which run on city streets or in private grounds as an alternative to the use of private cars and as a complement to public mass transportation and non-motorized travel.

Communication technologies used in cybercars:

- Various communication schemes have been used and are now operational on various systems: GSM and GPRS mostly for communicating with the users through their mobile phones, and Wi-Fi (IEEE 802.11) for the communication between vehicles and infrastructure. High bandwidth communication is needed in case of transfer of images, for example for remote control of the vehicles.

http://www.cybercars.org/docs/CyberCars%20Final%20Report-V2.pdf – final report
http://www.cybercars.org/indexold.html
http://www.adase2.net/

Commercial and economic issues

Supplier

Low volume production meant high costs.

Technical issues

Supplier

- Vehicle controls: limited performances and especially poor reliability
- Navigation and guidance: problems exist
- Obstacle detection and avoidance: vision system solutions not robust enough for implementation into cybercar without human intervention. Laser sensors had limitations in terms of performance and cost.
- Vehicle platooning: only limited experience was available on this topic.
- Fleet management: problems with vehicle distribution versus demand.
- Unpredictable environment in city (vehicles, pedestrians) caused problem for remote driving.

5. Composition Of Mobile Pre-trip, On-trip Services (COMPOSE)

Background

Project Duration 28 months, starting from August 2002.

The COMPOSE project aims to define the specifications and demonstrate an innovative mobile service package for travellers based on the full integration of the mobile Pre-Trip (3D navigation in city environment) and On-Trip (in-car location based & satellite broadcast/multicast and last mile) service components. COMPOSE offers the full coverage of mobile users needs during the pre-trip and on-trip phases through a single access point for continuous information broadcasting (weather forecast, news & sport, cultural & entertainment information) and on demand information (messages, points of interest, route guidance, dynamic traffic information). COMPOSE aims to overcome the drawbacks of state-of-art solutions by pursuing a service-integrated approach that encompasses pre-trip and on-trip services considering that on-trip services could be split in in-car and last-mile services:

pre-trip services, whereby users access the COMPOSE platform by both fixed PC and PDA. In the former the user can perform a virtual tour (3D application) by navigating on a rich Geographical Information environment related to a selected area (trip itinerary and time) as well as access the Personalised Travel Information Services (weather, news, etc.). In the latter the user can access to dynamic route planning and traffic information as well as messaging services.

(on-trip) in-car services, whereby users can get wireless-link access by PDA to both broadcast/multicast one-way services and point-to-point two-way services (location based services)
Satellite Broadcast/Multicast Services: (on-way services) information is delivered at low data rate through **S-UMTS** capability in order to provide continuously updated information. This approach will allow quasi-real time

refreshing of the always-available information. In this sense, COMPOSE moves the TV Tele-Text concept into the vehicle. Data Carousel includes Electronic News, Weather Forecast Report, Cultural and Entertainment Information. Multicast service foresees transmitting data packets to selected users whether on the basis of location or user group.

Terrestrial Location Based Services: (two-way services) provided by means of a service provider that offers services based on multi-layer geographic data info. This includes traffic information and traveller information (e.g. Points of interest) delivered and displayed on top of the Geo-information, Messaging Services, route planning and guidance services, support services (Tracing & Tracking) for professional users. Such services is accessed through a GPRS connection.

(on-trip) last-mile services (based on 3D/4D technology) whereby the mobile user, equipped with a PDA, can receive guidance during its final part of the journey, for example from the car parking spot to and from the chosen destination.

http://galileo.cs.telespazio.it/compose/compose_frame.html

Technical issues

Supplier

- **Pre-trip applications** - road network data needs to be enhanced so that it better enables and supports the automatic integration of 3D elements for query and display. Necessary enhancements to the framework data and the automatic integration and delivery of 3D content must be done within a coherent business and technical model if pre-trip applications are to be a commercial success and acceptable to end-users. There needs to be a close working partnership between the data vendors and the pre-trip 3D application developers.
- **Satellite comms** - TCP/IP protocols were not optimised (i.e. they exhibit long roundtrip delays, which may hinder the operation, and even introduce vulnerabilities in protocols working with timeouts). There are a few works on adapting TCP/IP protocols to satellite communication in order to cope with the above mentioned constraints.
- The **bandwidth** of the 2-way communication system is limited. This constraint may have impact on the speed of services and can therefore effect the COMPOSE service.
- Technically immature equipment in terms of size, weight, and complexity of the device
- Information overflow due to a non-personalisation of the different applications

Demand

- **3D Maps**, the traditional data collecting method used during the Compose project was time consuming process; need for the development of cost efficient source material collection and source material processing methods for the production of 3D City Models. Tele Atlas has plans to further elaborate the use of mobile mapping data in combination with intelligent object recognition tools to be able to produce 3D maps in a cost-efficient way.

Commercial and economic issues

Supplier

- Incorrect price/quality relation of the 3D visualization.

Demand

- **The Last-Mile application** needs to be developed to suit the range and capabilities of the devices and platforms most used by the mobile pedestrian. Many of the owners of travel destinations already have CAD data related to their properties. They should be educated to see the commercial benefits of making this data available in a form that would facilitate on-the-fly integration into last-mile applications.
- **Size of mobile terminal** installed in the car is too big for commercial use
- **Cradle** for mobile terminal requires too many cables / leads for commercial use
- Potential lack of readiness of the consumer market

The way forward

- Develop smaller user terminal
- Need further research for market opportunities for Galileo opportunities
- Exploitation of S-UMTS technology towards different bit rates
- See final report for detail of conclusions and recommendations

Participants

COMPOSE project is carried on by a consortium of seven partners from six Countries with specific expertise in practical exploitation of combined positioning and communication technologies for providing services for travellers.
COMPOSE Project executed by an Industrial Consortium led by Telespazio.
Space Engineering (I)
Alcatel Bell (B)
Skysoft (P)
Teleatlas (NL)
ARS Traffic & Transport Technology (NL)
MobileGIS (Ireland)
HiTec (Austria)
TIM (Telecom Italia Mobile)
INRETS (French transport services institute) will support COMPOSE with their intelligence of the final user needs and service
ACI: Automobil Club Italia (Italian car drivers association)
OREGIN

6. Human Machine Interface (HMI) Issues: Comunicar

Background and Objectives

Comunicar's main goal is to design, develop and test an easy-to-use on-vehicle multimedia Human-Machine Interface (HMI). Such HMI will manage the communicative exchange with the driver taking into account his/her workload, the different environment conditions and traffic scenarios.

http://www.comunicar-eu.org/
http://www.adase2.net/
http://www.springerlink.com/content/r1up0pvrr580g0ym/

Cultural and social issues

Demand

So far the HMI results have not yet yielded in systems for practical use, and they usually are limited to user warnings.[1]

Commercial and economic issues

Supplier

Due to product liability issues the systems cannot be marketed as accident prevention systems but rather as comfort systems or at most as collision mitigation systems.[2]

[1] http://www.sparc-eu.net/sparc/Background and Objectives.php
[2] http://www.sparc-eu.net/sparc/Background and Objectives.php

7. GLORIA

Background and Objectives

Project details

Project Acronym: GLORIA
Project Reference: IST-1999-20600
Start Date: 2000-09-01
Duration: 24 months
Project Cost: 1.93 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-08-31
Project Status: Completed Project Funding: 988784.00 euro

http://www.eu-gloria.org

GLORIA tests new alternatives for the position signals, develops and optimises combined GNSS/ Loran-C receiver systems and tests them in a series of road and rail applications and simulations including navigation, fleet management, traveller information in public transport, public transport management systems, intermodal goods monitoring and electronic fee collection.

GLORIA investigates solutions to the mobile European citizen and unveils a valid migration path for the future GALILEO and a prerequisite for competitive future European value added services for mobility.

The results were positive, with potential for market introduction.

It is proposed to initiate further research and technical development of LORAN-C based navigation with emphasis on the applicability to the rail sector.

Legal, Regulatory and institutional issues

Supplier

One of the most important influencing factors for a successful implementation and diffusion of GLORIA's results is the existence of NELS, which is currently the major institutional framework sustaining the operation of the European part of LORAN-C. A prolongation of LORAN-C strongly depends on, whether it is accepted as part of the Galileo infrastructure, and whether it is considered in the ERNP. NELS is facing a typical "chicken and egg" problem: politicians want the participation and engagement of users and industry to promote a continuation of LORAN-C and NELS, and industry is not willing to invest into producing LORAN-C user equipment given the uncertainty of the continuation of NELS. In this context GLORIA can be seen as first step to escape this vicious circle by providing an integrated LORAN-C / GNSS receiver which will address attractive markets thus helping to increase both policy's and industry's interest in LORAN-C.

Technical issues

Supplier

- For several years the use of cellular communication networks for positioning purposes has been discussed, mainly for location based services. While communication aims at maximum coverage with a minimum number of transmitters (meaning minimal overlaps between network cells), positioning based on time measurements requires the simultaneous reception of signals involving three or more transmitter stations. Thus, for optimised positioning the transmitter density of current cellular networks would have to be increased significantly.
- Focus is on hybrid receivers - comparative tests of different hybrid navigation systems are needed. This is a possible area for future research.

Participants

Teleconsult Hofmann-Wellenhof & Partner Oeg	Austria

De-Consult Deutsche Eisenbahn-Consulting Gmbh	Germany
Ziv- Zentrum Fuer Integrierte Verkehrssysteme Gmbh	Germany
Reelektronika B.V.	Netherlands
Vereinigung High Tech Marketing	Austria
Aktiengesellschaft Fuer Sicherheits- Und Informationssysteme Im Transportwesen, Asit	Switzerland

8. Adaptive Integrated Driver-vehicle Interface

Background and Objectives

To generate the knowledge and develop methodologies and human-machine interface technologies required for safe and efficient integration of Advanced Driver Assistance Systems (ADAS), MS and nomad devices into the driving environment.

Specifically, to develop and validate a generic Adaptive Integrated Driver-vehicle InterfacE (AIDE) that employs innovative concepts and technologies in order to:

29. Maximise the efficiency, and hence the safety benefits, of advanced driver assistance systems,
30. Minimise the level of workload and distraction imposed by in-vehicle information systems and nomad devices and
31. Enable the potential benefits of new in-vehicle technologies and nomad devices in terms of mobility and comfort, without compromising safety.

The AIDE concept will be implemented, demonstrated and validated in three different test vehicles: a city car, a luxury car and a heavy truck.

Cultural and social issues

Demand

- Safety benefits of ADAS may be significantly reduced, or cancelled out altogether, by unexpected behavioural responses to the technologies, e.g. system over-reliance and safety margin compensation.
- MS and nomad devices may induce dangerous levels of workload and distraction
- Potential conflicts between different independent systems interacting with the driver further increase the risk for mental overload and unexpected behavioural effects

Participants

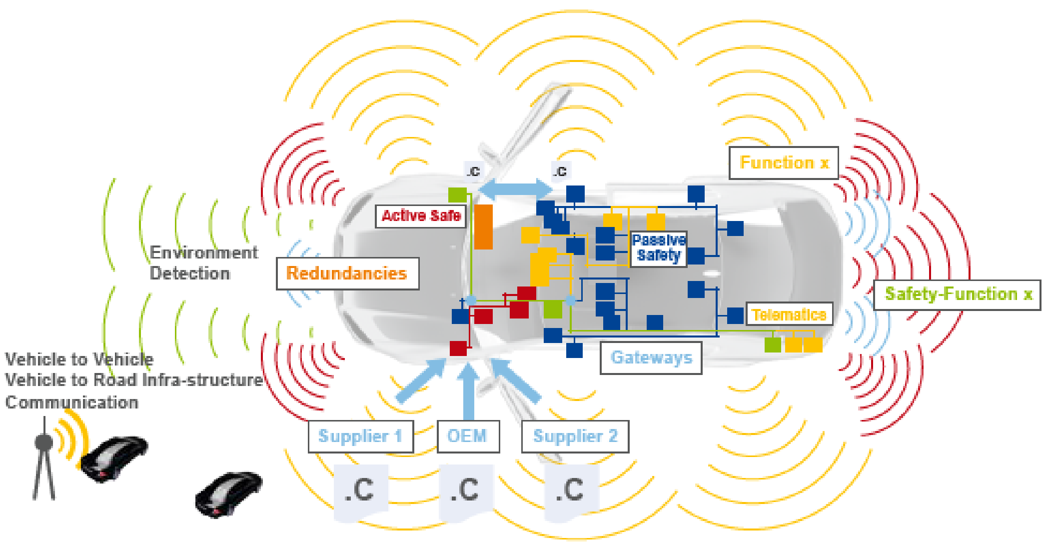
Centre For Research And Technology Hellas	Greece
Netherlands Organisation For Applied Scientific Research - Tno	Netherlands
Fundacion Para La Investigacion Y Desarrollo En Automocion	Spain
Bmw Forschung Und Technik Gmbh	Germany
Robert Bosch Gmbh	Germany
European Road Transport Telematics Implementation Coordination Organisation S.C.R.L.	Belgium
Institute Of Communication And Computer Systems	Greece
Centro Tecnico De Seat Sa	Spain
Statens Vaeg- Och Transportforskningsinstitutet	Sweden
Centro Ricerche Fiat Societa Consortile Per Azioni	Italy
University Of Leeds	
Bundesanstalt Fuer Strassenwesen	Germany
European Commission - Joint Research Centre	Belgium
Adam Opel Aktiengesellschaft	Germany

Siemens Vdo Automotive	France
Universita Degli Studi Di Genova	Italy
Regienov	France
Motorola Limited	
Institut National De Recherche Sur Les Transports Et Leur Securite	France
Linkoepings Universitet	Sweden
Daimlerchrysler Ag	Germany
Valtion Teknillinen Tutkimuskeskus	Finland
Nuance Communications International Bvba	Belgium
Kite Solutions S.N.C. Di Ing. Carlo Mauri E Dr. Nadia Cacciabue	Italy
Telenostra As	Norway
Fundacion Para La Promocion De La Innovacion, Investigacion Y Desarollo Tecnologico En La Industria De La Automocion De Galicia	Spain
Ford Werke Gmbh	Germany
Universita Degli Studi Di Modena E Reggio Emilia	Italy
Peugeot Citroen Automobiles Sa	France
Universitaet Stuttgart	Germany

9. EASIS: Electronic architecture and system engineering for integrated safety systems

Background and Objectives

An integrated approach to vehicle safety systems is essential in reaching the road safety targets set by the European Commission Transport Policy. For the realization of such Integrated Safety Systems, powerful and highly dependable in-vehicle electronic architectures and appropriate development support are necessary. These elements must be standardized to achieve an improvement in system quality with shorter development times and lower system costs. The goal of the EASIS project is to define and develop the mentioned technologies to enable the realization of future integrated systems.



Elements of Integrated Safety Systems

http://www.easis-online.org/wEnglish/download/index.shtml?navid=13

Cultural and social issues

Demand

- Handling of high system complexity

Commercial and economic issues

Supplier

- For the realization of Integrated Safety Systems (ISS) a powerful, highly dependable in-vehicle electronic architecture – both hardware and software – is necessary. Those elements, which are not competition-relevant for OEMs and suppliers, must be standardized to achieve an improvement in system quality with shorter development times and lower system costs. One major part of this electronic architecture is the software architecture upon which the Integrated Safety Systems shall be executed.
- No single party involved in the development of integrated safety systems will be able to take over the sole responsibility for system safety and dependability. Methods and approaches are necessary that support shared responsibilities.

Technical issues

Supplier

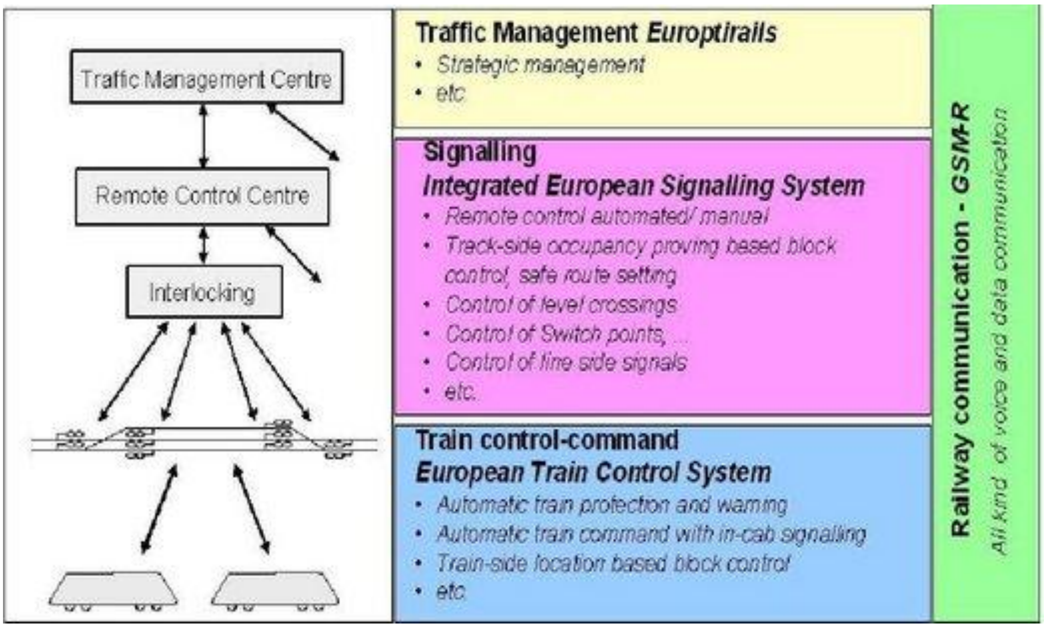
- Integration of domain (Cabin, Chassis, Powertrain) overlapping safety functions with high dependability
- Integration and multi-usage of environment sensing
- Integration of telematics services for safety systems
- need for an ontology or meta-model to give a well-defined basis for the description of artefacts and activities throughout the engineering process

10. The European Rail Traffic Management System (ERTMS)

Background and Objectives

The **E**uropean **R**ail **T**raffic **M**anagement **S**ystem (ERTMS) is an EU "major European industrial project" to enhance cross-border interoperability and signalling procurement by creating a single Europe-wide standard for railway signalling with the final aim of improving the competitiveness of the rail sector.
It contains three basic elements:

32. **GSM-R** (Global System for Mobiles - Railway) - the communication element containing both a voice communication network between driving vehicles and line controllers and a bearer path for ETCS data. It is based on the public standard GSM with specific rail features for operation e.g. Priority and Pre-emption (eMLPP) - Functional Addressing Location Dependent Addressing - Voice Broadcast Service (VBS) - Voice Group Call (VGC) - Shunting Mode - Emergency Calls - General Packet Radio Service (GPRS option) - Fast call set-up
33. **ETCS** (European Train Control System) - the signalling element of the system which includes the control of movement authorities, automatic train protection and the interface to interlockings. It allows the stepwise reduction of complexity for train drivers (automation of control activities) - It brings track side signaling into the driver cabin - It provides information to the onboard display - It allows for permanent train control - Train driver concentrates on core tasks.
34. **ETML** (European Traffic Management Layer) - the operation management level intended to optimise train movements by the "intelligent" interpretation of timetables and train running data. It involves the improvement of: real-time train management and route planning - rail node fluidity - customer and operating staff information



Cultural and social issues

Supplier

No support for the railways which implement or are willing to implement GSMR. Lack of a structure of experts from railways and consultants which is able to satisfy future demand on behalf of UIC (The International Union of Railways). http://www.uic.asso.fr/baseinfo/projet/projet.php?id=155

a) GSM-R: Broadband in the train (E-Train)

Background and Objectives

Start date: 01/01/08 - End date: 31/12/09

The project will contribute to the development of the harmonised strategy of ground-train communications for the benefit of IM and operators. The main objectives are to assess and consolidate the user's needs in the field of enhanced broadband communications with trains and to specify the related services and their harmonised minimum QoS.

The currently applied technologies are very diverse and rely on ground-supported networks (GPRS/EDGE/UMTS, Wi-Fi, Wi-MAX and other). All current developments are only pilot applications to passengers, based on empirical and ad-hoc arrangements without a systematic investigation of actual needs and hence no harmonised specification of services and their minimum necessary quality.

For a progress map of the rail GSM infrastructure in Europe: http://www.uic.asso.fr/uic/spip.php?article430

Participants

Project Manager: Gerge Barbu (email: barbu@uic.asso.fr)

b) GSM-R: Advanced GSM-R (A-GSMR), Frequency management (Rail)

Background and Objectives

Start date: 01/01/08 - End date: 31/12/09

The European Train Control System (ETCS) at Level 2 should replace lineside signalling, and should provide a full automatic train protection including train supervision. In order to achieve these goals, there is a need of a data service, which will help to overcome future restrictions especially in dense area. Following this line, A-GSMR will assess the readiness of IP-based solutions (e.g. GPRS) to be available for ETCS level 2 to overcome future restrictions especially in dense areas. A-GSMR will also gather and manage the frequency needs for railways, related to all frequencies and the common needs. The A-GSMR will act as an interface between railways and European frequency authorities and as the centre of competence in the field of telecommunication for railways.

The major activities in 2008 will be:

35. **GPRS,** Standards development, finance or co-finance a measurement campaign, work plan underway within ERA for finalizing the cost benefit analysis, reaching an efficient solution. The measurement campaign should result in the definition of reachable QoS parameters. If reasonable there should also be a project-proposal in accordance with GSM-R and ETCS Industry to reach the goal of having products and update of application available in 2010 at the latest.
36. **Radio Frequency Group,** Support the campaign for frequency band extension, defend GSM-R spectrum against any interferences and disturbances (e.g. UMTS).

For a progress map of the rail GSM infrastructure in Europe: http://www.uic.asso.fr/uic/spip.php?article430

Participants

Project Manager : Dan Mandoc (email: mandoc@uic.asso.fr)

c) GSM-R: European Railway IP Infrastructure (IP-I)

Background and Objectives

Start date: 01/01/08 - End date: 31/12/09

The project contributes to the development of the harmonised strategy of "Common Railway Telecom Network". The development indicates the enhanced use of IP networks for communication and generalisation of Ethernet interfacing. Railways shall use as far as possible standard market products when railway telecom infrastructures migrate towards generalised use of IP interfaces and standards. The objective of the project is to prepare the transition to the following target scenario: European Railway IP Network "IP-I" as a bearer for information, telephony and mobile telecom applications.

For a progress map of the rail GSM infrastructure in Europe: http://www.uic.asso.fr/uic/spip.php?article430

Participants

Project Manager: Dan Mandoc (email: mandoc@uic.asso.fr)

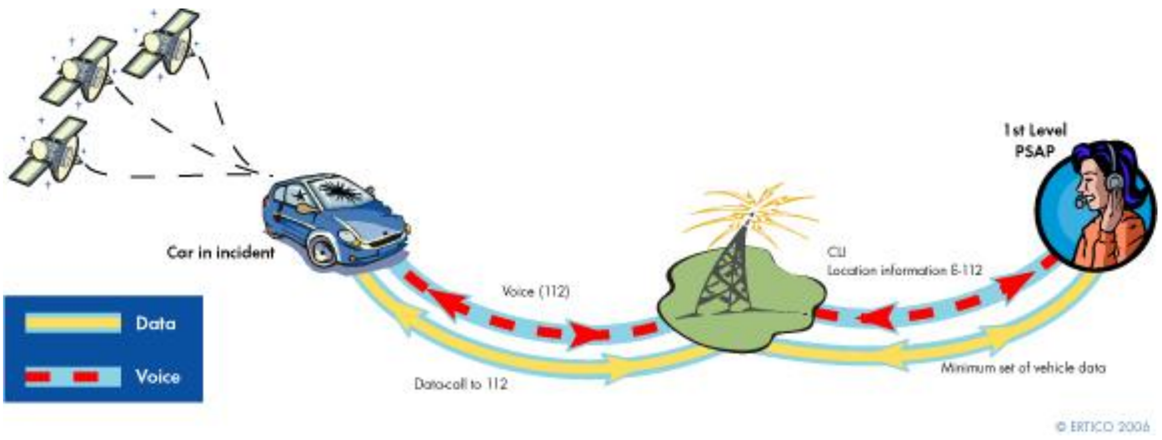
11. Tiefensee: Electronic Systems improve road safety and help prevent congestion

Pan-European rescue system "eCall" – scheduled for EU roll-out Sep 2010.

On behalf of the Federal Government, Wolfgang Tiefensee, the Federal Minister of Transport, Building and Urban Affairs, signed a Memorandum of Understanding on the rescue system eCall. With this, Germany is supporting a Europe-wide introduction of this electronic emergency call system, which is designed to speed up rescue operations.

Sometimes it can take a long time for the rescue services to reach the site of an accident, especially at night or in remote areas. With eCall, a signal is transmitted automatically when an air bag is released, giving the exact position of the accident to the emergency response centre. Satellites support the rescue services in locating the crashed vehicle.

http://www.bmvbs.de/-,2655.997720/Tiefensee-Electronic-Systems-i.htm



Legal, Regulatory and institutional issues

Supplier

Emergency centres and rescue services fall under the responsibility of national, regional or local governments, or appointed agencies. Action within Member States is therefore essential to prepare and equip emergency services for the implementation of eCall. Some Member States are ahead of others in implementing eCall proposals.

Commercial and economic issues

Supplier

Despite its success, eCall hasn't been rolled in the EU yet for the three reasons:

- cars have not been fitted with eCall devices – in Sep 2010 all new cars will be equipped with eCall devices;
- at present, the single European emergency number 112, or its location enhanced version E112 is working in 12 out of 27 Member States;
- emergency centres and all rescue services must be capable of processing the location data transmitted by eCall

Participants

So far, the MoU has been signed by:
Germany,
Austria,
Finnland,
Sweden,
Slovenia,
Lithuania,
Italy,
Greece,
Cyprus,
Switzerland,
Norway,
Iceland and
the European Automobile Manufacturers.

http://ec.europa.eu/information_society/doc/factsheets/049-ecall-en.pdf
http://www.bmvbs.de/en/-,1873/Transport.htm

12. InteGRail

http://www.integrail.info/fp6.htm

Background and Objectives

Development of vehicle and vessel concepts for both passengers and freight, characterised by interoperability and inter-connectivity, for cross-operation between different transport routes and networks supported by advanced mechatronics, on-board electronics, information and communication systems

13. SIRTAKI

Background and Objectives

Project details

Project Acronym: SIRTAKI
Project Reference: IST-2000-28303
Start Date: 2001-09-01
Duration: 36 months
Project Cost: 3 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-08-31
Project Status: Completed
Project Funding: 1.45 million euro

The strategic goal of SIRTAKI is the development and assessment of an advanced tunnel management system that specifically tackles safety issues and emergencies and the integration within the overall network management (road and rail).

For more info on the technologies used within the project, look at the website (below).

http://www.sirtakiproject.com

Participants

Regie Autonome Des Transports Parisiens	France
Sitaf Spa - Societa Italiana Traforo Autostradale Del Frejus	Italy
Servicios Y Obras Del Norte, S.A.	Spain
Instituto Dalle Molle Di Studi Sull'intelligenza Artificiale	Switzerland
Risoe National Laboratory	Denmark
Fit Consulting S.R.L.	Italy
Sinelec - Societa' Per Azioni	Italy
Safetec Nordic As	Norway
Research Center Of The Athens University Of Economics And Business	Greece
Ajuntament De Barcelona	Spain

14. New generation sensorial systems: Densetraffic

Background and Objectives

DENSETRAFFIC is developing use of stereo vision and radar to assess complex traffic situations. Its primary objective is to develop and demonstrate a Forward Looking Radar Sensor (FLRS) with improved capabilities that will allow operation in Stop&Go modes and early detection of Cut-In situations. This will enhance the functionality of the sensor in an Adaptive Cruise Control system.

The objectives of the project are the development of a computerized sensor system, eventually to be included in all vehicles that will reduce the rate of accidents on Europe's roads, by automatically avoiding collisions. The system aims to advance ACC systems to true collision avoidance by including automatic emergency braking capabilities, possible because of the improved monitoring of the road situation in front of the vehicle.

See www.densetraffic.org for further details.

Cultural and social issues

Demand

The main risks to the introduction of better performing FLR sensors include:

- Low rate of acceptance by the final customers will delay the introduction of second generation sensors.
- This same low rate of acceptance will also retard the cost reduction which is strongly dependent on the high volume (100 kunits/year at least).

Commercial and economic issues

Supplier

The risk from a supplier point of view is OEM's require even lower cost and especially smaller sizes.

Technical issues

Supplier

A risk to stop adoption from the technical point of view includes the false alarm rates (at the level of the Adaptive Cruise Control (ACC)) should be lowered.

Participants

Groeneveld Groep B.V (Coordinator)
United Monolithic Semiconductors S.A.S
EADS Deutschland GmbH Microwave Factory
RoadEye FLR GP (Scientific Coordinator)
ERA Technology Ltd.
DAF Trucks N.V.

15. Global Intermodal Freight Transport Systems (GIFTS)

Background and Objectives.

Project details

Project Acronym: GIFTS
Project Reference: IST-2000-29364
Start Date: 2001-09-01
Duration: 36 months
Project Cost: 5.24 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-08-31
Project Status: Completed
Project Funding: 2.69 million euro

The main GIFTS aim is to develop a fully Integrated Operational Platform - GIP - for managing, in a total sense, door-to-door freight transport in an intermodal environment all around Europe. The GIFTS aim is to setup a system providing a full service to freight transport operations accessible to the Small and Medium players. GIFTS will provide applications for the operational (e.g. track, trace and monitor the door-to-door journey, aid in trip management, fleet management), as well as all the e-commerce functions and insurance of a door-to-door freight transport chain (including order matching, e-document transfer, e-payment). The GIP communication systems (based on current terrestrial and satellite mobile systems and emulation of the future UMTS) will interface the overall GIFTS components. Three validation campaigns will be carried out in a real life transport environment for road, *rail* and e-commerce applications.

At the heart of the platform is the GIFTS service centre, which integrates and manages information from different actors in the transport chain. For tracking and communications purposes trucks, trains or ships are fitted with mobile terminals, while the location of containers and goods is monitored via GPS. Additional e-commerce services, such as acquiring insurance, document transfer or e-payment are also available, with all the services capable of being accessed by transporters or recipients over the Internet.

GIFTS developed a platform of services with a web-based architecture to operate as a single integrated service along and across the entire supply chain. Its three components are:

- *A navigation system*, involving GPS (Global Positioning System) and EGNOS (European Geostationary Navigation Overlay Satellite system).
- *A communication system,* involving wireless technology, such as GPS, ORBCOMM, GPRS and SUMTS (satellite UMTS), and wired technology, such as Internet/PSTN.
- *An information system,* providing services and using the communication and navigation systems between users' systems and the GIFTS platform.

http://gifts.newapplication.it/gifts/

16. Combine2

Background and Objectives

Project Reference: IST-2001-34705
Start Date: 2002-03-01
Duration: 20 months
Project Cost: 2.07 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-10-31
Project Status: Completed

Project Funding: 1.04 million euro

http://cordis.europa.eu/fetch?ACTION=D&CALLER=PROJ_IST&QM_EP_RCN_A=61530
http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/77559/highlights/COMBINE;2

COMBINE 2 aims at investigating an innovative solution for managing rail traffic in real time, to provide improved service and better exploitation of existing infrastructure. The proposed solution utilises detailed real time information on train positioning to provide timely short-term plans and optimise train speeds accordingly.

Results

In 2005, the COMBINE 2 algorithms were being used to automate and optimise management of Line 1 of the Milan metro which carries around half a million passengers a day, with the project partners planning more commercial applications in the future.

17. In-vehicle Platform Integration: INVETE

Background and Objectives

The INVETE project has specified, developed and validated a modular, multi-application, intelligent IVT, which responds to the user needs of the drivers and the operational requirements of bus and taxi companies.

http://www.transport-research.info/web/projects/project_details.cfm?id=2827&page=funding

Legal, Regulatory and institutional issues

The project identified a range of potential institutional and legal issues which could create barriers to the technology developments that were demonstrated in the project. See the final report for further details.

These barriers included:

- Judicial status of Demand Responsive Transport (DRT)
- Potential operators and competitive situation
- The potential buyers of the DRT service

Commercial and economic issues

The project identified a range of potential commercial issues which could create barriers to the technology developments that were demonstrated in the project. See the final report for further details.

- Working with other public transport modes and services
- Pricing issues
- Payment and ticketing systems
- Privacy protection issues
- Dispatching issues.

18. TRAINCOM

Background and Objectives

Project details

Project Acronym: TRAINCOM
Project Reference: IST-1999-20096
Start Date: 2000-12-01
Duration: 36 months
Project Cost: 8.02 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-11-30
Project Status: Completed
Project Funding: 3.8 million euro

http://www.traincom.org

The TRAINCOM project intends to fully specify and develop a communication system for telematics applications in the railway field, integrating the on-board network (e.g. TCN), GSM radio links and Internet technologies. Based on this system, which offers ubiquitous remote access to on-board equipment, the project will develop two important applications related to dynamic passenger information and locomotive interoperability, setting up validation sites in different Countries. The project will focus on and contribute to main issues like standardisation and interoperability. A conformance test specification for TCN will be prepared and a suitable automatic testbed developed, so as to favour interoperability of devices and subsystems. Interoperability of applications will be considered in all specifications, which will be proposed for standardisation. An architecture and some basic elements of a maintenance support system, for remote, real-time monitoring of equipment on board trains, will be developed as well.

Participants

Alstom Transport Sa	France
Red Nacional De Ferrocarriles Espanoles	Spain
Trenitalia S.P.A.	Italy
Atos Origin S.P.A.	Italy
Ansaldobreda S.P.A.	Italy
Firema Trasporti Spa	Italy
Bombardier Transportation Italy S.P.A	Italy
Bombardier Transportation Gmbh	Germany
S.C. Silogic S.R.L.	Romania
F.A.R. Systems Spa	Italy
Construcciones Y Auxiliar De Ferrocarriles S.A.	Spain
Deutsche Bahn Reise&Touristik Ag	Germany
Oesterreichische Bundesbahnen	Austria

19. TRIDENT

Background and Objectives

Project details

Project Acronym: TRIDENT
Project Reference: IST-1999-10076
Start Date: 2000-01-01

Duration: 30 months
Project Cost: 3.46 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-06-30
Project Status: Completed
Project Funding: 1.48 million euro

To encourage travellers to make use of different modes of transport, the switch from one means of transport to another has to be smooth and easy. This requires reliable and efficient communication between the different transport modes, in order to provide multi-modal services with a high level of quality, reliability and timeliness. The TRIDENT project aims to establish mechanisms for the sharing and exchange of common and reusable data to enable and support multimodal services.

Website unavailable

Participants

Ministerie Van De Vlaamse Gemeenschap	Belgium
Agenzia Per I Trasporti Autoferrotramviari Del Comune Di Roma	Italy
Mizar Mediaservice S.R.L.	Italy
S.T.A. Societa Trasporti Automobilistici Societa Per Azioni - Agenzia Per La Mobilita Del Comune Di Roma	Italy
Transport, Infrastructure & Telematics Nv	Belgium
Regie Autonome Des Transports Parisiens	France
La Poste Suisse Car Postal	Switzerland
Mva Limited	
West Yorkshire Passenger Transport Executive	
Vlaamse Vervoermaatschappij De Lijn	Belgium
Centre D'etudes Techniques De L'equipement-Mediterranee	France
B+S Ingenieur Ag	Switzerland

20. E-PARKING

Background and Objectives

Project details

Project Acronym: E-PARKING
Project Reference: IST-2000-25392
Start Date: 2001-08-01
Duration: 24 months
Project Cost: 2.8 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-07-31
Project Status: Completed
Project Funding: 1.09 million euro

The E-PARKING project will develop an analysis of the most appropriate security architecture system required to use a mobile phone or any other device equipped with Bluetooth technology as a method of electronic booking and payment.

The project will research on the generation of an easily deployable system for parking space optimisation.

To this effect, E-PARKING aims at including new user-friendly and safe technologies in the booking and selling process of parking spaces in order to increase competition and productivity in such an important every-day-activity.

In this sense, the project will advance Europe's strength in applying mobile communications and will improve urban and mobility management (e.g. a better usage of scarce resources).

The Consortium will stress its application to other sectors than the parking one (e.g. cinemas, museums, thematic parks, sport & music events, public transport, road & rail & air passenger transport, tolling, ticketing, credit cards and banking).

Participants

Ericsson Telecommunicatie B.V.	Netherlands
Allmobile. Com Ag	Switzerland
Interparking Sa	Belgium
Mobistar	Belgium
European Union Road Federation Aisbl	Belgium
Universidad De Alicante	Spain
Universitaet Zuerich	Switzerland
Fidal	France

21. TRACKSS

Background and Objectives

To develop and / or improve a number of sensing technologies:

On-board vehicle sensors:
Ice-detection; Video-camera with enhanced night vision, lane/roadside recognition, detection vulnerable users; Infrared sensor to detect an infrared emitter with vehicle ID; Smart dust for in-vehicle applications; Electromagnetic sensor for pedestrian detection

External sensing technologies:

- In-road inductive loops; Laser scanners (for infrastructure);
- Video cameras for infrastructure;
- Smart dust for infrastructure;
- Space-borne/airborne sensors;
- Advanced radar sensor

22. EMMA

Background and Objectives

The main objective is to build a build a middleware platform for wireless cooperative sensing objects (wicos). 3 levels of wicos will be tested:

37. Engine sensors protoytped by CRF such as: exhaust gas sensors; oil conditions sensors; pressure sensors; position sensors for VVS (variable valve actuator);
38. Car level sensors with: the engine as a single wico plus radar sensor, video sensor, EPAS (electronic power assisted steering);
39. Supra car level sensors: using the car as a wico itself. Smart dust would be used for communication.

23. HIGHWAY

Background and Objectives

HIGHWAY is to offer higher safety and location-based value added services where interactions between the person in control, the vehicle and the information infrastructure are addressed in an integrated way. HIGHWAY, through the combination of smart real-time maps, UMTS 3G mobile technology, positioning systems and intelligent agent technology, 2D/3D spatial tools and speech synthesis/voice recognition interfaces will provide European car drivers/bikers/pedestrians/etc. with e- safety services and at the point of need interaction with multimedia (text, audio, images, real-time video, voice/graphics) and value-added location-based services.

http://www.ist-highway.org

Participants

Tele Atlas Data Gent Nv	Belgium
Wind Telecomunicazioni S.P.A.	Italy
Centro Ricerche Fiat Societa Consortile Per Azioni	Italy
Tieliikelaitos	Finland
Netxcalibur Srl	Italy
Teliasonera Finland Oyj	Finland
Motorola Electronics S.P.A.	Italy
Genimap Oy	Finland
Ict Turku Oy Ab	Finland

24. Autonomous Driving: Chauffer 2

Background and Objectives

The aims of CHAUFFEUR 2 are driver assistance systems to make it possible that a truck can follow any other truck or car at a safe following distance, and being laterally guided. Thus the driver benefits from lane keeping systems and distance control systems. A further objective is a demonstration of Platooning: create an electronically coupling for at least three trucks. Apart from these technical goals, legal and liability questions, traffic effects, socio-economic benefits as well as driver and user acceptance are being looked upon.

Website link does not work.

25. Co-operative Driving: CarTalk

Background and Objectives

CarTALK is focussing on new driver assistance systems which are based upon inter-vehicle communication. The main objectives are the development of co-operative driver assistance systems and the development of a self-organising ad-hoc radio network as a communication basis with the aim of preparing a future standard

Website link does not work.

26. HMI Issues: Darwin and Euclide

Background and Objectives

DARWIN:

The aim of DARWIN was the development of a vision enhancement system based on infrared techniques. The human machine interface approach is based on a head-up display technology designed to address car drivers' requirements.

EUCLIDE:

EUCLIDE is a follow up of the DARWIN project and concentrates on enhanced human machine interface for on vehicle integrated driver support. For the vision enhancement it is using head-up display. The aim is to develop an HMI showing data fusion of infrared and radar for vision enhancement in order to deliver critical situation information.

http://www.crfproject-eu.org/

27. Digital Maps & Multimedia: Next-Map, ACT-Map

Background and Objectives

With the aim to enable new ITS applications as well as improve or extend existing ones, the NextMAP project is evaluating the technical and commercial feasibility of enhanced map databases required for in-vehicle ITS applications.

The aim of ActMAP is the dynamic actualisation of in-vehicle digital map databases. This includes the desired investigation and development of standardised mechanisms to deliver actualised map components to be integrated and used by in-vehicle applications.

http://www.ertico.com

28. CVIS – Cooperative Vehicle Infrastructure Systems

Background and Objectives

The CVIS project aims to design, develop and test the technologies needed to allow cars to communicate and network directly with the roadside infrastructure.

The objectives are as follows:

- Create a standardised in-vehicle and roadside module capable of connecting continuously and seamlessly using a wide range of communication media, including mobile cellular and wireless local area networks, short-range microwave (DSRC) or infrared.
- Develop techniques for enhanced vehicle positioning and improved local dynamic maps, using satellite navigation and the latest methods for location referencing.
- Define and test new systems for cooperative traffic and network monitoring for use both in vehicle and roadside equipment, to detect incidents instantly and anywhere.
- Develop architecture, software and hardware prototypes for a number of example cooperative applications and services for urban and interurban traffic management, as well as freight and fleet management.

- Create guidelines and tools addressing key non-technical challenges to deployment such as user acceptance, data privacy and security, system openness and interoperability, risk and liability, public policy needs, cost/benefit and business models, and roll-out plans for implementation

The study runs from February 2006 – January 2010.

See http://www.ertico.com/en/activities/efficiency__environment/cvis.htm for more details.

Participants

5T s.c.r.l, AVVC, ATC, Autoroutes du Sud de la France, BAE Systems, BMW, Robert Bosch, Centre for Transport Studies - Imperial College London, CNRS/Heudiasyc-Université de Technologie de Compiègne, Communauté Urbaine de Lyon, Cork Institute of Technology, Daimler, Department for Transport, German Aerospace Center (DLR), Dutch Ministry of Transport, Public Works and Water Management, Efkon, Forum of European National Highway Research Laboratories (FEHRL), Fiat Research Centre, Highways Agency, Hessen Traffic Centre (HSVV), HTW - University of Applied Sciences Saarbrücken, Infoblu, INRIA, Intempora, Istituto Superiore Mario Boella, Kapsch TrafficCom, Laboratoire Central des Ponts et Chaussées, Lacroix Trafic, Lindholmen Science Park, LogicaCMG, Makewave, Mapflow, mm-lab, Mizar Automazione, Navteq, Peek Traffic, POLIS, Provincie Noord-Brabant, PTV, Q-Free, Reial Automóbil Club de Catalunya (RACC), Ramsys, Renault, Siemens, SINTEF, Swedish Road Administration, Technolution, Tele Atlas, Telecom Italia, Thales Alenia Space France, Thetis, Thomas Miller, TNO, Transport for London, TRIALOG, Vialis, Vlaamse Overheid, Vodafone, Volvo Technology Corporation, Ygomi Europe Kft.

29. Satcoms in support of transport on European Roads (SISTER)

Background and Objectives

The SISTER - "Satcoms in Support of Transport on European Roads" - project will promote the integration of satellite and terrestrial communication with Galileo, the European satellite navigation system. The project's goal is to enable mass-market take-up by road transport applications.

Satellite navigation services have already proved their value in a large range of road transport applications. Many of these applications require one or two-way communications services in order to function. In many cases to date, terrestrial communication systems such as GSM and GPRS have been employed. However, there are numerous circumstances in which these technologies may not be sufficient to meet the communications requirements. These include:

- High-availability applications in which communications coverage must be comprehensive, such as emergency applications
- High-reliability applications in which guaranteed quality of service is required, such as dangerous goods tracking
- High-capacity applications in which the terrestrial network infrastructure may be too expensive for the distribution of large volumes of data to many users, such as digital maps updating.

Although satellite communications do not replace the need for terrestrial services in many of these applications, they do serve to complement them and thus lead to an overall superior solution.

To validate the project's results, five application demonstrations will be carried out at test sites across Europe:

- eCall (Sweden)
- Map updating (Austria, Germany and Slovenia)
- Road user charging (Czech Republic)
- Dangerous goods, integrated testing of eCall, map updating and road user charging (Belgium and the Netherlands)
- Enhanced Galileo services (UK)

This study runs from November 2006 – November 2009.

For more information see www.sister-project.org.

30. DIAMOND: road and rail

Background and Objectives

The aim of this project is to demonstrate the technical and commercial feasibility of Intelligent Transport Systems (ITS) services provided over DAB, either as stand-alone or combined with GSM and/or positioning.

Project Website not working

31. ADASE II

Background and Objectives

Project details

Project Acronym: ADASE II
Project Reference: IST-2000-28010
Start Date: 2001-08-01
Duration: 36 months
Project Cost: 1.2 million euro
Contract Type: Thematic network contracts
End Date: 2004-07-31
Project Status: Completed
Project Funding: 1.2 million euro

ADASE II is a thematic network that integrates international, national and regional activities in the field of Active Safety and Advances Driver Assistant Systems. ADASE II investigates new paths for European transport systems. Advanced Driver Assistance Systems (ADAS) are concepts to improve transport safety, efficiency and comfort without additional loads on resources (energy and land use), on environment and on quality of life. ADASE II combines new vehicle technologies (including innovative vehicle control) with telematic links to traffic management centres, other vehicles and service providers. The vehicle gains information about the (near and far) driving environment and informs the driver, warns him in hazardous situations or even reacts by releasing the driver from some driving tasks. Besides safety related aspects ADASE II will offer the basis for improved interfaces to other transport modes and profitable additional applications and services such as smart travel advice, tele-commerce, in-car entertainment, mobile office support etc.

Participants

Bayerische Motoren Werke Aktiengesellschaft	Germany
Centro Ricerche Fiat Societa Consortile Per Azioni	Italy
Avv Transport Research Centre Of Rijkswaterstaat (Rws)	Netherlands
Association Europeenne Des Fournisseurs Automobiles	Belgium
Jaguar Cars Limited	
Compagnie Financiere Et Industrielle Des Autoroutes	France
Regienov	France
Peugeot Citroen Automobiles Sa	France
Centre D'etudes Techniques De L'equipement-Mediterranee	France

32. BRIDGE

Background and Objectives

Project Acronym: BRIDGE
Project Reference: 033546
Start Date: 2006-07-01
Duration: 36 months
Project Cost: 12.96 million euro
Contract Type: Integrated Project
End Date: 2009-06-30
Project Status: Execution
Project Funding: 7.5 million euro

BRIDGE is an Integrated Project addressing ways to resolve the barriers to the implementation of the EPCglobal Network in Europe. Integrated Projects (IPs) are ambitious, objective-driven with a programme approach. They involve industry (including SMEs), research institutions, and preferably potential users. The project comprises several chapters composed of working packages. The name of the project stands for "Building Radio frequency IDentification solutions for the Global Environment".

BRIDGE is a 3 year project which started in July 2006. Its consortium is composed of 30 partners, including GS1 organisations, universities, solution providers and private companies, in Europe and China.

The objective of the BRIDGE project is to research, develop and implement tools to enable the deployment of RFID and EPCglobal Network applications. The project will develop easy-to-use technological solutions for the European business community including SMEs, ensuring a basis for collaborative EPCglobal systems for efficient, effective and secure supply chains.

http://www.bridge-project.eu/

Participants

Eidgenoessische Technische Hochschule Zuerich	Switzerland
British Telecommunications Plc	Uk
Universitat Politecnica De Catalunya	Spain
Technische Universitaet Graz	Austria
Sap Ag	Germany
Costruzioni Apparecchiature Elettroniche Nucleari C.A.E.N. - Societa' Per Azioni	Italy
Aida Centre S.L.	Spain
Gs1 France Sarl	France
Nestle Uk Ltd	Uk
Gs1 Uk Limited	Uk
Melior Solutions Limited	Uk
Domino Uk Limited	Uk
Kaufhof Warenhaus Ag	Germany
Gardeur Ag	Germany
Gs1 Germany Gmbh	Germany
Article Numbering Center Of China (Ancc, Gs1 China)	China
Confidex Ltd	Finland
Benedicta Sas	France
Asociacion Espanola De Codificacion Comercial	Spain
Sony Logistics Europe B.V.	Netherlands
Verisign Uk Ltd	Uk

Cosg Sas	France
Frostream Limited	Uk
The Chancellor, Masters And Scholars Of The University Of Cambridge	Uk
Centro De Tecnologia De Las Comunicaciones, S.A.	Spain
Upm Raflatac Oy	Finland
Instytut Logistyki I Magazynowania	Poland
Fudan University	China
Northland Gmbh	Austria

33. New generation sensorial systems: APOLLO

Background and Objectives

The APOLLO project develops an intelligent tyre for better road traffic safety. In the intelligent tyre, innovative sensors are integrated into tyres for monitoring its condition, road condition, and tyre-road interaction. Sensor signals are wirelessly transmitted from the tyre for interpretation of data.

http://www.vtt.fi/tuo/projects/apollo/
http://www.adase2.net/

34. New generation sensorial systems: Carsense

Background and Objectives

A consortium of 12 European car manufacturers, suppliers and research institutes has found together under the head of the CARSENSE programme. This programme, sponsored by the EC shall develop a sensor system that shall give sufficient information on the car environment at low speeds in order to allow low speed driving. This article shall describe the main targets of the programme linked to the improvement of the individual sensors and in the merger of the information in a fusion box.

http://www.carsense.org/
http://www.adase2.net/

35. New generation sensorial systems: RadarNet

Background and Objectives

The goal of the RadarNet project is to develop a new type of low cost radar network for automotive applications and to prepare the realisation of first applications: urban collision avoidance, collision warning, stop & go functionality, airbag pre-crash warning, parking aid.
The development of a multifunctional radar network for the realisation of different new automotive applications will significantly reduce production costs, facilitate fast system development and reduce time-to-market. The new systems will improve safety of future vehicles with benefit for passengers and other road users.

http://www.radarnet.org/start.htm
http://www.adase2.net/

36. Collision Warning – Mitigation: Chameleon

Background and Objectives

The main objective of the Chameleon project is to SUPPORT, DIRECT and VALIDATE the development of pre-crush sensorial system to detect imminent impact in all type of scenarios (urban, rural and motorway).

www.chameleon-eu.org
http://www.adase2.net/

37. PREVENT

Background and Objectives

The project supports the Commission actions that aim to promote the development, deployment and use of Intelligent Integrated Safety Systems in Europe. PReVENT will help drivers to avoid accidents Depending on the significance and timing of the danger, the systems will alert the drivers as early as possible, warn them and, if they do not react, actively assist or ultimately intervene.

In PReVENT, a number of subprojects are proposed within the clearly complementary function fields: Safe Speed and Safe Following, Lateral Support and Driver Monitoring, Intersection Safety, and Vulnerable Road Users and Collision Mitigation. Additional cross-functional fields have been prioritised regarding the common understanding of functional architectures, validation and impact evaluation principles, sensor data fusion, map related matters and liability issues as well as cohesion of strategies paving the way for early market introduction. After three of the four years of PReVENT, a common Safety Application Roadshow will be organised with all participants contributing, exhibiting the results and creating awareness as an important milestone in preparation for the European market.

http://www.prevent-ip.org

Horizontal activities (sub-projects) looking at how to remove barriers to market introduction:

RESPONSE 3: aim to obtain a Code of Practice (CoP) for the development and testing of ADAS for the European industry. Translating the key issues of 'reasonable safety' and 'duty of care' the CoP will give a basis for definition of 'safe' ADAS development and testing, also from a legal point of view.

MAPS&ADAS: subproject is driven by needs identified by the ADASIS Forum with regard to the use of digital maps as primary and/or secondary sensors for ADAS.

The access to map data by applications other than navigation requires a standardised interface to avoid specific solutions dependent on OEMs and application suppliers. This will enable reduction of implementation costs and near future market introduction. The production of ADAS maps require the procurement of ADAS attributes

ProFusion I and II: was in close connection to all vertical subprojects (VSPs) in PReVENT that lead activities related to sensors and sensor data fusion. At the end of this preparatory phase, recommendations for a proposal on sensors and sensor data fusion concepts were given. In a second phase, the R&D-oriented project ProFusion II is focusing on research work of common interest in the field of sensors and sensor data fusion.

INSAFES: The general goal of INSAFES is to improve the functionality and reliability of applications developed within IP PReVENT, and to advance from stand-alone safety applications targeting one specific function to an integrated system covering a vast range of applications. This priority of INSAFES focuses on the full coverage of the area around the vehicle, in order to warn the driver, intervene or mitigate the effects of an accident. Through the modular integration of several functions, the INSAFES system aims to bring added-value to the end user, showing that high functionality can be achieved at a lower price.

Selected Subprojects:

a) INTERSAFE

- Development and testing of an intersection driver warning function on a demonstrator vehicle, based on precise relative vehicle localisation, path prediction of other objects and communication with traffic lights
- Development of an advanced intersection safety system, using a dynamic simulator environment for assessing future active safety applications and sensor system requirements

http://www.prevent-ip.org/en/prevent_subprojects/intersection_safety/intersafe/

Project Lead: IBEO Automobile Sensor GmbH

b) APALACI

APALACI is developing a system for advanced pre-crash and collision mitigation, including innovative sensor fusion techniques. The APALACI application is based on the detection of a collision event some instances before it occurs to improve the intervention of on-board systems and enhance the protection of car occupants, thus mitigating the severity of unavoidable crashes. In addition, a specific application of APALACI — namely Start Inhibit for trucks — prevents accidents at low speed by monitoring the frontal area close to the vehicle.
http://www.prevent-ip.org/en/prevent_subprojects/vulnerable_road_users_collision_mitigation/compose/compose_02.htm

Objectives:

- Enhance protection of car occupants by developing advanced pre-crash interventions:
- Improving the effectiveness of braking manoeuvres according to the detected collision scenario to mitigate the severity of unavoidable collisions
- Improving the control of restraint systems for pre-crash interventions Prevent low speed accidents with obstacles or pedestrians in the frontal area of trucks

Project Lead: Centro Ricerche Fiat

http://www.prevent-ip.org/en/prevent_subprojects/vulnerable_road_users_collision_mitigation/apalaci/

c) UseRCams

The IP PReVENT subproject UseRCams focuses on the development of an affordable active 3D sensor, which is vital in providing improved obstacle detection and classification at short range.

UseRCams is developing and testing a versatile 3D sensor technology for urban collision protection (for pre-crash or blind spot surveillance applications), which will be capable of delivering detailed depth information by combining excellent lateral resolution and depth information. UseRCams will furthermore develop and test signal processing algorithms for the 3D image sensor to provide object and VRU localisation and classification.

Project Lead: Siemens

http://www.prevent-ip.org/en/prevent_subprojects/vulnerable_road_users_collision_mitigation/usercams/

38. Reference Section

Other useful links:

http://www.aide-eu.org/
http://www.uic.asso.fr/uic/spip.php?article429 – describes some of the EU working groups for GSM and Rail. Also descriptions of ongoing projects in this field.
http://www.cvisproject.org/en/home.htm

Finland

39. Centre for Wireless Communications – University of Oulu - Finland

http://www.cwc.oulu.fi/home/index.html

PULSERS II - Pervasive Ultra-wideband Low Spectral Energy Radio Systems

PULSERS is a 6th framework project examining many issues of UWB systems including WLAN, WPAN and sensor networks. PULSERS examines both high and low data rate systems with integrated location and tracking. In PULSERS, CWC's main focus is physical layer techniques for low data rates, location and tracking algorithms and MAC issues.

CRUISE

CRUISE is a 32 member EU network of excellence. The main objective of CRUISE is to plan and coordinate open research activities on communication and application aspects of wireless sensor networking in Europe. It brings together a diverse group of partners from academic and independent research and development (R&D) organisations, each with an international reputation and expertise in specific areas of wireless sensor networking. These partners will integrate their expertise and knowledge gained from projects to build a strong team that will jointly work for the creation of a State-of-the-Art Knowledge Base, and make this base available to the general public. Joint work will consist of information collection, comparison, validation and dissemination. CRUISE will focus its research toward the solution of specific theoretical and technological problems that will enable the building of sensor network applications that can significantly benefit the European society.

http://www.government.fi/ministeriot/lvm/en.jsp - Ministry for Transport and Communications

Nokia

Nokia has launched the Nokia 6212 classic featuring integrated Near Field Communication (NFC). The 3G handset allows consumers to conveniently share content, access services and information as well as conduct payments and ticketing with one tap of the device. The Nokia 6212 classic is expected to start shipping in the third quarter of 2008 in select markets in Europe and Asia with an estimated retail price of EUR 200 before taxes and subsidies.

http://www.nokia.com/A4136001?newsid=1209331

40. P-Innovations, Automatic Vehicle Guidance System, Tampere, Finland

Perhaps one of the biggest problems with parking a vehicle in a car park, be it a multi-storey or open air facility, is the human element. Many companies are now trying to provide sophisticated guidance systems, which not only tell the driver where to park but can also keep tabs on the vehicle while it is in the car park.
In mid-2007, the P-Innovations research project, led by the VTT Technical Research Centre of Finland started a pilot scheme to investigate automatic vehicle recognition and dynamic guidance in a single parking structure.

The project was started in a car park in Tampere and has used RFID (radio frequency identification) and optical number plate recognition. The combination of these two technologies has allowed floor-specific vehicle amount calculation and also vehicle parking guidance. This project represents the first time in Europe that a parking application has used passive long-range RFID remote identification for vehicle identification.

The project, which ran until the end of 2007, has been led by VTT and Tekes (Finnish Funding Agency for Technology and Innovation) with funding of €60,000. Other companies involved from a funding and technology perspective include Tampereen Pysäköintitalo Oy, Idesco Oy, Audio Riders Oy, Vidamin Oy, Finnish LED-Signs Oy and Ramboll Finland Oy.

TECHNOLOGY

The project has aimed to test how UHF (ultra-high frequency) RFID identification and optical registration plate recognition can be used for automatic vehicle identification using a sample of 50 pilot users. The project also examined the use of variable signals including signposts (variable message signs), lights and also audible signals for situation sensitive guidance and notification in parking structures (guiding vehicles into a vacant parking space).

One of the objectives of the experiment was to give the six involved companies a chance of identifying products and technology that could be used in this application and also to collaborate and generate ideas for future development of parking management systems.

IN ACTION

The project used floor-specific vehicle monitoring and passage monitoring for the trial. The passive RFID and number plate recognition allowed vehicles to be identified and then tracked and directed via signs so that the car park could be controlled from a central control centre. The system also used smart speakers for the automated payment area, which would react to a person standing in front of them and give instructions in several languages.

In addition, the car park, provided by Tampere Parking Houses Ltd, was wired with a localised FM radio channel to give out messages related to parking in the building; it was thought that this could also be used as an advertising medium. The RFID technology could also be taken a step further to log the vehicle in and out of the building via the 'portal' exits and this 'time' could then be used as the basis for automatic payment for the parking space instead of having to go through payment machines.

EQUIPMENT

For the automatic vehicle identification and monitoring: the RFID readers used were manufactured by Idesco Ltd and the model was the IR 9000. The ALPR (automated license plate recognition) application was provided by Vidamin Ltd and was based on an ALPR library by Visy Ltd. The cameras used in the ALPR system were made by Bosch.

For the dynamic guidance part of the system: variable message signs were provided by Finnish LED-Signs Ltd. The smart loudspeakers were built by Audio Riders Ltd and tailored into the needs of the project. The same applies to the audio distribution device used in radio transmitting. The radio transmitters were commercial AudiaX transmitters.

The software managing the whole system was implemented by VTT.
Tami Koivuniemi, the development manager for Tampere Parking House Car Parks, commented: "The project provided the consortium with valuable experience on applicability and functionality of the AVI, AVM and dynamic guidance concepts both separately and as integrated system.

"The pilot user feedback was only positive and partly laudatory. It was especially seen that the piloted concept greatly made it easier for season ticket customers to access the car park. 100% of the pilot users were eager to continue the use of the concept.

"The project has aroused great interest both in Finland and internationally. The project consortium is thus proud to be in the frontline of developing advanced parking services. Parts of the concept are sure to be taken into operative use in Tampere Parking House car parks in the near future."

http://www.roadtraffic-technology.com/projects/pinnovations/

Germany

41. CargoMover (Rail) – 2002/03

Background and Objectives

The CargoMover is basically a small freight train, operating automatically, with the flexibility of a truck yet without its limitations from traffic jams or rest times. It can individually summoned by enterprises that need to ship cargo.

CargoMover uses data from a wide range of sensors. Five radar sensors observe what is going on up to 70 meters ahead of the train, calculate distances to objects and the relative speeds of other trains. Meanwhile, a video camera follows the course of the track. When combined with vehicle speed information, the data from this camera can be used to derive three-dimensional information about obstacles on the track. Two infrared laser scanners — one works at track height and the other swivels from side to side, scanning the area in front of the CargoMover — ensure that the car can manoeuvre with extreme accuracy.

A standard industrial PC is all that's needed to combine and evaluate the data. This means that CargoMover can move independently. But to ensure that it can also make use of timetables and integrate itself into overall logistics, it needs a means of communicating with headquarters — for example, via the GSM/R network — and a link to the European Train Control System (ETCS). The ETCS makes it possible to drive automatically, because it transmits route information such as train signals, speed limits, and track status indications directly to the vehicle. An engineer (driver) is not necessary because ETCS also transmits train braking and control signals. This means that headquarters knows exactly which trains are where — an important prerequisite for optimized logistics.

The two prototypes will spend at least the next two years at Wildenrath, fine-tuning the various systems and looking at other potential applications such as multiple-unit operation and autocouplers.

Legal, Regulatory and institutional issues

Supplier

Before the CargoMover can be put into service it would need approval from the Federal Railway Office (EBA).

Commercial and economic issues

Supplier

On a commercial basis, is still years away. Although the introduction of ETCS is planned across Europe, its implementation is expected to take several years.

Participants

The Institute for Railroad Vehicle Technology at the RWTH (mechanical systems)
The University of Brunswick (computer technology)
Siemens TS in Brunswick and Erlangen, Germany (braking systems, signal boxes)
The Siemens Information and Communication Mobile Group (GSM-Rail digital mobile radio network)
Siemens Corporate Technology (CT) in Munich (sensor technology)

http://w1.siemens.com/innovation/pool/en/publikationen/publications_pof/pof_fall_2002/cargomover/article.pdf

42. Car2Car Communication System

Info taken from following source, dated August 2007 http://www.car-2-car.org/fileadmin/dokumente/pdf/C2C-CC_manifesto_v1.1.pdf

Background and Objectives

The CAR 2 CAR Communication Consortium is a non-profit organisation initiated by European vehicle manufacturers, which is open for suppliers, research organisations and other partners. The CAR 2 CAR

Communication Consortium is dedicated to the objective of further increasing road traffic safety and efficiency by means of inter-vehicle communications.

Objectives:

- to create and establish an open European industry standard for Car2Car communication systems based on wireless LAN components and to guarantee European-wide inter-vehicle operability
- to enable the development of active safety applications by specifying, prototyping and demonstrating the Car2Car system to promote the allocation of a royalty free European wide exclusive frequency band for Car2Car applications
- to push the harmonisation of Car2Car Communication standards worldwide
- to develop realistic deployment strategies and business models to speed-up the market penetration

The CAR 2 CAR system shall provide the following top level features:

- automatic fast data transmission between vehicles and between vehicles and road side units transmission of traffic information, hazard warnings and entertainment data
- support of ad hoc CAR 2 CAR Communications without need of a pre-installed network infrastructure
- the CAR 2 CAR system is based on short range Wireless LAN technology and free of transmission costs

Ad hoc CAR 2 CAR Communications enable the cooperation of vehicles by linking individual information distributed among multiple vehicles. The so-formed Vehicular Adhoc Network (VANET) works like a new 'sensor' increasing the drivers' range of awareness to spots which both the driver and onboard sensor systems otherwise cannot see.

The CAR 2 CAR system electronically extends the driver's horizon and enables entirely new safety functions. CAR 2 CAR Communications form a well suited basis for decentralized active safety applications and therefore will reduce accidents and their severity. Besides active safety functions, it includes active traffic management applications and helps to improve traffic flow.

Next stage: Demonstrators, interoperability field trial, Specifications as input to standardisation

Legal, Regulatory and institutional issues

Supplier

- Legal questions such as liability represent an important prerequisite, for example in a scenario where a useless or wrong message provokes a change of driving behaviour and eventually results in a road accident. It is unclear who might be held responsible in this case. The situation will become even more complicated when co-operative driving applications based on C2C-CC appear in the market.

Cultural and social issues

Supplier

- In some countries privacy is mandatory due to customer request or by law. In other countries laws enforce the technical capability of driver identification in every situation. Consequently, the C2X System must incorporate the different requirements for anonymity and security across Europe.

Demand

- Anonymity of the vehicle and its driver must be protected to a level at least comparable to which users of mobile phones feel comfortable with, today. One of the technical approaches to accomplish anonymity is based on the use of temporary identifiers instead of fixed ones.

Commercial and economic issues

Supplier

- Only a joint initiative of all European vehicle manufactures, suppliers, scientific organizations and standardization bodies will lead to an economically promising and successful market introduction.

Demand

- Penetration rates: the car system must be able to work in areas of low and high penetration; it will take 6 years from introduction to reach %50 penetration rate.

Technical issues

Supplier

- If the system would use open bands like the ISM, robust communication and the required quality of service cannot be guaranteed. For this reasons, the C2C-CC supports the allocation of an effectively protected frequency band.
- The C2C Communication System must work in situations with a very small density of road traffic and in situations with a very high traffic density, such as traffic jams or major intersections. These two situations cause different technical challenges. In sparse situations: car is often out of transmission range of other cars that potentially could forward data. In dense situations, the data traffic of all cars can exceed the available bandwidth and overload the network.
- It is necessary in all cases, that a first generation system is compatible with systems of later generations.
- Some applications may require higher positioning accuracy than GPS.

Participants

For list of members see: http://www.car-2-car.org/index.php?id=135

http://www.car-2-car.org/

43. CISCO Systems: Deutsche Bahn and T-Mobile

Background and Objectives

Project Railnet—a strategic partnership between Deutsche Bahn (DB) and T-Mobile Deutschland to provide wireless Internet access aboard high-speed trains in Germany.

The technical solution connects passenger laptops, PDAs, and mobile phones to the nearest wireless hotspot located on a train, which, in turn, connects to T-Mobile Deutschland's broadband mobile network. In addition, each train is equipped with a central server that automatically connects with the WLAN as the train arrives at each station. This data is then relayed to a central communication system to update, for example, travel information to customers waiting further down the line.

Technical issues

Supplier

The project was highly complex and pushed the boundaries of public wireless network engineering. DB's ICE trains travelled at speeds of up to 300 kph There were also many more tunnels, and potential wireless 'blind spots,' compared to countries such as the Netherlands.

Results

The project created a business model that can be replicated to expand its portfolio of public WLAN services across other geographical and vertical markets.

http://www.cisco.com/web/about/ac79/docs/wp/TMobile_DBahn_CS_0728.pdf

44. Dynamic signposts with integrated congestion information - dWiSta

Background and Objectives

A dWiSta system was planned and installed as a pilot project in the Leipzig region at three federal motorway interchanges and eight motorway junctions. The acceptance of such information-based signposts was to be investigated, in particular with regard to their use at motorway junctions, and their effect was to be evaluated from a traffic control and economic point of view. An example of a cost-benefit analysis for the installation and operation of dWiSta at a motorway junction in the Leipzig region showed a high benefit ratio depending on the frequency of events, the traffic load and the detour factors. The results of the investigation consist of specific recommendations concerning the further implementation of dWiSta in the Leipzig region and of generally applicable usage criteria for dWiSta at federal motorway junctions.

Participants

http://www.bast.de/cln_005/nn_74636/DE/Publikationen/Infos/2007-2006/18-2007.html

Further Info

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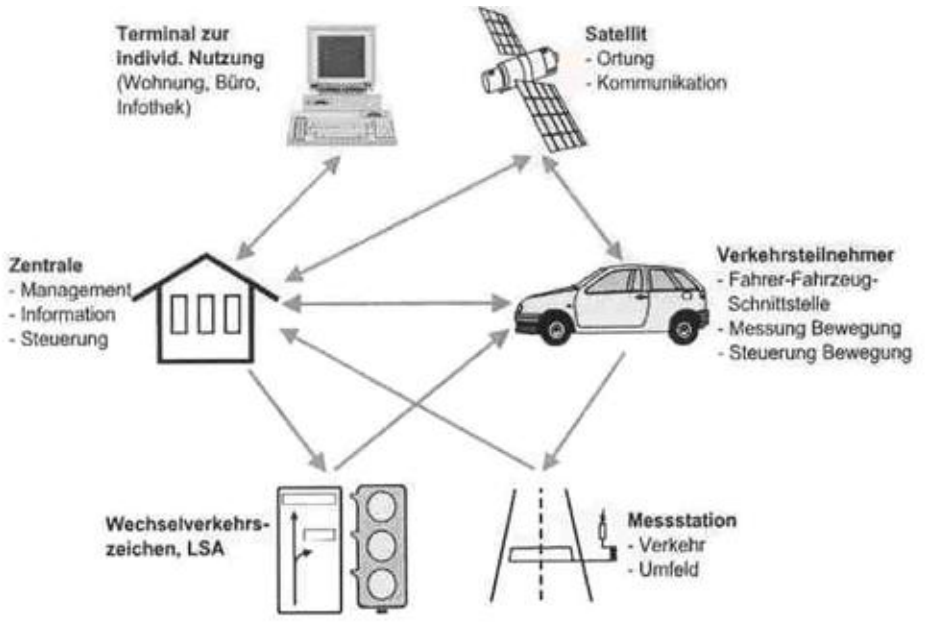
45. Use of new technologies for traffic information and guidance systems

Background and Objectives

The provision of modern information technology to control traffic has added a new dimension to road traffic engineering in recent years. The current level of development regarding telematics in traffic is characterised by attempts to prove the functionality of numerous technical elements and sub-systems. There has recently been a rapid development of private traffic information services which are largely based on mobile radio systems. Analysis of the current developments and demonstrations of their potential for contributing towards an integrated traffic management system is necessary from the perspective of traffic science, which has to deal with the traffic engineering strategies for the operation of new guidance systems. The aim of the present project was to develop solid concepts for the use of new technologies in different scenarios.

Participants



http://www.bast.de/cln_007/nn_74636/DE/Publikationen/Infos/2001-2000/10-2000.html

46. EU project on infrastructure and safety: In-Safety (05620)

Background and Objectives

Although new telematic applications are known to enhance traffic safety, specific results concerning infrastructure-aided systems - especially in conjunction with conventional traffic safety measures - are not yet available. This project is meant to investigate how conventional traffic safety measures can be aided through a use of new technologies like driver assistance systems. For this purpose, the Federal Highway Research Institute develops and rates implementation scenarios (road maps) comprising a combination of innovative and conventional traffic safety measures. Based on cost-benefit analyses, the recommended road maps are to support public authorities in rating investments in new telematic systems.

Participants

http://www.bast.de/cln_007/nn_74576/EN/E-Forschungsprojekte/e-laufende/e-fp-laufend-v2.html

47. Updates of technical delivery conditions for route control stations (TLS) 2002 (04621)

Background and Objectives

Traffic guidance implemented by means of alternating traffic signs and directions on interstate roads is being continued as part of a program by the Federal Ministry of Traffic, Construction and Housing lasting from 2002 to 2007. In this process, it is necessary to update the TLS bodies of rules relevant to system configuration in terms of additionally established applications, technological advancements and accompanying developments in standards. This primarily means an integration of faster data transfer facilities and various communication media such as fibreglass or copper cables and radio links. In addition to opening TLS to promising future technologies, these measures will streamline interaction between traffic and road engineering systems in tunnels so as to improve identification and management of disruptions.

Partners

http://www.bast.de/cln_007/nn_74576/EN/E-Forschungsprojekte/e-laufende/e-fp-laufend-v2.html

48. Stadtinfo Cologne Traffic and Parking Data System, Germany

Background and Objectives

PartnersStadtinfo Köln (City Info Cologne) is a research project financed by the German Federal Ministry of Research that centres around the collection of various traffic data to be distributed to diverse platforms including the Internet, portable devices such as PDAs and mobile telephones, in-car navigation systems and variable message signs throughout the city. The project was implemented over a four-year period from 1998 to October 2002 by 15 partners in co-operation with the city of Cologne at a cost of €16.1 million.

Stadtinfo Köln is a system that continuously collects various pieces of traffic data. The data collected includes: road traffic flows, construction site locations, events, route recommendations, short-term traffic forecasts, travel times between destinations, public transport timetables and fares, cancellations, comparison of travel times and cost for different modes of transport, parking information, parking forecasts, local weather forecasts and carpool services available. The data is stored in Cologne's traffic control centre and on a dedicated server.

Road traffic data is collected using existing infrastructure with traffic sensors (inductive loops) measuring the number of vehicles and traffic speeds at a specific location that are linked to Cologne's traffic light network. Additionally, 245 infrared sensors have been installed on 141 routes throughout the city.

The data is disseminated from the traffic control centre and the Stadtinfo server to various destinations. The traffic control centre distributes collective traffic data to a parking guidance system, variable message signs, videotext, TV, radio and the print media. Individuals can access specific information through the Internet, in-car systems, mobile telephones and specially installed traffic information points throughout Cologne.

Participants

The project is broken down into 15 working areas, which are implemented by 15 partners in cooperation with the City of Cologne. These partners include ave GmbH, BMW Group, CAOS GmbH, CarPool GmbH, Dambach GmbH, DLR e.V., Ford Research Center, Aachen GmbH, isac, RWTH Aachen, ISB, RWTH Aachen, Kölner Verkehrs-Betriebe AG (KVB), meteomedia Deutschland GmbH, PTV AG, Robert Bosch GmbH, SfV, University of Cologne and Siemens AG.

http://www.roadtraffic-technology.com/projects/stadtinfo

49. LKW-MAUT Electronic Toll Collection System for Heavy Goods Vehicles, Germany

Background and Objectives

In January 2005 a new toll system was introduced on the 12,000km of German autobahn for all trucks with a maximum weight of 12t and above. The new toll system, called LKW-MAUT, is a governmental tax for trucks based on the distance driven in kilometres, number of axles and the emission category of the truck (the average charge will be €0.12 per kilometre). The tax is levied for all trucks using German autobahns, whether they are full or empty.

The toll system has been constructed and will be administered by a company called Toll Collect. Toll Collect is a consortium formed by Daimler-Chrysler (45%, original controlling partner), Deutsche Telecom (45%, current controlling partner) and Cofiroute (10%). The system is a major undertaking that will affect over 1.5 million lorry drivers in Germany and the rest of Europe. The tolls collected will be used by the government on road improvements and new road construction.

The investment into the system by Toll Collect is believed to be in the order of €700 million. The system will monitor 1.3 to 1.5 million trucks, which travel an estimated 23 billion km/year. This means that the system should collect an estimated €3 billion per year.

CONTRACT HISTORY

The German government officially awarded the contract for the system to Toll Collect in August 2002. This was contested by a rival consortium, AGES-MAUT (Shell, Vodafone and various financial institutions), but the case was lost and the contract stood. The government contract initially called for the system to be ready by August 2003 and severe financial penalties were incorporated for any delays.

Several delays occurred in the system development due to various technical problems, which led to an announcement of a cancellation of the contract in February 2004 (only one year to build such an extensive and complex system was not really realistic). A renegotiation of the contract followed in March 2004 with more realistic timelines and financial penalties agreed between the German government and Toll Collect (who took a 5% cut in fees).

The first phase of the system was due to be up and running by January 2005 and a phase two modification by January 2006. A financial penalty of €780 million was agreed if the January 2005 deadline was missed, but if the January 2006 deadline is missed for version 2 the penalties are unlimited. The German government has lost €3 billion because of the late introduction of the system and recovery of this is being pursued through legal arbitration.

To account for the renegotiations in the contract, Toll Collect carried out an extensive reorganisation of its resources to meet the new terms of the contract and gave Siemens a major role in the development of phase two of the project. So far the first phase has been judged by independent observers to be a success (it collected € 665 million in its first three months of operation). Many European countries are watching the system closely as this is the first time a GPS-based toll system has been used.

GPS-BASED TOLL SYSTEM

The toll system will not be based on toll booths or plazas on the highways themselves but instead will work via several methods: On Board Units (OBU), manual payment terminals and via the internet.

OBUs work via GPS and the on-board odometer or tachograph as a back-up to determine how far the lorries have travelled by reference to a digital map and GSM to authorise the payment of the toll via a wireless link.

Manual payment is available for those vehicles not equipped with an OBU; there will be over 3,500 toll payment terminals at motorway service stations or rest areas where drivers can enter the details of their journey and pay the toll in advance (only in Euros if it is cash, or by using a credit card or oil company/fuel card) and receive a ticket receipt.

For those drivers who would like to pay the toll well in advance there is also the option of paying via the Internet.

In addition to 300 toll checker gantries strategically located throughout the country, Toll Enforcement will also rely on mobile patrols, consisting of a fleet of 300 vehicles with 540 officers of the Federal Office of Freight (BAG). The officers will patrol the autobahns, checking vehicles and drivers to see if they have paid the toll or have the OBU installed (these vehicles will be equipped with an infrared short range DSRC (Dedicated Short Range Communications) system that can be used to scan and monitor trucks in motion). The BAG will have police powers to request trucks to stop for examination at any point during their journey.

The autobahn system will also have a 300 gantries equipped with IR detection equipment and high resolution cameras able to pick out trucks via profiling (and record number plates). These send a DSRC signal to a DSRC transponder (which are part of the OBU) in the lorry to check on the accuracy of the GPS as a back-up and also alert BAG officers to toll violations. The OBU will also be able to work with the new Galileo satellite system for positioning (fully operational 2008) which is being developed in Europe as a more accurate alternative to GPS. As of January 2005 over 300,000 vehicles had been fitted with OBUs but the target for the end of the year is well over 500,000.

TWO-STAGE MODEL

The toll system will be fully functional from the start, with no restrictions. The automatic section of the system will be activated in two stages (phases): software version 1.0 has a digital map of the toll road network and the fee parameters. As of January 2005, the map and fee parameters cannot be updated via the wireless GSM mobile telecommunications. However, foreseeable changes in the toll network have been pre-programmed into version 1.0 and will become effective as required on the appointed date. In the course of regular workshop visits, e.g. for servicing inspections, the OBU software will be updated to version 2.0 by January 2006. This version will guarantee that the digital map and the fee tariffs are constantly updatable.

CONTRACTORS, SUPPLIERS AND EQUIPMENT INSTALLED

Deutsche Telecom is the controlling shareholder and operations managers for the project while T-Systems, a subsidiary of Deutsche Telecom, are the general contractors with responsibility for system construction, fixed-line infrastructure and programming. T-Mobile and Vodafone are handling the GSM mobile communications section of the project.

Siemens have been given the responsibility as technical project coordinators for the OBU version 2.0 software. The toll payment terminals were supplied by Hoeft Wessel AG of Hanover (contract value estimated at €87 million) and NCR (National Cash Register) of the USA. Grundig (DIN slot mounted type) and Siemens (on dash board type) are the two suppliers for the OBUs. The OBUs use a GPS system manufactured by Navman NZ of New Zealand in conjunction with Unitronic of Germany, using a Rockwell Conexant design (contract worth $40 million). The OBU also uses a GSM wireless unit supplied by Wavecom of France. There are 1,850 authorised installer and servicing companies for the OBUs in Germany and surrounding countries. VITRONIC of Wiesbaden, Germany, were given complete responsibility for the enforcement of the tolling system and provided the 300 gantries, located nationwide, for the system.

DSRC (DEDICATED SHORT RANGE COMMUNICATIONS) SYSTEM

The toll gantries and BAG enforcement vehicles use a multifunctional active infrared 1Mbit/sec DSRC system supplied by EFKON of Austria, which has supplied over 1 million enforcement devices for the system. The car systems will also include a mobile office, payment terminals, copiers and scanners to create court proof evidence of toll violations and one hand-held enforcement device per vehicle. The full DSRC system contains dual interfaces:

- EFKON is also providing infrared multilane free flow enforcement for 300 sites in busier locations such as border crossings and roads leading into cities. These are designed for vehicle speeds of up to 250km/hr. In addition, there will be 200 solar powered GPS-backup beacons for locations that cannot be tolled by GPS, for example exits after tunnels and road construction sites. All EFKON equipment has been deployed under the ISO TC 204 CALM standard for full compatibility with other supplied equipment.

Participants

http://www.roadtraffic-technology.com/projects/lkw-maut/

50. Traffic Management Centre (VMZ Berlin), Germany

Background and Objectives

The objective of the Berlin Traffic Management Centre (known as VMZ Berlin in Germany) has been to record and evaluate the traffic situation in Berlin. Specifically, the aim was to integrate all Berlin transport into an efficient city traffic management system. This has included individual and public passenger transportation as well as commercial transportation.

The data gathered has been used to generate comprehensive traffic information and aid informed management decisions to improve the traffic situation in Berlin. The creation and operation of the Traffic Management Centre will cost €16m. The project was begun in late 2001 and was completed at the beginning of 2003 with all infrastructure in place.

"The data gathered has been used to generate comprehensive traffic information and aid informed management decisions to improve the traffic situation in Berlin."

INFRASTRUCTURE AND CONTRACTS

At completion, a total of 50 WebCams and over 200 infrared sensors had been installed in locations such as Potsdamer Platz and the TV Tower Interchange (Dreieck-Funkturm). These feed traffic-related data into the central Traffic Management Centre computer centre (40 servers) which controls 22 outdoor electronic display units and a network of existing data centres.

The Traffic Management Centre infrastructure is the property of the City-State of Berlin, but a joint venture between DaimlerChrysler Services AG and Siemens AG (VMZ Berlin GmbH) was given a contract to operate the VMZ Berlin for ten years. VMZ Berlin operates in partnership with Berlin transport companies, Berliner Verkehrsbetriebe (BVG) and S-Bahn Berlin GmbH. DaimlerChrysler Services supplied the WebCams.

FREE ONLINE: ROUTE PLANS, TRAFFIC AND PARKING INFORMATION

The Traffic Management Centre offers an array of free services online, including route plans for both private and public transport, current traffic situation information and parking space availability in the city. Arrival and departure schedules for Berlin's three airports are also displayed on the Traffic Management Centre website.

When using the online routing services, a user can enter selected locations such as airports, museums and government buildings as starting points or destinations. As part of the total integration of the city traffic system in 2005 Siemens introduced a new meter-less parking system in Berlin where users can pay by using their mobile phones. So far this has been a resounding success.

INTERMODAL ROUTING PLANNER

The Traffic Management Centre is Germany's first intermodal dynamic route planning service that is able to plan trips combining both private car and public transport. The intermodal route planner encompasses the driving time to Park&Ride stations, including connection times, enabling a traveller to plan the optimum departure time as well as the time required for the entire journey.

The Traffic Management Centre evaluates traffic data for the full transport infrastructure in Berlin, as well as providing a selection of short, medium and long-term traffic forecasts. The information generated by the intermodal routing is able to combine various modes of transport for a given journey. Moreover, information systems for road construction sites and city events are available.

With the increasing popularity of mobile handset information systems and satellite navigation systems, this data will soon be available to be downloaded directly onto a vehicle’s navigation system or via SMS and WAP mobile phones for a subscription fee.

INFRARED SENSOR DETECTION NETWORK

The Traffic Management Centre's detection network obtains traffic information through its 200+ infrared sensors as well as assessing images from WebCams and construction site/planned city event reports, as well as the 2,000 traffic lights in the city. The infra-red sensors were supplied and installed by Siemens.

INTERCHANGE WEBCAMS

50 WebCams provided by DaimlerChrysler Services have already been installed at significant traffic interchanges with more to follow. Images of the current traffic situation at places such as the Autobahndreieck Funkturm, Potsdamer Platz and Alexanderplatz are shown on display panels throughout the city and are updated every five minutes, assisting travellers to make informed decisions about the route they will take.

SIEMENS TECHNOLOGY

CONCERT from Siemens is used for the VMZ Content Platform in Berlin. This system includes various modules such as the simulation component MONET/VISUM-online by PTV for generating and forecasting traffic situations. MONET stores statistical as well as dynamic data and completes the information by analysing the traffic conditions.

Moreover, the system provides a traffic forecast for the next 15–30 minutes by using a traffic simulation programme. The calculation of the current and forecasted traffic situation is being updated in cycles of five to 15 minutes. Similar to weather forecasts, MONET forecasts traffic volumes, travel times and network capacities.

ADDITIONAL ONLINE TRANSPORT SERVICES

The Traffic Management Centre has developed a wide range of transport services in addition to the intermodal route planner. For example, a motorist can access the Traffic Management Centre's Web address for current information, including:

- The traffic situation in Berlin
- Construction site notifications <>
- Important traffic-related events
- Traffic-based route planner for road traffic and public transport
- The arrival and departure times at the three Berlin airports
- Public transport timetables
- A parking information system
- A city map service (available free of charge)

The HEAVEN (Healthier Environment through Abatement of Vehicle Emissions) project is being tried out across European cities. Real-time traffic data is collected from a network of measurement points and environmental data is processed and integrated into a Decision Support System (DSS) within the Traffic Management Centre. HEAVEN will allow forecasts of pollution to be made street by street across the city.

EYE IN THE SKY

In August 2006, during the FIFA World Cup in Germany, DLR ran traffic projects in several German cities including Berlin. Data was collected using cameras on air based units. Camera images sent wireless to the traffic management centre and simultaneously generated aerial maps provided objective visual information about the traffic situation and the predicted build-up of traffic over each 30 minute period.

"A motorist can access the Traffic Management Centre's Web address for current information."

Frank Hellberg, Managing Director of Air Service Berlin CFH GmbH, who used DLR technology in Berlin said: "This air-supported system for recording traffic data has opened the door to even further-reaching applications, for example in disaster management."

The module used to record traffic data consisted of the ANTAR camera system and analytical software called Traffic Finder. Together, these provided automatic, real-time extraction of traffic data.

ANTAR includes a conventional camera and a thermal imaging camera, as well as an inertial measurement unit for online geo-referencing and a computer unit for the data management. The Traffic Finder software analyses incoming images online – that means identifying cars, classifying by the shape and measuring its velocity – and defines road-based traffic parameters.

Data was collected, analysed and prepared as a basis for traffic predictions using modern optical and infrared cameras mounted on a Cessna 172 aircraft in Berlin.

Participants

http://www.roadtraffic-technology.com/projects/vmz/

51. EuroMetropolis

Background and Objectives

The initiative combines the topics of traffic information, travel management and networking (e.g. linking cars with the home and office). The initiative also supports the development of the needed infrastructure.

- Traffic information: The goal is to provide reliable traffic information throughout Europe. Combined with dynamic, customised navigation services, this results in safer, more efficient traffic flow and a more pleasant and relaxed journey for the driver.
- Travel management: In future, points of interest (POI) will be continually updated during the journey to reflect the time of day and the location. Depending on the purpose of the journey, the driver can select particular POIs and have these transmitted to the vehicle. This turns the navigation system into nothing less than a personal travel companion.
- Networking: In a networked world, vehicles will also be able to communicate with home, office and other locations. The goal is to give people access to their personal data, music and information, irrespective of where they happen to be.

Infrastructure

In order to achieve these aims, the initiative also supports the development of the infrastructure needed to provide information on the move, focusing on satellite positioning, WLAN networks and digital broadcasting in particular.

The EuroMetropolis region

The region encompassing Hannover, Braunschweig, Wolfsburg and Berlin is an important hub of European transport routes and therefore an excellent testing ground for traffic services. The launch of an ITS infrastructure will enhance the region's appeal for companies wishing to trail the new generation of in-car services.

Participants

http://www.gzvb.de/index.php?id=746

52. INVENT

Background and Objectives

The research initiative INVENT (intelligent traffic and user-oriented technology) is advancing the development of intelligent vehicle systems that will provide the required information and alert drivers to hazardous situations.

The German Federal Ministry for Research and Education is supporting the research cooperation of 23 partners in INVENT. The research initiative focuses on three main themes, each involving a number of projects: "Driver Assistance and Active safety," "Traffic Management 2010" and "Traffic Management in Transport and Logistics."

http://www.invent-online.de/index.html

53. Useful links:

Siemens Traffic Control Business
http://www.industry.siemens.de/traffic/EN/INDEX.HTM

The Federal Highway Research Institute (Germany)
http://www.bast.de/cln_007/nn_74576/EN/E-Forschungsprojekte/forschungsprojekte__node.html?__nnn=true

Hong Kong

http://www.hkwtia.org/wtia/government.htm
http://www.ofta.gov.hk/en/ad-comm/main.html
http://www.cedb.gov.hk/ctb/eng/new/index.htm
http://www.itc.gov.hk/en/welcome.htm
http://www.innotech.gov.hk/en/inno_forces/research.development.centre.html
http://www.itf.gov.hk/

UK

54. The Advanced Protection of Vulnerable Road Users

Project Description

The specific aims of the APVRU project were as follows:

- To demonstrate technology capable of detecting (accurately and reliably) the presence of pedestrians under representative environmental conditions.
- To investigate the human factors and accident statistics relating to pedestrian impacts, so as to quantify the need for the proposed system, and to identify the potential benefits.
- To specify the sensor system and associated components required for a pedestrian protection system.
- To investigate the reliability of the technologies developed in the programme and their likely safety benefits.
- To assess the sensing system in a test environment that replicates real world scenarios.
- To identify the way forward for pedestrian protection technology, and to pave the way for taking such systems into production.
- To provide input into standards and policy development.

The APVRU system has provided the basic foundations of a "proof of concept" vulnerable road user detection system. Such a system may provide the basis of future systems that would decelerate the vehicle to reduce the impact speed and/or activate an active safety system on the front of the vehicle designed to mitigate the injury to the vulnerable road user.

However, there are a couple of technical and institutional issues. Further research and development is required before such a system can be exploited commercially.

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1002&Submit.x=15&Submit.y=19
http://www.trl.co.uk/apvru
http://www.trl.co.uk/apvru/APVRU%20Final%20Report.PDF – Final report

Lead Partner

TRL

Contact

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Tel: 01344 770199, Fax: 01344 770356, Email: mmccarthy@trl.co.uk

Participants

Jaguar Cars Ltd
InfraRed Integrated Systems Ltd (IRISYS)
University of Surrey

Technical issues

Supplier

- HRR units were used because of good balance between modern technology and low cost production. However, their range is limited to 20m, which does not allow enough time/distance to stop the vehicle.
- Continuous use (connection and reconnection) of HRR units severely affected reliability of communications link – better design of electrical connector required for long term use
- The radar system could benefit from faster update/ scanning rates, which would require faster local processing capability and further algorithm development.
- Greater imaging resolution would also benefit but this would require higher communications bandwidth and localised processing capabilities.
- Further research/development required to improve sensitivity of IR tracking system, etc. Focus is on sensor development: update frequency and reaction time.
- Technical issues should not be a problem to overcome since the advancement of computer processing capabilities is advancing so fast.

Legal, Regulatory and institutional issues

Supplier

- UK and EU concerned with wide scale use of ultra wideband radars in the 24GHz ISM band by the automotive industry. Concerns expressed by existing users such as the Home Office, fixed service providers, direct satellite broadcasters, radio astronomers, space science services. The UK Radio Communications Agency has been asked to review the relevant issues. M/A-COM which produces HRR units has ceased production in the EU.
- In USA - concerns over HHR unit and use of 24 GHz ISM band have been resolved.

55. Project: Cell Phone Radar (CPR) - Investigation for Transport Applications

Objectives

Cell phone radar (CPR) is a low-cost passive method of detecting and tracking moving objects (vehicles, people, animals etc.). In its simplest form CPR uses the radio transmissions being made by mobile telephone base stations to 'illuminate' objects in its 'cell'. The objective of this research is to investigate the CPR concept to explore how it could fulfil DfT policy objectives, in the area of road transport. Of particular interest is the ability of CPR to monitor traffic flow for traffic management purposes, especially in adverse weather conditions.

Description

The study will assess the needs of monitoring as a tool to deliver transport policy and how the emerging CPR concept could assist the needs of UK transportation and transport policy options. It will focus on the concept's ability to offer monitoring services where it is currently absent or limited and its ability to meet these needs.

Contractor(s)

Faber Maunsell
The Johnson Building, 77 Hatton Garden, London, EC1N 8JS
020-7645-2000

Roke Manor Research Ltd
Roke Manor, Romsey, Hampshire, SO51 0ZN
+44 (0) 1794 833 525

Contract details

Cost to the Department: £30,000.00
Actual start date: 09 November 2004
Actual completion date: 31 March 2005
Publication(s)

Cell Phone Radar Investigation for the DfT - Final Report
Author: Faber Maunsell
Publication date: 01/03/2005
Source: Faber Maunsell website
More information: http://www.fabermaunsell.com/newsmedia/44/17/index.jsp
Departmental Assessment Status: The study is likely to help deliver transport policy and how emerging CPR concept could assist the needs of UK transportation and transport policy options

Technical issues

- In some cases there are gaps in the data currently available to support these developing needs or the sensors are vulnerable to road maintenance.
- Performance in very congested conditions, as with other sensors, may be a challenge for accuracy and so represents a risk. This needs to be explored in a real world test.
- Research is needed to address the risks of whether CPR will be able to track individual vehicles across a network in this way. Whilst CPR cannot identify individual traffic for evidential purposes it could be used to cue a camera and this could be explored further

In order for CPR to be a viable commercial option, the following must be addressed:

- stakeholders need to be able to relate to CPR output in transport terms, i.e. as maps not as radar output. This is a relatively straightforward task reflecting previous radar systems and is already underway to some extent;
- more work is needed to fully examine sensor timing for traffic control and volume of vehicles able to be tracked, but indications are that these can be at least addressed by increasing processor power;
- short-term roadside tests are needed to prove some of the outstanding technical questions on coverage, accuracy and classification issues, especially in congestion and for stationary traffic;
- on-road pilots are needed to explore implementation issues such as mounting and power and to examine the potential for CPR in real world sites.

56. Smart Roads – Trials

Start-End Date: 12/1998 -03/2002
Project status: Completed
Publication Status: Not Published
Project value: £118,000
Project Contractor: Scott Wilson Pavement Engineering Ltd
HA Project Sponsor: Lloyd, W

Background

In 1995, the Agency set up a research project to examine the feasibility of monitoring roads using devices embedded in the pavement structure. Although measurement devices have been used for many years in instrumented roads for research purposes, it was felt that the technology had reached a stage where instruments are available (or could be developed) that may be sufficiently reliable, cheap, accurate and robust.

The research showed that the concept of 'Smart' pavements was not only feasible but also could be worthwhile if the information collected on the performance of pavements was used to make maintenance and design decisions. The study established that it was possible to measure satisfactorily subgrade vertical stress, strain and deformation in bituminous layers, temperature and moisture. This study was set up to establish whether the performance of actual roads carrying live traffic can be monitored. The project proposes that sensors should be installed in a suitable road and a monitoring regime established over a two year period. The objective is to investigate whether measuring devices can be installed and monitored at low cost, provide useful information and shown to be robust. The ultimate aim is to use the collected information to improve maintenance decisions and the design of pavements and their foundations.

The current trials are using a second generation of sensors installed into existing pavements in order to monitor the changes occurring over a two-year period. A range of subgrade sensors have been installed, as well as instrumented cores which use **wireless telemetry** for downloading data to a roadside receiver. Deformation within bituminous layers is also being monitored.

The work has already resulted in improved installation procedures. In the future it will be possible to show whether measuring devices can be installed and monitored at low cost; and how the data can be used to improve the design and maintenance of pavements and their foundations. The project further developed a miniaturised electrical core and these were installed.

Technical issues

Supplier

After the full period of time it was found that, despite however much care and attention was used to strengthen the core, circuits were not totally waterproof, nor were batteries as good as had been hoped.

Other sensors, although continuing to give readings, were not totally consistent.
Moisture sensing, although thought to be a difficult problem, was performed using gauges sourced from another industry and were found to be accurate and reliable.

Commercial and Economic issues

The project continues to show that the concept is valid, and that properly designed and manufactured gauges will provide useful and valid information. The UK needs to ensure that there is a sufficient and worthwhile market for the equipment for further movement in this field.

57. Wireless communication to road users for Urban Traffic Management

Project Description

March 2000 - Urban traffic congestion results in delays to travellers and increases in urban pollution. It also disrupts the provision of efficient public transport services resulting in more travellers opting to use their own vehicle.

UTMC-14 was one of a series of Urban Traffic Management and Control projects, part of the ongoing development of the UTMC Technical Specifications.

The overall aim of this project was to develop and demonstrate a specification for roadside to vehicle communications, and for fixed link wireless communications for traffic management systems. Based on current and future requirements for wireless communications, the project defined technical guidance that was then tested at a demonstration site.

This project addressed the full current range of wireless communications technologies, from 5.8 GHz for short range vehicle links to VHF and point-to-point microwave.

http://www.dft.gov.uk/162259/165240/244921/326557/327187/14wp300.pdf

Trials report:
http://www.dft.gov.uk/162259/165240/244921/326557/327187/14trep.pdf

UMTC system background and other projects:
http://iht.org.uk/publications/network/downloads/UTMCboundininsert.pdf

Legal, Regulatory and institutional issues

Supplier

- There is a possible licensing issue with wireless systems, even when the application was primarily for public service use (e.g. passenger information systems). If the system as implemented also provided private operators with information having a commercial benefit, even if only incidental, then this may impact on licensing of the service. The RA indicated that this was a complex issue and would require further study to determine if a "third party service" was being provided.

Technical issues

Supplier

- The area of most concern was the high number of CRC errors that occurred during the communications session. Subsequent investigations suggest that there is a problem with the way the protocol stack handles the radio link. However, resolution of this problem would require further investigation.
- All data communications between the UTMC14 Workstation and the Beacon were carried via a PSTN dial up line and a 458 MHz point-to-point UHF radio link connected in series. Data not passed efficiently in some instances.
- The integration of wireless and wire-line implemented for the trial was effective although fairly crude in nature. This particular integration issue will have a major impact on the architecture and implementation of UTMC Communications and needs also to be considered in general terms.
- The Bit Error Rate performance was never satisfactorily measured in basic performance terms at any time in the trial.
- Buses: the basic lack of infrastructure for additional cabling in the vehicles made it difficult to achieve a neat installation with concealed cables. This is an issue that needs to be addressed by the industry as a whole.

Demand

- Radio modem suffered from overheating due to being placed next to heat sources.

Participants

Leicester City Council
Arriva Fox County Ltd
Q-Free ASA
Siemens Traffic Controls Ltd

Lead Partner
Howard Humphreys Transport Planning

Results - What Happened Next?

The technical framework established within UTMC-14 was incorporated into the national UTMC Technical Specification. Key guidance, such as the use of licensed spectrum and the approach to IP networking over constrained bearers with UDP rather than TCP, has influenced a number of traffic management systems around the country since then.

This has enabled fully-functional UTMC systems to be deployed more cost-effectively to difficult-to-access sites, leading to better management of congestion and other traffic parameters.

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1079&Submit.x=17&Submit.y=9

58. Project: Pedestrian Detection Techniques

Background

Objectives

The objective is to publish advice on the use of detectors for different uses and junction and crossing types.

Description

This project is studying the performance of new pedestrian detectors which are starting to become available. With more advanced detectors it should be possible to realise more sophisticated traffic control in order to give a fairer allocation of time to pedestrians at traffic signals and pedestrian crossings.

New types of imaging systems are becoming available, using CCTV, infrared and laser technologies. Automatic number-plate readers are being deployed in access-control and in data collection of journey times and journey movements. The project will provide advice on how these systems perform in different circumstances, and provide an understanding of their performance limitations under varying environmental and traffic conditions.

Contractor(s)

TRL Limited
Crowthorne House, Nine Mile Ride, Wokingham, Berkshire, RG40 3GA
+44 (0)1344 773131

Contract details

Cost to the Department: £195,744.68
Actual start date: 24 October 2002
Actual completion date: 30 September 2007

http://www.dft.gov.uk/rmd/project.asp?intProjectID=9189

59. Project: Co-operative Vehicle Highway Systems (CVHS) benefits, technology, demonstrations, institutional and behavioural issues.

Objectives

The main objectives of the study were to:

- determine whether CVHS is a viable strategic concept and identify the potential form(s) of CVHS that provide the best balance of benefits, investments and risks;
- develop an over-arching strategy for the implementation of a CVHS vision and propose a 'route map' to deployment of CVHS;

- develop business cases at an appropriate level of detail for each stage of the route map in order to identify both quick wins and longer term potential benefits; and,
- identify the issues that must be addressed in order to realise the vision of CVHS and propose methods by which these issues can best be addressed.

Description

The capability to link vehicle to vehicle and vehicles to the network management systems opens up new opportunities for the way the road transport system functions. Many benefits have been predicted and claimed for systems that closely couple a vehicle and its infrastructure; however these need to be proven, and institutional, legal and administrative problems need to be addressed, before any system can be put into service.

Contractor(s)

No contractors specified.

Contract details

Cost to the Department: £248,600.00
Actual start date: 30 June 2003
Actual completion date: 31 March 2005

60. Project: Co-operative Vehicle Infrastructure Systems (CVIS) – A Policy Perspective

Objectives

One of the objectives of CVIS is to define and test new systems for cooperative traffic and network monitoring for use both in vehicle and roadside equipment, to detect incidents instantly and anywhere. In the framework of the CVIS, the Deployment Enablers sub-project tasks are to look into the non-technical barriers to cooperative systems deployment. DfT is leading a Work Package looking at the policy impacts and opportunities for CVIS and is continuing to explore the legal, administrative, technical, institutional, implementation and public acceptance issues so that a balanced view is reached

Description

The future concept of communication between individual vehicles and the roadside infrastructure has the potential to bring about significant road safety and network efficiency benefits. Running alongside the DfT's earlier CVHS feasibility study to identify and quantify the extent of policy delivery benefit and to consider potential barriers, pitfalls and dis-benefits, we also committed to take part in the co-funded European Co-operative Vehicle Infrastructure Systems project (CVIS).

With CVIS, drivers can influence the traffic control system directly and get individual guidance with the quickest route to their destination. Speed limits and other road sign information, as well as warnings of approaching emergency vehicles and similar urgent messages will be sent wirelessly to the vehicle and displayed to the driver. To validate the project's results, CVIS technologies and applications will be tested at one or more test sites in seven European countries including the UK.

Contractor(s)

Bittern Consulting Ltd

5 Cheney Gardens, Middleton Cheney, Banbury, Oxfordshire, OX17 2ST
01295 713 916

Contract details

Cost to the Department: £52,300.00
Actual start date: 12 March 2000
Expected completion date: 29 January 2010

61. Project: Electronic Vehicle Information: Drivers, Enforcement, Entry and Tolling (EVIDENT)

Objectives

The main project objectives are to:

- establish what potential public and private Electronic Vehicle Identification (EVI) requirements might be, identify the stakeholders and organisations likely to be linked with these, determine those which can be implemented using EVI, and establish potential common elements for each application, including potential cost benefits;
- address legal, human and institutional issues related to the implementation of EVI technology; and
- develop a strategy for the way forward in terms of Government involvement, possible future developments, demonstrations and implementations.

Description

The initial stage will define and specify a Europe-wide (potentially EU-mandated) Electronic Vehicle Identification method, to enable a unique and consistent method of identifying vehicles. The project is more than an 'electronic number plate', as in a developed form it can address road pricing, licence enforcement, parking management and several other areas.

Contractor(s)

TRL Limited
Crowthorne House, Nine Mile Ride, Wokingham, Berkshire, RG40 3GA
+44 (0)1344 773131

Contract details

Cost to the Department: £60,000.00
Actual start date: 04 June 2001
Actual completion date: 31 January 2002

Publication(s)

Because Cars Have Fingerprints Too. Electronic Vehicle Identification Applications in Road Transport. Traffic Technology International Review of Advanced Traffic Management
Author: TRL Ltd
Publication date: 01/04/2002
Unpublished
Source: Contact: gulam.rai@dft.gsi.gov.uk

Paper. Electronic Vehicle Identification for Road Traffic Information and Enforcement. 11th International Conference on Road Transport Information and Control London 2002
Author: TRL Ltd
Publication date: 01/03/2002

Unpublished
Source: Contact: gulam.rai@dft.gsi.gov.uk

Summary of results

This research identified current and future needs for Electronic Vehicle Identification, taking into consideration the concepts, potential benefits and awareness of legal, institutional, sociological and technological issues which may arise. Furthermore, key applications were identified with references to concerns and issues.

62. Project: EU Statement of Principles for Human-Machine Interaction (HMI) and e-Safety

Objectives

The main objective of this project is to support expert Human-Machine Interaction (HMI) contributions to the EC e-Safety HMI safety Expert Group in order to:

- review the existing Statement of Principles based on recent experience;
- develop verification procedures through consensus;
- extend the Principles to cover e-Safety systems, including 'Nomadic' devices; and
- address HMI issues related to advanced driver assistance systems.

Description

In-vehicle driver information and support systems (eg navigation, communications, collision warning) need to be carefully designed so that they do not distract the driver and can properly support the driving task. In December 1999 the European Commission (EC) adopted the European Statement of Principles (SoP) in acknowledgement of the importance of Human-Machine Interaction (HMI) safety for in-vehicle telematics. In recommending adherence to the SoP, the EC urged the European motor manufacturing and in-vehicle information systems supply industry to comply with the SoP which outlined a number of basic safety requirements concerning the design of, and driver interaction with, in-vehicle information, communication and entertainment systems. Member States were invited by the EC to take steps to encourage industry to comply with the SoP and report back on the awareness of SoP within the industry and the degree of compliance to the SoP by the industry by December 2001. Only a handful of Member States reported back. In recent months an EC e-Safety Working Group has identified the potential safety benefits of driver information and assistance systems for the driver and has recommended that HMI issues be given urgent attention. An Expert Group for HMI has therefore been set up under the e-Safety initiative. This Expert Group will effectively address the HMI safety issues as the 'next steps' to the outcome of the EC SoP exercise. The Department has been leading the HMI scene in Europe for many years. It also has in place Design Guidelines, a Code of Practice and Checklist for the assessment of HMI safety of in-vehicle information systems. These are deployed to assess novel in-vehicle information systems and also for the assessment of licensable systems such as dynamic route guidance systems. It is essential for the Department to sustain this lead and influence European initiative to address the UK requirements. The Department intends to do this through supporting expert resources through this project.

Contractor(s)

TRL Limited
Crowthorne House, Nine Mile Ride, Wokingham, Berkshire, RG40 3GA
+44 (0)1344 773131

Contract details

Cost to the Department: £52,000.00
Actual start date: 28 July 2003
Actual completion date: 31 October 2005

Publication(s)

Assessment of knowledge of the EC Statement of Principles for HMI (Final Report)
Author: TRL, Crowthorne House, Nine Mile Ride, Berkshire, RG40 3GA
Publication date: 31/10/2005
Source: PR/T/029/2001

EU Statement of Principles for HMI: Final Report
Author: TRL, Crowthorne House, Nine Mile Ride, Berkshire, RG40 3GA
Publication date: 31/10/2005
Source: TRL540

63. Project: Optimise - Optimising Interaction Between Drivers and Information Systems

Objectives

The main objectives of this project are to:

- identify the conflicting demands that arise from using multiple in-vehicle systems;
- produce and validate guidelines/evaluation tools to enable assessments to be made of multiple in-vehicle systems; and
- study the impact that multiple systems, both single and co-ordinated units, have on the driver's performance.

Description

Existing guidelines for in-vehicle driver information systems and their evaluation are based on single systems and their interaction with the driving task. With an increasing number of such devices becoming available, such as Trafficmaster yQ and Oracle and more expected over the next few years, the Department needs to understand the issues that arise when more than one such system is present within a vehicle.

Contractor(s)

TRL Limited
Crowthorne House, Nine Mile Ride, Wokingham, Berkshire, RG40 3GA
+44 (0)1344 773131

Contract details

Cost to the Department: £126,213.00
Actual start date: 19 May 1998
Actual completion date: 30 April 2001

Publication(s)

PR/TT/051/99. Considerations in the Design and Use of Multiple In-Vehicle Information Systems
Author: TRL Ltd
Publication date: 01/12/1999
Unpublished
Source: Contact: gulam.rai@dft.gsi.gov.uk

PR/TT/057/99. Driving and Driver Information Systems: A Task Analysis
Author: TRL Ltd
Publication date: 01/12/1999
Unpublished

Source: Contact: gulam.rai@dft.gsi.gov.uk

PR/TT/138/99. Conflicting Demands From the Driving Task
Author: TRL Ltd
Publication date: 01/12/1999
Unpublished
Source: Contact: gulam.rai@dft.gsi.gov.uk

Paper. T C Task Analysis of In-Vehicle Mobile telephones. Presented at the ITS World Congress Toronto 1999
Author: TRL Ltd
Publication date: 01/03/1999
Unpublished
Source: Contact: gulam.rai@dft.gsi.gov.uk

Paper. Gender Differences in Primary and Secondary Task Performance During Simulated Driving. Presented at the Annual Conference of the Ergonomics Society Grantham 1999
Author: TRL Ltd
Publication date: 01/03/1999
Unpublished
Source: Contact: gulam.rai@dft.gsi.gov.uk

Summary of results

This study delivered all outputs as planned. It produced and validated guidelines to enable assessments to made of multiple in-vehicle systems, identified the conflicting demands that arise from using multiple in-vehicle systems and studied the impact these systems have on the drivers performance.

64. Project: Road Traffic Advisor - Evaluation

Objectives

The main objective of this project is to evaluate the Dedicated Short Range Communications technology, which includes safety and user acceptance and represents the Department's contribution to the partnership.

Description

The main project, Road Traffic Advisor is a public / private partnership project from the UK PROMOTE group where DTi is providing up to 50% of the total project cost under the Technology Foresight initiative. It is addressing the issues of driver information using Dedicated Short Range Communications (DSRC) including a demonstration of real-time driver information from roadside equipment to the in-vehicle device. This related research project concerns evaluation of the DSRC technology including safety and user acceptance and represents the Department's contribution to the partnership.

Contractor(s)

TRL Limited
Crowthorne House, Nine Mile Ride, Wokingham, Berkshire, RG40 3GA
+44 (0)1344 773131

Contract details

Cost to the Department: £164,936.00
Actual start date: 05 December 1996
Actual completion date: 30 April 2001

Publication(s)

There Are No Publications for This Project

Author: TRL Ltd
Publication date: 30/04/2001

Summary of results

This project effectively trialed the main Road Traffic Advisor (RTA) project, which proved to be over ambitious and ultimately resulted in exhaustion of resources. The net result was that the evaluation was severely curtailed, resulting in the following:

- Only initial evaluation of driver safety was carried out using a limited number of subjects, ten drivers, to establish that RTA systems could be successfully used by naïve volunteer drivers to complete a range of representative tasks without causing undue concerns for HMI safety; * the evaluation was performed under a constrained environment as drivers were accompanied by the administrator;
- the trial was carried out only during daytime, off-peak traffic conditions; and
- the tasks were defined by experimental plan.

Although the conduct of this project could not be faulted, the objectives were not all fulfilled as longitudinal evaluation of driver information for sustained periods under normal driving conditions was not carried out.

Departmental Assessment Status: Project completed prior to the implementation of the Departmental publications scheme.

65. Project: SHOrt Range SENsors for automotive applications (SHORSEN)

Objectives

- Assess the ability of radar, infra-red and computer vision systems to detect vulnerable road users;
- Investigate potential techniques for determining the size of pedestrians in order to optimise protection strategies; and
- Install hardware developed on a demonstrator vehicle in order to evaluate sensor performance in simulated scenarios.

Some of this work is complementary to the investigations under the APVRU project and data exchange between programmes is continuing.

Description

This project is to investigate the application of short-range sensors to reduce the effects of an impending accident. The system can be used to control the 'firing' of airbags and seat belt pre-tensioners.

Long-range forward facing sensors have been developed to be used in conjunction with Adaptive Cruise Control systems. However these are not suitable for detecting imminent pre-crash conditions. An array of forward and sideways short-range sensors is required. The project looks to identify potentially suitable radar, infra-red and computer vision devices and develop their attributes for this short-range application. The necessary algorithms will be developed to identify the type of crash that is imminent and take avoiding or mitigating actions.

The detection of human targets by radar is possible and has been demonstrated over many applications such as automatic opening of supermarket doors and vehicle/building security detectors. In such applications a false detection does not however represent a major concern. In a vehicular pedestrian protection system it may lead to the deployment of an external explosive airbag or some other pedestrian friendly structure, which may subsequently obscure the driver's view, thus creating a dangerous situation from a safe scenario. Similarly, a missed detection by a door opener may be annoying but rarely life threatening. Equally the non-detection of a pedestrian is potentially life threatening.

It is necessary to detect and evaluate the motion of the pedestrian to assess the danger potential. A pedestrian walking down the street, or approaching a kerb, is not necessarily in danger. It will be necessary to be able to estimate the size of the pedestrian using the sensor, as damage mitigation solutions required to cope with accidents involving adults may be dangerous if triggered in accidents involving small children.

Contractor(s)

Jaguar Cars Ltd
Engineering Centre, Abbey Road, Coventry, CV3 4LF
01203 216101

University of Birmingham
Centre for Urban and Regional Studies, Edgbaston, Birmingham, B15 2TT

Cranfield University
The Cranfield Centre for Logistics and Transportation, Cranfield, Bedford, MK43 OAL
01234 751122

Contract details

Cost to the Department: £255,000.00
Actual start date: 01 November 2000
Actual completion date: 23 April 2004

Publication(s)

SHORSEN Final Report
Author: Jaguar Cars Ltd, Cranfield University, The University of Birmingham
Publication date: 01/02/2004
Unpublished
Source: Contact: davidj.rowe@dft.gsi.gov.uk

SHORSEN Final Report Executive Summary
Author: Jaguar Cars Ltd, Cranfield University, The University of Birmingham
Publication date: 01/02/2004
Unpublished
Source: Contact: davidj.rowe@dft.gsi.gov.uk

Summary of results

This project demonstrated the overall feasibility of using radar and / or computer vision systems to detect pedestrians, but it highlighted the potential limitations of such systems and emphasised the fact that these systems need considerable further development prior to being offered onto the market. The project delivered most of the planned outputs and, although the practical application to restraint systems was not pursued this area is addressed to some extent in the APVRU project. The project results were generally credible and any areas where caution is needed in interpreting the results are clearly identified in the final report.

http://www.dft.gov.uk/rmd/project.asp?intProjectID=10433

66. Mobile Environmental Sensing System Across a Grid Environment (MESSAGE)

The website is still under construction, see http://155.198.92.106/pmesg.html.

Background

The overall aims of this project are:

- To harness the potential of diverse, low cost and ubiquitous environmental sensors to provide data to address key scientific challenges in the field of transport and environmental monitoring and modelling and analysis.
- To develop a flexible and reusable e-Science infrastructure to support a wide range of scientific, policy-related and commercial uses and applications for the resultant data and to demonstrate the operation and utility of this infrastructure in diverse case study applications.

These aims lead to a number of specific objectives:

- To develop the capability for suitably equipped vehicles and individuals to act as mobile, real-time environmental probes, sensing transport and non-transport related pollutants and hazards.
- To extend existing e-Science, sensor, communication and modelling technologies to enable the integrating of data from heterogeneous fixed and mobile environmental sensors grids in real time to provide dynamic estimates of pollutant and hazard concentrations.
- To demonstrate how these data can be usefully correlated with a wide range of other complementary dynamic data on, for example, weather conditions, transport network performance, vehicle mix and performance, driver behaviour, travel demand, pollutant exposure and health outcomes.
- To implement relevant e-Science tool sets and (fixed and mobile) sensor and communication system in a number of selected real-world case study applications, involving close collaboration with business and the public sector, and to thereby demonstrate their value to the research and policy community.

This is a £3.5million, 3 year research project, jointly funded by the Department for Transport and EPSRC and beginning in October 2006.

Contacts

Dr. Robin North (Tel: +44 (0) 20 7594 5977) or Professor John Polak at the Centre for Transport Studies, Imperial College London for information regarding the MESSAGE Project.

67. Alternative Detector Technologies

Start-End Date: 12/2000-01/2002
Project status: Completed
Publication Status: Not Published
Project value: £182,000
Project Contractor: Atkins
HA Project Sponsor: Beale, S
Reference: 63Y76130

Introduction:

There are many problems associated with the use of apermanent loop to detect the presence and speed of vehicles for traffic management. These include; poor reliability and associated high life-cycle cost and the fact that a total lane closure is required to carry out any maintenance/reinstallation.

Project Objectives:

This project will assess, test and trial non-loop based vehicle detection and measurement systems and recommend those suitable for use by the Highways Agency. A successful outcome to this project will result in more cost effective vehicle detection and therefore cheaper MIDAS (Motorway Incident Detection and Automatic Signalling) systems. The detectors will also allow MIDAS to be installed on sections of the network where loops cannot be used, i.e. Concrete pavements, Bridges and viaduct sections, e.g. elevated section of the M4.

Summary:

The results from this project have lead to full scale trials of fibre optic detection technology.

http://www.ha-research.gov.uk/projects/index.php?id=518

68. EVALUATION OF LOW COST CCTV TRIALS FOR NETWORK MONITORING

Section: Congestion, All projects in this section
Start-End Date: 01/2005 -07/2006
Project status: Completed
Publication Status: Not Published
Project value: £212,412
Project Contractor: WSP Ltd
HA Project Sponsor: Slip, J
Reference: Y201364

Introduction:

This research aims to evaluate alternative CCTV technology including : Cameras, arising from recent technical advances allowing high quality, low cost, digital cameras to become commercially available; Image distribution, through innovative application of wireless and Internet technologies. This work will evaluate and develop the technological applications and conduct the relevant trials in order to prove the applicability alternative low-cost CCTV technology for infill cameras; to expand temporary and permanent CCTV coverage of the Highways Agency (HA) network in those areas where coverage is absent.

Project Objectives:

To evaluate and develop relevant technological applications and conduct the relevant trials utilising commercially available low cost digital cameras. The applications include:

- Satellite applications for wireless CCTV
- Microwave Transmission for wireless CCTV
- Mobile communications for wireless CCTV
- GSM, GPRS, 3G and other bespoke mobile communications technology
- WLAN communication for wireless CCTV.

Summary:

This research has offered much benefit to the Highways Agency / Department for Transport. Operational off the shelf low cost technological solutions have been trialled in support of the roll out of low cost cctv across the HA network; a pick list of suitable technologies and their functionality and constraints is readily available to support the expansion of HA CCTV network coverage. A operational wireless cctv platform has been successfully deployed and encouraged local Area Teams to invest in this technology for the purposes of supporting network management through the monitoring of incidents/special events. The use of wireless technology has been proven to facilitate network coverage in areas where cable infrastructure is non-existent with fixed wireless cameras about to increase coverage on the HA network in the far South West. The potential exists for the rapid deployment of temporary and / or mobile CCTV cameras, throughout the UK monitor road works and / or incidents. This research has facilitated further research and development for in vehicle systems for the Highways Agency Traffic Officers.

Publications:

Low Cost CCTV for Network Monitoring Final Report. Authors: Paul Warren, Masud Hussain, Douglas Newton; Publisher: WSP Group; Owner: HA Safety Standards & Research.

69. Assessment Of Wireless Lan Technology In The Roadside Environment

Section: Congestion, All projects in this section
Start-End Date: 07/2003 -07/2003
Project status: Completed in Programme Year
Publication Status: Not Published
Project value: £15,000
Project Contractor: WSP Ltd
HA Project Sponsor: James, K
Reference: Y102818

Introduction:

With the use of wireless LAN's becoming commonplace, it was decided to undertake a small scoping study to investigate the use of this low cost and off the shelf technology, for vehicle to vehicle and roadside applications.

Project Objectives:

Review the research carried our in this field and the technologies available. Determine the operational performance of each wireless protocol for road applications and examine issues such as link security and reliability. Generate a detailed report outlining findings and recommendations for future work with this technology.

Summary:

- Standard 802.11a is not optimised for roadside to vehicle applications, however the USA are developing an enhanced version for this environment.
- Use of this in the UK would require discussion and approval with Radio Communications Agency.
- UTMS-TDD developed as part of the 3rd generation mobile networks may be capable of providing a viable alternative to WLAN and some TDD demonstrators have already been developed in the UK.
- The study highlighted roadside communication scenarios in which 802.11b, 802.11a R/A and UTMS TDD could be applied and recommendations for further work in this area.

Publications:

Final report now available.

70. Innovative Delivery Of Digital CCTV Images

Section: Congestion, All projects in this section
Start-End Date: 10/2003 -03/2005
Project status: Completed
Publication Status: Not Published
Project value: £179,000
Project Contractor: WSP Ltd
HA Project Sponsor: James, K
Reference: Y103637

Introduction:

The project follows on from the successful VIH trial and aims to further exploit the digital images by the development of new delivery services using new mobile communications and digital media, such as 2.5 and 3G, wireless LAN and digital TV. The aim being the ability to access quality freeze frame and moving images remotely for HA and third parties. The resulting service would be extremely useful for network monitoring and operation and information purposes.

Project Objectives:

The aims of the project are:

- To investigate the open standards and proprietary methods of delivering CCTV images across mobile, TV and internet media.
- To develop internal demonstrators for HA use and promotion of these services and technology.
- Tie in the CCTV information to the TIH and develop website services supporting Handheld and mobile devices.

Summary:

Project start has been delayed due to re-work of the task specification to include support for the HA's new role as network operator.

Publications:

Final report and website supporting handheld devices will be available for HA and public.

71. Short Range Sensors for Automotive Applications

Project Description

The main objectives of the project were:

40. Evaluate the short-range performance of existing ACC radar sensors and understand their performance limitations when used for safety applications.
41. Develop a short-range radar sensor array to cover a wide-angle field of view so that objects in blind spot areas of narrow-angle, long-range ACC radar may be detected.
42. Develop an optical sensing and analysis system for accurate object localisation and classification.
43. Combine the information from both radar and vision systems to maximise overall system performance in terms of accuracy, reliability and robustness.

Technical Issues

Supplier

Arrays of 24 GHz radar devices available from a supplier in pre-production form were evaluated for this task, and whilst able to detect pedestrians it did not prove possible to use the devices to accurately and unambiguously locate a pedestrian or other objects. Although a negative outcome, it was still very valuable information.

Participants

Autoliv Ltd
University of Birmingham
Cranfield University

Lead Partner
Jaguar Cars Ltd

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1077&Submit.x=11&Submit.y=18

72. Safety Critical Sensor Integration for Autonomous Vehicles

Project Description

The AVERT project undertook a detailed investigation into the potential environmental benefits to be gained by adjusting gasoline engine management strategies dynamically via external infrastructure signals. The project assessed how these adjustments could be implemented without compromising driveability or safety.

- Developed from state-of-the-art developments from other fields, in particular automotive with a fail-safe, safety critical, self-deterministic architecture.
- Capable of providing robust detection of the environment around the vehicle (i.e. vehicle position relative to the track, other vehicles and obstacles).
- Suitable for application in Personal Rapid Transit systems, using the ULTra PRT system as a testbed.

Results - What Happened Next?

The project successfully investigated the development of a sensing system and demonstrated the feasibility of the fusion-based approach.

While significant sensor improvements are required to meet the specific target application, a number of promising new technologies were developed, including stereo vision and associated algorithms, an optical ranging device and a fault tolerant approach to data fusion. The operational requirements of the ULTra system is now understood, and a test and validation specification for the system was established.

A framework safety case was developed for rapid construction of the production safety case, once the appropriate sensing technology was available.

The development of the simultaneous detection of obstacles and guideway will be continued to make it more robust. This will enable it to detect obstacles in different scenarios and to make the detection in real-time. The accuracy of the 3-dimensional reconstruction will also be improved.

The concept of the direct method for object reconstruction from image motion will be exploited in the development of other reconstruction algorithms in different scenarios, for example, for autonomous navigation in the absence of guideway.

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1003&Submit=Go

Participants

Advanced Transport Systems Ltd
Praxis High Integrity Systems Ltd
University of Bristol
University of Warwick

Lead Partner
TRW Conekt

73. Bone Scanning for Occupant Safety

The BOSCOS Project investigated methods whereby car occupants, on entering the vehicle, could be measured to assess their skeletal condition and the restraint system parameters adjusted specifically for their biomechanical limits. This would be a step towards smart restraint systems that can provide near optimum restraint conditions for each vehicle occupants.

The main gains were anticipated through reductions in chest injuries by the selection of restraint system parameters that were more sympathetic to the biomechanical limits of car occupants. Ultrasound was selected as the most appropriate technology to use, since the equipment is typically light weight and portable and has minimal health issues.

Results - What Happened Next?

A prototype for scanning the index finger was developed to use alongside existing clinical scanning techniques. Tissue samples from patients undergoing replacement hip operations were gathered, with patient consent, and the tissue samples tested to determine their mechanical properties. Correlation of the scan readings against the test data gave encouraging results.

Front impacts, full width and offset, resulting in AIS 2+ chest injuries attributable to the seat belt were identified as the focus for the development work in the project after study of real-world crash analysis.

Computer simulations identified that if BOSCOS type scanning systems were implemented in cars, during lower speed crashes there would be a 20% reduction in chest injury costs with the potential for the benefits to rise to 28% if the systems were successfully implemented during higher speed crashes and there were no increases in other injury indices.
Integration of an ultrasound based scanning system into a vehicle was investigated: the physical aspects (where can it be located and how easily does it fit), environmental aspects (compatibility with other vehicle systems and environmental operating conditions), interaction and communication with the restraint management system, additional hardware and software customer acceptability, hardware costs and vehicle manufacturer profitability requirements.

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1096&Submit=Go

Participants

Nissan Technical
Centre Europe
TRW Automotive
Autoliv
McCue
Cranfield University at Shrivenham
Loughborough University (VSRC)

Lead Partner
Cranfield Impact Centre

74. Future Antenna Technology for Cars and Trucks (FATCAT)

Project Description

Using extremely high frequency (63 GHz) links, vehicles will be able to communicate with each other to form co-operative platoons, to use collision avoidance systems and to alert drivers to manoeuvres by other vehicles. Links with a network of roadside beacons will give drivers pre-information about traffic flow, parking at their destination and a range of communication and entertainment services. The antenna must be able to provide all-round coverage and handle safety-critical messages, while being low cost and compatible with the design and styling of the car.

Results - What Happened Next?

The most significant achievements of the FATCAT programme were the successful design, manufacture and testing of a 21dBi shaped reflector antenna at 63GHz.

Modelling the performance of antennas installed on a vehicle and derivation of guidelines for materials surrounding the antenna.

Identification of viable manufacturing routes for mass-production at unit-costs of less than 10GBP.

During FATCAT several technical areas were identified where further work would assist in preparation for the implementation of telematic systems. These include system architecture studies (to decide the structure and protocols needed for multiple vehicles to communicate with each other and with a network of roadside beacons) and millimetre-wave propagation (in alternative weather, motorway / urban / rural conditions). It will also be necessary to consider how the proven FATCAT antenna designs can be modified to simplify manufacture, minimise cost and increase reliability.

There was a follow on project called FATCAT2.

Participants

University of Birmingham
BSH Industries Ltd

Lead Partner
BAE Systems Advanced technology Centre
(formerly Marconi Research Centre)

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1004&Submit.x=17&Submit.y=9

75. Future Antenna Technologies for Cars and Trucks (FATCAT2) - Phase 2

Project Description

Develop designs for antennas for communication between vehicles and with the roadside infrastructure at 63 GHz.

Results - What Happened Next?

Experience gained on FATCAT2 enabled MILTRANS, another Foresight Vehicle programme, to achieve a successful demonstration of real-time millimetre wave data links between moving vehicles.

BAE Systems communications will develop its millimetric capability. Leverage for this funding is provided by the successful outcome of FATCAT2 and the demonstrated hardware. We are looking into combining the FATCAT2 devices with MEMS (micro-electromechanical) devices to produce a low loss switched beam system.

BAE Systems, with further funding from an Overseas Research Scholarship and Scholarships from the Department of Electronic and Electrical Engineering at Birmingham University, is exploring further the rectangular coax and active antenna concepts.

Millimetre wave antennas are also expected to be exploited in both civil and military high data rate communication systems.

Participants

University of Birmingham
Panorama Antennas Ltd

Lead Partner
BAE Systems Advanced Technology Centre

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1068&Submit.x=10&Submit.y=13

76. Millimetric Transceivers for Transport Applications (MILTRANS)

Project Description

MILTRANS set out to design and demonstrate a high capacity millimetre wave data link for vehicle communications and to investigate cost-effective manufacturing methods.

The project aims were:

- To design and demonstrate the operation of a high capacity inter-vehicle and vehicle-to-roadside data link operating in the 63-64 GHz frequency band that will be suitable for the next generation of advanced data services and traffic management systems
- To investigate design and fabrication techniques which are expected to allow a significant reduction in the production cost of such data links.

Results - What Happened Next?

The objective was achieved. The successful outcome of this project has resulted in a system demonstrator and a body of knowledge which will enable high-capacity communication systems to be developed to support a wide range of applications in transport telematics. A 3-month project extension was agreed to allow additional demonstrations to be carried out for the main sponsor.

BAE Systems and QinetiQ are now engaged in developments that build on the knowledge gained and the technology developed.

Opportunities are being actively sought to include the outputs of MILTRANS in demonstrator projects currently being prepared by innovITS (UK Centre of Excellence for Transport Telematics and Sustainable Mobility).

The system costs now need to be reduced to a viable level for widespread implementation, by building on the technical and opportunity findings of the programme.

Participants

QinetiQ
University of Birmingham
Panorama Antennas Ltd>Participants

Lead Partner
BAE Systems

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1113&Submit.x=17&Submit.y=14

77. Probe Vehicle Information for Traffic Management and Road Network Operations (PROBE-IT)

Project Description

The aim of the project was the development of a fully working system for the transmission of position-related information from a dynamic database to in-vehicle systems.

The overall objective was to demonstrate an end-to-end process of information transfer utilising emerging commercially-available, wireless communications technology. The process was developed in three phases: non-dynamic data flow; dynamic data flow and floating vehicle application.

Results - What Happened Next?

The Probe-IT project implemented and demonstrated a framework for the sourcing and exchange of geo-referenced information between traffic management systems, an integrated data source and in-vehicle systems such that the data is always timely and accurate.

The technology used to implement the framework is widely available and comprises GPRS as wireless communication medium and the Travel Information Highway (TIH) in conjunction with the Internet for fixed communications. In 2001, when this project began, this technology was new and innovative.

To demonstrate the framework, the project has implemented navigation and traffic regulations advice (speed and waiting restrictions) as in-vehicle applications.

Participants

Jaguar Cars Ltd
Navigation Technologies
University of Southampton
Kingston University
Essex County Council

Lead Partner
WS Atkins Transport Systems

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1078&Submit.x=15&Submit.y=7

Link to presentation: http://www.foresightvehicle.org.uk/public/info_/PROBE-IT/ProbeIT%20Project%20Completion%20Day.pdf

78. Radar-controlled Automatic Lane Following

Brief Description

This project set out to study the feasibility of developing radar-visible road markings and the use of radar for steering control. The initial aim was to undertake an initial one-year feasibility study to examine and test the following:

- The viability of developing radar-visible road markings and fixtures.
- The feasibility of using radar-visible road markings to delineate carriageway lanes, centre lines and boundaries.
- The suitability of the radar system developed for Autonomous Cruise Control (ACC) by Jaguar Cars for lateral control.
- The feasibility of using a radar-visible rumble strip as part of an automated safety system for halting vehicles which enter a breakdown lane.

Results - What Happened Next?

The project resulted in a detailed knowledge of the radar reflectors performance of a number of different types of potential reflectors and demonstrated that it is possible to enhance the reflectivity of roadmarking paint to some degree.

The work has shown that an increase in radar reflectivity can be obtained by low cost means, but the level of reflectivity currently achievable needs to be increased. The results are a significant potential benefit to future automotive radar systems.

Participants

Prismo Ltd
Jaguar Cars Ltd
University of Birmingham

Lead Partner
TRL

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1088&Submit.x=15&Submit.y=11

79. Road Origin and Direction Attained by Radar

Project Description

The project set out to assess the viability of determining the road geometry ahead of a vehicle via analysis or radar images.

A knowledge of the road geometry infrastructure ahead of the vehicle is necessary for future automotive safety systems. The project aims to produce a measurement of the road trajectory approximately 200m ahead of a radar equipped vehicle using backscattered radar energy from the road edges and highway infrastructure.

With suitable signal processing, an image of the traffic scene covered by the radar sensor was developed. This opens up the possibility of using image processing techniques to enable the radar data to be processed to produce a predicted path with the added benefit of all weather performance and additional high resolution range and velocity data inherent in radar data.

Results - What Happened Next?

New algorithms for the determination of the road geometry were developed. This resulted in a software package called ROADVIEW which included real-time analysis, debugging and displaying the results of the road geometry determination off-line.

The road edge detection algorithms were incorporated into Jaguar's Forward Collision Warning (FCW) application a few months after the project ended. A brief test was done off-line based on the FCW application using pre-recorded radar data with synchronised video. The results were quite promising, showing good potential of detecting road edge accurately.

Participants

University of Birmingham
Cranfield University

Lead Partner
Jaguar Cars Ltd

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1008&Submit.x=20&Submit.y=11

http://www.foresightvehicle.org.uk/public/info_/ROADAR/2002_01_0820.pdf- need to buy paper due to copyright issues.

80. Road Traffic Adviser

Project Description

A Dedicated Short Range Communications system (DSRC) would allow messages supporting a number of applications to be sent to specific vehicles, and data that are potentially useful to other vehicles to be collected. Information could include warnings of hazards ahead and advice on avoiding congestion. The RTA project set out to create a national test facility for further work on DSRC systems.

Result - What Happened Next?

The project partners developed a media independent communications architecture for the delivery of travel information services between the roadside and vehicles.

An associated RTA infrastructure project consortium installed demonstration DSRC infrastructure along the M25 and M4 motorways between Gatwick and Swansea as well as providing application services. RTA equipped a number of vehicles (both private and public service vehicles) with transmit � receive devices to demonstrate the successful operation of the system and the travel information applications supported by the project.

A European funded project, MARTA (Motorway Applications for Road Traffic Advisor) combined the findings of the RTA project with that of the French project AIDA (Application pour l�Information Des Autoroutes) and other similar work in Japan to make recommendations for the production of a draft European Medium Range Pre-Information (MRPI) Travel Information tandard. The CEN standard has recently been produced.

Participants

Southampton University
Rover Group
University of Wales, Cardiff
GEC-Marconi
Loughborough University
LucasVarity
Motor Industry Research Association
Department of the Environment, Transport and the Regions
Highways Agency
Jaguar Cars

Lead Partner
TRL

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1076&Submit.x=13&Submit.y=21

81. Short and Long Range Integrated Multifunction Radar and Communication Sensors (SLIMSENS)

Project Description

SLIMSENS is a three-year programme to link microwave, radar and broadband in a next-generation mobile communications system which, working via voice recognition, will let vehicle drivers and passengers tap into traffic information, web browsing on the move, online shopping and even video conferencing.

The objective is to extend the current function of 77 GHz radar transceiver devices in their operation as radar sensors for adaptive cruise control with the ability to detect obstacles which are much closer to the vehicle and over a wider field of view. A short range, ~ 0.5Km, high data rate communication function is also integrated into the unit.

Benefits

SLIMSENS will reduce the number of sensor/communication devices which will need to be fitted to a vehicle. It is expected hat the resulting products will be manufactured by UK companies and will be highly competitive internationally.

Progress So Far

A new novel antenna has been designed which combines the long and short-range requirements. The 77 GHz transceiver design is in an advanced stage and the demonstrator unit which integrates the antenna, 77 GHz radar and 63 GHz communications unit is modelled in pro-engineer. Advanced antenna designs are being fabricated by the university partner.

Participants

BAE Systems
Birmingham University
L.E.W Techniques Ltd
Jaguar Cars Ltd

Lead Partner
e2v Technologies

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1144&Submit.x=11&Submit.y=8

http://www.aael.co.uk/

82. Virtual Vehicle Information Displays

Project Description

The amount of on-board information that is available to drivers is dramatically increasing. There is a danger that drivers, who should be devoting more attention to the driving task, will be bombarded by large volumes of un-prioritised information.

The aim of this project was to create a system that will allow the realistic design, testing and evaluation of both the form and function of multiple automotive information systems for both commercial and private vehicles.

The original objective of VIVID was to create a Virtual Reality prototyping environment to assess the different methods of integrating the information sources available to drivers such as mobile phones and in-car navigation technologies.

Results - What Happened Next

The project has delivered a powerful and user-friendly toolkit for the evaluation of different prioritising paradigms within in-vehicle systems. The flexibility offered by the system in supporting different experimental parameters, coupled with a robust data logging model to facilitate post-experiment empirical evaluation of the behaviour of the test subject offers a powerful toolkit, appropriate for use at an early stage of the in-vehicle system design life-cycle.

The VIVID system provides the ability to define and run a controlled vehicle simulation which offers a number of key advances over the current state of the art regarding experimental driving simulators:

Road structure definition: User friendly graphical tool delivering rapid road plan construction and execution for any computer controlled vehicle.

Test vehicle layout: Ability to define test vehicle characteristics including messengers, spatial considerations, visual representation and test subject viewpoint positioning.

Test environment definition: Evaluation of previously defined road structures and vehicle layouts under controlled conditions, to include general experimental, in-vehicle devices, external parameters (e.g. junction complexity, traffic information warnings), in-vehicle device interaction and automated trigger points.

Night vision definition tool: Night vision definition tool capable of simulating an augmented display window within the running simulation, based on either colour ramping (appropriate for simulating traditional night vision displays) or by direct control of brightness, colour and tint appropriate for simulating near-infrared based systems.

Participants

Loughborough University (HUSAT)
Thales Optronics Ltd
OCF Ltd

Lead Partner
PERA

http://www.foresightvehicle.org.uk/dispproj1.asp?wg_id=1074&Submit.x=14&Submit.y=10

83. Acis

A solutions provider that specialises in transport intelligence within the community.

http://www.acis.uk.com/Home/tabid/36/Default.aspx

84. EVITA

Background and Objectives

Background
Future automotive safety applications based on vehicle-to-vehicle and vehicle-to-infrastructure communication have been identified as a means for decreasing the number of fatal traffic accidents. Examples of such applications are local danger warnings and electronic emergency brakes. While these functionalities inspire a new era of traffic safety, new security requirements need to be considered in order to prevent attacks on these systems. Examples of such threats are forced malfunctioning of safety-critical components or the interference with the traffic flow by means of fake messages.

Objectives
Secure and trustworthy intra-vehicular communication is the basis for trustworthy communication among cars or between cars and the infrastructure. Therefore, the objective of the EVITA project is to design, verify, and prototype architecture for automotive on-board networks where security-relevant components are protected against tampering and sensitive data are protected against compromise when transferred inside a vehicle.
By focusing on the protection of the intra-vehicle communication EVITA complements other e-safety related projects that focus on the protection of the vehicle-to-X communication.

http://www.evita-project.org/

85. NoW

Background and Objectives

Network on Wheels was founded by Daimler AG, BMW AG, Volkswagen AG, Fraunhofer Institute for Open Communication Systems, NEC Deutschland GmbH and Siemens AG in 2004. Siemens left the consortium in 2006. Their part was taken over by IMST GmbH and embedded wireless GmbH. NoW is a German research project which is supported by Federal Ministry of Education and Research. Besides the partners the Universities of Mannheim, Karlsruhe and Munich and the Carmeq GmbH co-operate within NOW.
The main objectives are to solve technical key questions on the communication protocols and data security for car-to-car communications and to submit the results to the standardization activities of the Car2Car Communication Consortium, which is an initiative of major European car manufacturers and suppliers. Furthermore, a test bed for functional tests and demonstrations is implemented which will be developed further on toward a reference system for the Car2Car Communication Consortium specifications.

The communications protocols developed in NOW

Network on wheels will support active safety applications as well as infotainment applications and will thus provide an open communication platform for a broad spectrum of applications. This is of particular importance regarding the market introduction of car-to-car communication systems.

Main objectives of NOW

- Communication protocols and data security algorithms for inter-vehicle ad hoc communication systems.
- To support active safety applications, infotainment applications with infrastructure and between vehicles.
- Radio systems based on IEEE 802.11 technology.
- Standardization on European level with the Car2Car Communication Consortium.
- Implementation of a reference system.
- Planning of introduction strategies and business models.

Challenges that have to be mastered

- Specification of position based routing and forwarding protocols.
- Adaption of wireless LAN under realistic radio conditions.
- Fundamental questions on vehicular antennas.
- Data security in vehicular ad hoc networks.
- Secure and fast communication between vehicles.

http://www.network-on-wheels.de/

86. PRE-DRIVE C2X

Background and Objectives

The European project PRE-DRIVE C2X prepares a large scale field trial for vehicular communication technology. Based on the European COMeSafety architecture for a vehicle to x communication system, the project develops a detailed specification for such a system and a functionally verified prototype. The prototype will be robust enough to be used in future field operational tests.

PRE-DRIVE C2X develops an integrated simulation model for cooperative systems that enables a holistic approach for estimating the expected benefits in terms of safety, efficiency and environment. This includes all tools and methods necessary for functional verification and testing of cooperative systems in laboratory environment and on real roads in the framework of a field operational test.

Vehicular communication

Communication between cars or car to infrastructure (C2X) can provide the next leap in active safety. Instead of only monitoring vehicle and driver behaviour to assess danger (phase 1 - Feel), or to monitor the immediate environment around the vehicle to detect hazardous situations (phase 2 - See), C2X goes the decisive step further. It gathers detailed information on surrounding environment (vehicles and infrastructure) to extend the driver's awareness of upcoming potential danger (phase 3 - Communicate).
Communication provides the driver with information that goes beyond autonomous sensor range and beyond the driver's visual range. Communication provides the driver with enriched details and quality.

The driver receives pertinent information on the current driving situation that extends the safety time margin. The view is extended beyond the physical horizon and includes non-observable attributes and traffic rules. C2X communication creates an information horizon that improves the driver's response time by foresighted driving.

PRE-DRIVE C2X is developing a common European system for vehicular communication based on the overall description of a common European architecture for a vehicle to x communication system defined by the COMeSafety project task force that included the cooperation of the SAFESPOT, CVIS, COOPERS integrated projects and of the Car 2 Car Communication Consortium.

The expected achievements of PRE-DRIVE C2X are:

- Consistent system architecture for a European cooperative driving system, developed in collaboration with the EU funded support action COMeSafety following the architecture framework drafted by the COMeSafety partners.
- An integrated simulation tool set that allows assessing all aspects of vehicular communication
    - Technical aspects.
    - Traffic and safety impact.
    - Environmental effects such as influence on CO2 emissions and fuel consumption.
- Robust prototype hardware and software components suitable for use in field operational tests.
- Commonly agreed use cases for vehicular communication systems.
- Verified methods and tools for field operational tests with vehicular communication.
- Demonstration, functional verification and impact assessment of PRE-DRIVE C2X/COMeSafety architecture.
- Contribution to relevant standardisation activities.
- Public awareness of benefits of vehicular communication technology.

http://www.pre-drive-c2x.eu/

87. PRECIOSA

Background and Objectives

Research and development in the field of Intelligent Transport Systems (ITS) currently focuses on the next generation of technology in transportation. Co-operative Systems is the key term which includes a new way to collaborate between individual travellers, the operators of transport systems, and service providers, all equipped with state-of-the-art technology. By introducing Vehicle to Vehicle (V2V), Vehicle to Infrastructure (V2I), and Vehicle to X (V2X) communication, new potential is opened up to improve safe and "green" mobility.

This type of co-operative system requires mobile and ad hoc networks. For deployment success, an inevitable prerequisite is the availability of secure and safe communication with assured privacy. Co-operative systems involve the handling of location and user information. Thus some core functions in co-operative systems include - if required and permitted - the identification of traveller movements, e.g. to draw conclusions about the traffic status.

Consequently questions of privacy are inherently connected to co-operative intelligent transport systems whether they are public services, private services, or basic system functions. Yet the requirements of observing moving patterns as well as assuring privacy seem contradictory.

Objectives

The goal of PRECIOSA is to demonstrate that co-operative systems can comply with future privacy regulations by demonstrating that an example application can be endowed with technologies for suitable privacy protection of the location related data of individuals.

The major objectives of the PRECIOSA project are to:

- Define an approach for the privacy evaluation of co-operative systems in terms of communication privacy and data storage privacy.
- Define a privacy aware architecture for co-operative systems which involves suitable trust models and ontologies, a V2V privacy verifiable architecture, and a V2I privacy verifiable architecture, and which includes the architecture components for protection, infringement detection, and auditing.
- Define and validate guidelines for privacy aware co-operative systems.
- Investigate specific challenges for privacy.

http://www.preciosa-project.org/

88. INTRO

Background and Objectives

Intelligent Roads

INTRO is a research project supported by the European Commission with the aim of developing innovative methods for increased capacity and safety of the road network. This combines sensing technologies and local databases with real-time networking technologies. The project is being conducted by FEHRL institutes together with partners from the ITS and research sector.

Objectives
By adding intelligence to infrastructure, it is possible to:

- Reduce the number of road accidents.
- Reduce the maintenance costs of these infrastructures, which are constantly increasing in Europe, in relation to the volume of traffic and in particular heavy vehicles.
- Optimise the capacity of existing infrastructure.

The required intelligence can generally come from existing technologies (sensors, communications, databases, real-time network management, etc).

INTRO (“Intelligent Roads”) is developing innovative methods to increase the capacity of road infrastructure and to maximise the safety and well being of drivers, passengers, crew and pedestrians. These involve the use and combination of existing technologies as well as combining them with developing technologies.

Three main strands of research are being conducted:

- Surface safety monitoring
    - Integration and testing of real-time warning systems at network level to achieve a significant decrease in the number of accidents due to ”surprise effects” from sudden local changes in weather resulting in low friction and hence skidding.
    - Increasing drivers´ attention to low road friction by only a few percent may result in significantly higher reduction of accident rates due to its non-linear relationship.

    - Europe's most advanced driving simulator will be used to optimise for driver responses to new types of information.

- Traffic and safety monitoring
    - Combination of different sensor data will enable the estimations of entirely new real-time safety parameters and performance indicators to be used in traffic monitoring and early warning systems.

- Intelligent pavement and intelligent vehicles
    - Innovative use and combination of new and existing sensor technologies in pavements and bridges in order to prevent accidents enhance traffic flows and significantly extend the lifetimes of existing infrastructure.
    - A prolonged lifetime of high capacity roads could thus be obtained using novel methods for early warning detection of deterioration and damage of road surfaces.

http://intro.fehrl.org/

89. sim^{TD}

Background and Objectives

Background
The sim^{TD} research project is shaping tomorrow's safe and intelligent mobility through researching and testing car-to-X communication and its applications. The project started in September 2008 and will run for four years. sim^{TD} will put the results of previous research projects into practice. For this purpose realistic traffic scenarios will be addressed in a large-scale test field infrastructure around the Hessian city of Frankfurt. The project will also pave the way for the political, economic and technological framework to successfully set up car-to-car and car-to-infrastructure networking.

To achieve those objectives, numerous automotive and telecommunication companies, the Hessian state government and renowned universities and research institutions have partnered up. The Federal Ministry for Economics and Technology, the Ministry for Education and Research as well as the Ministry for Transport, Building and Urban Affairs are funding and supporting the project.

Objectives
sim^{TD} is pursuing the following principle objectives:

- Increased road safety and improved efficiency of the existing traffic system through the use of car-to-x communication.
- Definition and validation of a roll-out scenario for the identified functions and applications for scientific questions through practice-oriented experiments and field operational tests.
- Consolidation of car-to-x functions from the categories of traffic efficiency, driving and safety as well as value-added services.
- Definition, analysis, specification and documentation of those functions that are to be developed and tested, as well as of the resulting requirements for the overall system for selected functions and tests within sub-project 1.
- Development of test and validation metrics and methods in each phase of the overall system development in order to allow measurement and evaluation of the results.
- Consolidation and harmonisation of requirements from the standpoint of feasibility and performance as well as their compatibility of requirements within the sub-projects.
- Verification of functions and requirements within the context of individual milestones.

During a systematic and methodically sound process, the consortium partners selected the following functions in the categories traffic, driving and safety as well as value-added services. As a first major result, the following functions were selected for implementation:

1 **Traffic**
Functions

1.1 **Monitoring of traffic situation and complementary information/basic functions**

- Data collection in the infrastructure side
- Data collection by the the vehicle
- Identification of road weather
- Identification of traffic situation
- Identification of traffic events/incidents

1.2 **Traffic (flow) information and navigation**

- Foresighted road/traffic information
- Road works information system
- Advanced route guidance and navigation

1.3 **Traffic management**

- Alternative route management
- Optimized urban network usage based on traffic light control
- Local traffic-adapted signal control

2 **Driving and safety**
Functions

2.1 **Local danger alert**

- Obstacle warning
- Congestion warning
- Road weather warning
- Emergency vehicle warning

2.2 **Driving assistence**

- In-vehicle signage/traffic rule violation warning
- Traffic light phase assistant / Traffic light violation warning
- Extended electronic brake light
- Intersection and cross traffic assistance

3 **Additional services**
Functions

3.1 **Internet access and local information services**

- Internet-based usage of services
- Location-dependent services

http://www.simtd.de/index.dhtml/564ace1730112a4322ig/-/enEN/-/CS/-/

90. Pervasive Computing: Trends and Impacts

Background and Objectives

Background
The dissemination and use of modern information and communication technologies (ICT) are considered to be preconditions today for dynamic economic growth and future viability in global competition. At the same time, the processes of change triggered, enabled and accelerated by ICT are enormous. The new technologies have an ever-expanding ripple effect on the economy, public administration, science, scholarship and private life. They exert influence on social and individual life. The development of mobile telephony and Internet technology during the past ten years exemplifies the transformative potential of ICT.

Digital information and services are going mobile and can be called up from any location. A trend toward pervasive computing is emerging - that is, the ubiquitous and invisible use, creation, processing, transmission and storage of information. The "computerisation of the world" is being accelerated by technological and economic developments. Everyday objects are becoming "smart objects", which are linked together into networks, react to their environment, and interact with their users.

The present study was prepared for, and in cooperation with, the German Federal Offce for Information Security (BSI) in an interdisciplinary collaborative arrangement between VDI/VDE Innovation und Technik GmbH, Fraunhofer Institute for Secure Information Technology und Sun Microsystems GmbH. The expert survey upon which this study is based was carried out in the summer of 2006.

Objectives
The study investigates the central trends in pervasive computing and considers them from technical, economic and social perspectives. It emphasises the level of analysis that is located between individual case studies and the global, comprehensive picture, and that can be mapped onto the application areas of pervasive computing. The study bundles the specialised knowledge of German and international experts who were asked for their assessment of pervasive computing in interviews and an online survey.

The study's findings underscore the fundamental potential of pervasive computing. They also show, however, that different application areas and sectors will profit from this potential at different speeds and with qualitative idiosyncrasies. In addition, the study makes clear that pervasive computing not only poses technical problems, it also comprises serious social, economic and judicial challenges that require active solutions and management.

This study is intended to provide a differentiated perspective on the opportunities presented by and impact of pervasive computing. It aims to provide decision-makers in politics and industry with a foundation for future action in a networked world. The study thus ends by identifying the fields of action in which pervasive computing will be shaped in the future. For those interested in pervasive computing, it seeks to demonstrate which uses for smart objects can be expected, and how they will influence our lives in the future.

https://www.bsi.bund.de/cae/servlet/contentblob/486908/publicationFile/30670/Percenta_elay_pdf.pdf

91. Links:

Policy issues for the future intelligent road transport infrastructure: http://www.foresight.gov.uk/Previous_Projects/Intelligent_Infrastructure_Systems/Reports_and_Publications/Intelligent_Infrastructure_Futures/Reviews/Policy_issues.pdf

http://www.sika-institute.se/Templates/Page____413.aspx
http://www.berr.gov.uk/dius/innovation/technologystrategyboard/page40224.html

Annex C (Environment)

1. CLuster Initiative for Flood and Fire emergencies (CLIFF)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

The main objective of CLIFF is to improve on -going disaster management (DM) applications as well as simplify the development of new systems by increasing and optimising the contribution of earth observation (EO) data. CLIFF will support this objective by paving the way towards the standardization of the various components making a typical EO enhanced emergency system. Standardization will help closing the gap between the different actors such as end-users (e.g. Civil Protection) and specialists (EO data providers, modellers) that could eventually share a common technical language. It will also stimulate the development of an operational European service market supported by the sharing of procedures, interfaces and resources (e.g. cross-projects telecommunication links).

The key output of CLIFF will be a set of documents providing the framework for the standardization of critical components for DM activities. Thus, the key downstream objectives of CLIFF are:

- standardized flood and fire information collection, integration, and exchange;
- the provision of new business models for environmental information services;
- improved decision support strategies, decision support tools and their integration into open networks;
- provide new concepts for and experiences.

Work description

CLIFF shall consist of a horizontal review and analysis studies of pre-selected past and on-going flood and fire projects. Starting with a characterization of end-users and a compilation of their requirements, a thorough analysis of key elements composing operational end-to-end chains will be performed. This will cover in particular application specific issues (e.g. data flow, models), meteo, and service aspects (e.g. telecommunications, user interfaces) For each of these topics, best-case practices will be identified as well as remaining weaknesses. Conclusions will be gathered in the form of recommendations and in particular recommendation for standardization. The experience acquired in the course of the CLIFF project will be shared in the form of report that will support risk management activities well beyond the scope of the base selected projects. It is also expected that the outcome of CLIFF will be extended by the creation of working groups that will materialise the standardization efforts. The recommendations should also pave the way to new projects that would reinforce particular domains such as, for example, the development of tools providing users with a uniform access to distributed satellite resources or the development at European scale of specific databases. In order to cover the many disciplines that will be addressed by CLIFF, the consortium includes top-level expertise in communications, end users services, meteo, hydraulic and fire models as well as EO data handling and processing. Additionally all involved companies have a practical knowledge in real application development being prime contractors or participating to several disaster management related projects that will serve as the basis for this horizontal study.

Milestones

The main output of CLIFF project will be reports covering the various components of the DM chain as derived from horizontal review and analysis studies of pre-selected projects and from workshop recommendations.

These documents will provide recommendations on the following:

- Simplifying access to EO data and address mission planning aspects; service interfacing with users;
- Technical, value-added, and model data exchange;

- Communications and service / system limitations.

Project details

Project Acronym: CLIFF
Project Reference: IST-1999-14104
Start Date: 2000-09-20
Duration: 22 months
Project Cost: 449320.00 euro
Contract Type: Preparatory, accompanying and support measures
End Date: 2002-07-19
Project Status: Completed
Project Funding: 449320.00 euro

Project Reference: IST-1999-14104E
Start Date: 2000-09-20
Duration: 18 months
Project Cost: 150651.00 euro
Contract Type: Preparatory, accompanying and support measures
End Date: 2002-03-19
Project Status: Completed
Project Funding: 150651.00 euro

http://tempest.ESRIN.ESA.IT/NCLIFF

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=1&CAT=PROJ&QUERY=011a9bd1f8e4:6a7d:42a8ac14&RCN=60855

http://cordis.europa.eu/fetch?CALLER=IST_UNIFIEDSRCH&ACTION=D&DOC=8&CAT=PROJ&QUERY=011ae342e581:c47f:1e3dbee6&RCN=60857

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2. Friendly Operational Risk Management through Interoperable Decision Aid Based on Local Environment (FORMIDABLE)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

FORMIDABLE's main objective is to propose a European Standard Methodology for Natural Hazards Management based on the consensus of major Mediterranean Civil Protections, and to develop an interoperable support system prototype which integrates the resulting guidelines. The project consortium includes partners from Mediterranean industries (developers, integrators, service company), research and educational institutes, and customer organisations in charge of operational emergency management in their respective countries. The resulting system will represent the standardised access to data and knowledge required to manage natural risks, with all means to access, maintain and exchange information for natural hazards, in particular those with a fast evolution time typical of the Mediterranean countries.

FORMIDABLE aims to address the general lack of co-ordination and poorly unified approach to emergency management scenarios, as highlighted in : a critical analysis of major problems and failures encountered by emergency management operations. Often actions have been planned and executed with a limited perspective on the true scale of events and the responsibilities involved. Although the repetition of an event can be regarded as a constant factor, damage extent and type of intervention required are variable. For this reason the Emergency Management methodology should will include flexibility and simplicity to ensure efficient intervention and immediate relief to affected citizens.

Milestones

Milestone 1: T0 + 8 months: Methodology Review;
Milestone 2: T0 + 10 months: System Design;
Milestone 3: T0 + 24 months: Prototype integration;
Milestone 4: T0 + 28 months: Field trials - Italy / Field trials - Spain;
Milestone 5: T0 + 30 months: End of Project

Result 1) Establishment of a European Standard Methodology for Emergency Management;

Result 2) Development of a system prototype able to make the resulting methodology operational, easily accessed and controlled.

Project details

Project Acronym: FORMIDABLE
Project Reference: IST-1999-11679
Start Date: 2000-01-01
Duration: 30 months
Project Cost: 3.42 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-06-30
Project Status: Completed
Project Funding: 2 million euro

http://www.formidable-project.org

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=3&CAT=PROJ&QUERY=011a9bd1f8e4:6a7d:42a8ac14&RCN=57856

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3. Forest fire risk and hazard assessment: a holistic approach (FORFAIT-A)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

FORFAIT sets out to develop and demonstrate a Decision Support System (DSS) to assist planners, regulators and industry in optimising the management of forest fire risks, on a holistic, integrated and traceable basis. It will aid in implementing measures that eliminate or mitigate harm to humans, the environment and business, using a cost benefit approach where appropriate and depending on local regulatory requirements.
FORFAIT will uniquely combine generic and time varying site-specific information (via electronic links from field and satellite data sources), state-of-the-art predictive models, and expert knowledge. Recognising that in general there are many different decisions that could be made in any given situation the system will use fuzzy logic to suggest the most appropriate course of action and a probabilistic framework to take account of uncertainty in the parameters.

Objectives

44. To contribute to the protection of national resources and improvements in health and safety as applicable to forest fires.

45. To integrate established and emerging technologies, including electronic data gathering, in order to design and build a Decision Support System for use as a tool in planning, educational, regulatory and business contexts.

Project details

Project Acronym: FORFAIT-A
Project Reference: IST-1999-10649
Start Date: 2000-01-01
Duration: 30 months
Project Cost: 2.28 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-06-30
Project Status: Completed
Project Funding: 1.29 million euro

http://www-cesia.iata.fi.cnr.it/forfait/index.htm

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=6&CAT=PROJ&QUERY=011a9c292bc0:f86b:7ffc151a&RCN=60805

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4. Geo-spatial warning systems Nisyros volcano (Greece). An emergency case study (GEOWARN)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

Large parts of Southern and Central Europe are situated in tectonically, seismic and volcanological extremely active zones. With the growth of population and tourism, vulnerability and risk towards natural hazards have expanded over large areas. Socio-economical aspects, land use, tourist and industrial planning as well as environmental protection increasingly require needs of natural hazard assessment. The availability of powerful and reliable satellite, geophysical and geochemical information and warning systems is therefore increasingly vital. Besides, once such systems have proven to be effective, they can be applied for similar purposes in other European areas and worldwide. Technologies today have proven that early warning of volcanic activity can be achieved by monitoring measurable changes in geophysical and geochemical parameters. Correlation between different monitored data sets, which would improve any prediction, is very scarce or missing. Visualisation of all spatial information and integration into an "intelligent cartographic concept" is of paramount interest in order to develop 2-, 3- and 4-dimensional models to approach the risk and emergency assessment as well as environmental and socio-economic planning.

Objectives

- 2+3D Topography & Bathymetry
- Elevation (DEM) & Landscape models (DLM)derived from conventional & satellite data
- Visualisation of different monitored data sets
- Correlation of all spatial information
- Intergration into "intelligent cartographic concept"

As result: Easy and user friendly interaction

- 2, 3, and 4D modelling of hazard (scenarios, zonation), vulnerability, risk and emergency assessment - The Early Warning System (EWS) in case of hydrothermal-explosive and volcanic reactivation.

Project details

Project Acronym: GEOWARN
Project Reference: IST-1999-12310
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 2.75 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 1.35 million euro

http://www.geowarn.org/

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=4&CAT=PROJ&QUERY=011a9bd1f8e4:6a7d:42a8ac14&RCN=60825

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5. Interactive Services and Management Support for Environment Impact Assessment and Permitting Procedures (INTERACT)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

Objectives

This project will to create an integrated and interactive system to support permit and Environmental Impact Assessment (EIA) procedures for environmental protection authorities and to provide direct interactive services to professional external users and the general public.

The system architecture consists of three parts: A Virtual Front Office, based on HTML, can be adapted easily to local needs; A Middle Ware Layer, based on Java and XML, and makes the Front Office interface with backends; The Backend, containing exchangeable modules, which often already exist in sites. GIS-or Alphanumeric Systems (Databanks) can be adapted using specific wrappers that serve the data via JDBC to the Front Office. INTERACT provides default backends, including an Internet capable GIS (WebMap) for storing and displaying geographic information and an Environmental Management System (UMsys) that provides the Front Office with alphanumeric data related to industrial plants and permitting procedures.

The data warehouse is compliant to the European Catalogue of Data Sources (CDS). The user-interface will be GIS-based and customizable by the user, with secure transaction and user identification facilities. The project participants will integrate these environment-related services into their authorities' general WWW-services.

Project details

Project Acronym: INTERACT
Project Reference: IST-1999-11372
Start Date: 2000-01-01
Duration: 27 months
Project Cost: 4 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-03-31
Project Status: Completed
Project Funding: 2 million euro

http://www.interact-project.org

http://cordis.europa.eu/data/PROJ_FP5/ACTIONeqDndSESSIONeq112422005919ndDOCeq1307ndTBLeqEN_PROJ.htm

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=5&CAT=PROJ&QUERY=011a9bd1f8e4:6a7d:42a8ac14&RCN=60811

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6. Marine Environmental Response Data Management and Acquisition using Internet data brokerage (MERMAID)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

Over the past decade numerous national, European and international programmes have focused on the generation of data on the natural environment. Very little of this large amount of data is actually utilised by the ultimate end user who provides services to the citizen e.g., in support of maritime emergencies (marine pollution, search and rescue). Through the development of an Internet-based Data Broker capable of cataloguing, storing/referencing and accessing of environmental datasets, the user will be able to search for, choose, purchase and download data subsets for their specific and immediate data requirements. The Data Broker technology will be designed as an "open to all" service for data providers and users.

Objectives

Development of a seamless, minimum intervention link (Data Broker) to allow end users working in the marine environmental emergency application domain to access and use large distributed datasets of environmental parameters.

Primary User/Data Provider Objective: Development of a major 'virtual shopping centre' for environmental data providers and users. This virtual shopping centre will provide near real-time user access to major international datasets with inherent support at user sites for sophisticated end user applications, and simple web browser-based data reader/viewer applications.

Key Technology Objectives: Development of web-enabled neutral formats for environmental data transmission and exchange based on existing standards and improved for temporal knowledge representation and management. This to be combined with the development of web-enabled methods (incorporating e-commerce) to search, extract, compress and transmit the variety of data types routinely encountered.

Work description

A system design and implementation approach has been developed to meet a number of key considerations:

- Seamless linkage between end users and distributed datasets;
- Open non-exclusive system for both end users and providers;
- User friendly interfaces to the data broker with ease of registration and access;
- Accommodation of different methods of end user access;

- Structured evaluation and reporting of Data Broker links and usage will be conducted at the three principle user sites (CEDRE, MCED and NC) as well as the principle data provider sites (MO and BMT).

The following prototype components will be developed:

- Data Management (including Metadata Database, Data Warehouse, and Data Packaging);
- E-Commerce Engine;
- Data Broker Interface;
- Web-based Data Broker Prototype;
- Operational Data Broker Applications.

Project details

Project Acronym: MERMAID
Project Reference: IST-1999-10637
Start Date: 2000-01-01
Duration: 31 months
Project Cost: 2.15 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-07-31
Project Status: Completed
Project Funding: 1.11 million euro

http://cordis.europa.eu/fetch?CALLER=IST_UNIFIEDSRCH&ACTION=D&DOC=3&CAT=PROJ&QUERY=011ada708b8a:8298:4843a434&RCN=60804

http://cordis.europa.eu/data/PROJ_FP5/ACTIONeqDndSESSIONeq112422005919ndDOCeq1444ndTBLeqEN_PROJ.htm

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7. Operational Solutions For The Management Of Inundation Risks In The Information Society (OSIRIS)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

Rationale, motivations and objectives

Recent catastrophic flood events in Southern and Central Europe (France, Italy, Spain and Poland, Czech's Republic, Germany) have demonstrated the need to change the traditional approach to information dissemination in the critical situations and in particular:

- To increase the awareness of the citizens concerning inundation risks and to increase citizen's involvment in the prevention and crisis management processes;
- To prepare citizens and crisis managers for efficient protection and rescue measures during inundation crisis periods;
- To improve the quality of information made accessible to all flood crisis stakeholders (crisis managers, rescue and civil protection organisations, citizens) before, during and after the crisis period using cutting-edge advances in ICT;
- To increase the rapidity and flexibility of access to information using emergent information transmission and distribution supports, and tprocessing information at all levels (central and local) in various locations.

Project details

Project Acronym: OSIRIS
Project Reference: IST-1999-11598
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 2.86 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 1.75 million euro

http://www.ist-osiris.org/

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=7&CAT=PROJ&QUERY=011a9bd1f8e4:6a7d:42a8ac14&RCN=60813

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8. RemOte sensing Anti-Pollution System for geographical Data Integration (RAPSODI)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

Oil-spills regularly pollute maritime waters and coasts of Western Europe year after year. The integration of data from aircraft and satellite sensors is an important aspect of any effort to abate such pollution damages. In addition strong co-operation between radar signal and image-processing researchers, radar designers and anti-pollution operators is targeted to build up additional know-how and to strengthen European understanding on image processing and interpretation for maritime oil-spills. In this framework, the RAPSODI project proposes to develop an airborne Synthetic Aperture Radar (SAR) remote sensing system, dedicated to oil-spill. This platform is based upon a technology developed as part of the AMED project.

The RAPSODI prototype will be developed in close co-operation between signal processing experts and pollution remediation experts. It will be tested in real-life conditions and, if event occurs, on real oil-spill emergency situation.

Objectives

- To develop necessary knowledge and sensor specifications, and processing algorithms in order to address maritime oil-spill pollution monitoring in an emergency situation as well as in routine surveillance mode;
- To propose a concept of an airborne system for maritime pollution surveillance missions to complement space borne imagery use;
- To design a dedicated system that effectively contributes, to the necessary efforts against maritime pollution by developing detection, estimation and tracking functions, and taking advantage of the diversity and specificity of remote sensors which operate in maritime pollution missions.
- This system will be developed and tested to support to operational clean-up actions, through sensor information integration, efficient man-machine interface and decision aids.

Work description:

- Characterisation of radar parameter for airborne SAR application;
- Access to raw data from the first experiment monitoring;
- Airborne SAR images will be geo-referenced and algorithms will be developed using image segmentation for detection of supervised oil spills;
- Decision and anti-pollution support will be implemented and first version of prototype is demonstrated;
- The prototype will be tested using data recorded in real-life conditions, and possibly from real pollution.

Project details

Project Acronym: RAPSODI
Project Reference: IST-1999-12290
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 1.5 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 845315.00 euro

http://humanitarian-security.jrc.it/oilspill/rapsodi.htm http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=12&CAT=PROJ&QUERY=011a9c292bc0:f86b:7ffc151a&RCN=60836

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9. ROBOtic delivery of SENSors in a seismic risk assessment framework (ROBOSENSE)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

It is necessary to improve methods for structural risk assessment. This will enable operators of large infrastructures to meet new standards for seismic risk assessment at a lower cost. The approach will be to develop a low-cost climbing robot capable of reaching remote parts of large structures; sensors for structural inspection and instrumentation; and mission management systems. The results will be evaluated via field tests. Their impact on structural risk assessment capabilities will be quantified and disseminated.

Objectives

The key objective is to remove the need for human climbers, who are scarce and expensive, and not well-suited for carrying out objective, repeatable inspection protocols.

The technical objectives are:

- to develop a low-cost climbing robot to convey sensors to remote parts of large structures;
- to develop robotic methods of attaching sensors to the structure;
- to develop advanced sensors for surface inspection using visual, acoustic, magnetic and radar sensing techniques;
- to develop a user interface supporting robot navigation, data acquisition and display, and analytical facilities;
- to capture best practice for objective and repeatable inspection before and after seismic shocks;
- to quantify and disseminate benefits for the ability of operators to meet structural assessment standards.

Work description

The main tasks will be to capture the current state of the art in structural assessment as a baseline:

- to capture user requirements and technological constraints, and derive a specification of the ROBOSENSE system;
- to develop the core technologies, including the robot vehicle, robotic instrumentation mechanism, sensor payloads, and mission management software;
- to integrate the technical components, and manufacture enough robots and sensors to enable end-user evaluation;
- to evaluate the technology via field tests, developing and capturing an objective, repeatable structural risk assessment protocol, and quantifying the resulting benefits;
- to disseminate the results of the project, especially its impact on best practices in structural risk assessment, and to prepare for exploitation.

Milestones:

- State of the art and requirements captured, system designed;
- Core robot, sensors and software technology developed;
- Evaluation systems manufactured and integrated, field tests planned and baseline information gathered;
- Evaluation completed, benefits measured against quantitative yard sticks;
- Final project results will be a robotic inspection system including vehicle, sensors and software; and an objective, repeatable robotic structural assessment protocol.

Project details

Project Acronym: ROBOSENSE
Project Reference: IST-1999-11976
Start Date: 2000-01-01
Duration: 37 months
Project Cost: 2.22 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-01-31
Project Status: Completed
Project Funding: 1.5 million euro

http://www.it-innovation.soton.ac.uk/

http://cordis.europa.eu/data/PROJ_FP5/ACTIONeqDndSESSIONeq112422005919ndDOCeq1984ndTBLeqEN_PROJ.htm

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=8&CAT=PROJ&QUERY=011a9bd1f8e4:6a7d:42a8ac14&RCN=60835

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10. A Robot For Volcano Exploration (ROBOVOLC)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Action Line: 1.1.2.-1.5.2 Environment risk and emergency management systems

The main objective of this project is the development and trial of an automatic robotic system to explore and perform measurements in a volcanic environment. A major aim of the proposed robot will be that of minimising the risk for volcanologists who are involved in work close to volcanic vents during eruptive phenomena. Observations and measurements of the variables relating to volcanic activity are of greatest interest during paroxismal phases of eruptions, which unfortunately are also the time of greatest risk for humans.

Technical objectives of the project

- The design, implementation and trial of a prototype robot suitable for autonomous and/or semi-autonomous exploration of natural and extremely rough unstructured environments.
- The design, implementation and trial of a small measurement system for lava and volcanic gas analysis and sample.

Key Issues

This robot can be considered as a new tool that will contribute directly to reducing the risk for people operating in proximity to active volcanic vents. Moreover this robot will have a relevant impact on the mitigation of the volcanic risk both in general since it will contribute to improving knowledge about volcanic phenomena and particularly because it will be integrated in the volcanic surveillance system to be used when the approach to active vents becomes too dangerous for human live but information is vital for a correct forecast of dangerous eruptions. For instance, during long-lived volcanic eruptions like large dome inflation the evaluation of the lava dome stability will significantly improve the forecasting of dome failures and pyroclastic-flow forming eruptions.

The robot activity will contribute to an integrated risk management system by means of the updating, using GIS, of areas potentially threatened by catastrophic eruptions with geographical information about the volcanic products dispersion and volcanic hazard assessments to obtain an almost real-time early warning and to inform Civil Protection authorities about dangerous volcanic eruptions approaching.

Expected achievements/impact

The project ROBOVOLC requires both robotic and volcanology expertise. The involved partners have a recognised expertise in Europe as regards Service robotics both for industrial and academic aspects. The two research institutes involved are among the most important research institutes on volcanology in Europe. The proposed project needs the complementary expertise that these partners together can offer and that cannot be found in a single country. The problem of volcano monitoring and forecasting is a large problem and is common to more than one European country which emphasises the need for pan-European co-operation in the RTD.

The social cost of an eruptions such as 1992-93 eruption at Mt. Etna (Italy) and the ongoing eruption at Monserrat Island (UK) actually is carried out by a single European country but in case of very large eruptions as that expected at Vesuvius, costs can cover a considerable portion of gross internal product of a single country, it will be shared among the whole European Communities. In this way the improving of volcano monitoring technologies and eruption forecasting capabilities should collect the contribution of complementary expertise existing in different organisations of the European Communities.

Arising from the RTD co-operation, further co-operation in exploiting the results of the project will be generated. Between the two industrial partners they have extensive European networks with other companies which will enable them to extend the European dimension beyond the project duration.

This project will enable us to improve knowledge of volcanic activities especially during dangerous active phases. In this way the safety of volcanologists employed in collecting such a kind of measurement will considerably improve.

Historically many scientists studying eruptions from unsafe places suffered serious injuries. In the last decade alone, due to both the unpredictable timing and to the magnitude of volcanic phenomena, several volcanologists have died surveying eruptions.

The improvement in the working conditions for volcanologists that are directly involved in the monitoring of dangerous eruptive activity will enhance the systematic study of these phenomena for which until now data are not yet available.

Another important aspect to be considered concerns the improvement in the anticipatory capability of the volcanic activity by way of continuous updating during eruptive phenomena also when they become very dangerous for volcanologists.

This could improve volcanic risk assessment contributing to an integrated risk management system for obtaining an almost real-time early warning, useful to Civil Protection authorities to inform and protect citizen from dangerous volcanic eruption consequences. This will lead to huge savings in potential losses caused by damage to buildings, land, equipment, livestock and injury to humans.

From this point of view the proposed project will contribute to achieve a very important social objective of the Community: the improving of the safety, and in general the quality of life, of the people living around active volcanoes located in the European countries.

Technical Approach

The main innovative aspect of this project is the possibility of taking measurements during volcanic eruptions and the development of a robotic system for the exploration of one of the most difficult environments on the surface of the Earth. Measurement activities and sampling near active eruptive vents are normally not possible because of the extremely dangerous operative conditions due to both the unpredictability of volcanic activity and the very harsh environmental conditions. Up to date only a few observations close to active vents have been reported. They are related to unusually safe conditions or unscrupulous persons that run strong risks and sometime suffer serious personal injuries. However, only gas and lava sampling close to eruptive vents has been reported, probably due to the difficulties to operate with complex instrumentation.

Close to active eruptive vents the measurement and sampling processes are fundamental in volcanology and progress has been mainly in three fields: magmatic gas geochemistry, physical modelling of magma degassing, and stability assessment of the craters and domes. Even if several volcanological and geophysical topics will benefit from these data, we highlight the main contribution of the robot-aided fieldwork to the above mentioned topics.

Magmatic gas geochemistry: due to the rapid mixing between the gas released by the magma and atmosphere it is quite difficult to make accurate measurements of the quantity of some gas species produced by volcanoes that are abundant also in the atmosphere. In particular the CO2 released during the eruption could contribute significantly to the global warming of the planet. Accurate measurement of this during the eruption of basaltic magma, in which it is more abundant, will help to better discriminate natural and human activity contributions of the CO2 increase in the atmosphere.

Physical modelling of magma degassing: dynamics of the gas bubbles that rise up in the magma and disrupt at the surface drives all eruptions. Its modelling depend on the geophysical data collected close to the disrupting surface where the bubbles burst. This process is very frequent in active craters of the basaltic volcanoes where explosive activity is produced. Unfortunately it observation and measurement is often prevented by the funnel shaped geometry of the volcanic vents, so a very close approach with specific instrumentation (stereo cameras, Doppler-radar, etc.) is necessary to collect these data.

Stability assessment of the craters and domes: active volcanic crater and dome structures are subject to a rapid growth during an eruption and often collapse under their own weight and due to endogenous forces. Dome collapses produce very dangerous pyroclastic flows and surges. Crater collapses block the erupting vent and can produce large explosions due to gas overpressures inside. The measurement of the instability of craters and domes will be very useful to forecast dangerous eruptive phenomena, however due to the unpredictability of these collapses fieldwork is not possible without a robot.

In known, published literature, there is only one example of a robot specifically developed for volcano exploration, Dante II. Dante II is a frame walking robot designed at CMU (Carnegie Mellon University) Field Robotics Center (FRC) for Volcano explorations. In particular it was tested on Mt. Spurr volcano (Alaska) in July 1994.

There are many other examples of robots that have been designed for planetary exploration and that have been tested on volcanic sites. In fact there are many similarities between volcanic terrain and many planetary sites. It is important to observe that not one of these robots has been totally developed in an EC country. As important examples that we can cite is the Marsokhod Planetary Rover (designed from the Russian Academy of Science's Institute for Space Research Institute (IKI)), Sojourner(JPL), Rocky7 (JPL).

Details concerning these and other innovative walking machines can be found in the Walking machine catalogue set up by Dr. Berns of FZI (Germany).

The lessons learnt from these previous machines and the advances made in robotic walking will be directly applied to the new ROBOVOLC machine to be developed. The major innovations will be in the mechanical structure and materials (lightweight, dust proof, heat and impact resistant), locomotion systems (intelligent control, robust traction for the harsh and unstructured environment), guidance (environmental mapping, intelligent path-planning, autonomous decision making) and sensors (integration of a variety of sensors for robust localisation and environment reconstruction, an effective user interface).

The development of the subsystems will follow a modular plan which is been promoted from the EC Thematic Network for this area of technology CLAWAR. The aim of developing such modularity in the robotics area is to promote rapid prototyping, reduction in development costs and widespread adoption of the solutions developed. The modularity that is being developed addresses several aspects ranging from mechanical, electrical, electronic, communications and functionality viewpoints. The concept of plug-and-play units that can "broadcast" their presence within a distributed computing hierarchy is likely to be employed, so that operational strategies can be modified to maintain optimal performance. This is the basis for the development of the modules that the CLAWAR project is promoting. For example the walking strategy of a six legged machine may need to be modified if one of the legs fails (which is likely in the hostile environment being addressed) and the failure is broadcast to the rest of the system for remedial actions to be initiated. The aim of developing a modular approach is so that a set of "lego type blocks" can be constructed and put together to meet a range of specific requirements for a range of applications. In this way the ROBOVOLC machine developed as part of this project could have several spin off uses where the modules can be used in other applications. For example the modules could be utilised in other machines developed for unstructured environments (earthquakes, demining, fire-fighting, and other dangerous or inaccessible situations).

In this project it is not the intention to develop new standards, but to utilise the new methods of modularity that have been promoted in this area by others. In particular the data collected by the measurement system will utilise the format adopted by European volcanologists (EMEWS project, ENV4980728 : IPGP (Partner 3) is co-ordinator for this project and Partner 2 is also involved) so that there is easy transfer of information between the different systems being developed for use in predicting and observing volcanic activity.

Furthermore, the integration of the modular subsystems developed on the project will in itself represent a major advance in the state of the art in this research area.

In particular the mechanical structure and the materials to be adopted should ensure that the robot is resistant to rainfall that contains erupted fine particulates. It will also need to be fast and agile so that the problems encountered with the Dante II do not arise. The locomotion system adopted should allow the robot to move easily over volcanic terrain. Since the volcanic environment is very harsh, innovative solutions are to be explored across the range of wheeled, legged, climbing, tracked, or hybrid robotic typologies.

The measurement system should permit an accurate reconstruction of the surrounding environment both for autonomous or tele-operated operations. New navigation and path planning algorithms will be developed to investigate the capability of performing a given task autonomously.

A suitable user interface comprising a reconstruction of the environment will be designed to allow a non-expert operator to manoeuvre the robot or the measurement system to program such functions.

A real-time webcam filming the inside of a volcano will be posted on the web during the testing of the Robovolc machine. Several surveillance cameras actually operate on volcanoes to film their eruptive activity. Some of these are posted on the World Wide Web. In particular the International Institute of Volcanology (Partner 2 CNR-IIV) has set up three volcano cameras in 1993 and have posted volcano images in real-time on the web since 1995. This new webcam filming the inside of a volcano will represent a major scoop because such activities have never been shown displaying such strong and unusual conditions and it will be useful to demonstrate the feasibility of the Robovolc project to people all around the world.

The integration of all these subsystems in the trials of the robot will be performed directly on active European volcanoes. To date, a robot for volcano exploration and measurement has never been implemented in an EC country.

Project details

Project Acronym: ROBOVOLC
Project Reference: IST-1999-10762
Start Date: 2000-03-01
Duration: 36 months
Project Cost: 2.43 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-02-28
Project Status: Completed
Project Funding: 1.7 million euro

http://www.robovolc.dees.unict.it/

http://cordis.europa.eu/fetch?CALLER=PROJ_IST&ACTION=D&DOC=9&CAT=PROJ&QUERY=011a9bd1f8e4:6a7d:42a8ac14&RCN=60806

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11. Advance Distributed Architecture for telemonitoring services (ADA)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

The parts of the Environmental Monitoring systems related to sensing and data collection are becoming the most critical aspect for the capital and operational costs of users together with the reliability of the resulting system. The project wants to tackle these aspects defining a general purpose architecture of Transmission Data Services embedded in the Telecommunication Networks services which exploits the most efficient available telecommunication services combined with the most promising basic innovations in the areas of Intelligent sensors and Intelligent terminals. With this system architecture the project will strongly contribute to paving in an innovative way the implementation of DSNs (Distributed Sensor Networks) in a tremendously different order of magnitude.

Objectives:

- ADA/s objective is to develop and validate an affordable and innovative network architecture, embedded in the actual communication infrastructure, to be tested through the implementation of a Distributed Sensor Network composed of fixed and wireless terminals, that are made of innovative low cost, low consumption and small size sensors, for indoor and outdoor environmental applications;
- To design and deploy an easy scalable and modular architecture that will enable interoperability among all subsystems (sensor & terminals, services and clients) enabling to set up custom-made solutions whether at the service or at the client side due to the innovative network and telecommunication features (dynamic access to the information, remote configuration of terminals and multimodal communication and billing);
- To prove the ADA network features and its further exploitation possibilities through extensive partial testing of subsystems, computer simulations and whole system field trials;
- To carry out operational validation (for outdoor application only) through the physical deployment in parallel to existing network of monitoring sites in one main European city (Spain);
- To liase with other information systems for a dynamic evaluation of position and instantaneous measurement of pollutant concentrations;
- Hence, allowing for the dynamic assessment of human exposure outdoors. ADA initially aims at supporting pollution abatement and also at exploring the exploitation possibilities of applications of a wider scope such as personal exposure or emergency and traffic management.

Work description:

ADA will be developed through 9 Work Packages:

- WP1- Business model and architecture components definition: develops business models for the ADA architecture offering all the contemplated services. Sets all system/subsystems specifications at sensor, terminal and services level for overall compliance. It determines the required SW and HW components;
- WP2- Implementation, test and validation plan: defines a test and validation plan for laboratory activities, computer simulations and whole system small scale field trials of the envisaged applications (air quality management and gas leak detection as well as portable sensors for personal exposure measurements);
- WP3- System development: Based on WP1 develops all the different subsystems: A one packaging solution at the sensor level; A sensor terminal supporting most relevant communication possibilities (wireless GPRS, GSM and blue tooth, fixed ISDN lines). A Sensing System Provider and an Application Service Provider providing all the services contemplated in the ADA network, (dynamic configuration, dynamic network access, plug and play terminals, localisation and synchronisation, data search, transaction manager and terminal life cycle management);
- WP 4- Integration, tuning, lab test and deployment: integrates all subsystems developed at WP3, carries out the partial testing and tuning of the sensors, the terminals and the ADA services. It deploys the whole system solution for the field trials;
- WP 5- Field trials: of the considered applications (air quality monitoring in indoor and outdoor environments) verifying functionality, installation, long-term assessment and comparison with existing air quality networks;
- WP6- Evaluation: Based on on-going results from WP4 and WP5 the evaluation stage assesses in various aspects the ADA network, including all technical achievements, system effectiveness, service provisioning, the cost benefit analysis and the expected contribution to standardisation in terms of subsystem requirements for interoperability;
- WP7- Dissemination: ensures the spread out of the ADA project progress and results at national and EU level among potential users and actors that may take advantage of the ADA network;
- WP8- Project management defines the overall organisation, ensures coordination of work packages and different partners and quality assurance procedures for a successful achievement of all project objectives;
- WP9-Exploitation: will develop the business plans for specific exploitation of all research and industrial partners.

Milestones:

46. Functional specifications and System Architecture;
47. (ML1) To prove the feasibility of sensors, applications and network integration;
48. System developed and integrated, prototypes;
49. (ML2) Demonstration of system operation in laboratory and real conditions;
50. Inter comparison of applications with fixed network of outdoor monitoring stations Through this project, a highly innovative general purpose architecture that is modular, easy scalable and interoperable will be developed, tested and validated in real conditions for indoor and outdoor air quality applications and its exploitation opportunities exanimate for other tele-monitoring services.

Project details

Project Acronym: ADA
Project Reference: IST-2000-28452
Start Date: 2001-08-01
Duration: 30 months
Project Cost: 4.19 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-01-31
Project Status: Completed
Project Funding: 2 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=46&CAT=PROJ&QUERY=011e88d77f68:7dee:1580f4b7&RCN=57785

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12. Air Pollution Network for Early warning and on-line information exchange in Europe (APNEE)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

http://www.faw.uni-ulm.de/apnee

APNEE's objective is to establish services for human centred management of cities by building a geographic information portal for urban air quality. APNEE will serve citizens as well as professionals, European Authorities (Local and Regional) and relevant European institutes. This portal will provide online visualisation means about real-time air pollution, and special features like discussion boards, online newsletters and early warning systems. Dissemination of information will be based on highly sophisticated technology standards like WAP, GSM, SMS, WEB and GIS. The Project will serve requirements specified in EU-directives relating to citizen information on health threatening air pollutants. APNEE provides an interface to air pollution management systems and facilitates dissemination of appropriate information to affected groups of citizens. The prime focus is on air pollution management, rather than air pollution measurement, forecasting or alert systems. Once APNEE is in place, there will be a dedicated information service to inform citizens on the potential impacts of their behaviour. Rather than broadcasting alarms on air quality (through news media), APNEE aims to increase citizen's ongoing knowledge of air quality and how their behaviour can influence it.

Objectives:

The APNEE project aims to increase the knowledge of citizens on air quality and develop the exchange of information both on a local level in European cities and at normal & regional levels among European institutions. Dissemination of quality information will take place by implementing new communication lines such as mobile telephone functionality, multimedia, electronic panels and the Internet. The APNEE project will integrate new information technologies as additional management modules in existing Air Quality Management Systems in European cities.

Prime objectives are to:

- implement an interface to available information on air pollution and design a harmonised classification methodology;
- implement user-friendly information services for citizens, public and private organisations, and business communities;
- develop the exchange of information among professionals, local and regional authorities across Europe, and relevant European institutions;
- introduce and facilitate forecasting of pollution and data modelling. APNEE services aim to become the reference portal for topical and real time environmental air quality information.

Milestones:

- User requirements (UR) inventory concerning air pollution warning and information;
- Generalised UR methodology analysis for use in all interested EU countries;
- Exhaustive "shopping" basket for APNEE related technologies
- Detailed market analysis for horizontal and vertical markets;
- Detailed technical and functional specifications for online air pollution and warning systems;
- General approach for building intuitive interfaces on large amounts of data;
- Operational air pollution warning and information system;
- Detailed evaluation report;
- Overall dissemination and use plan.

Project details

Project Acronym: APNEE
Project Reference: IST-1999-11517
Start Date: 2000-01-01
Duration: 24 months
Project Cost: 4.82 million euro
Contract Type: Cost-sharing contracts
End Date: 2001-12-31
Project Status: Completed
Project Funding: 2.7 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e88e25a68:e5a8:03dcb54a&RCN=57858

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13. APNEE Take Up - trials (APNEE-TU)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2001-1.4.1 Best practice and trials in Environment Management

http://www.apnee.org

Project APNEE contributes to the European research on systems and services for the citizens by enabling citizens to access and exchange information on air pollution in urban regions via different information channels. This proposal describes the planned APNEE project take-up trial, called APNEE-TU, which is intended to adapt and test the APNEE systems to and at additional user sites in Europe, the adaptation and trial of new technologies (like handheld, PDAs as well as new mobile protocols like GPRS and UMTS) for the dissemination of air pollution information, thus innovating APNEE with novel technologies and novel applications of technology. In addition, the results of this proposed project will lead to a valuable extension of the overall business model and exploitation plan of the APNEE services in collecting and evaluating experiences and results of the trial.

Objectives:

The overall objectives of the hereby proposed trial project APNEE-TU are the adaptation of the APNEE Web GIS and regional servers to new user sites, web integration with user site specific systems, installation of mobile service in user countries, adaptation to / improvement by new mobile technologies and interfaces, improvement by new content through new air quality indexes and modelling & integration with weather information, UV-index, customisation by integrating APNEE-solutions in national information, dissemination strategies for national authorities, improvement of technological platform and state of the art solutions by adapting to GPRS/UMTS and mobile positioning systems, extension and optimisation of the APNEE business model and exploitation by the results of the trial.

Work description:

The overall work in APNEE-TU will comprise: WP 1 will analyse the new and modified user requirements at the new application sites. A checklist will be elaborated based on the UR to be used for the trials at validation stage. Afterwards in WP 2 "Adaptation of APNEE", the components and services of APNEE will be adapted. This includes the adaptation of technology, functions and user interfaces. Furthermore, new types of content will be integrated. There will be an installation phase (WP3) before each of the trials. It comprises the installation of the software, the population of the database and - if applicable - the integration with weather forecast. There will be two field trials involving citizens (WP4) at each participating user site and other organisations with interest in APNEE during high season of air quality problems. In WP5 "Measurement and evaluation of results" each application site and commercial partner will compile measurement criteria. For the field trials, a policy and a protocol will be prepared and established. Commercial partners and national authorities will define the criteria of success. Overall goal of this work package is the evaluation of the trial. The exploitation of the project results (WP6) includes efforts to integrate APNEE solutions in national information dissemination strategies while the research partners will exploit the results in other projects. In addition, the commercial partners will develop business models and estimate the market impact and legal implications to initiate the commercialisation of APNEE. Many activities contribute to the dissemination of the results of APNEE-TU (WP7), such as publishing, marketing, conferences and the like. This strategy will be co-ordinated with the dissemination plan that will be created early in the project and documented in the dissemination results deliverable.

Milestones:

- M0 Successful and quality assured project management;
- M1 User requirements specification;
- M2.1 & 2.2. Prototypes available for field trials;
- M3 Installed and operational final APNEE-TU service;
- M4.1 & 4.2 Field trials results;
- M5.1 & 5.2 & 5.3 Measurement and evaluation of results;
- M6 APNEE-TU exploitation activities and plan;
- M7 APNEE-TU dissemination activities.

Project details

Project Acronym: APNEE-TU
Project Reference: IST-2001-34154
Start Date: 2002-04-01
Duration: 24 months
Project Cost: 2.31 million euro
Contract Type: Preparatory, accompanying and support measures
End Date: 2004-03-31
Project Status: Completed
Project Funding: 1.4 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=2&CAT=PROJ&QUERY=011e88e25a68:e5a8:03dcb54a&RCN=63593

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14. Computerised video camera image analysis for monitoring pollution in *water* (*BLUE WATER*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

Standard checking for water pollution is done by spot-sampling and chemical analysis. This method is expensive, slow, localised and occasional. It is not known how long pollution has been present, or what its future dispersal pattern may be. This project develops a fast, continuous, reliable, informative and cheap system for monitoring water quality, which is of great interest to authorities responsible for pollution control at sea, beaches and waterways. Such agencies also have an interest in reaching the public with such information. The project will provide a solution that uses a remote camera to sense water-borne pollutants by computerised image analysis. Pollutants in water have a damping effect on the water surface, which can be recovered by wavescape interrogation. A network of internet-linked, pole-mounted cameras will provide constant monitoring of pollution. The installations provide a high-profile promotion platform by means of ruggedised video terminals for publicity and to disseminate information to the public

Objectives:

BLUE WATER will, using video cameras and image analysis, develop a system for constant monitoring/early warning of pollution in water. Anthropogenic/biogenic slicks (from hydrocarbons, fish oil, algal bloom, bacteria etc.) leave surface signatures by damping wave motions, which the system will detect in concentrations of 1 to 8 mg/m2. Suspended solids damp waves will be detectable at 100 mg/litre. The major random cause of high pesticide and heavy metal levels (5 to 7 orders of magnitude) is from accumulation by biogenic slicks, detectable as above. Pollutant presence will be detected by comparing wavescape with normal water surface for similar conditions (wind, rain, tide, depth etc.). Experimental data gathered in tanks and open sea will be used to build image analysis algorithms. The project will develop a sophisticated HCI (Human-Computing-Interface) with prediction and analysis functionality. Dissemination will be achieved by installing ruggedised display terminals, on which web pages / video can be viewed by the public.

Milestones:

- MS1 end month 7. Video data for image processing, Software specs. End user prep, and requirements, Market Intelligence.
- MS2 end month 16. Test sites hardware installed. All modules prototyped & Integrated in test sites. Basic detection running. First exploitation report. Consortium Agreement.
- MS3 end month 24. Software completed, tuned and tested. Full detection ability realised.

- MS4 at project end. System, exploitation plan, documentation, product definition ready for roll-out planning.

Project details

Project Acronym: BLUE WATER
Project Reference: IST-1999-10388
Start Date: 2000-03-01
Duration: 30 months
Project Cost: 2.86 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-08-31
Project Status: Completed
Project Funding: 1.8 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e88ea8db2:f89e:5d8e7425&RCN=57774

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15. Humanitarian Demining in Water (HDW) (*BULRUSH*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.2 Data Fusion and Smart Sensor Technologies for Humanitarian Demining

There are around 70 million landmines deployed worldwide, with probably 15% laid in shallow inland water areas. Currently, there is no effective method for detecting and identifying these underwater mines. The BULRUSH consortium have a MOU with the Croatian Mine Action Centre (CROMAC) to validate a vehicle-based sensor system for humanitarian demining in water, using the unique DRUMS(tm) sonar and the Double Eagle ROV. The system will be certified to the UN 99.6% QA standard with CROMAC. TMS leads the system design and integration. The Guigne International (GIL) DRUMS(tm) high-resolution parametric sonar detects and identifies underwater buried objects. BOFORS supplies ROV technology. The sensor, vehicle and integration skills of the partners combine to develop and provide a safe, rapid and cost-effective solution to humanitarian demining in water.

Objectives:

To validate a vehicle-based sensor system for humanitarian demining in water that has the potential to offer a quantum increase in capability and productivity, Thomson Marconi Sonar SAS will design a prototype demining system exploiting Guigne, modular mine-detection and identification sonar components with TMS SAS operational software and an operationally-qualified remotely operated vehicle (ROV) from BOFORS, presently used in a marine mine-hunting role. The objective is for the ROV to carry the DRUMS (TM) sonar into a shallow water test site in which 1,000 deactivated landmines have been positioned. The prototype system will be tested to pass the UN standard for humanitarian demining by detecting at least 996 of these mines. The ultimate goal is for rapid detection and identification of all 1,000 mines.

Work description:

The approach to this project is to use the maximum number of off-the-shelf components, both hardware and software, to meet the program goals. This still leaves significant research and development components to the program, it is by no means a strictly "plug the blocks together" approach. The availability of these components reduces the technical risk factors. A three phase approach will provide clear visibility into the project, allow the continuous build-up of a database of targets and allow the progressive development, integration and testing of software and hardware modules. The first phase will build a field prototype of the sensor array to be installed on the vehicle.

This will provide early confirmation of the applicability of the sensor array, as well as allow it to be used for database development and sensor, algorithm and signal processing testing and troubleshooting in phase 2.

- Requirements and functional specification
- Rapid fabrication of Field Data Unit, a smaller prototype matrix sonar;
- Field deployment for data collection and creation of a buried landmine database
- Development and refinement of existing sonar target classification methodology and supporting software.

Phase 2 will see the integration of the sensor package into the vehicle as well as the development of the operator interface.

- Continuation of data collection and target classification methodology and supporting software;
- Fabrication of the full-scale prototype matrix sonar;
- Integration of the positioning system
- Refinement of existing and proven ROV-control software;
- Integration of the sonar with the ROV and final testing ;- Deployment of prototype to the test site

Phase 3 will involve the system level evaluation with reference to a further certification in Croatia.

- Completion of data collection and target classification methodology and supporting software
- Creation of a mine detection test site
- Test trials of the prototype at the test site.

Milestones:

51. Month 5: mockup of the final system with ability to collect data on mines, documentation and test resuls.
52. Month 13: data base on mines, final system integrated, documentation and test results.
53. End: result of the evaluation in the minefield test zone in Croatia, exploitation plan, final report.

Project details

Project Acronym: BULRUSH
Project Reference: IST-2000-26419
Start Date: 2001-01-01
Duration: 14 months
Project Cost: 4.58 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-02-28
Project Status: Completed
Project Funding: 1.26 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e88ed8382:5c70:43fe5c4f&RCN=54369

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16. Concept for Low-risk Efficient Area Reduction based on the Fusion of Advanced Sensor Technologies (*CLEARFAST*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.2 Data Fusion and Smart Sensor Technologies for Humanitarian Demining

The ClearFast aims at improving the efficiency and safety of humanitarian demining operation by

54. reducing the false alarm rate,
55. increasing the clearance rate,
56. increasing the rate of survey.

CLEARFAST proposes 3 main innovations:

57. A new step concept for minefield survey;
58. for the 1st step, implementation of a novel Analysis of image sequence under changing natural illumination using a Multi-temporal & Multi-spectral IR(MSIR)sensor optimised for background rejection;
59. for the 2nd step, a Motion-driven data fusion using Ground Penetrating Radar, electromagnetic Metal Detector with sensitivity adaptation and MSIR reducing the well-known weaknesses of IR imaging.

CLEARFAST proposes a system qualification both in a controlled environment and in realistic conditions. Although Level 2 survey is the main application area, CLEARFAST may be used for Level 3 of quality assurance.

Objectives:

The ClearFast objective is to improve the efficiency and safety of demining operation by:

60. reducing the false alarm rate,
61. increasing the clearance rate by proving more accurate survey data,
62. increasing the rate of survey.

To achieve this objective, ClearFast aims at developing a robust mine detection system, relying on fusion of multiple sensor data - GPR, IR, MD. The system performance, however, ultimately depends on the performance of the individual sensors. Hence ClearFast will reduce the well-known weaknesses of IR imaging by implementing a novel multi-temporal/multi-spectral IR system. The MD array will be adapted in sensitivity to achieve improved detection and imaging capabilities. Besides the technological innovations, ClearFast proposes a novel concept for Level 2 surveys, and validation in a controlled environment and in realistic conditions.

Work description:

ClearFast develops a transportable mast-mounted MSIR sensor and a multisensor platform mounted on a vehicle. Both systems are based on the requirements of a two-phase Level 2 survey model. The post-project exploitation, aiming at covering the full range of activities required in mine clearance, also envisages airborne (Level 2) and hand-held systems. ClearFast includes several phases, each of them ended by a formal review.

Phase 1 defines the system according to the ClearFast concept, the end-user requirements and the technology constraints.

Phase 2 is planned for signal processing enhancement of individual sensors and adjustment to the system interface requirements. It includes data fusion for the multi-temporal MSIR sensor.

Phase 3 concerns multi-sensor data fusion. Two developments are carried out in parallel for risk mitigation. The first design involves the adaptation to APL detection of an existing probabilistic algorithm for target detection based on a learning process of the local environment. The second design is based on algorithms for deterministic shape/attribute verification.

Phase 4 is the integration of the system components in the Level 2A survey platform and the multi-sensor platform.

Phase 5 is dedicated to tests and performance evaluation in realistic conditions. This phase is driven by a commercial demining end-user, to demonstrate that:

63. Level 2A surveys increase efficiency, speed and safety of subsequent Level 2B minefield delineation and area reduction, and
64. the Level 2B multi-sensor suite and associated data fusion allows for reducing the false alarm rate.

Special attention is given to the selection of a representative set of objects, normally triggering false alarms in the target area within the Balkan. For efficiency evaluation, the main parameters are number of undetected mines, number of false alarms, potential improvement that can be obtained between prototype and industrial system, operational cost, speed and safety.

Milestones:

- T0 + 6 months: System design, Components requirements & Interface Specifications
- T0 + 18 months: End of sensors enhancement
- T0 + 20 months: Demonstration of data fusion algorithms
- T0 + 23 months: Start of use of level 2A survey in a real demining operation
- T0 + 26 months: Start of field trials for data fusion
- T0 + 30 months: End of field trial evaluation and dissemination of the results

Project details

Project Acronym: CLEARFAST
Project Reference: IST-2000-25173
Start Date: 2001-03-01
Duration: 30 months
Project Cost: 4.4 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-08-31
Project Status: Completed
Project Funding: 2.2 million euro

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17. The Virtual European Coastal and Marine Data Warehouse -*CoastBase*- An open system architecture for integrated, distributed coastal and marine information search and access (*COASTBASE*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

Coastal areas are important for a wide variety of human and natural uses. Authorities need sound information concerning these uses and the interactions between actors developing and implementing policy for integrated coastal zone management. At different policy levels within Europe, the need for tailor-made information, which is essential for sustainable marine and coastal management, has been recognised. The search and access to aggregated and interpreted information is essential, but is costly and time consuming. Mechanisms for accessing information on the European coastal zone are lacking, notably in the area of maintenance of metadata/data links to search and access data, as well as tools for filling information gaps within organisations and for facilitating information sharing. Coastbase will develop an automatically updated electronic system architecture providing multilingual search and access facilities to distributed information sources and a European coastal database "CoastBase", holding European level products as indicators, maps and reports. Different innovative technical modules will be built to convert the content, check on quality, secure user access and aggregate the information. An essential aspect of Coastbase is the design and implementation of a Communication and Feedback mechanism among European authorities. This will automatically provide information sources with details of resulting products coming from their information and allow them to comment on the data handling, enhancing the European involvement of authorities at local up to European level.

Objectives:

To develop a Virtual European Coastal and Marine Data Warehouse, using innovative techniques to improve marine and coastal environmental assessments and policy making, as well as to ensure effective, continuing pan-European co-operation on information flow.

Specific objectives include:

- Improve information search and exchange capabilities at different aggregation levels by development of one virtual interface (CoastBase) connecting different information sources.
- Establish communication and feedback mechanisms to enhance capacity of local and regional authorities to learn from how other bodies use and apply their data.
- Provide authorities, research institutes, universities, private sector and public with easy internet access to CoastBase.
- Achieve broad acceptance and Europe-wide participation through user friendliness and a multilingual architecture.
- Achieve accessibility that permits interconnectivity of meta-databases and ability to query meta- and real data, while maintaining access control with the information sources.

Work description:

The work involves development of technological architecture, establishment of communication and feedback mechanisms, development of user interfaces for those using and providing aggregated information on the CoastBase Server.

Main elements are information search and access, aggregation and interpretation at European Level. The technical architecture development draws on recent technological developments. Development of a broad supported architecture, involving organisations at all European levels. Realising innovative architecture that provides search facilities (multilingual catalogue, index and geographical) and access to the CoastBase-server and connected information sources. A generic system will be developed to connect and automatically update local metadata and CoastBase metadata into one CDS (Catalogue of Data Sources)-based virtual frame. This allows dynamic querying of real information. Separate modules will be developed that provides automatic feedback of the information source, permitting information custodians to check and recommend improvements to information handling. Through 8 workpackages over a 2-year period, the Consortium will scope Coastbase information needs and functionality; prepare and implement a system design; test and improve the system in co-operation with the end-users; make the system publicly available. CoastBase consists of a working conceptual system architecture linking representative information sources. Europe-wide collaboration is fundamental, information is to be accessed at local, regional and national organisations. The CoastBase-server provides the virtual "door" to information sources through interfaces for querying and displaying results. Information will be accessed either by:

65. Dispersed information sources via metadata and data links;
66. European level aggregated Marine and Coastal in formation from the CoastBase-server itself via an internet accessible Database.

Milestones:

- A virtual, multilingual, multi-platform, internet-accessible architecture for searching and querying distributed coastal and marine information sources, supporting aggregation, quality control, security, access authorisation and conversions systems.
-
- CoastBase-server holding aggregated European level information.
-
- A virtual unified CoastBase search system for dispersed sources and CoastBase-server.
-
- A feedback module for information custodians to check and comment on information handling of information from local up to European level. CostBase provides a system and related working structure enhancing on several levels European coastal management and information sharing.

Project details

Project Acronym: COASTBASE
Project Reference: IST-1999-11406
Start Date: 2000-01-01
Duration: 24 months
Project Cost: 2.2 million euro

Contract Type: Cost-sharing contracts
End Date: 2001-12-31
Project Status: Completed
Project Funding: 1.1 million euro

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18. Enhancement of three existing technologies and data fusion algorithms for the test and Demonstration of Multi-sensor landmine detection techniques (DEMAND)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.2 Data Fusion and Smart Sensor Technologies for Humanitarian Demining

DEMAND is an answer to the most pressing requirements in the South Eastern Stability Pact Region caused through the threat of Anti-Personnel-Landmines (APL). DEMAND will improve state of the art technology to achieve better accuracy than traditional APL detection techniques currently used in the field for close in detection (i.e. metal detector and prodder) while considerably speed and decreasing false alarms. We will build a prototype composed of a simple trolley like platform with three advanced and enhanced state-of-the-art sensors, i.e. metal detector (MD), ground penetrating radar (GPR) and a biological vapour sensor (Biosensor) whose measurement results will be strengthened through beyond-state-of-the-art Data Fusion. The prototype performance will be evaluated in extended field tests in Kosovo. The 5 industrial partners in the project intend to develop a fully engineered detector within 1-1.5 years after the end of the project and to commercialise the product through a joint venture.

Objectives:

The main objective of the DEMAND project is to help provide an answer to the most pressing requirements in the South Eastern Stability Pact region caused by the threat of Anti-Personnel Landmines (APL). DEMAND will show that an improvement in state of the art technology can achieve better accuracy than APL detection techniques currently used in the field for close in detection (i.e. metal detector and prodder) while considerably increasing speed and decreasing false alarms. We will build a prototype system composed of a simple trolley like platform with three enhanced-beyond-state-of-the-art sensors, i.e. Metal detector, Ground Penetrating Radar and a biological vapour sensor (Biosensor), whose measurement results will be strengthened through beyond-state-of-the-art Data Fusion. The system performances will be evaluated in extended fields tests in Kosovo. The 5 industrial partners in the project intend to develop a fully engineered detector within 1-1.5 years after the end of the project and to commercialise it through a joint venture.

Work description:

The main work in the project will be the building and integration of the four main components of the system (MD array, GPR array, Biosensor and Data Fusion) for operation. All of these components come from previous technological developments and, in a number of cases, precisely from Humanitarian Demining. The GPR array and the Data Fusion are based on the feasibility study of the EUREKA! ANGEL project; the GPR core technology will be an improvement from the RTD DEMINE project for Humanitarian Demining funded under the EC 4th Framework Programme; and the MD is an enhancement of a commercially available and tested demining sensor. The work-plan reflects both the main goal of fielding a prototype to assess its performance and the idea of refining existing technologies purposely developed for Humanitarian Demining. In this sense the phase devoted to technical conception and specification of the system will be limited in time (6 months) as well as the development and construction phase (1 year). On the other hand, the phases concerning integration-test-refiniment-final test and assessment will take more than half of the duration of the project (1.5 years). The limiting of the mechanical integration of the system to a minimum is a crucial factor to keep the resources for the project focused on the key technological issues to reach the above mentioned objectives. The main tasks of integration will be those connected to Data Fusion and developing of the survey strategy and performance evaluation parameters. The 5 industrial partners in the project are committed to the successful commercial exploitation of the project results in demining and in other industrial applications. During the project an exploitation plan will be developed by the partners based on a business plan for a joint venture, marketing and distribution of the DEMAND product.

Milestones:

6 MILESTONES:

- M1: Completion of the Biosensor Viability Report
- M2: Completion of the technical conception and specification of the system
- M3: Completion of the development of the three sensor, i.e. Metal detector, Ground Penetrating Radar and the Biosensor
- M4: Successful operational integration of the demonstrator and the results of the laboratory testing
- M5: Completion of the DEMAND detector performance evaluation at JRC and in Field tests in Kosovo
- M6: Completion of the project and initiation of the DEMAND product's business plan for successful commercial exploitation.

Project details

Project Acronym: DEMAND
Project Reference: IST-2000-25351
Start Date: 2001-02-01
Duration: 30 months
Project Cost: 3.7 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-07-31
Project Status: Completed
Project Funding: 2 million euro

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19. Detection and Imaging of Antipersonnel Landmine by Neutron Backscattering (DIAMINE)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.2 Data Fusion and Smart Sensor Technologies for Humanitarian Demining

The project proposes to build and in-field test a novel smart system for totally plastic Antipersonnel Landmime detection based on the neutron backscattering technique. The system will have minimum hazard, very simple human interface, and capability of imaging APM. The integration of this system with a modified Metal Detector will be studied, and a final prototype with the two sensor heads will be prepared and tested.

Objectives:

The objective of DIAMINE is to develop a prototype of hand-held landmine detector using the neutron back-scattering technique. A low-activity source (252Cf, about 105 fast neutron/second) will irradiate the soil. The yield of low-energy back-scattered neutrons depends on the quantity of hydrogen in the irradiated volume. The presence of land-mine causes a localised strong increase of the yield. The comparison of the instantaneous count-rate with other parameters acquired on-line (source- soil distance and previous yield values due only to soil moisture) will be used to automatically detect the presence of a localised anomaly, giving a simple message to the operator. In some conditions, the hits distribution of the detector will provide an "image" of the hidden object to lower the false alarm rate. Validation tests in laboratory and in-field are planned. The coupling with a Metal Detector will be studied. The use of such detector in vehicle mounted system will be also explored.

Work description:

The DIAMINE project is supposed to run without gaps, in a unique phase, in recognition of the urgent need to make new tools available to Humanitarian De-mining operators. Monte Carlo simulations of the detector response to neutron back scattering will be performed from a specimen of soil containing a landmine to define detailed performances of the system. At the same time, the large area (40 x 40 cm2), position sensitive thermal neutron detector will be developed. Such detector has to work very close to the fast neutron source (252Cf or Am-Be radioactive sources emitting 105 neutrons/second) and therefore has to be insensitive to the direct radiation from the source, including the gamma-rays. Furthermore the detectors have to be light mass and mechanically robust to be employed in field. They have to be radiation resistant and should not require special care in handling and have to be serviced on site. The neutron detector will be integrated with suitable front-end electronics ad hoc prepared in a specific work package. Simultaneously, computing and Man-Machine interface will be developed using data from simulations and special Metal Detector (MD) heads will be studied to allow the integration with the neutron backscattering system (NBS). Finally, prototypes of hand-held systems will be prepared, including MD, NBS heads and ancillary sensors to determine the detector-soil distance and the scan speed. Information from such sensors will be used to correct on-line the NBS response. The developed hand-held systems will be tested in laboratory as well as in field conditions with real mines. The final tests will be performed at the indoor Rudier Boscovic facility in Zagreb as well as in a test field by a Balkan Mine Action Centre in Croatia. The use of the developed sensors in vehicle mounted systems will be also exploited

Milestones:

- At 06 months: cross validation of MC calculations;
- at 09 months: report in end-user requirements and design suggestion;
- at 12 months: go-nogo selection of the NBT detector;
- at 16 months: report on soil characterization, and decision on integration between NBT and MD;
- at 18 months: go-nogo delivery of the NBT detectors;
- at 24 months: delivery of software and MMI, adapted Metal Detector, and report on vehicle-mounted system;
- at 27 months: delivery of NBT detector prototypes;
- at 30 months: delivery of the first hand-held prototype;
- at 33 months: delivery of the hand-held prototype, and start of final outdoor tests;
- at 36 months: end of technical activities;
- at 38 months: delivery of Edited Final Report.

Project details

Project Acronym: DIAMINE
Project Reference: IST-2000-25237
Start Date: 2001-01-01
Duration: 36 months
Project Cost: 2.8 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-12-31
Project Status: Completed
Project Funding: 1.7 million euro

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20. Decision support system for local sustainable development based on eco-budget methodology (DESTINY)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

The concept of environmental budgeting emerged from the definition of sustainable development stated in the Aalborg Charter. The concept involves the setting up of an environmental budget (ecoBudget) plan for a single year, passing it through the council, executing it, and evaluating the actual environmental spending in an environmental budget balance.

The objective of the DESTINY project is the development of a unified computer-based decision support system (DSS) designed to enable local authorities to implement the ecoBudget concept. It allows environmental priorities within the principles of sustainable development to be determined, the monitoring of progress against environmental plans, and the communication of results. The DESTINY target users are the local authorities, regional authorities as supervising users, and industries with an environmental impact.

Objectives:

The objective of the DESTINY project is the development of a comprehensive computer-based decision support system (DSS) designed to enable local authorities to implement the eco Budget concept. It allows setting of environmental priorities for sustainable development; monitoring of progress against environmental plans and dissemination of outcomes to others via Internet.

The DESTINY target users (and customers) are:

67. Local Authorities, as the direct user of the DESTINY tools
68. Regional Authorities as supervising user
69. Industries, for evaluating their environmental impact.

A key element of DESTINY will be the facility for access by both elected representatives and the general public.

Work description:

The DESTINY project will be performed in four phases:

- PHASE 1: Preparation & system specification. The tasks are: Overall requirements for DESTINY including user requirements and the international framework on legal and procedural pre-conditions for environmental budgeting; Theoretical basis for environmental budgeting and setting up of environmental indicators and targets, and their interaction and harmonisation with financial budgets; Functional specification and design for all the components of DESTINY; Communication between all the modules;
- PHASE 2: System development. This phase will cover development of all DESTINY components and will be executed in two stages. The first stage will develop a prototype and 1st demonstrator version. The second will update DESTINY in line with experience from the verification trials.
- Tasks are:
- Development of interfaces to users and external databases, GIS and EIS;
- Development of environmental budget module including interfaces to the financial budget;
- Development of the decision engine, system rule base and decision making protocols, together with modules for risk assessment, scenario generation and cost benefit analysis;
- Development of an Internet Forum module to provide communication tools for sharing of information about environmental budgets;

- Development of training aids; Design and implementation of a DESTINY prototype to provide early feedback from the users;
- Integration and testing of the DESTINY system, and review of the system against requirements and users experience.
- PHASE 3: System trials and evaluation. DESTINY will be verified by trial application in Germany, Greece and Italy, followed by evaluation of the trials.4th Phase - Dissemination. This will include generation of exploitation plans and dissemination material which will be updated as the project develops.

Milestones:

- Month 3: Website and project controls;
- Month 6: System requirements and theoretical basis;
- Month 9: Software specification;
- Month 15: Delivery of prototype version of DSS;
- Month 18: Delivery of first demonstrator version of DSS;
- Month 26: Release of second demonstrator version of DSS;
- Month 28: Sites report;
- Month 30: Final report, Destiny system release and exploitation plan.

Project details

Project Acronym: DESTINY
Project Reference: IST-2000-29570
Start Date: 2001-10-01
Duration: 30 months
Project Cost: 1.86 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-03-31
Project Status: Completed
Project Funding: 990972.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89b86ed2:d851:65a8c693&RCN=60434

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21. Data Integration System for MARine pollution and water quality (DISMAR)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2002-1.4.1 Intelligent systems and services for civilian and environmental crises management

Marine monitoring of water quality and pollution is carried out in many different ways around Europe, using either aircraft or ship based observations, satellite data, in situ measurements from automatic buoys or Ferry Box systems, or by various combinations of these methods. Forecasting of physical parameters is carried out more or less operationally, whereas modelling of bio-chemical processes is more on the research level. Coupled physical-biochemical models and oil drift models are in some cases used in semi-operational mode. Previous projects have addressed specific observing methods or information system, which facilitate access to data. Little effort has been put into combining monitoring and forecasting of marine pollution and water quality in one system, and to develop end-to-end service chains, which can operate across national borders. This is the aim of DISMAR.

Objectives:

Develop an intelligent system for monitoring and forecasting of the marine environment to improve management of natural or man-induced pollution crises in coastal and ocean regions of Europe, supporting public administrations and emergency services responsible for prevention, mitigation and recovery of crisis such as oil spill pollution and harmful algae bloom. A prototype will be built for integration of multi-source data and numerical models for use in forecasting and risk assessment. The capability of a prototype will be tested and evaluated by regional applications. The benefit of using satellite data in synergy with other observing systems will be demonstrated in the context of GMES.

Work description:

The main challenge of DISMAR is to develop a system which can

70. provide access to a wide range of data types relevant for the marine environment, both archived and near-real time data;
71. combine observational data with models for improved forecasting and risk assessment;
72. synthesize information from various data sources, sensors and model simulations using data fusion methods;
73. be useful as a decision support and crisis management system.

DISMAR will reach these goals through the following workpackages:

- WP100: Project management;
- WP200: Requirement analysis and DISMAR prototype design, focusing both on user requirements and technical choices related to GIS and web-system;
- WP300: Select and provide existing data, products and models relevant for the project;
- WP400: Exploit new observations and models which have significant potential to improve quality of marine monitoring of oil spills and algae blooms;
- WP500:Define and implement a structure for data and products, including metadata, useful for all study areas for oil pollution and water quality applications;
- WP600: Develop a prototype user-specific decision support system for cost-effective management of crisis due to oil pollution and harmful algae bloom incidents;
- WP700: Regional demonstrations of the prototype system and validation by feedback from users;
- WP800: Multi-sensor data feature extraction using data fusion techniques, and combinations of model predictions and image data;

- WP900: DISMAR results will be disseminated to identified end-users, to the scientific community, through the GMES implementation and to the EU via EEA;
- WP1000: Evaluation and assessment.

Milestones:

74. Architecture and design study of the system completed (month 6);
75. Harmonised data and product repository, version 1. Processing chain for existing data/model simulations (month 12);
76. DISPRO-1 developed. Processing chain for new observing capabilities (month 22);
77. Complete validation of DISPRO-1 (month 24);
78. DISPRO-2 developed. Data/products repositories fully populated (month 34);
79. Complete validation of DISPRO-2 and finalize all project tasks (month 36).

Project details

Project Acronym: DISMAR
Project Reference: IST-2001-37657
Start Date: 2002-08-01
Duration: 36 months
Project Cost: 3.92 million euro
Contract Type: Cost-sharing contracts
End Date: 2005-07-31
Project Status: Completed
Project Funding: 2.25 million euro

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22. Environmental Data Exchange for Inland Water (*EDEN-IW*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

The Environmental Data Exchange Network for Inland Water (EDEN-IW) project aims to develop at European level a service integrating disparate heterogeneous government databases on inland water. This will make existing distributed environmental data available to users through an intelligent interface acting as a one-stop shop.

Objectives:

The objectives of the Environmental Data Exchange Network for Inland Water (EDEN-IW) project is to make existing distributed environmental data available to users through an intelligent interface acting as a one-stop shop, where users will be able to address their needs for Inland Water data through one common interface, independent of:

- physical or logical location of the databases;
- the database languages used;
- the specific nomenclature used in a specific database;
- users knowing which database or databases contain the relevant information.

This is achieved by a sophisticated set of open software agents that advertise, broker, and exchange the data requested by the user. Data is harmonised while maintaining autonomy of the data custodians, as databases are integrated into an efficient tool for decision support by a shared knowledge base. The technology provides uniform access to disparate information resource without imposing additional requirements. The prototype produced in this project can contribute to creating a new standard for environmental data exchange that eases environmental reporting and planning.

Work description:

The research project has 5 main trusts:

80. Advanced technological research in order to enhance the functionality of the open source intelligent multi-agent software (Distributed Semantic Agents);
81. Research and develop a specific application on Inland Water data e.g. connect a number of relevant data bases to the system;
82. Enrich the possibilities for environmental management by adding new types of intelligent software agents, capable of providing decision makers with decision support and knowledge needed to manage complex environmental management situation related to inland water;
83. Assure efficient and effective semantic management, by developing a relevant, specific Inland Water ontology and specific Inland Water glossaries, supported by two external reference multilingual thesauri, allowing easy extension to multi-language situations;
84. Serving the user community, which currently consist of European Environment Agency, US Environmental Protection Agency, US Department of Defence, US Department of Energy, the Italian Ministry for the Environment and the European Topic Centre for Inland Water.

The perspectives and the visions of this project are that a user (policy maker), will be able to get rapid answers to environmental questions on inland waters, without any knowledge about the data sources might be available, with coverage ranging from global to continental, from national to local, following political boundaries, or catchments areas as required. In principle a large number of inland water databases in the world could be linked together with this technology, providing a world wide inland water database.

Milestones:

- Delivery of an inland Water open source application with informatics support consisting of databases, thesaurus, ontology and decision support giving a value-added environmental information service which provide easy access to currently difficult accessible data;
- Completion of a decision support system on top of the tool provides easy access for non-expert users and decision makers.

Project details

Project Acronym: EDEN-IW
Project Reference: IST-2000-29317
Start Date: 2001-07-01
Duration: 36 months
Project Cost: 4.84 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-06-30
Project Status: Completed
Project Funding: 2.42 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89bf1ec4:96f7:268d70d0&RCN=60436

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23. European Generic Emergency Response Information System (*EGERIS*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

The EGERIS objective is to provide Civil Protection organisations and national or regional authorities concerned with emergency management with the most recent information and communication technologies developments to support them in their Emergency Management operations during the Response phase and, to a lesser extent, the Preparedness phase. General purpose tools are planned to be integrated into EGERIS providing a full range of emergency Communication, Information and Decision Making functions. EGERIS has also a firm commitment to implement open systems approaches to achieve standardisation, interoperability and portability.

Objectives:

EGERIS objective is to provide Civil Protection organisations (and different actors in Emergency Management) with Information and Communication technologies that improve their overall efficiency during the preparedness and the response phases of a crisis. EGERIS generic architecture will form an Intelligent Emergency Information System based on the last generation Communication Network that relies on innovative open IP techniques (IPFN). These IPFN techniques will interconnect various transmission methods with a new set of tools for the crews in the field that will use vehicle mounted Information Centres and hand held terminals. EGERIS will help them acquire or dispatch the pertinent information they need to the various levels of the organisation and will support them in their operational decision making process.

Work description:

In the 27 months project timeline the main tasks are:

- Up to month 6: "User and system requirement definition". User & system requirements will be defined and selected with several EU and Czech Republic Civil Protection Organisations. This analysis will be based on the standard methodology out coming from FORMIDABLE IST project. FORMIDABLE methodology will be complemented and extended with requirements from organisations not involved in project FORMIDABLE;
- Months 6-12: "Analysis and Design". The design will address the full system based on the user and system requirements. At the end of the period focus will be turned to definition of the demonstrator which will implement the major functions for the different levels command and control;
- "Pilot Development & Integration": The pilot will be integrated for four tests sites. The tools will be adapted to the specific applications involved;
- Month 15-16 First Field trial to test service effectiveness and identify major improvements needed in first prototype;
- Month 22-26: Second field trial for full evaluation of the second version of the prototype;
- Dissemination and exploitation: Dissemination activities, promotion of the project and standardisation activities will carried out.

Milestones:

- M1 at month 6: Specifications Review;
- M2 at month 12: Design Review
- M3 at month 17: Components Development Review;
- M4 at month 22: Version 2 Field trials readiness Review;
- M5 at month 27: Final Evaluation Review.

Project details

Project Acronym: EGERIS
Project Reference: IST-2000-28345
Start Date: 2001-08-01
Duration: 27 months
Project Cost: 7.58 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-10-31
Project Status: Completed
Project Funding: 4.1 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89c1a8a7:17ba:26747526&RCN=57836

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24. European Grid of Solar Observations (*EGSO*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2001-5.1.9 CPA9: Grid test beds, deployment and technologies

The ESGO will create a virtual archive by federating solar data centres scattered across Europe into a data Grid. This will dramatically enhance access to data for both the solar and non-solar communities and will for the first time make data available on demand to the user. The project will employ intuitive web-like interfaces and advanced search and visualization tools to match observations made by numerous space- and ground-based observatories. A major innovation will be the provision of a Solar Feature Catalogue that will allow complex searches based on solar phenomena and events. The EGSO will also provide the facility for the evaluation of extended time series of large, complex data sets at source, without the need to download them. This Grid test bed will federate six data centres located in France, Italy and the United Kingdom, but the design of the EGSO will scale to include as many data archives world-wide as wish to participate.

Objectives:

The ESGO aims create a virtual archive by federating solar data centres scattered across Europe into a grid in order to enhance access for both the solar and non-solar communities. EGSO will create a catalogue of solar features at different wavelengths to provide an innovative way of conducting data searches based on phenomena. It will create a unified catalogue of space- and ground-based solar observations to facilitate the identification of matching data sets based on date, time and location on the Sun, and provide search and visualisation tools using web-based interfaces to assist the user when examining the catalogues. Other tools will locate data identified in the search and retrieve them for more detailed analysis, extracting and calibrating them where necessary. EGSO will also provide the facility for users to upload their own software to analyse extended time intervals of large, complex data at source data centres, where their volume makes it impractical to retrieve them.

Work description:

The EGSO will be constructed from several component parts, catalogues, search and visualisation tools, and federation middleware that combine many solar data centres into a virtual archive. The observational catalogues will be built from existing catalogues where possible, but will use a standard format designed to facilitate searching for matching observations at many wavelengths. Dependencies on ancillary data will be removed to produce catalogue files that are independent and self-describing; if required, observatories will be consulted to help resolve inadequacies in existing logs. The solar feature catalogue will be created using image recognition tools developed for the project. Full disk ground- and space-based imagery will be processed to build a catalogue of the occurrence and location of features such as filaments, active regions, flares, coronal holes. Tools to search the catalogues using web-based user interfaces will be developed with visualisation techniques designed to aid the user in their selections of the data; full-disk synoptic images and quick-look products will be used to assist the process. The federation middleware provides the underlying fabric of the EGSO. It must provide controlled access to selected data and other resources at the sites, while ensuring the security of the grid as a whole. While standard data reduction techniques based on Solar Soft will be used for the extraction and calibration of data, the capability will be created to execute code provided by the user for more complex analysis of large volumes of data at the data source. Where possible, tools used in the project will be based on open source code - these will be augmented and refined as necessary and any such additions will also be open source. Extensive consultations with users will ensure EGSO provides the capabilities the community requires. Issues related to user authentication and security for the diverse user community will be resolved during the project.

Milestones:

85. Architectural design of the EGSO based on scientific requirements, user community input, and surveys of appropriate technologies;
86. Demonstration federation of solar data centres, providing limited data access and a test bed for full development;
87. Creation of observing catalogues and the catalogue of solar features;
88. Full federation of data centres, with tools for integrated data extraction, processing and retrieval through interactive catalogue searches, providing full user access.

Project details

Project Acronym: EGSO
Project Reference: IST-2001-32409
Start Date: 2002-04-01
Duration: 36 months
Project Cost: 3.17 million euro
Contract Type: Cost-sharing contracts
End Date: 2005-03-31
Project Status: Completed
Project Funding: 2.4 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89c49e95:9717:4c93d91a&RCN=63592

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25. Earth Observation Linking SMES To face real time natural disaster management (*EOLES*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2002-1.4.1 Intelligent systems and services for civilian and environmental crises management

The main goal of the present project is to improve drastically the 'real time features' of current applications in order to provide services under time constraints typical of natural disaster management (say hours and not days); events such as floods, earthquakes, forest fires and oil spills can then be covered through space observation, measuring their impacts on the environment and allowing for better support to the impacted people or environment.

Objectives:

The targeted system will couple meteorology and environment data in real time to provide either early warning of relief systems within a decision support architecture compatible with the time frame of natural disasters.

Work description:

This consortium of service providers has constructed a project with a consortium of RTD providers, to develop and to implement within the existing portal two generic functions and two specific service applications:

89. The fast delivery through the Internet of large, high definition, satellite-generated images;
90. The geo referencing of any satellite image within very short deadlines (less than three hours as compared to about a week to-day);
91. An image processing capability:
92. to analyse storm damages in forest;
93. to implement object oriented techniques for image enhancement and segmentation in order to perform land - use classification and optimisation
94. An image processing and capability to assess flood damages based on the expertise of Geoscience (France).

Milestones:

Once operational, such real time capabilities will also help service providers and their client end users to build a set of data which describe, with appropriate details, past events related to natural disasters and which, therefore, allow to sort out good practices to manage similar natural disasters in the future.

Project details

Project Acronym: EOLES
Project Reference: IST-1999-57450
Start Date: 2002-08-01
Duration: 24 months
Project Cost: 1.8 million euro
Contract Type: Cooperative research contracts
End Date: 2004-07-31
Project Status: Completed
Project Funding: 900000.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89dab8dc:19b7:012bb00b&RCN=63569

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26. European Climate Change Monitoring and Prediction System (EUROCLIM)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

The EuroClim project will develop and validate an advanced climate change monitoring and prediction system for Europe. The system will focus on societal consequences of climate change. The European cryosphere, e.g. the Euro-Arctic region and high-mountain areas with seasonal snow, will be used as an indicator for climate change. Snow and ice variables will be extracted and processed by advanced ground and satellite sensor technology and algorithms. The variables will be applied in regional climate and statistical models in order to predict changes and make scenarios. Project partners havecommitted themselves to make EuroClim an operational long-term monitoring system if the prototype system is a success.

Objectives:

The main goal of the project is to develop an advanced climate monitoring and prediction system for Europe. This is achieved through seven sub-goals:

95. Determination of climate-change user needs
96. Development of architecture and technology for generic, scalable and distributed processing and storage of geographical data
97. Development of methodology for precise retrieval of cryospheric variables, based on integrated analysis and storage of multi-sensor, multi-resolution and multi-temporal data
98. Improvement of the accuracy of algorithms for retrieval of cryospheric variables from earth-observation data
99. Improvement of climate models in order to predict future climate accurately
100. Development of new statistical tools for trend estimation, scenario analysis and uncertainty assessment

101. Establishment of an operational service.

Work description:

The project will be carried out through seven work packages:

- WP 1: System design identifies the potential users and carries out a comprehensive user investigation. The results of that steers the system design work.
- WP 2: Development of models and algorithms will improve state-of-the-art algorithms for cryospheric parameter retrieval and methodology for climate and statistical modelling. The cryospheric parameters include: sea-ice coverage and thickness; snow coverage, wetness, anisotropic reflectance; and glacier equilibrium line altitude, ice velocity and surface topography. These constitute key variables sensitive to climate change.
- WP 3: System development will develop the prototype system. The system includes modules for extracting the cryospheric variables from ground and remote sensing data. The data are stored in an advanced, distributed GIS system connecting all the storage and processing sites comprising the EuroClim network. Each database is an innovative storage system for multi-resolution raster data. Modules for climate modelling and statistical analysis generate trend estimation, scenario analysis, uncertainty assessments, etc. A web-based system presents the results. The presentation-products include GIS-maps and animations.
- WP 4: System validation will verify and test the system in a large-scale version able to monitor the whole Europe.
- WP 5: Evaluation monitors the performance of the project and the results of the various deliverables.
- WP 6: Dissemination and exploitation will ensure that the user groups are continuously informed about the project development and results, generating interest and preparing the operational of the system.
- WP 7: Project management ensures a co-ordinated approach towards the project objectives.

Milestones:

- Completion of a user requirements report, which gives necessary input for making the system design report;
- Completion of algorithms and model development (fundamental for the system development work, including a proof-of-concept report);
- Completion of a prototype system (verified and evaluated through a step-wise process);
- Completion of an operational system (following various dissemination material and exploitation activities).

Project details

Project Acronym: EUROCLIM
Project Reference: IST-2000-28766
Start Date: 2001-09-01
Duration: 36 months
Project Cost: 4.87 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-08-31
Project Status: Completed
Project Funding: 2.86 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89de8ec8:b625:5f3e869c&RCN=60439

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27. Forest environmental monitoring and management system (FOREMMS)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

http://www.nr.no/foremms

The purpose of this project is to develop and demonstrate an advanced forest environmental monitoring and management system prototype. The operational version of the system is intended to be deployed all over Europe for monitoring forest vegetation resources at regional, national and international (European) scales in order to measure both man-induced and natural changes of the environmental status. The system will utilise and process from field personnel, automatic measurement stations, airborne sensors and satellite data of high and medium resolution with advanced algorithms. The detailed information is measured at point locations around Europe, and the low medium-resolution satellite data is used to extend the data, and will be further investigated with statistical and visualisation tools. The prototype to be developed in the project will be demonstrated at three locations covering the three major European forest types (northern boreal coniferous forest, continental temperate mixed forest and Mediterranean dry forests).

Objectives:

- To develop and demonstrate an advanced forest environmental monitoring and management system prototype;
- To develop a system that is in accordance with current and future user needs and requirements;
- To monitor forest resources at the three scales - regional, national and international;
- To improve and integrate advanced remote sensing technology based on airborne and spaceborne sensors for the extraction of forest environmental parameters;
- To advance techniques for multi-scale integration of information in order to improve large-scale coverage by scattered information from more detailed scales;
- To develop techniques for the derivation of forest meta-data/higher-order information from spatial-temporal (4-D) collected data;
- To contribute to the development of a standard scheme for European-scale collection and analysis of forest environmental parameters;
- To prepare for the deployment of the system covering the total European forest resources.

Work description:

The user needs and requirements will be determined and investigated in full depth in order to be able to develop the system. It comprises monitoring at three levels (scales):

102. Selected intensive and small-size key-biotype areas (nodes) of a typical size of 20 km[2] monitored in full detail by automatic field sensors, field studies and very-high-resolution airborne very-high-resolution remote sensing;
103. Fixed (including Level-1 areas) and sampled position high-resolution satellite images covering e.g. 10% of Europe's forest each time;
104. Spatial statistical parameter prediction for Europe's total forested area based on medium resolution satellite data, data from Level 2, previous monitoring of the same area and meteorological data.

Automatic field sensors are intended to measure air, precipitation and soil variables continuously (e.g., related to man-induced pollution). Very-high-resolution airborne data are typically collected each few years in a measurement campaign supported by field personnel doing detailed sample measurement. The high-resolution satellite data cover an area of typically 3000-30,000 km[2], including at least one node area and is acquired at about the same time as the airborne and field campaign. The medium-resolution satellite data is acquired frequently through the vegetation season. The project will improve classification and inversion techniques for maximal information extraction of environmental forest parameters from airborne and spaceborne remote sensing sensors. A multi-scale data analysis approach will be developed in order to make an accurate monitoring of the total European forested area possible. The environmental data in the system are stored in a spatial-temporal database (the three spatial dimensions and the time dimension). There are subsystems for advanced interactive data visualisation, time series statistical analysis, scenario simulation and map and statistical report generation. Through its international efforts, the project will contribute to the generation of standards that define appropriate parameters for monitoring, analysis methodology and data storage and exchange.

Milestones:

105. A report on user needs and requirements related to a forest monitoring and management system,
106. A report on the design of the forest monitoring and management system,
107. A prototype system for forest monitoring and management,
108. System demonstrators in Finland, Poland and Italy,
109. An evaluation of the system,
110. Plans for deployment of the system,
111. Advancement of algorithms for analysis of airborne and satellite imagery for forest parameters,
112. Advancement of methods for combination of multi-scale environmental data,
113. Advancement of methods for trend analysis of data derived from remote sensors.

Project details

Project Acronym: FOREMMS
Project Reference: IST-1999-11228
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 2.15 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 1.33 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=2&CAT=PROJ&QUERY=011e89e0f68a:e876:7663a731&RCN=57775

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28. Geographic Information and Mathematical Models Inter-operability (*GIMMI*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2001-5.1.3 CPA3: Use of Geographic Information

GIMMI (Geographic Information and Mathematical Models Inter-operability) aims at bridging the gap in Pesticide Impact Assessment domain between Data/Service Providers, Scientists and Final Users by:

- allowing the inter-operability via web of GI environmental protection services physically distributed and locally managed and maintained by their own inventors and generators- providing the proper IT structures to represent and manage temporal knowledge inside a GI system;
- integrating in the IT infrastructure state-of-the-art legacy systems for document management and report generation.

GIMMI will support 3 kinds of services:

- On-line Data Access, when the user seeks to ""drill down"" into the huge amount of GI distributed in different formats and in different sites;
- On-line Simulation, when the amount of data involved and the time required to answer allow it;
- Off-line Study, when the requested services require huge amounts of data, long time or human experts.

Objectives:

The role of Geographic Information in environmental protection has always been considered of key importance by local and central governments for a real success and explosion of any information and citizens protection service.

Current drawbacks on citizen demands for inter-operable data and services in the environmental domain have hurdled their adoption and proliferation:

- Lack of a real inter-operability platform, intended as the capability of building a neutral representation for describing GI-based services, like those implemented by environmental protection mathematical models, decision support and risk assessment systems;
- Lack of a real representation and management of temporal knowledge;
- Lack of a real integration of GI with Legacy Systems, and in particular, with data and document management systems, report generation systems. In some environmental protection domains, like in the

Pesticide Impact Assessment, no initiatives exist at all due to the complexity, multi-disciplinarily and geographical distribution of the competencies.

The GIMMI project will develop:

- A GIS-based GUI system to capture and interpret all the user's interactions;
- A dynamic multi-channel Web/Wap interface for a direct access to the services by fixed and mobile devices;
- An On-line Analyser which will be in charge for all the GIMMI on-line services;
- An Off-line Query Builder which is in charge to perform complex studies;
- Both the On-line and Off-line Service Managers will be interfaced with an E-commerce engine;
- A Metadata repository will govern all the services provided by GIMMI.

Work description:

The Consortium intends to work according to a rapid prototyping approach, which will deliver an integrated early prototype version of the system by mid-project. The second phase of the Project will deliver the GIMMI Final Prototype and develop the two demonstrative applications. As part of WP1, user scenarios and requirements will be elicited. The project co-ordinator TXT will support Users in translating the results of the analysis of their domains into user requirements. Moreover, a Technological and Methodological study shall be conducted in parallel by the Research-oriented partners, in order on one side to identify and assess the last technological solutions provided by the market; on the other side to better position the project inside a methodological, theoretical and scientific framework. WP2 will focus both on the detailed specification and architectural design of the GIMMI Suite. Task 2.1 shall deal with the specification of system requirements and usage scenario, while T2.2 shall proceed with the architectural choices and identify the modular decomposition of each single GIMMI tool.

All responsible IT partners will conduct development of the 1st prototype of the GIMMI modules independently in WP3 tasks:

- Task 3.1 shall develop the GIS-based multi-channel GUI;
- Task 3.2 will develop the On-line Analyser;
- Task 3.3 shall develop the Off-line Query Builder;
- Task 3.4 will develop the inter-operability platform between GI and non-GI systems.

WP4 will be dedicated to integration and testing of the GIMMI 1st prototypes. In WP5 the GIMMI pilot installations will be implemented, based on feedback provided by the testing and validation efforts in WP4, according to an iterative development approach. In WP5, special attention will be placed to create two customised pilots who will meet as much as possible the generalised requirements defined in WP1. WP6 will be dedicated to continuous assessment and evaluation of the whole project, assuming the role of Quality Assurance WP. All partners will be active in WP7 for Dissemination and Exploitation of project results, and they are committed to prepare, before the end of the project, a detailed business plan and to implement it after the project termination. In WP8 a sound Project Management will be granted by TXT, with support of all partners in the consortium.

Milestones:

- M6 User Requirements, Models, System Specifications and System Design;
- M12 1st Prototypes (individual modules), First Results from Dissemination and Exploitation;
- M15 1st Prototype (Integrated), Early Testing and Evaluation, Revised Specifications and Design;
- M24 Test Cases, Results from Dissemination and Exploitation;
- M30 Demonstrators Evaluation, Final Results from Dissemination and Exploitation. The main GIMMI result will be the promotion of Integrated, more eco-compatible Crop Management systems in Agriculture.

Project details

Project Acronym: GIMMI
Project Reference: IST-2001-34245
Start Date: 2002-04-01
Duration: 30 months

Project Cost: 2.82 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-09-30
Project Status: Completed
Project Funding: 1.84 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89e3a4a4:9313:276b895a&RCN=63595

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29. HARMONISEd, accurate and reliable prediction methods for the eu directive on the assessment and management of environmental noise (HARMONOISE)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

The European commission has recently published the Draft Directive on the Assessment and Management of Environmental Noise. The commission announces, e.g. in article 1 that intelligent, common, harmonised computation methods with ensured accuracy need to be developed. None of the many existing methods in the Member States satisfies these requirements. The HARMONOISE project intends to develop and validate such methods for the Assessment and Management of Noise from Road and Rail Traffic. The project will build on the most recent scientific achievements in all Member States and will also provide consensus amongst future users throughout the EC. For this purpose the Consortium has a wide international and scientific background. The methods to be provided will be implemented as obligatory under the Directive and will thus find a wide use for purposes of noise planning, mapping, zoning, noise abatement measures and strategies and for compliance checks.

Objectives:

114. To develop methods by which the sound power output and the directivity of sources of road and rail traffic can be described and assessed as an accurate physical quantity which is independent of short distance sound propagation;
115. To establish a better correlation with future legislation on limiting the noise generation;

116. To define the format of databases by which source dependent data and location dependent data can be collected and stored;
117. To define the minimum set of meteorological conditions which are to be distinguished in order to derive the long term average noise indicator Lden for 3 different periods of the day (day, evening, night) with sufficient accuracy;
118. To apply advanced scientific tools to model and describe the sound propagation under these conditions;
119. To validate the models against empirical data of the highest level of definition;
120. To integrate the above steps into one system of methods to be applied by users anywhere in the EC.

Work description:

Prediction methods for environmental noise from road and rail traffic and from industrial sources are available in various EU member states. These methods show many lacunae: some of them cannot produce the harmonised noise indicator Lden; others show insufficiencies in e.g. the separation of source power output and propagation (usually leading to different propagation models for different sources, which can not be justified from a scientific point of view). Complicated propagation conditions (e.g. multiple reflections in built up areas) show low accuracy. The Harmonoise project will collect the empirical data on which the existing methods were based as well as the models themselves and use these as a starting point for improvement and harmonisation. The source description will be based on true physical quantities (sound power level, directivity), independent of the propagation conditions. The range of different operation conditions included in the source data (e.g. driving in urban areas, in hilly areas, on wet road surface) will be expanded and statistics will be included with respect to the occurrence of these conditions. A database structure will be developed which is to contain source related information and geographical information. The sound propagation under a range of meteorological conditions will be modelled for various geographical situations including a range of ground absorption properties. Scientific tools will be applied for this modelling and the data generated will be fed into a propagation database. The models for source and propagation will be integrated and expanded so that multiple paths and multiple reflections can be treated. Empirical data will be collected for long term average noise levels under a range of conditions and for various sources and the results will be used as the reference for validation of the integrated model. Finally, the method will be provided to the member states as a set of definitions and standards.

Milestones:

- Specification of methods to be developed;
- Measurement methods for the sound power output of different sources;
- Database for source related data;
- Meteorological conditions to be distinguished;
- Selection of tools for propagation modelling;
- Database containing propagation information-Integration of source and propagation data;
- Validation of developed models against empirical data;
- Finalised methodology, suitable for implementation in harmonised EU environmental noise policy.

Project details

Project Acronym: HARMONOISE
Project Reference: IST-2000-28419
Start Date: 2001-08-01
Duration: 36 months
Project Cost: 5.12 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-07-31
Project Status: Completed
Project Funding: 2.6 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89e71e26:7643:4e2bc2d2&RCN=57829

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30. Healthier Environment through Abatement of Vehicle Emission and Noise (HEAVEN)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

http://heaven.rec.org

Integrating environmental information society technologies and existing transport demand management systems, the experienced consortium-including urban environment, health and transport agencies, industrial suppliers and researchers- will develop and demonstrate in six major European cities (Berlin, Leicester, Paris, Prague, Rome & Rotterdam) a fully integrated decision support system. This system will provide the possibility to evaluate mobility related emissions (including those pollutants under consideration by the EU for new directives), on the basis of advanced real-time monitoring and modelling of key pollution sources. In addition, this project will establish a data platform for the assessment of emissions and health effects for air pollutants and noise, caused by traffic. HEAVEN will directly support and provide European added value for the implementation of the European Air Quality Framework Directive and its daughter directives and the future Framework Directive on noise.

Objectives:

HEAVEN will contribute to the implementation of EU directives and national/local laws on air and noise quality by demonstrating a decision support system (DSS) which assesses the pollution reduction of transport demand management strategies (TDMS) in large urban areas on the basis of the use of integrated environmental IST and emissions and dispersion forecasting. An integrated information platform will provide to key actors and the public information on the state of air and noise pollution levels and will support long-term planning and data exchange with health authorities.

The high-level objectives of HEAVEN are to:

- Improve the basis for decision-making by providing integrated and real-time information on key pollution factors (including pollutants for which new directives are being proposed);
- Inform key actors and the public on the state of air and noise pollution levels;
- Enhance the information quality concerning the effects of various air pollutants and noise on health.

Work description:

- User needs analysis and definition of systems implementation framework;
- Design of the functional, communication and physical architectures for the monitoring, decision and information systems;
- Draft implementation plan;
- Development of integrated DSS to evaluate mobility related emissions of TDMS;
- Local verification plans;
- Implementation and evaluation of the on-site, real-life operation of the fully verified DSS;
- Exploitation and business plan.

Project details

Project Acronym: HEAVEN
Project Reference: IST-1999-11244
Start Date: 2000-01-17
Duration: 36 months
Project Cost: 6.65 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-01-16
Project Status: Completed
Project Funding: 2.8 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89ea2af9:4141:76a5efef&RCN=57849

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31. Integrated Computational Assessment of urban air quality via Remote Observation Systems NETwork (*ICAROS NET*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

ICAROS NET aims at the development and demonstration of a networked interactive computational environment that allows the integration and fusion of environmental information from remote sensing observations, ground air quality measurements, and pollution transport models in order to minimize uncertainty in decision-making regarding operational air pollution control and abatement. The goal is to maximize cost-effectiveness of urban management, increase the reliability of environmental monitoring and enhance quality of life in European cities. This telematic network will be applicable to on-line monitoring of air quality and atmospheric incidents alert at the regional and urban scales; it will also support the harmonisation of air quality management in the EU. Four pilot sites are foreseen, covering urban and regional settings in 3 EU member states (Lombardy, Athens and Munich) and one PECO country (Budapest, Hungary).

Objectives:

ICAROS NET aims to develop and implement a networked interactive computational environment that allows the minimisation of uncertainty in decision-making regarding operational air pollution control and abatement in the urban environment and enhances the coherence in Trans boundary environmental monitoring.

ICAROS NET will be based on:

121. Fusion of various environmental information classes including data from satellite-based remote sensing, ground-based air quality measurements and atmospheric modelling;
122. Sharing of the knowledge acquired through environmental data fusion among policy-makers and concerned stakeholders using current and future telematics infrastructure;
123. Supporting environmental management through a decision support system.

Work description:

The project is organised in the following tasks:

124. Identification of the state of environmental monitoring and of telematics infrastructure in the verification sites;
125. Development of the ICAROS NET networked environmental monitoring system:

126.2.a. Implementation of the ICAROS data assimilation method within an object-oriented computational environment using the appropriate data sharing and analysis techniques for each verification site;

127.2.b. Network-based integration of state-of-the-art air quality monitoring techniques as defined in phase 1, following the data assimilation methodology described in task 2.3. Application of the ICAROS NET methodology and implementation of the ICAROS NET networked computational environment in four verification sites;

128.3.a. The case of Milan, Italy. Integrated air quality assessment due to urban activities including power generation and transport in a densely-populated urban environment;

129.3.b. The case of Athens, Greece. Integrated assessment of air quality in a severely polluted urban conurbation, developed rapidly in terms of human population growth and industrial activities;

130.3.c. The case of Munich, Germany. Integrated air quality assessment due to urban activities, including power generation and transport in a typical European city;

131.3.d. The case of Budapest, Hungary. Integrated air quality assessment due to urban activities including power generation and transport in a densely-populated urban environment in a new EU member state (PECO country);

132.3.e. Development of inter-regional ICAROS Network for exchange of environmental information pertinent to air quality assessment and early warning of extreme atmospheric pollution incidents.

Milestones:

133. Evaluation of the state of air quality monitoring in the verification sites;

134. Functional integration of the air quality monitoring techniques employed and information fusion;

135. Computational assessment of air quality using information fusion and inference techniques;

136. Network integration of air monitoring systems with the computational platform through state of the art telematics;

137. Coupling of ICAROS NET with decision-support system for environmental management.

Project details

Project Acronym: ICAROS NET
Project Reference: IST-2000-29264
Start Date: 2001-09-01
Duration: 36 months
Project Cost: 2.45 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-08-31
Project Status: Completed
Project Funding: 1.28 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89ec41f7:67d0:605c6b65&RCN=57835

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32. Information system for Marine Aquatic Resource Quality (*I-MARQ*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2001-5.1.3 CPA3: Use of Geographic Information

i-MARQ will deliver real-time information on coastal water quality into a variety of end-user markets, via a dynamic GIS-based system. The project will develop and validate advanced data fusion, modelling and management algorithms to generate high-quality data content. The system will support decision-making by various end-user groups including:

- Citizens concerned about environmental quality in recreational waters;
- Local authorities seeking a quality tourism cachet and wishing to avoid hazard to public health;
- Companies seeking to validate environmental performance and avoid liabilities from pollution incidents.

Objectives:

The goal of the project is to develop and validate a prototype GIS-based system which can deliver information on environmental quality of coastal waters. Market analysis has identified a significant demand for such information by a variety of users. To achieve this, the project will:

- First, develop data processing technologies able to generate information from heterogeneous data sources and dynamic models, according to defined user requirements;
- Second, integrate the above within a real-time GIS under a scaleable data management framework;
- Third, validate and evaluate the above with selected users and with reference to a dedicated horizontal user group.

Work description:

The project will be carried out in 10 main workpackages (WPs), of which:

- WP1 will be dedicated to the management;
- WP2 will develop a users' specification and establish evaluation benchmarks. This will enable;
- WP3 to define the i-MARQ architecture and establish a technical specification for the system modules;
- WP4, WP5 & WP6 will then develop the innovative technological modules which can generate the information content. Specifically, WP4 will define the data management protocols to permit data assimilation and characterisation; WP5 will develop data fusion algorithms, which can combine intermittent spatially rich image data with sparse ground-based data, and link with simulation algorithms. WP6 will configure imaging codes to generate grid data from satellite and video data sets;
- WP7 will set up the above on a central i-MARQ server, and configure a commercial GIS suite to present water quality parameters with relevant user functionality, supporting access via web/wap browsers, intranet or messaging via email or GSM/UMTS;
- WP8 will perform system test and launch a prototype system to pilot the technology, perform validation and identify opportunities for refinement;

- WP9 will evaluate user responses to the pilot system against user-defined benchmarks;
- Finally WP10 will disseminate results and progress to a wide range of potential beneficiaries, and develop an exploitation plan. In addition, WP2 and WP9 will work with a horizontal user group (HA1) comprising a wide range of users from: public authorities concerned about tourism promotion; companies seeking regulatory compliance and avoidance of incident liabilities; and public interest groups.

Milestones:

During 36 months the project will deliver:

138. Key technologies for creating high quality information content for the i-MARQ GIS;
139. An operational pilot i-MARQsystem delivering real-time geographic information in selected regions;
140. Validation of performance and evaluation report, leading to a robust commercialisation plan.

Project details

Project Acronym: I-MARQ
Project Reference: IST-2001-34039
Start Date: 2002-05-01
Duration: 36 months
Project Cost: 3.46 million euro
Contract Type: Cost-sharing contracts
End Date: 2005-04-30
Project Status: Completed
Project Funding: 2.25 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89ef9573:6aa0:1f9357b3&RCN=63591

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33. Estimation of human IMPACT in the presence of natural fluctuations (IMPACT)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

http://www.mai.liu.se/impact/index.html

The project aims at developing, testing and disseminating generic decision support tools that can match technological advancements in environmental monitoring and facilitate interpretation of time series environmental data. The approach is novel in the sense that mechanistic models based on physical, chemical and biological concepts and theories are fully integrated with statistical methods.

Objectives:

The objective of the project is to introduce a new set of tools which will bridge the present gap between purely statistical analysis of environmental monitoring data and mechanistic environmental modelling based on biological, chemical and physical concepts and theories. The specific tools objectives are to:

- Match technological advances in environmental monitoring;
- Facilitate estimation of environmental impact in the presence of natural fluctuations in the environment;
- Bridge the gap between statistical data analysis and mechanistic modelling.
- Moreover these tools also aim to involve the following specific procedures:
- Time series decomposition methods in which a given series of environmental data is divided into two components respectively representing meteorologically-induced fluctuations and meteorologically normalised estimates of human impact;
- Significance tests that permit retrospective impact assessment in the presence of co-variates representing natural fluctuations;
- Model reduction procedures that facilitate merging of statistical and mechanistic approaches.

Work description:

Tools development facilitating interpretation of time series of environmental data is divided into three types of activities:

- Development of generic computational procedures that can bridge the gap between statistical analysis of environmental monitoring data and mechanistic modelling based on physical, chemical and biological concepts and theories;
- Testing of the procedures developed on a representative selection of environmental quality data and mechanistic models driven by meteorological or other naturally fluctuating inputs;
- Incorporation of end-user views in the design of the decision support tools that shall be developed.

Milestones:

- Scientific documentation of the methods and theoretical framework in which mechanistic models can be merged with statistical techniques to extract anthropogenic signals from time series of environmental data;
- Scientific documentation of case studies on water and air quality that demonstrate the performance and benefits of the new tools compared to the tools presently used;
- End-user-tested software and targeted presentations.

Project details

Project Acronym: IMPACT
Project Reference: IST-1999-11313

Start Date: 2000-01-01
Duration: 36 months
Project Cost: 1.59 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 899862.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89f53e96:d664:74c6af61&RCN=60810

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34. Intelligent Air Monitoring Network (INTAIRNET)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

There is a growing concern in the European Union (EU) about the consequences of urban air pollution on public health. Although every EU country has been instructed to establish a network of air control stations in its cities, the limited number of these expensive fixed stations and the lengthy air sampling and data collection/processing does not allow fast dissemination of this information to the public. The objective of this project is to provide the EU with a cost-effective, upgradeable, user-friendly and intelligent air monitoring network covering Europe, and capable of meeting the 2005 air quality requirements. This dynamic network will, through the Internet via websites, not only inform on quasi real time the European citizens of air quality status anywhere in the EU, but also help the decision-makers to more effectively manage urban air quality. Fabrication of mobile and communicating (GSM/GPS) microstations will integrate low-cost, sensitive gas sensors based on nanostructered metal oxide materials.

Objectives:

The overall objective of this project is to provide the EU with a cost-effective, upgradeable, user-friendly and intelligent air monitoring network (mobile and communicating microstations) covering the whole European continent, complementing existing fixed air control stations, and capable of meeting the 2005 air quality requirements. This dynamic network will, through the Internet, not only inform on quasi real time the European citizens of air quality status (maps of NO_2, NO, O_3, CO, CO_2 concentrations) anywhere in the EU, but also help the decision-makers to more effectively manage urban air quality by controlling factors such as road traffic, and also help scientists to refine mathematical predictions of urban air pollution in cities.

Milestones:

Main milestones:

- deagglomerated nanosized powders of metal oxide semiconductors;
- optimum methods for dispersion of nanopowders in liquid medium; advanced substrates;
- NO2, NO, CO, O3 and CO2 sensors;
- Network development
- electronic modules for sensor remote maintenance, and for GSM/GPS communication systems;
- air filtering/drying system;
- software for network administration, communications control and data processing;
- websites for information dissemination and network control.

Ultimate result: network of communicating gas sensing microstations linked to a central data processing station.

Project details

Project Acronym: INTAIRNET
Project Reference: IST-1999-12615
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 3 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 1.9 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=74&CAT=PROJ&QUERY=011e89f2a159:fa66:6c099f44&RCN=57860

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35. Intelligent Systems for humanitarian Geo-InfraStructure (ISIS)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2002-1.4.1 Intelligent systems and services for civilian and environmental crises management

"The common goal of all agencies involved in responding to natural and man-made disasters is to alleviate suffering. The simple basis for co-ordinated action masks a wide range of complicated activities, competing demands and chaotic work conditions. The use of GIS and remote sensing for disaster response is now well established (...) but the full potential of these linked technologies is still far from realised. The primary obstacle to effective application of geographic information for crisis preparedness and response is the lack of a clearly defined and efficient way to collect, analyse and share relevant data among participating agencies. The creation of an internet-based cartographic process, which would combine both foundation data of baseline geo-spatial and imagery data with thematic data from field missions, is a much-needed step toward the goal of more effective crisis management." W. B. Wood, US Department of State. The objective of the ISIS is to achieve a significant and measurable increase in interest and awareness in the use of web mapping and state-of-the-art geo-information techniques by NGO's. Those techniques could allow them to:

- Collect geographical information on the field;
- Repatriate the field information to the headquarters and to disseminate it to the field;
- Share information among different sections of a same humanitarian organization or between collaborating organisations.

Objectives:

The objective of the ISIS study is to achieve a significant and measurable increase in interest and awareness in the use of web mapping and state-of-the-art geo-information techniques by NGO's.This will be made through:

141. An analysis and an assessment of the users' needs, requirements and practices;
142. A technical review, analysis and comparative assessment of the web mapping, field GIS and telecommunication techniques.
143. The technical objectives of our study are:
144. To evaluate the potential use of web-mapping interoperable techniques available for geographical information sharing and multiple data sources combination (including harmonisation aspects);
145. To evaluate the field GIS techniques available for information collection during field operations;
146. To assess the use of telecommunication techniques for geographical information transmission;
147. A broad dissemination of the associated information in meetings (e.g. GMES workshops), on the Internet (website, forums) and through publications.

Users network: In order to reach our goals a network of users is being created (MSF-B, ICBL, ECHO). This network must integrate a broad range of humanitarian actors.

Work description:

The ISIS project will last for 18 months and is divided in 5 main work packages. The work plan includes the following steps:

148. An analysis and an assessment of the users' needs, requirements and practices. MSF-B will serve as a first basis for the definition of the needs of the users network including ICBL and ECHO. The user practices assessment includes the following aspects: present use of geographical information, users procedure for acquisition of geographical information, software and hardware basis at the user level. The user requirement definition includes the following aspects: content of geographical information; scales of maps and documents; delivery time expected and needed; compatibility with internal structure

and management of information; context (economical and sociological) and local geocoded information; relevance of information for global internal and external communication;

149. A technical review and analysis of the web mapping, field GIS and telecommunication techniques for field geo-information collection, repatriation, dissemination and sharing. The steps of this phase are: - identification of the key players (research projects and teams) and their actual state of development and principal future research axes; - Identification and analysis of three main technical approaches/philosophies and associated products for responding the needs of humanitarian organisations; - Identification and analysis of three leading companies and the technical characteristics of their products;

150. A comparative assessment of the different technical solutions and approaches wrt. users pre-defined criteria;

151. A users evaluation of the comparative assessment, with feedback regarding their potential use of the assessed techniques in their organisations;

152. A broad dissemination of the associated information in meetings (e.g. GMES workshops), on the Internet (website, forums) and through publications. The goal of this phase is to interest a higher number of NGO's in the use of web-mapping and geo-information techniques. An associated goal is to raise their awareness to these techniques.

Our approach is based on four dissemination tools:

- Support to EC - GMES workshops in terms of organisation and animation;
- A project presentation in electronic and paper form;
- The issuing of high-level publications related to the project objectives and results;
- The development of a special website to the attention of scientists, developers, industries, professionals, end-users and the public. It will include electronic on-line forums to ensure constant dissemination between the workshops.

Milestones:

- Kick-Off (KO): Project management plan;
- KO + 3m: Dissemination plan;
- KO + 4m: Project website and on-line presentation;
- KO + 6m: Report on operational needs, requirements and practices of users network;
- KO + 10m: Issuing of technical survey and critical analysis report;
- KO + 12m: Annual report and project presentation (glossy brochure);
- KO + 18m: Final review and reporting; Expression of interest from users network in the use of web-mapping and geo-information techniques.

Project details

Project Acronym: ISIS
Project Reference: IST-2001-37532
Start Date: 2002-08-01
Duration: 18 months
Project Cost: 259207.00 euro
Contract Type: Preparatory, accompanying and support measures
End Date: 2004-01-31
Project Status: Completed
Project Funding: 219981.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=5&CAT=PROJ&QUERY=011e89f95b40:8342:609833218&RCN=63578

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36. Integrated Weather, Sea Ice and OCean service system (*IWICOS*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

The IWICOS project aims to increase the safety and cost-effectiveness of fisheries, sea transport and exploitation of marine resources in Northern European waters. The project will develop a marine information system, which will provide a single-entry access to meteorological, sea ice and oceanographic (met-ice-ocean) data and products. The system will be based on data provided by weather forecasting, ice and research centres.

Objectives:

The objective of IWICOS is to develop a prototype marine information system which will provide a single-entry access to meteorological, sea ice and oceanographic (met-ice-ocean) data and products.

The prototype will include an end user system which allows users to select, order and retrieve products offered by the consortium and to pay electronically. Innovative met-ice-ocean products will be developed which combine satellite, weather, ice and ocean data and are suitable for transmission via the Internet or other communication channels.

Work description:

The IWICOS prototype will be designed with specifications of functionalities based on requirements from users of met-ice-ocean data, including those working at sea. A set of meta-ice-ocean products, which are suitable for electronic transmission, will be developed and adapted to various regional requirements.

A PC based end user system will be built to retrieve and display met-ice-ocean products in a user-friendly way. The system will use Internet and other networks in combination with Inmarsat and cellular telephone, allowing IWICOS to function in coastal and sea areas.

A product retrieval and management system is to be developed and used by each service provider of the consortium to handle ordering and distribution of products to a number of users, including payment/invoicing.

Practical demonstrations of the IWICOS system will be performed for a limited number of end users at sea in the Baltic region, the Greenland/Iceland region and the Arctic. Finally, validation and market analysis for services based on the prototype will be performed.

Project details

Project Acronym: IWICOS

Project Reference: IST-1999-11129
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 1.96 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 1.3 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e89fee884:03c3:6f1517cb&RCN=60808

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37. LOw Cost CATastrophic Event Capturing (*LOCCATEC*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

http://www.loccatec.org

Effective search & rescue operations are amongst the most promising means to reduce human casualties following collapse of buildings due to catastrophic events.

Time is critical for a successful rescue and the prompt availability of reliable information is vital. LOCCATEC could enhance significantly the effectiveness of the rescue management and operations, providing a quick survey tool to detect and locate trapped people.

It is based on small, low-cost capturing devices to be pre-installed in buildings.

Each capturing device, triggered by the event, records what happened in a given space during an eventual collapse.

This information is downloaded wirelessly to central units providing the rescuers with a rapid estimate as to the number of people present in each building space at the moment of the event, the structural state of ruins and eventual possible pathways.

Objectives:

153. Development of a prototype system, which would provide the rescue teams quickly and cost-effectively reliable information on:
154. a.The presence (or not) of people in each building space during a collapse;
155. b.The state of the ruins (possible pathways, structural integrity).The LOCCATEC prototype will be a fully functional pre-industrial prototype, including at least one central unit and a number of capturing devices, the functionality of which will be tested against the specified requirements;
156. Significant enhancement of the effectiveness of the rescue management and operations by providing a tool to perform a quick survey of the disaster site to detect and locate trapped people and plan the subsequent rescue operations in the quickest and most effective way.

As part of an overall emergency response system, it would allow personnel, equipment and information to be dispatched where it is most needed and assist in setting rescue priorities and planning the rescue effort quickly and efficiently.

Work description:

LOCCATEC will be a prototype system aiming at promptly providing the rescuers with information on trapped people and the state of the ruins. It will be based on small, low-cost, autonomous capturing devices to be pre-installed in each building space. Each capturing device, adequately integrated and packaged so as to survive an eventual building collapse, triggered by the catastrophic event (e.g. earthquake), would record what happened in a given space just during the collapse. The rescue team, equipped with the LOCCATEC central unit, upon arriving at the vicinity of the collapsed building, would transmit a signal triggering the wireless download of the information stored in each capturing device. Image processing techniques could yield an estimate as to the number of people present in each space at the moment of the event. The rescue team would have a quick indication on the number of people trapped in each space and some information on the structural state and the possible pathways in the ruin.

Each capturing device will comprise: Optical sensor, FIFO non-volatile memory chip, IR illuminating LED, triggering device, wireless low-power communications and suitable back-up battery. Each central unit will comprise: Communication and localisation equipment to trigger, identify, download the captured information and locate the capturing devices as well as display and image processing capabilities. The LOCCATEC system will be open and flexible with various sensor and triggering options, according to the space and the environment. It can eventually serve as platform for other sensors, like a microphone, which would be activated by the signal that triggers the transmission of the capturing data and would provide the rescue teams with real-time acoustic information.

Milestones:

157. Requirements and specifications;
158. Design;
159. Implementation;
160. Integration;
161. Testing.

Project details

Project Acronym: LOCCATEC
Project Reference: IST-2000-29401
Start Date: 2001-08-01
Duration: 36 months
Project Cost: 3.34 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-07-31
Project Status: Completed
Project Funding: 1.7 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a00d536:6a67:59b46085&RCN=60438

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38. Assessing and MonitoriNg the environmental Impact of mining activities in Europe using advanced Earth Observation techniques (*MINEO*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

http://www.brgm.fr/mineo

The project MINEO aims at developing Earth Observation (EO) based methods and tools for assessing and updating environmental status and impact in European mining areas. Furthermore it will develop their integration into Geographic Information Systems tools and models for further use in the environmental management decision-aiding process.

Objectives:

- To exploit advanced Earth Observation methods (Hyper-spectral imaging) in order to provide EC end users (industry, decision-makers) with new and regularly updated thematic layers for environmental databases relating to mining areas and to develop operational tools for preparing and updating these layers;
- To develop tools and methods to exploit this hyper-spectral data and facilitate its use in sustainable information systems that locate and monitor environmental risks relating to mining sites and aid the decision processes. Such tools will give a sound basis for effective environmental management through dialogue between industrialists and decision-makers, ensuring a sustainable development of the mineral industry, which faces increasing environmental pressure and regulatory controls;
- To integrate the above tools into Geographic Information Systems applications and models for further use in the environmental management decision-aiding process.

Milestones:

- MSynopsis of the socio-economic situation in mining environments in Europe;

- Development of spectral libraries (hyperspectral images), dedicated image processing and GIS pollution-transfer models for diverse European environments;
- Generic image-processing and GIS methods and tools for pollution detection and monitoring;
- Concept of data dissemination and standardisation.

Project details

Project Acronym: MINEO
Project Reference: IST-1999-10337
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 3.16 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31
Project Status: Completed
Project Funding: 1.5 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a046593:6a64:72640bc3&RCN=60800

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39. Geographic Distributed Information Tools and Services for the Mobile Information Society (*ODIN*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-5.1.1 CPA1: Integrated applications platforms and services

The ODIN project aims at developing innovative paradigms for the design of open, distributed, and networked tools to boost the integration of an entire new class of just-in-time, interactive, value-added, map-based and personalised services for the mobile citizen (tourist, entrepreneur, commuter, farmer).

ODIN will provide citizen/tourist/SMEs in rural areas with easy mobile access to just-in-time, geo-spatial Web applications (intelligently integrating administrative, business, environment, transport, weather, culture & leisure information with e-commerce purchasing, booking and payment) to improve quality of life and raise business in the regions targeted by the project.

The industrial strength of ODIN lies in the collaborative work of a complementary set of medium-sized IST System Integrators, Mobile Telecommunication Operators and major IST Developers in digital information and Geographic Information Systems.

ODIN also includes committed Regional Service Providers [Public administrations, local authorities] with a deep interest in the rationalisation and cost-effectiveness of their operations through the use of the ODIN platforms and services.

Work description:

With the cellular market in Europe reaching its maturity, the growing competitive pressure is causing mobile telecom operators to increasingly target the mass market, yet also paying particular attention to the needs of their high-value business subscribers, by launching tailor-made services to suit the needs of everyone.

Innovative offerings, launching of new ranges of voice and data value-added (internet) services targeting the growing market of handheld digital wireless devices, are issued at rocket speed.

In parallel, the development of new map-based web-service paradigms based on high degree of integration information (resulting from different, networked information), interactivity, and personalisation (while delivered on conventional fixed network and devices) such as those issued by the IA 1011 TITAN project (4th Framework Programme), have been proven successful in large European rural areas.

Within the long-medium term future, we envisage a situation where a growing demand of just-in-time, map-based, integrated and tailored Web-based information services will be arisen by the increasingly mobile citizen (worker, tourist, entrepreneur, farmer).

As a matter of fact, this situation poses a number of new integration problems to be tackled. ODIN is to satisfy these emerging requirements.

The project will firstly undertake the definition of a global system architecture for the delivering platform and services compliant to the guidelines ISO/ODP (Open Distributed Processing) 10746, and, specifically contributing to the work of the ISO TC-211/OpenGIS Consortium set up to define standards on spatial data interoperability (some of the ODIN participants are active partners within this Consortium).

Then, the specification and implementation of an integrated ODIN Toolkit able to access spatial and non-spatial information sources by means of the XML/Java power and to visualise them just-in-time and dynamically over wireless hand-held devices.

Milestones:

ODIN is based on concrete work to be carried out in four European regions, and the expected main results include the:

162. Specification and implementation of the Information Connector, Information Manager and Information Visualisation networked and interoperable tools;
163. Specification, implementation and validation of advanced services to improve citizens quality of life through the provision of applications specifically devoted serve the mobile user.

Extensive Demonstration (6 months) of the services being provided, establishing project benefits (covering assessment of technical results, usability, and cost-effectiveness, and impact as well) and innovation's transferability to other places.

Project details

Project Acronym: ODIN
Project Reference: IST-1999-70498
Start Date: 2000-04-01
Duration: 30 months
Project Cost: 956848.00 euro

Contract Type: Demonstration contracts
End Date: 2002-09-30
Project Status: Completed
Project Funding: 350959.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a064f06:a3d8:428dc6b8&RCN=58397

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40. Geographic Distributed Information Tools and Services for the Mobile Information Society (*ODIN*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-5.1.1 CPA1: Integrated applications platforms and services

ODIN will provide citizens/tourists/SMEs in rural areas with easy mobile access to just-in-time, geo-spatial Web applications (intelligently integrating administrative, business, environment, transport, weather, culture and leisure information with mobile (e-commerce purchasing, booking and payment) to improve the quality of life and raise business in the regions targeted by the project.

Objectives:

The ODIN project aims to develop innovative paradigms for the design of open, distributed, and networked tools to boost the integration of an entire new class of just-in-time, interactive, value-added, map-based and personalised services for the mobile citizen (tourist, entrepreneur, commuter, farmer).

Work description:

The project will first undertake the definition of a global system architecture for a mobile delivery platform and services that will be compliant with the ISO/ODP (Open Distributed Processing) 10746 guidelines, and, specifically adhere and contribute to the work of the standardisation committees in the spatial data interoperability sector (such as the OpenGIS / ISO TC 211) and the context of Wireless Applications (such as the WAP Forum).

ODIN will then specify and implement an integrated Toolkit capable of accessing spatial and non-spatial information sources using XML/Java and viewing them just-in-time and dynamically over wireless hand-held devices.

Finally, the project will specify, implement and subsequently extensively validate just-in-time, intelligent services for the mobile citizen/business, so as to improve their quality of life and raise business activity in large rural areas.

Specification and implementation of the following networked and interoperable tools:

- the Information Connector tool to enable the acquisition of spatial and non spatial data from networked sources, converting it to XML format and integrating it into the ODIN toolkit;
- the Information Manager tool to create a single access point to spatial and non-spatial information;
- the advanced Information Visualisation tool, to provide the front-end, end-user delivery service for all data and managed information.

Specification, implementation and validation of advanced services to improve citizens' quality of life through the provision of applications specifically targeting the mobile user.

In particular, the integrated set of services will cover the following categories:

- public and community services;
- environmental services;
- tourist services;
- mobile e-commerce services;
- cultural heritage services.

Project details

Project Acronym: ODIN
Project Reference: IST-1999-10498
Start Date: 2000-04-01
Duration: 30 months
Project Cost: 6.27 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-09-30
Project Status: Completed
Project Funding: 3.15 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=2&CAT=PROJ&QUERY=011e8a064f06:a3d8:428dc6b8&RCN=58396

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41. Decision support system for Risk Assessment and Management of FLOODs (RAMFLOOD)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2002-1.4.1 Intelligent systems and services for civilian and environmental crises management

The objective of the project is to develop and validate a new decision support system (DSS) for the risk assessment and management of emergency scenarios due to severe floods. The new DSS will combine environmental and geo-physical data from earth observation, satellite positioning systems, in-situ sensors and geo-referenced information with advanced computer simulation and graphical visualisation methods for generating knowledge contributing to the risk and damage assessment prevention of floods and the design of effective response actions maximising the safety of infrastructures and human life.

Work description:

The project work will be split into the following workpackages:

- WP1: Specification of the RAMFLOOD DSS features and user requirements;
- WP2: Collection and management of geo-physical and environmental data;
- WP3: Multiscale analysis of environmental and geo-physical data;
- WP4: Risk analysis and computer simulation of floods;
- WP5: Integration of the RAMFLOOD DSS system for risk assessment and management of floodplain areas;
- WP6: Validation of the new RAMFLOOD DSS for the forecast and management of emergency scenarios due to severe floods in two European regions;
- WP7: Pre-standardisation guidelines for design and management of flood prevention and control scenarios;
- WP8: Dissemination and exploitation plans;
- WP9: Project management;
- WP10: Assessment and evaluation. Pre-standardisation activities leading to harmonised models for capturing and filtering the necessary environmental data, the functionalities of the flood computer simulation and visualisation tools and the general architecture of the new decision-support system will also be a relevant part of the project work. Additional tasks will focus on the definition of a consistent approach for the design and management of flood prevention scenarios including the definition of adequate emergency policies.

Milestones:

- Specifications of RAMFLOOD DSS features (month 3);
- Processed remote sensing data (month 9);
- Multiscale analysis system (month 13);
- Database of flood risk criteria (month 16);
- RAMFLOOD DSS (month 20);
- Validation of the RAMFLOOD DSS in two flood plain scenarios in Spain and Greece (month24);
- Dissemination and exploitation plan (month 24).

Project details

Project Acronym: RAMFLOOD
Project Reference: IST-2001-37581
Start Date: 2003-01-01
Duration: 24 months
Project Cost: 1.82 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-12-31
Project Status: Completed
Project Funding: 1000000.00 euro

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42. Accompanying Measure on Natural Risks Management (RISK_FORCE)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2002-1.4.1 Intelligent systems and services for civilian and environmental crises management

RISK_FORCE is an accompanying measure focused on the management of natural risks: fires, floods and landslides. To serve the GMES objectives, it uses the results and assures the continuity of EC projects and studies together with national operational achievements, associating in 4 workshops the end users, the scientific entities, institutions, services and data providers, and industries. Within 15 months, RISK_FORCE will produce a shared European protocol for natural risks management, a service specification, and an implementation plan. RISK_FORCE is a decisive step towards the design of a generic European platform for natural risks management, fostering cooperation between European entities dealing with prevention, early warning, crisis management and post crisis assessment, and providing a significant contribution to both the GMES feasibility assessment, and to the preparation of a Risk integrated project as part of the 6th FP.

Objectives:

RISK_FORCE will associate a wide community of European actors of the natural risks management domain in order to improve data, products and service quality, according to EU orientations and policies. Outcomes of several on-going high quality studies on natural risks management will be compared with the results and lessons learned in significant operational projects and with existing means and practices. RISK_FORCE objective is thus to build upon and enrich the scope of EU funded RTD projects (such as CLIFF), and to converge towards:1-a shared vision of a Natural Risks management protocol for structuring adequate systems and services in Europe;2-services and application requirements and specifications for a common platform;3-a strategy for the next steps, compliant with the 6th FP working logic and with the principles of the first phase of the GMES action plan.

Work description:

RISK_FORCE is organised in 4 steps.

- Step 1: Field validation with "feed" activities. Operational cases and RTD results are compared. The operational projects taken into account are PACTES, FFO, PROCLAQ, while the RTD studies are CLIFF, FORMIDABLE, EGERIS, OSIRIS, FORFAIT, DECIDE, RMS, WARM. All facets like operational procedures, policies, practices, regional specificities, data sources (terrestrial, airborne, space), products, services requirements, existing equipments, are addressed, taking also into account the International Charter for space data acquisition and delivery;
- Step 2: Confrontation through 4 workshops. The objective is to identify the consensus built on a service vision. The issues from step 1 are presented then discussed and validated. The 4 workshops are therefore opened to the end users, public institutions, scientists, service and data suppliers and industry. They are addressing in sequence the best practices and operational concepts (workshop 1), then the risks characterization and user requirements (workshop 2), then the assessment of relevant technologies, data and products (workshop 3), and finally the preparation and agreement on a natural risks management protocol (workshop 4);
- Step 3:Consolidation. The consolidation is initiated from the results of each workshop. The partners collaborate through engineering activities to build and produce, along with the feed activities, a common lexicon for risk management, the protocol for an European risk management platform, the operational requirements for such a GMES service structure, the service specifications, and then the implementation plan;
- Step 4:Agreement. Users are again invited to validate the final results. In particular, the institutional bodies forming the RISK_FORCE steering committee animate and register the consensus in a final agreed version of the protocol, to approve the service definition and its proposed implementation.

Milestones:

- Within 15 months, RISK_FORCE provides all issues able to contribute to the preparation of the 2003 official report completing the GMES initial period. In addition to a monthly report, the significant steps and outputs are:
- Kick off at T0;
- 4 workshops at T0+4, T0+6, T0+8, and T0+12 months with their specific report and action plan;
- MTR at T0+6 with an interim report and the preliminary requirements;
- then FR at T0+15 with the protocol, the users requirements, service specification, and implementation plan.

Project details

Project Acronym: RISK_FORCE

Project Reference: IST-2001-37203
Start Date: 2002-09-01
Duration: 15 months
Project Cost: 748102.00 euro
Contract Type: Preparatory, accompanying and support measures
End Date: 2003-11-30
Project Status: Completed
Project Funding: 649517.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a10e179:e1b3:40bda02c&RCN=64700

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43. System for European Water monitorING (SEWING)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

http://www.sewing.mixdes.org

As the deficit of clean water becomes more of a problem in Europe, there is a need to develop easily accessible, cheap and reliable microsystems, which could be used for water pollution monitoring and early warning of many water European resources. The equipment available so far is mostly of laboratory type and measures water samples inserted to the measuring device. The objective of this proposal is to create a system of continuous water pollution monitoring in real time. Small and relatively cheap smart sensors are developed, which, when inserted in many places of water resources, collect data about pollution. "Ion Selective Field Effect Transistors" (ISFET) are used as sensors. Covering them with ion-selective membranes creates sensors called CHEMFETs. Data processing, coding, storing and transmitting circuits are integrated in the smart probe. Software for visualiation of the results will also be developed.

OBJECTIVES

164. Developent of methods for design and realisation of prototypes of flexible and reliable microsystems, based on new types of ISEFTs selectively sensitive to various polluting ions, and immune to interference, temperature and deterioration over time;

165. Development of sensors suitable for detection of a selected variety of non-organic polluting ions, with a broad range of sensitivity for ion concentrations and or all types of water resources and (in the future) waste water in high-risk industrial regions;
166. Development of a relatively cheap and easily accessible system for monitoring and early warning of water pollution.

DESCRIPTION OF WORK

The project combines partners in electronics, information, environmental and chemical engineering and involves end-users, i.e. institutions responsible for water management. The following tasks were carried out during the project:

167. Choice of the most important areas, where the microsystems will be used. Creation of ion-selective materials for sensors, sensitive for monitoring of the relevant ions;
168. Production of Ion Selective Field Effect Transistors (ISFETs) sensors, sensitive to the selected ions (CHEMFETs) and having the requested range of selectivity and sensitivity. The sensors are assessed from the point of view of selectivity, sensitivity, temperature dependence, hysteresis, stability on time, etc.;
169. Computer simulation of the whole system;
170. Development of software and hardware for data from sensors coding, transmission, collection, storing and processing;
171. Assembling all the parts into one smart microsystem, optimised from the point of view of cost, reliability, accuracy and lifetime. Lifetime is particularly important as most existing ISFETs can be now used continuously for not longer than days or a few weeks;
172. Testing the prototypes of the microsystems in a real environment by institutions responsible for water management;
173. Industrialisation of the prototypes by industrial partners.

Project details

Project Acronym: SEWING
Project Reference: IST-2000-28084
Start Date: 2001-09-01
Duration: 40 months
Project Cost: 2.41 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-12-31
Project Status: Completed
Project Funding: 1.2 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011ea7a3d4fa:0f6f:09f22f6b&RCN=60437

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44. Satellite-based Information System on Coastal Areas and Lakes (SISCAL)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

The objective of SISCAL is to create a software processor providing Near-Real-Time data products derived from satellite data and ancillary GIS-based information. During the development phase of this project, the focus will be on water-related products for end users monitoring coastal areas or lakes. The data products shall be tailored to individual needs of each end user so that the latter does not require specialised in-house knowledge on remote sensing or image processing. This way, SISCAL aims at closing the gap between satellite data providers and end users. Data transport will entirely take place over the internet, both download of satellite data from the receiving stations as well as dissemination of the finalised data products to end users. An user-friendly interface will allow the end user to interactively explore and display data products on the internet. Commercialisation prospects of the processor will be analysed, and a business model be prepared.

Work description:

In order to achieve the objectives of the proposed project, work is required in the following domains:

- Identification and specification of the end user needs within the consortium for Near-Real-Time (<12h after satellite overpass) water-related data products accessible to Earth Observation techniques
- Selection of the most appropriate instruments, evaluation algorithms and ancillary data bases for the identified data products;
- Development of a converter transforming the data formats of the different satellite instruments into the format used by the data processor;
- Development of automated data retrieval scheme from satellite receiving stations;
- Development of the Near-Real-Time data processing scheme for the specified data products;
- Development of the GIS processor adding ancillary digital information to the satellite images;
- Development of a product retrieval and management system to handle ordering and distribution of data products between the central data processing server and the individual end user, including payment and invoicing (data brokerage);
- Evaluation of the data products by the end users based on their expertise on the observed ecosystems and taking advantage of their routine monitoring programmes;
- Establishment of an internet server dedicated to internal communication between the consortium members as well as public presentation of the SISCAL project;
- Presentation of the data processor to potential customers outside the SISCAL consortium with regard to a future commercial exploitation.

Milestones:

- Month 0: Kick Off (KO) meeting;
- KO+3: project presentation;

- KO+6: SISCAL internet domain on-line, software requirements document, dissemination and use plan (DUP);
- KO+9: prototype detailed design document;
- KO+18: prototype operational testing and evaluation documents;
- KO+21: prototype demonstrator available on-line;
- KO+22: processor detailed design document;
- KO+30, market analysis;
- KO+32: prototype operational testing and evaluation documents;
- KO+36: Business model, technology implementation plan (TIP), final report, processor demonstrator on-line.

Project details

Project Acronym: SISCAL
Project Reference: IST-2000-28187
Start Date: 2001-09-01
Duration: 36 months
Project Cost: 2.16 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-08-31
Project Status: Completed
Project Funding: 1.48 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a14798b:b4fa:1d541cc6&RCN=60433

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45. SODA. Integration and exploitation of networked solar radiation Databases for environment monitoring (SODA)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

http://www.armines.org

Information about solar radiation is often restricted to very basic data such as annual radiation on horizontal surfaces for large geographical areas. There is a crucial need for more detailed information, for example concerning solar radiation on surfaces that are not horizontal (e.g. - windows of buildings and vineyards). Project SoDa will address needs of users (e.g. in agriculture, the construction industry and research) for quality information on solar radiation parameters by applying a user-driven methodology. A prototype service will be developed that will integrate and efficiently exploit diverse networked information sources to supply value-added information to a selected number of fields. The multi-disciplinary consortium gathers companies and researchers with the necessary expertise in solar radiation as well as from information and communications technologies. Customers and potential users are also represented via the involvement of commercial private vendors of solar radiation databases in addition to representatives of large international and local environmental research and development programmes.

Objectives:

- To answer the needs for high quality customer-tailored information on solar radiation;
- to integrate diverse sources of information presently available separately within a smart integrating network;
- to develop and operate a prototype service, which efficiently exploits the smart network, and which will be used and gauged by selected users;
- to increase the quality of the delivered information through improved modelling of time and space structures of the solar radiation, and improved matching to actual customer needs, to disseminate the achievements of the project, and to assess the sustainability of a permanent commercial service.

Work description:

- Dissemination and Use Plans;
- Prototype service version 1, then 2, made available and tested by customers;
- 1st and 2nd critical reviews of the project;
- Final versions of schemes for improved customer-tailored information;
- Final version of the prototype service. Conclusions and recommendations from users;
- Expression of benefits and value of the service;
- End of project. Final version of the technology implementation plan.

Project details

Project Acronym: SODA
Project Reference: IST-1999-12245
Start Date: 2000-01-01
Duration: 36 months
Project Cost: 2.11 million euro
Contract Type: Cost-sharing contracts
End Date: 2002-12-31

Project Status: Completed
Project Funding: 1.19 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=8&CAT=PROJ&QUERY=011e8a179c87:0f32:7f472223&RCN=60821

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46. SUrvey of MArine Resources (*SUMARE*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 1.1.2.-1.5.1 Intelligent environmental monitoring and management systems

The goal of SUMARE is to assess the capability of autonomous sensors used for monitoring marine resources in providing the information required to guarantee a sustainable exploitation of natural resources.

Two main advantages are expected:

- increased efficiency by reducing operational costs and accelerating deployment times;
- increased accuracy by improving spatial registration, appropriate sampling rates, guaranteeing overall coherency.

Objectives:

The first objective is to prove the usefulness of autonomous sensors for environmental monitoring, showing their efficiency in providing to competent authorities the data required to guarantee a safe and sustainable exploitation of natural resources. Besides obvious savings in terms of time and costs associated with the use of oceanographic ships, autonomous sensors offer the possibility of:

- adaptively selecting regions to be sampled in response to observed data;
- exploiting morphological characteristics of the sampled field to improve accuracy and consistency;

The second objective is to assess the multi-disciplinary issues underlying these goals: environmental knowledge modelling, data fusion, sensing and guidance.

Its results will be tested in two specific marine disciplines:

- monitoring of the evolution of sand banks;
- mapping of living/dead maerl.

Work description:

- Models of a priori knowledge;
- Adaptive sampling strategies;
- Contour tracking;
- Autonomous Underwater Vehicle (AUV) final configuration;
- Remotely operated Vehicle (ROV) final configuration;
- Sea trials assessment of quality and efficiency of mapping and classification missions.

Project details

Project Acronym: SUMARE
Project Reference: IST-1999-10836
Start Date: 2000-01-01
Duration: 42 months
Project Cost: 2.11 million euro
Contract Type: Cost-sharing contracts
End Date: 2003-06-30
Project Status: Completed
Project Funding: 1000000.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a19d0ee:0026:6cd91a02&RCN=60807

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47. TElematics Architecture Study for Environment and security (*TEASE*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

Success of the European initiative hinges on the existence of a suitable architecture for services, information and communication fluxes. Objectives of TEASE study is to develop such an European-scale architecture:

- innovative and optimally designed for operational environment, risks and security management, with an optimised use of state-of-the-art information technologies;
- featuring a high capability to inter-operate pre-existing parts of various types: data, services, actors originally not designed to interface to each other;
- integrating organisational aspects and favouring market opportunities.

A development plan will target a quick and reliable implementation of GMES network, starting by a pilot-project.

Collaboration of top level European Environmental users agencies and validation by workshops will ensure a high relevance of the study results and very strong benefits for the European Community.

Objectives:

GMES missions require to develop dedicated and closely networked operational services, relying on a suitable architecture for information and communication fluxes.

TEASE objectives are:

- to analyse and synthesise various users information technology needs (services content, access) and other constraints (organisational, economic)
- to select and model existing bricks from which to build;
- to study possible architectures for the GMES information and services network, both on technical (functional, physical, operational), economic and organisational aspects, and characterise and evaluate those technologies components that are key and critical. While initially focusing on selected applications, a generic architecture will be extrapolated for environment, risks and security management;
- provide directions and recommendations for short- and mid-terms follow-on phases, e.g. a proposal for a focused pilot-project, and a draft overall development plan starting with.

Work description:

The study is organised in two phases.

Phase 1 aims at collecting, analysing and validating inputs to be used for phase 2 of the study:

- analysis of needs relative to selected applications within GMES missions areas (environment, risks management, security). While thematic aspects of user-oriented needs should fully re-use results of EUFOREO project (IST 2001), other user-oriented aspects (how to access data and services) as well as non-user constraints (organisational, commercial, legal) will be studied in depth. These needs will be captured and formalised through Use Cases analysis, and extended to generic applications of GMES;
- selection and description of relevant existing bricks (information networks) from which to build the future GMES services and information network;
- synthesis of above results, confrontation versus existing parts, and validation of the whole by a board of actors (users, institutional bodies) through an "Information technology needs validation workshop";

Phase 2 aims at starting the definition of an architectural concept for a GMES information & services network, and at drafting a development plan, according to following steps:

- exploration of potential architectures against identified needs, initially on specific selected applications, then extended to generic concept;
- identification and integration of critical technologies and components, key factor for successfully implement the GMES information & services network;
- synthesise of above results and validation by a board of actors through an "Architecture validation workshop"
- definition of short- and mid-term development plan, with proposal of an application specific pilot-project.

Milestones:

Two milestones are foreseen to allow a board of actors (users, institutional bodies) to validate the results through two workshops (WS):

- WS1: validation of the user needs and of selected existing bricks from which to build the GMES network (services, competencies, actors);
- WS2: validation of the GMES network architecture concept.

The results consist in a concept definition of this architecture, and in a short- and mid-term development plan, with proposal for a pilot-project.

Project details

Project Acronym: TEASE
Project Reference: IST-2000-29397
Start Date: 2001-06-16
Duration: 17 months
Project Cost: 490129.00 euro
Contract Type: Preparatory, accompanying and support measures
End Date: 2002-11-15
Project Status: Completed
Project Funding: 266804.00 euro

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48. TELEMonitoring and Advanced teleControl of high yield wastewater treatment plants (*TELEMAC*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

http://www.ercim.org/telemac/

The TELEMAC project will design a modular and reliable system supporting a remote telemonitoring and telecontrol of small depollution units with no local expertise.

By using a network of smart sensors, robust advanced control procedures, fault detection and isolation techniques, a remote expert will manage the complex non-linear anaerobic digestion process via Internet and assist the local technician.

The history of the supervised plants will feed a learning data base in order to improve the process management.

The TELEMAC project focuses on bringing new methodologies issued from the IST field to the conservative world of water treatment.

It will enhance new services for SMEs generating concentrated pollutants.

This will enhance the creation of new companies to improve the management of wastewater treatment and cogeneration through the Web.

Objectives:

Targeting an unstable biological process, the TELEMAC project proposes a set of adaptive and customisable tools for the small units in order to improve the quality of their depollution process, reduce the treatment cost and increase the derivate products output. It is stressing on the synergy expected from the merger of robust advanced control algorithms and supervision systems based on artificial intelligence techniques.

Its objectives are to:

174. Provide a set of tools to assist a remote expert centre in managing a wastewater treatment plant through Internet. This will improve the process reliability and quality;
175. Guarantee a customised depollution system to SMEs characterised by a low cost, plug and play installation and easily portable architecture;
176. Decrease the depollution cost (maintenance cost, operational cost, post treatment cost, initial investment);
177. Improve derived products output, and in particular provide a biogas quality suitable for cogeneration.

Work description:

The TELEMAC project will rely upon 7 specific yet inter-dependent work packages:

- WP1 will run the experimentation and validation aspect of the project. It is therefore the cornerstone of the TELEMAC project as it is involved from the very beginning by providing data (at lab, pilot and industrial scale) and in every major step of the project, up to the final validation;
- WP2 will focus on the Smart Sensors development. It will specify the sensors requirements, design and build both hardware and software sensors, integrate fault residues in the sensors to improve the information reliability, validate and integrate optimally sensors from lab to full industrial scale;
- WP3 will provide the Advanced Control system relying upon validated models normal and abnormal working conditions. It will develop models, on line estimate the main model parameters, and design robust controllers to achieve optimal control and help the process to recover in case of failure;
- WP4 will design the supervision system by providing an adaptive fault detection and isolation strategy. It will develop knowledge base and data base management, learning algorithms and provide assistance to human to help them address the problems;
- WP5 will develop the Telemonitoring dimension of TELEMAC, analysing information security requirements and setting up web based interfaces and communication tools. It will integrate all the TELEMAC modules into a functioning whole;
- WP6 will ensure an efficient exploitation and disseminating of the results, both in the scientific and industrial domains. This last point will rely on a deep end users' involvement and a prepared implementation phase;
- WP7 will coordinate the project scientifically and administratively. It will create the necessary conditions for the project to achieve its objectives and perform the project review to guarantee the quality of the actions implemented.

Milestones:

- T0 + 6: Initial system architecture and system management strategies defined;
- T0 + 15: Database for measurements recording and plant architecture description completed;
- T0 + 18: First TELEMAC Software version delivered;
- T0 + 22: Set of models reliable an able to describe most of the situations completed;
- T0 + 24: Set of algorithms in order to tackle the fault detection and isolation objectives delivered;
- T0 + 27: Hardware prototype of the adaptive sensor with robust probes ready;
- T0 + 27: Software sensors for state forecasting accompanied with fault residues;
- T0 + 28: Set of robust controllers integrated;
- T0 + 33: Instrumented plants piloted with the TELEMAC software tested;
- T0 + 36: Final TELEMAC software delivered.

Project details

Project Acronym: TELEMAC
Project Reference: IST-2000-28156
Start Date: 2001-09-01
Duration: 36 months
Project Cost: 4.6 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-08-31
Project Status: Completed
Project Funding: 2.07 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a1e63e4:9b4b:57651e95&RCN=60435

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49. Social Learning on Environmental issues with the Interactive Information and Communication Technologies (*VIRTU@LIS*)

Background and Objectives

Funded under 5th FWP (Fifth Framework Programme)

Research area: 2000-1.4.1 Intelligent environmental management, risk and emergency systems

Good communications between public authorities, private sector firms and citizens can enhance understanding and trust, which are essential ingredients for mobilising citizens' efforts in situations of emergency (e.g. contamination crises) and wider environmental governance. ViRTU@LiS aims to create learning tools for improving citizens' awareness of environmental management and risks. The project will develop computer-based learning tools, exploiting state-of-the-art ICT that organise current scientific knowledge about selected environmental domains for non-scientific audiences.

With interactive virtual/augmented realities it is hoped that users can:

178. gauge how their personal way of living impacts on the environmental feature or resource in question;
179. explore alternative possibilities for social and economic changes towards sustainability.

Objectives:

ViRTU@LiS will develop computer-based learning tools, exploiting state-of-the-art ICT, that organise current scientific knowledge about environmental management challenges and risks to non-scientific audiences. The tools will show the links between individual lifestyles, governance and larger-scale sustainable futures. The four domains selected are agricultural pollution, climate change, aquifer water resources and marine capture fisheries.

These goals will be achieved for the selected domains by developing four types of ICT tools, namely:

180. Personal Barometers, allowing quantification of environmental impacts of individual lifestyles;
181. Scenario Generators, exploring changes in patterns of economic activity towards sustainable resource use;
182. Virtual Visits including Virtual Libraries within larger Virtual/Augmented Reality;
183. Multi-player Games about problems of governance and resource access.

The prototypes will support free-access citizens learning and commercialisation perspectives, tested for scientific quality and user effectiveness.

Work description:

The ViRTU@LiS project brings together a consortium of specialists in information technology, sustainable development, environmental modelling, public policy and governance, learning psychology and open learning, to develop computer-based learning tools on ecosystems and natural resources. The four domains are agricultural pollution, climate change, aquifer water resources and marine capture fisheries. Four types of ICT tool (listed above) will be developed using emerging ICT capacities, user-friendly interfaces and virtual worlds will allow structured learning about personal and aggregate societal impacts on environmental resources, and will link the user to simulation models, videos, on-line data bases. The suite of ICT tools will be validated scientifically by Knowledge Quality Assessments, tuned for use in a variety of classroom and open learning modes and the context of participatory policy processes, and delivered in formats that can rapidly be diffused as public good or commercialised products.

A further outcome will be guidelines and demonstrations concerning new prospects of ICT to enhance researchers' own enquiry capacities and to enhance the effectiveness of communication to non-specialist audiences of scientific modelling results, and uncertainties, on complex high stakes environmental issues.

Milestones:

- Month 12: Completion of prototypes (barometer, scenario generator, virtual visit, multi-player game) in four domains (agriculture, climate, fisheries, water);
- Month 24: Completion of testing and "tuning" of prototypes for learning and policy contexts;
- Month 30: Diffusion of "tuned" products via internet, CD ROMs, reports & workshops. Definition of commercialisation prospects.

Project details

Project Acronym: VIRTU@LIS
Project Reference: IST-2000-28121
Start Date: 2001-09-01
Duration: 30 months
Project Cost: 1.63 million euro
Contract Type: Cost-sharing contracts
End Date: 2004-02-29
Project Status: Completed
Project Funding: 1.29 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a214444:1487:5713ac40&RCN=57873

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50. Integrating communications for enhanced environmental risk management and citizens safety (CHORIST)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management http://www.chorist.eu/

The CHORIST project will propose solutions to increase rapidity and effectiveness of interventions following natural hazards and industrial accidents, in order to enhance citizens' safety and communications between rescue actors.

The main objective is to develop a system made of the following subsystems:

184. A fully integrated, reliable and performing alert chain delivering alerts to authorities with inputs from heterogeneous sensors, disparate agencies and citizens;
185. Heterogeneous communication means (radio, TV, sirens, GSM) to dispatch messages from authorities to as many citizens as possible within the crisis area and with limited delay;
186. Secured, rapidly deployable and interoperable voice and high data-rate telecommunication systems (incl. ad-hoc networks) for in the field risk response teams.

A CHORIST system, addressing the different phases of crisis management (monitoring, preparation and response) will be designed to work with:

- The upstream systems used in the prevention and forecast phases,
- The downstream crisis management systems, i.e. Command and Control systems.

Interoperability with these systems, legacy or future, will be an essential criterion.

The CHORIST project will:

187. Involve users (Civil Protection Authorities, citizens and telecommunication operators) all along the project life, in order get their requirements and their feedback on the ongoing technical developments;
188. Derive technical requirements from the user inputs, then develop the three subsystems (alert chain subsystem, message dispatch subsystem and rapidly deployable subsystem) and finally integrate them into one CHORIST system;
189. Set up a demonstration in Spain to validate the proposed concepts and assess performances;
190. Promote the project to the broader scientific and user community (knowledge dissemination, standardisation, impact assessment and exploitation)

Project details

Project Acronym: CHORIST
Project Reference: 033685
Start Date: 2006-06-01
Duration: 36 months
Project Cost: 12.85 million euro
Contract Type: Integrated Project
End Date: 2009-05-31
Project Status: Execution
Project Funding: 7.09 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a2487e1:3781:15e6cb07&RCN=79341

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51. Restructuring demining research from regional, initiatives within Europe (DELVE)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.delve.vub.ac.be/

Humanitarian de-mining R&D has made good progress. There is now a better overview of R&D activities and communication between researchers has improved thanks to information sharing initiatives. Current research shows a stronger tie with end user needs and more emphasis on area reduction, trace explosive detection and remote sensing as well as environmental and soil conditions and a better understanding of the limitations of sensors and techniques Nonetheless, European R&D is still too fragmented, reducing its competitive potential. There is still no co-ordination between national research initiatives and insufficient collaboration of military oriented research and international projects as well as a lack of coordination between military and humanitarian de-mining R&D. DELVE will address these issues by catalysing the restructuring and defragmenting of European de-mining research, thereby strengthening the European Research Area.
Its goals are to:

191. improve co-ordination between research activities by mapping ongoing research initiatives and results;
192. enhance Internet-based communication to provide structured and efficient information;
193. encourage synergy and complementarities between disciplines and actors and disseminate knowledge, experience and results via forums, and
194. promoting long term sustainability and structure. DELVE will build on previous initiatives but will go further.

It will:

195. avoid research duplication by encouraging end users to collaborate (using a pro-active, but non-coercive role) and inform (R&D) decision makers about latest developments and requirements;
196. maintaining and restructuring a central repository of de-mining related information (DELVE Website);
197. encouraging the creation of Regional Networks;
198. enhancing researcher mobility;
199. generating clear overviews of national/supranational research;
200. fostering contacts (active and passive);

201.helping new member states, with R&D potential to quickly integrate.

Project details

Project Acronym: DELVE
Project Reference: 511779
Start Date: 2004-12-01
Duration: 28 months
Project Cost: 220000.00 euro
Contract Type: Specific Support Action
End Date: 2007-03-31
Project Status: Completed
Project Funding: 220000.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a273271:42c7:2f824604&RCN=72082

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52. Distant early warning System (*DEWS*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)
Research area: IST-2005-2.6.5.1.e Tsunami

The Distant Early Warning System (DEWS) proposal addresses the present major shortcomings and important societal problems related to early warning systems for tsunamis and other coastal hazards. DEWS will develop an innovative platform and services for the disaster management cycle between GITEWS hazard detection and warning/alarm. DEWS software will include models for tsunami wave spreading, assessment of vulnerabilities/consequences of natural disasters and systems for monitoring and crisis management, including information and decision support.

Early warning distribution architectures will be developed, including systems for prompt local warning of citizens and managing efficiently tsunami hazards and natural disasters in general. The project will provide an important innovative research contribution and improve EU competitiveness in the crisis management area. DEWS will build on existing capacities, cooperate with other EU research and develop a platform and services, allowing for flexible practical implementation to meet different requirements in countries. DEWS will have interoperability with international cooperation mechanisms, including UNESCO-IOC, to ensure relevance and transferability of results to other tsunami-prone areas.

DEWS will develop integrators for sensors and sensor networks, information logistics and dissemination modules, an early warning and warning distribution system, integrators for systems for local warning of the public, information and decision support products and a service bus. Testing will ensure future implementation and exploitation in different parts of the Indian Ocean Region. End-users will be involved in the development and testing to ensure the practical usefulness of the results. The consortium consists of large and small partners from

EU MS and INCO countries, combining qualified technological competence and application experience. Exploitation and dissemination of results will be an important task for the project.

Project details

Project Acronym: DEWS
Project Reference: 045453
Start Date: 2007-02-01
Duration: 40 months
Project Cost: 6.17 million euro
Contract Type: Specific Targeted Research Project
End Date: 2010-05-31
Project Status: Execution
Project Funding: 4.02 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=2&CAT=PROJ&QUERY=011e8a29171c:254f:4195e2b8&RCN=80517

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53. Dynamic Visual Network (DYVINE)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.dyvine.eu/

DYVINE objective is to design, develop and test a representative version of a surveillance network based on visual sensors (images and video, in situ or airborne) which can be configured as a function of the requirements and events. This network can be used to monitor any kind of area or infrastructure which can be threatened by natural of industrial disasters.

The scientific and technological objectives of DYVINE are to:

- Design a generic architecture encompassing a vast array of various types of visual sensors, fixed and mobile, ground-based and airborne. This architecture will propose system standards and sensors interfaces standards,
- Propose advanced solutions for the (re)configuration of the surveillance network as a function of the events,
- Study the communication means as well as develop new processing capabilities and networks necessary to integrate the largest possible forest of sensors,
- Study the exploitation applications and fusion/correlation algorithms to provide the operators with the most comprehensive synthetic situation picture.

The resulting test-bed will be demonstrated in the frame of a surveillance/disaster mitigation scenario in an urban environment. It will demonstrate real advances in Surveillance capabilities illustrating how one can have a global situation awareness with a large coverage and still detailed view.

The STREP will encompass industrial partners interested in the exploitation of the results (EADS, MARTEC, REALVIZ, WHITEBALANCE), leading URL in the sensor, communication and image exploitation domains (CEA, EPFL, University of Surrey, UPV) and a user group representing the final users and stakeholders for this type of system (from the cities of.Valencia, Miraflores and Segrate).

Project details

Project Acronym: DYVINE
Project Reference: 034307
Start Date: 2006-09-01
Duration: 24 months
Project Cost: 2.93 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-08-31
Project Status: Completed
Project Funding: 1.81 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a2b04d0:106d:45d5ed23&RCN=79761

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54. Electronic Risk Management Architecture for small-medium communities (*ERMA*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://erma-project.org/index.php?lang=en

ERMA aims to build a reference platform for risk management (natural /man-made disasters) with a specific focus on needs of small and medium-sized communities. This might be public bodies as well as private sector organisations with share obligations and duties for risk prevention and response. Hence, specific attention will be devoted to a customisable platform, tailored to the need for the individual risk at hand.

The current state of risk management can be characterised by the availability of many information sources. The question arises of how to draw conclusions from existing sources for the purpose of task planning, i.e.

- how to assess the risk level for a specific event
- how to govern the processes in collaborative way
- how to advise effected people, be they professional rescue forces or citizens.

ERMA strives to employ this information in combination with existing technology in order to provide risk assessment and communicate services in particular to the citizens before, during and after incidents.

In detail, ERMA will assist small and medium-sized communities to:

- Access monitored data related to various natural and industrial risks existing within their district
- Define and employ process guidelines for risk management, i.e. support proper processes for risk analysis and response
- Deploy and manage their adapted emergency telecommunications systems and implement a public com. system devoted to the information of their fellow citizens
- Manage all the elements (org./technical) related to the implementation of a risk management network at a local scale

ERMA will provide a platform for the exchange of information for the assessment of risks and for the response towards related bodies in case of a hazardous event. The system will be build upon a risk assessment platform, a process management component for the support of operational processes, and a collaboration platform for the exchange of information among systems and stakeholders.

Project details

Project Acronym: ERMA
Project Reference: 034889
Start Date: 2006-09-01
Duration: 24 months
Project Cost: 2.93 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-08-31
Project Status: Completed
Project Funding: 1.49 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a2c8d7c:c8ef:65c48a47&RCN=79523

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55. Innovative optoelectronic and acoustic sensing technologies for large scale forest *fire* long term monitoring (*EU-FIRE*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.eufire.org/

The problem of forest fires detection and monitoring is repeating every year with the same devastating effects on quality of life in wooded areas. Early detection and accurate monitoring remain the most important objectives to achieve to improve the effects of extinguishing operation, to increase the probability of fire confining, and thus to reduce damage to people and goods, and also costs for emergency management.

State of the art technology for fire detection, essentially based on infrared cameras and remote sensing, seems to be inadequate for a large scale forest fire long term monitoring, as it cannot guarantee, at low costs, both spatial and time continuity.

The EU-FIRE project will overcome the current limits through the exploitation of new technologies, and will provide the following breakthrough advancements:

202. A completely new design of acoustic systems for volumetric scanning, contributing to give a deeper monitoring of forest safety through the possibility to detect and track fires from the beginning by recognizing of its acoustic emission spectrum;
203. A completely new design of fibre optic sensors networks and optoelectronic piloting units for the detection of changes in fire associated parameters, such as temperature and gaseous emission, to realize protection rings around sensible structures;
204. A new acquisition unit for data collection from innovative units as well as from traditional sensors, such as cameras, anemometer, hygrometer, and manometer.

The full exploitation of the EU-FIRE scientific and technological results will lead, in the mid-term, to the provision of improved performance detection systems, and, in long term, to the establishment of a common European model for forest fire monitoring.

Project details

Project Acronym: EU-FIRE
Project Reference: 035299
Start Date: 2006-09-01
Duration: 36 months
Project Cost: 2.47 million euro
Contract Type: Specific Targeted Research Project
End Date: 2009-08-31
Project Status: Execution
Project Funding: 1.43 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a2e43df:7664:4199d33b&RCN=79404

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56. European illicit Trafficking countermeasures Kit (EURITRACK)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.euritrack.org/

Shipping is a key international industry; 95% of the world cargo is moved by ship corresponding to over 200 million containers per year exchanged between major seaports. This huge movement leads to a risk that a container could be used by a terrorist group. As a result, the maritime industry must consider very seriously any potential threat for disruption of the trade. Today, inspections of containers are largely based on X-or Gamma Ray systems but they provide limited information about contained objects such as their shape and density. Controllers cannot always distinguish between benign and threat materials and need additional information about the chemical composition of suspect items in order to detect illicit materials such as explosives, drugs or dirty bombs.

The 3-year EURITRACK STREP aims at increasing the security of the seaports by developing a European Illicit Trafficking Countermeasures Kit to non-intrusively detect explosives or other threat materials concealed in shipping containers. The project will offer to end-users a very useful tool, more advanced than commercial-off-the-shelf equipment in order to optimise the time needed for inspection. The system will consist of an innovative Tagged Neutron Inspection System (TNIS) that will non-intrusively permit an assay of the chemical composition of suspect contents located by X-Ray radiography. Software development is also a crucial part of the project since the innovation in the control system relies on the combination of two complementary techniques.

An embedded information system will implement decision-making algorithms taking also into account data from electronic seals. The complete concept will be validated in the largest French container seaport (Le Havre) by the end- users themselves: French Customs as leaders of a European Custom Expert Group.

Project details

Project Acronym: EURITRACK
Project Reference: 511471
Start Date: 2004-10-01
Duration: 41 months
Project Cost: 4.2 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-02-29
Project Status: Completed
Project Funding: 2.45 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a2fd54a:63d7:3a4a863c&RCN=71839

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57. Emergency ultra-wideband radio for positioning and communications (*EUROPCOM*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.ist-europcom.org/page2.aspx?title=project%20overview

In emergency situations, particularly within smoke-filled partially or completely collapsed large buildings, communications with rescue personnel can be difficult. Safety and co-ordination of the operations is hampered by a lack of knowledge of the location of emergency staff. The project will investigate and demonstrate the use of UltraWideBand (UWB) radio, to allow the precise location of personnel to be displayed in a control centre and simultaneously improve communications reliability. The feasibility of using UWB to search for survivors buried beneath rubble and to generate simple maps will also be investigated.

The main intended outcomes of the project are:

- Understanding of the overall application requirements and system issues
- Development of UWB technology, understanding issues that need to be addressed prior to product development
- Interface requirements with existing systems
- Performance measurements of a prototype system in a representative environment (Trials and demonstrations)

The approach that will be taken is summarised in the following ordered list of top-level work packages:

- Requirements definition and prioritisation, involving discussion with the potential users
- System design: An iterative process, involving carrying out experiments for the highest risk areas and potentially modifying design concepts as a result. Competing UWB technologies will be assessed and a choice will be made for the prototype.
- Prototype build and laboratory testing
- Trials: to provide full information on the system performance.

In addition, the project will monitor and provide input to, regulatory authorities (in particular the CEPT and ITU).

The project will fit with the following (partial extracts from the workprogramme):

- To develop open platforms, integrated systems and components for civil security applications.
- Research on key IST technologies, notably: robust and/or low cost smart sensors with communication and location capabilities.

Project details

Project Acronym: EUROPCOM
Project Reference: 004154
Start Date: 2004-09-01
Duration: 43 months
Project Cost: 4.22 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-03-31
Project Status: Completed
Project Funding: 2.5 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a3154a8:a455:55c10a6c&RCN=71916

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58. Interoperability and automated mapping (*INTAMAP*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.intamap.org/

The main objective of this project is to develop an interoperable framework for real time automatic mapping of critical environmental variables by extending spatial statistical methods and employing open, web-based, data exchange and visualisation tools. To illustrate the potential of the framework at the European scale we will apply the framework to produce a system for automatic mapping of radiation levels reported by 29 European countries that participate in the European radiological data exchange platform (EURDEP).

In case of hazards and emergencies (e.g. pollution peaks, nuclear/radiological accidents, flash-floods), maps of environmental variables interpolated from monitoring network measurements are needed in real time with minimum or no human intervention to reflect the monitored situation. In particular when dealing with unforeseen events ("hot spots" or extreme values) environmental monitoring systems (EMS) usually lack adequate automatic mapping systems. Because spatial interpolation has an associated interpolation error, an automatic mapping system must inform decision makers about the uncertainties associated with the interpolated maps, such as by means of probabilities that a critical threshold is exceeded over a certain geographic region. Combining these probabilities with population density yields a system for rapid assessment of exposed population at risk.
This project addresses key issues of GMES and integrates the results in an INSPIRE compliant framework, based on open standards (OGC/Orchestra/OASIS) and web (feature) services. Hence, the project has the ambition to lay down the foundations that set the technology and science necessary to realise the above objectives in the most accurate, reliable and extensible form.

Project details

Project Acronym: INTAMAP
Project Reference: 033811
Start Date: 2006-09-01
Duration: 36 months
Project Cost: 2.15 million euro
Contract Type: Specific Targeted Research Project
End Date: 2009-08-31
Project Status: Execution
Project Funding: 1.86 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a337d06:84cc:65522f0e&RCN=79515

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59. Interoperable GMES Services for Environmental Risk Management in Marine and Coastal Areas of Europe (INTERRISK)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://interrisk.nersc.no/

The overall objective is to develop a pilot system for interoperable GMES monitoring and forecasting services for environmental risk and crisis management in European marine and coastal areas. This pilot, the InterRisk system, will consist of a web portal offering access to all services, a suite of components for registration, maintenance and discovery of services, and a network of services in Norwegian, UK/Irish, French, German, Polish and Italian coastal waters.

The consortium will capture and analyse users' and service providers' requirements for sustainable GMES services, and design an open system architecture to accommodate the identified needs, based on established GIS and web services protocols, and compliant with INSPIRE recommendations. Ontologies and application schemas for the targeted application domains, monitoring and forecasting of oil spills, harmful algal blooms, eutrophication and environmental degradation, will be developed to enable data and metadata harmonisation between different service providers. Services will be implemented by a group of service providers in the consortium and integrated in the InterRisk system.

The services will be based on satellite data, in situ data and numerical models needed to monitor and forecast marine environmental degradation and crisis events. Both basic services, such as satellite data processing, in situ data delivery, model simulations, metadata catalogues, and complex services that will use several of the basic services, will be developed. Examples of complex services are oil spill fate prediction and water quality monitoring.

The network of InterRisk services will be embedded in the ESA Service Support Environment (SSE), which will provide the underlying infrastructure for the InterRisk system. Incremental development of services and SSE components will be used to facilitate rapid feedback from users and service providers, leading to improved products and services that can be sustained after the project.

Project details

Project Acronym: INTERRISK
Project Reference: 035253
Start Date: 2006-09-01
Duration: 36 months
Project Cost: 4.26 million euro
Contract Type: Specific Targeted Research Project

End Date: 2009-08-31
Project Status: Execution
Project Funding: 2.46 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a34ec19:c9dd:084937a7&RCN=80203

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60. Monitoring and intervention for the transportation of dangerous goods (MITRA)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.mitraproject.info/html/overview.html

The objective of MITRA is to prototype a new operational system based on regional responsibilities for the monitoring of dangerous goods transportation in Europe. This concept, derived from the Air Traffic Control domain, aims at providing the Civil Security centres with a real-time knowledge of the position and contents of dangerous vehicles circulating in their responsibility area, warning and alert displays in case of dangerous situations, and crisis management information, allowing intervention teams to react immediately in case of an accident, with a maximum of safety.

MITRA will entail cooperation between different European actors: Civil Security authorities, research organisations, industrial companies. The active participation of the end-users throughout the whole project duration will ensure adequate requirements capture. They will also be involved in the different project reviews (To+ 4, 7, 16, 21). The project will deliver (To+17) a prototype consisting of 3 User Monitoring Terminals, with the appropriate decision support software modules, together with a Risk-Knowledge platform, containing all information about dangerous goods and propagation models. Deployed in 3 major Civil Security centres (France, Germany and Spain) for field-trials and validation campaign, the system will be submitted to real-scale emergency scenarios.

MITRA will contribute to paving the way to the evolution of the European legislation in terms of dangerous goods transportation, through a long-haul dissemination campaign. A Web site (public/private) will be established at To+3, and two major User workshops will be organised at To+4 & To+22. Deploying MITRA in the regional Civil Security Centres in Europe is expected to save many lives among intervention forces and civil populations, improve the efficiency of the operations by at least 10% and contribute to the improvement of the interoperability between regional Centres, based on INSPIRE interface requirements.

Project details

Project Acronym: MITRA
Project Reference: 511361
Start Date: 2004-09-01
Duration: 26 months
Project Cost: 2.82 million euro
Contract Type: Specific Targeted Research Project
End Date: 2006-10-31
Project Status: Completed
Project Funding: 1.45 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a36c50a:6c2d:7858f0cc&RCN=71830

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61. European platform and roadmap for future public safety communication (*NARTUS*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.publicsafetycommunication.eu/

The SSA project proposal NARTUS is focused on creating a European Public Safety Communication Forum which will establish a European platform and roadmap for future public safety communication and will help to facilitate European integration in the area of Public Safety with particular focus on public safety communications and information systems.

The European Public Safety Communication Forum will include Conferences and will carry out other activities between the Conferences, designed to be interactive and consultative with public safety users, system providers and operators in as many European nations as possible.

Through the Forum Conferences and other consultative mechanisms, NARTUS will not only establish consultation processes and build consensus, it will also disseminate information, best practice and establish protocols through which it will be able to provide advice to policy makers and influence the development of standards for the benefit of public safety in Europe.

Once established, it is anticipated that the Forum will endure after the conclusion of the Project and will continue to build on the work completed during the Project lifetime.

Project details

Project Acronym: NARTUS
Project Reference: 034895
Start Date: 2006-06-01
Duration: 36 months
Project Cost: 760000.00 euro
Contract Type: Specific Support Action
End Date: 2009-05-31
Project Status: Execution
Project Funding: 760000.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a38247c:a1e1:1ffd62f3&RCN=79514

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62. OASIS : Open advanced system for disaster and emergency management (OASIS)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.oasis-fp6.org/

OASIS is an Integrated Project (IP) focused on Emergency and Disaster Management.
Conducted over 48 months, OASIS aims to define a generic crisis management system to support the response and rescue operations in the case of large scale as well as local emergencies subsequent to any kind of disaster and to facilitate the cooperation between the information systems used by the civil protection organisations.

Taking full advantage of, and leveraging work from, the previous projects (FP5, ESA and National initiatives) in the relevant domains, from the dual-use technologies, and in continuity of the successful developments in the EGERIS project, OASIS will:

205. analyse the users requirements to extract European generic system requirements,
206. specify and design a true generic, interoperable and open system architecture which will allow easy deployment at every level of the action chain (local, regional, national and European).
207. This generic architecture will rely on the integration of mature state-of-the-art technologies.
208. The project will provide the definition of:
209. the system backbone (data bases, common operating environment and fully interoperable message handling system), supported by a reliable and secure communication network,
210. the deployable broad-band wireless communication network,
211. the command and control functions,
212. the decision support software modules.
213. implement these architectural concepts through the development of 2 versions of a pre-operational system (POS1 and POS2), representative of the future European and national target system(s),
214. validate and evaluate POS1 and POS2 with users from different EU countries. The evaluation sessions will be performed in the frame of operational scenarios.

Project details

Project Acronym: OASIS
Project Reference: 004677
Start Date: 2004-09-01
Duration: 48 months
Project Cost: 19.54 million euro
Contract Type: Integrated Project
End Date: 2008-08-31
Project Status: Completed
Project Funding: 10.5 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a9fd3f7:c630:362b5d98&RCN=71884

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63. Open architecture and spatial data infrastructure for risk management (*ORCHESTRA*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.eu-orchestra.org/
Risk Management activities involve a range of different organisations at various administrative levels with their own systems and services. However, the sharing of relevant information that is required for dealing with risks is often limited to a raw data exchange with all the syntactical and semantical conversion problems. Thus, true efficiency, in most cases, is hindered by administrative and legal boundaries as well as a lack of interoperability on the technical side. Furthermore, the application of numerous and different policies, procedures, data standards and systems, results in co-ordination problems with respect to data analysis, information delivery and resource management, all critical elements of Risk Management.

The aim of ORCHESTRA is to improve the efficiency in dealing with risks by developing an open service architecture for risk management that is based on de-facto and de-jure standards. Emerging specifications out of the INSPIRE and GMES activities will be incorporated. Software adhering to the ORCHESTRA architecture will be able to interoperate, to a certain extent even at a semantic level, and organisations will be able to cooperate much more efficiently as it is currently possible.

More specifically the goals of ORCHESTRA are:

- To design an open service-oriented architecture for risk management

- To develop the software infrastructure for enabling risk management services
- To deliver an infrastructure integrating spatial and non-spatial services for risk management
- To validate the ORCHESTRA results in a multi-risk scenario
- To provide software standards for risk management applications

Two types of users will benefit from the ORCHESTRA solutions:

215. System-users: Providers of data and application services that are used for risk management
216. End-users: Civil protection agencies and private companies involved in risk management.

Project details

Project Acronym: ORCHESTRA
Project Reference: 511678
Start Date: 2004-09-01
Duration: 42 months
Project Cost: 13.64 million euro
Contract Type: Integrated Project
End Date: 2008-02-29
Project Status: Completed
Project Funding: 8.2 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=3&CAT=PROJ&QUERY=011e8a3c6c76:2ae3:6ccdb1b1&RCN=71859

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64. *OSIRIS* (Open architecture for Smart and Interoperable networks in Risk management based on In-situ Sensors) (*OSIRIS*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.osiris-project.eu

GMES is an information system which covers all the necessary steps from data acquisition to service delivery to the end-users. Data acquisition requires in-situ observations as well as space-based observations. By in-situ observations, we mean observations captured locally, i.e. within a few kilometres of the object or phenomenon being observed, thus including measurements taken at ground station or by aircraft. Space-based and in-situ observations are complementary, as both have limitations.

To address the limitations of in-situ monitoring systems, OSIRIS will focus on the state of the art technologies for smart sensors. The objectives of this project are to develop the technologies and necessary software for smart sensors networks deployments and operations.

The main objective of the OSIRIS project is to enhance the overall efficiency of the in-situ data processing chain by connecting the in-situ sensors via an intelligent and versatile network infrastructure that will enable the end-users to access to multi-domain sensors information.

Firstly, OSIRIS will address the smart deployment, use and reconfiguration of network of sensors in the monitoring or crisis phase. Secondly, it will develop architectures enabling the easy share of data and access of services, taking into account the data right management. Thirdly, it will provide the required technologies to allow for the customisation of sensors or sensors network to fulfil end-users needs and define interoperability within an In-situ Monitoring sensor web.

Finally, an experimental validation based on end-users requirements will be conducted to support the proposed concepts and investigate options to improve in-situ observations dissemination, addressing three thematic in the natural resources domain: forest fires monitoring, air pollution monitoring, water resource monitoring (in quantity and quality - pollution). A cost/benefit analysis will also verify technological choices made in OSIRIS.

Project details

Project Acronym: OSIRIS
Project Reference: 033475
Start Date: 2006-09-01
Duration: 32 months
Project Cost: 10.98 million euro
Contract Type: Integrated Project
End Date: 2009-04-30
Project Status: Execution
Project Funding: 6.46 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a3e23eb:fb55:28d581f3&RCN=80164

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65. Reaction to Emergency Alerts using voice and Clustering Technologies (REACT)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.react-ist.net/wordpress/

REACT aims at reducing risks to citizens and the environment by enhancing the interactivity of citizens with Emergency Services and by providing added value to integrated information coming from disparate sources.

REACT will:

- capture more of the information available from callers and automatic systems;
- complement the data with associated services able to semantically analyse and cluster environmental and crisis management information;
- make data available to PSAP operators through a GIS-based interface;
- allow the definition of operative scenarios to be used for an early identification of events and associated evolution patterns.

REACT will support existing emergency systems by providing an interoperable multimedia Enhanced Emergency Call Service, that would operate on an everyday basis and deal with the small to mid size incidents, that unless properly handled and coordinated, could escalate in scale.

The key contributions of REACT to the current emergency control services will be:

- Integration of the emergency caller location featured by the E112 and eCall;
- Call clustering and prioritisation through semantic, time, location - leading to clearer decision making and support (4D GIS);
- Automatic identification of keywords from the PSAP operator speaking supporting the filling of a job description form for starting the emergency call workflow;

- Interoperability across call centres and emergency services as REACT presents an XML GIS-based data store accessible using secure Web Services.

REACT will normalize warnings from various sources, allowing their aggregation and analysis so that additional knowledge can be extracted and presented to the PSAP operator as an aid to situational awareness, pattern detection and dispatching of resources.

The project includes demonstration in three pilot PSAPs across Europe (Italy, UK, Germany), where the developed platform will be used in combination with the existing infrastructures and procedures.

Project details

Project Acronym: REACT
Project Reference: 033607
Start Date: 2006-09-01
Duration: 30 months
Project Cost: 3.92 million euro
Contract Type: Specific Targeted Research Project
End Date: 2009-02-28
Project Status: Execution
Project Funding: 1.98 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=22&CAT=PROJ&QUERY=011e8a3fa103:3dcd:6dfc7097&RCN=79518

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66. Improvement of the emergency risk management through secure mobile Mechatronic support to bomb disposal (*RESCUER*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.rescuer-ist.net/

The RESCUER project focuses on the development of an intelligent Information and Communication Technology and mechatronic Emergency Risk Management tool and on testing it in five Improvised Explosive Device Disposal, and Civil Protection Rescue Mission scenarios. The project output will include guidance for management of risk, which extends the range of interventions possible beyond those, which are currently considered. The extended range of interventions will include tasks which are too risky at present to commit human involvement, tasks where access might not be possible without ICT and mechatronic support, tasks where such support would significantly enhance the speed, accuracy or range of tasks/sensors especially in EOD, IEDD, significant toxic/radiation/flammable/explosive contamination, mechanical failure and other relevant hazardous situations or combinations of hazards.

RESCUER is an intelligent mechatronic system capable of achieving given goals under conditions of uncertainty. In contrast to existing automated bomb disarming systems, which are, by definition, pre-programmed to deliver given behaviour and are therefore predictable, RESCUER may arrive at specified goals in a non-deterministic manner. This is possible due to RESCUER's improved flexibility, dexterity and intelligence comparable to a human rescue specialist.

RESCUER system will include multifunctional tools, two simultaneously working robot arms with dextrous grippers, smart sensors for ordnance, for human detection and for the assessment of the environment, autonomous vehicle and advanced information and communication facilities that will lead to improvement of the emergency risk management. RESCUER will implement the Emergency Risk Management Monitoring and Advising System that will integrate the information flows from the different sources, generate decisions, and build a secure wireless communication between the rescue specialist, the Risk Management Centres and the mobile device.

Project details

Project Acronym: RESCUER
Project Reference: 511492
Start Date: 2004-11-01
Duration: 42 months
Project Cost: 2.46 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-04-30
Project Status: Completed
Project Funding: 2 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a4205b4:6d55:2315fef7&RCN=74674

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67. *SANY* - Sensors Anywhere (*SANY*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://sany-ip.eu/

The European Commission (EC) and the European Space Agency (ESA) have established a joined Global Monitoring for Environment and Security (GMES) initiative. Sensors Anywhere Integrated Project (SANY) will contribute to this initiative by improving the interoperability of in-situ sensors and sensor networks, and allowing quick and cost-efficient reuse of data and services from currently incompatible sources in future environmental risk management applications.

Five major SANY objectives are:

217. Specify a standard open architecture for fixed and moving sensors and sensor networks capable of seamless "plug and measure" and sharing (virtual networks), applicable to all kinds of in-situ sensors, classical and ad-hoc sensor networks, virtual sensors (sensor-like software), roving and airborne sensors, and ensure interoperability between ground and in-orbit sensors.
218. Develop and validate re-usable data fusion and decision support service building blocks.
219. Assure a reference implementation of the architecture, i.e. an on-demand environment for accessing the GMES information and services is operational as GMES building block in 2008.
220. Assure the new architecture is generic and provides added value for end users.
221. Assure the outcome of SANY is accepted by end users and international organisations and contributes to a future standard applicable to GMES.

SANY inherits and extends the results of two high profile EC and ESA infrastructure projects; ORCHESTRA and MASS/SSE. All architecture specifications shall be publicly available and compatible with EC and ESA infrastructure initiatives, such as INSPIRE (standard interfaces with geospatial information) , and Heterogeneous Missions Accessibility project (standard interfaces for EO Ground Segments);

SANY specifications shall be validated by experts trough OGC technical committee and realised in three innovative risk management applications covering the areas of air pollution, marine risks and geo hazards.

Project details

Project Acronym: SANY
Project Reference: 033564
Start Date: 2006-09-01
Duration: 36 months
Project Cost: 11.24 million euro
Contract Type: Integrated Project
End Date: 2009-08-31
Project Status: Execution
Project Funding: 7 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a43e792:daa7:0a879e08&RCN=79757

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68. Sensor and computing Infrastructure for environmental risks (*SCIER*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.scier.eu/

The SCIER project will design, develop, and demonstrate an integrated system of sensors, networking and computing infrastructure for detecting, monitoring, predicting and assisting in the crisis management of natural hazards or accidents at the "urban-rural-interface" (URI), i.e., in areas where forests and rural lands interface with homes, other buildings and infrastructures. The overall goal of the SCIER system is to make the much neglected URI zone safer for the European citizens against any type of natural hazards or accidents.

To achieve its ambitious objective, SCIER pushes the state of the art and combines several technologies:

222. self-organizing, self-healing re-configurable sensor networks for the detection and monitoring of disastrous natural hazards,
223. advanced sensor data fusion and management schemes capable of deducing the required information needed for accurately monitoring the dynamics of multiple interrelated evolving hazardous phenomena (multi-risk),
224. environmental risk models for predicting the evolution of hazardous phenomena using a robust GRID computing infrastructure.

The proposed system promotes public-private sector cooperation: indeed, SCIER involves the private sector (e.g., house/land owner, security company) as an "active player" in the URI zone protection and the monitoring of hazardous events. A prototype system integrates state-of-the-art sensors (e.g., vision sensors, wireless sensor networks with low energy requirements) with the communications and computing infrastructure. The SCIER system will be demonstrated and evaluated in four European regions (Greece, France, Czech Republic and Portugal). Such sites have suffered in the past from forest fires and/or floods.

The project mobilizes partners from research institutes, academia, public authorities and SMEs and service providers from (7) EU countries which combine specialized skills with complementary expertise to fully cover the project requirements.

Project details

Project Acronym: SCIER

Project Reference: 035164
Start Date: 2006-07-01
Duration: 30 months
Project Cost: 3.27 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-12-31
Project Status: Execution
Project Funding: 2.09 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a471c17:f395:10894f47&RCN=80198

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69. Sensor for terrestrial and Airborne Radio-transmitter rescue search (*STARRS*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

STARRS project focuses on the design and development of technology for the improvement of environmental risk/crisis management, especially in search and rescue operations (to detect and locate victims' position with a good accuracy as well as to allow alert broadcasting to people in emergency situations.)

People in danger will be detected, located and rescued through their basic cellular radio handsets (GSM and UMTS mobile phones). Additionally, headquarters of rescue teams will be able to know the location of rescuers within the intervention area through their professional handsets (TETRA and TETRAPOL mobile handsets).

The STARRS project will study and develop two test beds (one for helicopter and one for a pedestrian rescuer), which will be tested and evaluated through field trials, in order to get operational performances. The STARRS testbeds will be autonomous from network, and then can be used in real disasters situations.

In order to define the multi path location algorithms of the test beds, a signal propagation study in some specific environments (as urban collapsed building) will be realized first. Then a system study will define detection and location protocols for GSM/UTMS and TETRA/TETRAPOL. In parallel, a signal processing study will aim to design appropriate tracking algorithms. Finally, the two tesbeds, with transmitters, antennas, receiver and processing unit will be developed and tested in selected scenarios.

Typical rescue situations/scenarios will be specified by the end users of the project in order to establish the requirements of the STARRS testbeds, such as: search of lost people in mountains areas, fire forests and collapsed buildings.

In addition, a new concept, called "Over The Air Safety Reply", that will allow automatic reply from rescue team handsets, will be promoted to 3GPP for standardization.

The results of the STARRS project will be disseminated throughout Europe, to network operators and rescue end users.

Project details

Project Acronym: STARRS
Project Reference: 033742
Start Date: 2006-10-01
Duration: 24 months
Project Cost: 3.91 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-09-30
Project Status: Completed
Project Funding: 2.43 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a491a49:884e:50f0ba21&RCN=80501

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70. Technology to support sustainable humanitarian crisis management (*STREAM*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://stream.etro.vub.ac.be/

The coupling of satellite, airborne maps and products (analysed/interpreted images) with field surveys provides an extremely useful framework for crafting a basic GIS of a site for projected and/or ongoing humanitarian intervention. In the case of displaced persons, locations of refugee settlements have to be efficiently evaluated e.g. in terms of food and water supply, and related facilities. Also important is the camp's short-term and medium-term effects to the surrounding environments. For the rehabilitation/repatriation case, previous war zones (suspected hazard areas) has to be assessed in terms of safety level and inhabitability. In another words, Mine Action aspects, including General Mine Action Assessment (GMAA), Technical Survey, Landmine Impact Survey (LIS), and Assessment Missions.

The project's goals are two fold, namely the development of (1) products, and (2) procedures for end-to-end technological platforms and tools for survey and decision support in humanitarian crisis:

225. Products for survey and decision support includes:
226. Mission planning and management, for space-/air-borne and field survey
227. Mobile Computing Infrastructure for field survey including ground truth acquisition and verification tools
228. Remote sensing data analysis and interpretation
229. Information Management and Decision Support System for structuring, analysing, synthesizing the acquired data and knowledge
230. Information Communication and Broadcasting
231. Procedures: many new ICT technologies cannot fully and properly exploited by Humanitarian Agencies until an appropriate contractual and operational framework is in place.

This project will address the planning, operational and logistic aspects of setting up and conducting a survey mission. Moreover, legal and contractual aspects for airborne survey will be investigated.

Project details

Project Acronym: STREAM
Project Reference: 511705
Start Date: 2004-12-01
Duration: 42 months
Project Cost: 3.89 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-05-31
Project Status: Completed
Project Funding: 2.5 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=39&CAT=PROJ&QUERY=011e8a4a80a5:cf48:037f3b13&RCN=72132

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71. Enterprise next generation Network Vision 2010 (U-2010)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.u-2010.eu/

Today modern society has reached a high dependability on ubiquitous services and networks. Especially in crisis or emergency situations the availability of these services is crucial. Today governmental and rescue entity communication services are characterized by a strong technical compartmentalization. The interworking and the availability of communication resources cannot be assured in crisis situations.

This proposal highlights and deploys concepts to enhance the availability of these services and of the existing networks by leveraging redundant communication channels wherever possible and using automatic redirection in case of network failures. In crisis situations rescue teams have to be assembled on the fly. Mobile and ad-hoc networks are seen as a possible solution for that. Additional research on these networks will be conducted in this project to fulfil the requirements of crisis intervention teams.

The problem of identification will be resolved using new research results in wireless and ad hoc networks, where esp. the integration of distributed knowledge of the current network environment (location information, RFID messages, recommended trust relations, etc.) into the protocols is a key issue for context adaptable recognition. With IPv6 there already exists a platform for many of the ICT aspects related to crisis scenarios.

With Luxembourg as first test bed and the Luxembourg Government as partner in the project, there is an ideal possibility to show the feasibility and usability of the results in a living environment and provide the basis for all European countries. A transfer of the technology through a deployment in Slovenia is planned in the second phase of the project.

The results of this project will not only be usable for governments risk and crisis management but will also become the integral part of enterprise and public networks fulfilling our Next Generation Network Vision for ubiquitous Networks in 2010 - "u-2010".

Project details

Project Acronym: U-2010
Project Reference: 035003
Start Date: 2006-05-01
Duration: 36 months
Project Cost: 6.49 million euro
Contract Type: Integrated Project
End Date: 2009-04-30
Project Status: Execution

Project Funding: 4.15 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a4d7e77:1dc1:0de5b070&RCN=79344

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72. Water Risk Management in Europe (*WARMER*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.zetaced.com/projectwarmer/

The project aims to create an extended system for on-line water monitoring with main purpose of risk management, integrating mixed technology in the areas of semiconductors, analytical chemistry, micro-mechanical fluidic systems, ICT, remote sensing and extensive networking of environmental water monitoring data.

The innovative idea is to develop an integrate an innovative field deployable monitoring system working on different innovative sensors, ranging from CHEMFETs, miniaturised potentiometric, voltammetric sensors and biosensors in industrial way, ready to be later improved for mass production. The system will be ready to be connected in a large network with of terrestrial "in situ" sensors and satellite remote sensing data.

This new measuring device will be integrated with conventional multi-parametric probes and flow sensors, to obtain the largest multi-parametric detection capability requested by the current European water directives. The proposed system will enable creation of a European-wide water monitoring and risk management system, which would handle both "hard risk" (catastrophic changes in water quality) as "soft risk" (slow, but dangerous).

The in situ monitoring system will form a network of nodes, consisting of a unified hardware platform using wireless modules and TCP-IP technology to allow the maximum flexibility. Satellite remote sensing of water parameters will be integrated with the in situ monitoring network in order to provide large-scale synoptic observation of water quality. In GMES, satellite observations need to be supported by in situ observation for validation of the satellite data and for observation of a wide range of biological and chemical parameters, which cannot be observed from space.

An extensive laboratory validation followed by field experiments including integration with remote sensing data will be performed.

Project details

Project Acronym: WARMER
Project Reference: 034472
Start Date: 2006-09-01
Duration: 36 months
Project Cost: 2.45 million euro
Contract Type: Specific Targeted Research Project
End Date: 2009-08-31
Project Status: Execution
Project Funding: 1.83 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a4eea62:7dbe:4542b126&RCN=79456

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73. Wide information network for risk management integrated project (WIN)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2002-2.3.2.9 Improving Risk management

http://www.win-eu.org/

The Wide Information Network (WIN) Integrated Project has the objective of integrating all existing reference results or initiatives to contribute to the design, the development, and the validation of what could be referred to as a "European Risk Management information infrastructure ". This information infrastructure will be a major element of the future overall European Spatial Data Infrastructure (ESDI).

The main issues tackled in WIN relate to:

- The definition of a data/information model valid for several thematic issues of risk management in Europe;
- The architecture of the info-structure optimised in terms of use of state-of-the-art information technologies (Web, Grid), and high capability to inter-operate data, services, and risk management actors;
- The coverage of business and organisational aspects through the sub-network and charters concepts.

The overall WIN duration is 36 months; 3 main milestones allow validating the progress of the project.

- The Preliminary Design Review performed at T0+12 months allows to check the the preliminary design of the information infrastructure, through analysis of draft version of Architecture Design Document and through demonstration of mock-ups and prototypes, illustrating the critical points of the architecture;
- The Critical Design Review performed at T0+24 months allows checking the detailed design, the progress of the system integration, and the definition of WIN experiments;
- The Final Review allows getting lessons learned from WIN experiments, to check final version of WIN deployment plan. It is proposed to have a full synergy between WIN project and two other main projects:
- ORCHESTRA project, in order to converge towards a common GMES architecture,
- The Marine and Coastal Environment Information Services implementation Project which would be the first real case experience for WIN deployment.

Project details

Project Acronym: WIN
Project Reference: 511481
Start Date: 2004-09-01
Duration: 40 months
Project Cost: 8.08 million euro
Contract Type: Integrated Project
End Date: 2007-12-31
Project Status: Completed
Project Funding: 4.4 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=11&CAT=PROJ&QUERY=011e8a5094c6:2e98:52b21a63&RCN=71841

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74. Wireless sensor Networks with self-organization capabilities for critical and emergency applications (*WINSOC*)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.winsoc.org/

The major problems in designing sensor networks are the high reliability required to the whole system, to be contrasted with the potential unreliability of the single sensor, and the possibility of congestions around the sink nodes that could prevent critical information to reach the control centres at the right time. The key idea of WINSOC is the development of a totally innovative design methodology, where the high accuracy and reliability of the whole network is achieved by introducing a suitable coupling among adjacent, low cost, sensors, that gives rise to distributed decisions, much more accurate than that of each single sensor, without the need for sending all data to a fusion centre. The whole network is hierarchical and composed of two layers: a lower layer, composed of low cost sensors, responsible for gathering information from the environment and producing locally reliable decisions thanks to proper interaction among the nodes, and an upper layer, composed of more sophisticated nodes, whose goal is to convey the information to the control centres.

The local interaction among the low cost sensors is the key point that increases the overall reliability and provides scalability and fault tolerance. Thanks to its distributed processing capabilities, the risk of having a congestion around the control nodes is strongly reduced. Building on this idea, the consortium has put together expertise from big companies, academies, research centres, end-users and SME's, to create a strong synergism between academic world, industries and end-users. The primary goals of WINSOC are to develop an innovative general purpose sensor network architecture having the distributed processing capabilities described above and to test applications on environmental risk management, with focus on landslides detection, gas leakage detection and large scale temperature field monitoring.

Project details

Project Acronym: WINSOC
Project Reference: 033914
Start Date: 2006-09-01
Duration: 30 months
Project Cost: 3.86 million euro
Contract Type: Specific Targeted Research Project
End Date: 2009-02-28
Project Status: Execution
Project Funding: 2.44 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a534f54:02c5:38c0dbf3&RCN=80173

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75. Wireless Infrastructure over Satellite for emergency communications (WISECOM)

Background and Objectives

Funded under 6th FWP (Sixth Framework Programme)

Research area: IST-2005-2.5.12 ICT for Environmental Risk Management

http://www.wisecom-fp6.eu/

The proposal will study, develop, and validate by life trials candidate rapidly deployable lightweight communications infrastructures for emergency conditions. The infrastructures will integrate several terrestrial mobile radio networks - comprising GSM, UMTS, WiFi, and optionally WIMAX and TETRA - over satellite systems, both lightweight and rapidly deployable, and thus suitable for public safety communication. Satellite systems intrinsically present very good characteristics for a rapid deployment of a telecommunication infrastructure when and where a terrestrial infrastructure is not available (e.g. after a natural or industrial hazard). The connection to the public networks (PSTN, ISDN, Internet) is directly provided at the satellite gateway, depending on the offered service. The WISECOM project will thus use INMARSAT BGAN and DVB-RCS, one for worldwide basic services, the other for larger bandwidth support.

The targeted infrastructure will cover bi-directional communication needs for voice and data, will be scalable, covering the needs for a few persons to larger groups, and should be easy to carry by a person, ideally as a carry-on cargo on planes. The infrastructure should cover the immediate needs in the first hours and days following an emergency. Furthermore, the system will integrate location-based services for emergency scenarios.

A secondary objective is to study and develop an easily deployable infrastructure meant for medium to longer term needs, useful during a recovery and rebuilding phase following an emergency.

The proposal will build on the experience of the partners in past EU projects such as WirelessCabin and TWISTER dealing in particularly with the integration of satellite communication systems and of terrestrial wireless communication networks. The infrastructures allow the integration of alert systems, communication to and from the citizen, and rapidly deployable emergency telecommunication systems.

Project details

Project Acronym: WISECOM
Project Reference: 034673
Start Date: 2006-09-15
Duration: 21 months
Project Cost: 2.53 million euro
Contract Type: Specific Targeted Research Project
End Date: 2008-06-14
Project Status: Completed
Project Funding: 1.28 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a543f36:cd41:1f0d144d&RCN=80486

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76. Advancing ICT for DRM in Africa (*AIDA*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.aidaonline.info

The AIDA project aims at acquiring and sharing knowledge about affordable ICT (Information and Communication Technologies) solutions in Africa with the ambition to reduce the risk of natural disasters and to improve the capacity to respond to disasters.

Many Developing Countries in Africa are exposed to serious natural disaster risks and their need for an adequate ICT infrastructure supporting DRM is high. Unfortunately, access to ICT knowledge and affordable ICT systems is often lacking.

The AIDA project will

- assess the natural hazards, the vulnerability of the communities and the disaster risks in Africa; and
- assess the role of ICT based systems in each hazard category; and
- explore the ICT trends and needs for the future; and
- test the usefulness of GEONETCast as an alert system; and

- share this information with all DRM stakeholders in Africa (by workshops and other); and
- prepare 3 showcases of operational African DRM systems for demo on these workshops; and
- promote and support the take-up of this technology for use in other disasters; and
- liaise with any new project in DRM with a significant involvement of African partners.

AIDA will test whether the existing GEONETCast infrastructure can be reused as a component of an alert or emergency system. AIDA sets up a testcase in South-Africa where the Forest Fire Association in Nelspruit, South-Africa will use the wildfire-alarms from CSIR within their operational activities to fight wildfires. If successful, many DRM systems can benefit from this technology.

The project is envisioned to have a big impact with a limited budget, by close cooperation with the AARSE and EUMETSAT conferences and within the UNeDRA network.

This effort will support authorities in Developing Countries in setting up their National Disaster Action Plans (as required by the Hyogo agreements) by offering knowledge about working ICT solutions and help them to better manage their disaster risks.

Project details

Project Acronym: AIDA
Project Reference: 223824
Start Date: 2008-06-01
Duration: 24 months
Project Cost: 1.27 million euro
Contract Type: Coordination and support actions
End Date: 2010-05-31
Project Status: Execution
Project Funding: 869000.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a5f2ce8:2de7:35c848f1&RCN=87364

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77. A novel architecture for modelling, virtualising and managing the energy consumption of household appliances (AIM)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.ict-aim.eu

The main objective of the project is to foster a harmonised technology for managing in real time the energy consumption of appliances at home, interworking this information to communication devices over the home network and virtualising it with the final aim of making it available to users through home communication networks in the form of standalone or network operator services.

Behind this scope, the main idea is to provide a generalised method for managing the power consumption of devices that are either powered on or in stand-by state. Especially for the second category of devices, the project will conceive autonomous, self-programmable mechanisms for stand-by state detection and power off, using all-device-fit, harmonised, own-developed interfaces.

AIM will apply its technology on white goods (refrigerators, kitchens, washing machines, driers), communication devices (cordless phones and wireless communication devices for domestic use) and audiovisual equipment (TV Sets and Set-top-boxes) and will be built around 3 use-cases:

232. Use-case for residential users (intelligent power management service for autonomous energy preservation).
233. Use-case for governmental organizations (metering service for energy planning and CoC compliance testing).
234. Use-case for legacy services operators (remote monitoring and management).

Although the AIM technology is going to be applied on a certain range of domestic appliances it will be deployed generically enough so as to be applicable on other appliance types, like heaters, solar panels, etc., of which use is less frequent but also important concerning energy conservation.

The AIM consortium consists of 11 partners (Eurescom, SWISSCOM, KELETRON, CEFRIEL, INDESIT, Döbelt Datenkommunikation, INFINEON, Power Plus Communications AG, SIEMENS, PHILIPS, BlueChip Technologies SA) from 5 European countries (Germany, Greece, Netherlands, Switzerland and Italy).

Project details

Project Acronym: AIM
Project Reference: 224621
Start Date: 2008-06-01
Duration: 24 months
Project Cost: 4.39 million euro
Contract Type: Collaborative project (generic)
End Date: 2010-05-31
Project Status: Execution
Project Funding: 2.61 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=3&CAT=PROJ&QUERY=011e8a623174:4c59:640ba6f7&RCN=86728

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78. Ambient-intelligent interactive monitoring system for energy use optimisation in manufacturing SMEs (AMI-MOSES)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.ami-moses.eu

The main business aim is to produce a leap forward in energy efficiency and cost reduction in manufacturing SMEs.

The AmI-MoSES project will develop an (ambient) intelligent monitoring system for energy consumption, dedicated to manufacturing SMEs, to provide comprehensive information about the energy use, and knowledge-based support for improvements in energy efficiency. Existing energy consumption data will be complemented by different information from AmI systems (e.g. AmI systems for interactions between human operators and machines/processes etc.) and process related measurements (e.g. specific manufacturing line temperatures) and fed to the SOA based platform. The platform will allow to build different SW services, using the measured and processed data, such as On-line diagnostics of energy related problems in an SME, Continuous improvement of energy consumption etc. The services will, among other functionalities, interactively provide suggestions of the appropriate actions for problem elimination and energy efficiency increase.

The decision making support for the energy efficiency increase will be also environmentally based, meaning that the problem elimination suggestions will always take care about the environmental performance from the manufacturing SME sectors, reducing the need for natural energy sources. The consortium SMEs will provide industrial testing environments, some of the major technical inputs including the energy measurement equipment, energy consumption monitoring, energy auditing, and energy saving expertise.

Project details

Project Acronym: AMI-MOSES
Project Reference: 224250
Start Date: 2008-09-01
Duration: 36 months
Project Cost: 2.78 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-08-31
Project Status: Execution
Project Funding: 2 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a63767c:4dcf:1629afbe&RCN=87371

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79. Boosting energy awareness with adaptive real-time environments (BE AWARE)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.energyawareness.eu

Reduction of energy consumption is a societal challenge that requires combination of technical, economical, and social means. So far, energy conservation has focused on new technologies and automation, treating users as passive consumers. However, strong evidence suggests that users can adapt actively their behaviour to energy saving with suitable feedback, support, and incentives, reducing significantly and cost-effectively energy use without impacting adversely their comfort.
At present, energy information flows are slow, aggregated, and hidden, being operated by a market lacking incentives and proper service models. The opaqueness discourages users to learn and apply conservation strategies in their everyday lives. However, novel ICT's offer opportunities for removing this bottleneck. In particular, ubiquitous interfaces combined with low-cost sensors support real-time information from energy networks and consumption, empowering users to learn and share conservation strategies.

BeAware studies how ubiquitous information can turn users into active players by developing:

235. an open and capillary infrastructure sensing wirelessly energy consumption at appliance level;

236. ambient and mobile interaction to integrate energy use profiles into users� everyday life;

237. value added service platforms and models where consumers can act on ubiquitous energy information while energy producers and other stakeholders gain new business opportunities.

BeAware combines research excellence with relevant industrial involvement. To ensure wide applicability, a Nordic and a Southern evaluation site are planned. A liaison with the CITRIS programme in the USA facilitates dissemination. The expected impact focuses on:

238. grounding the conservation potential to users' cognitive constraints and practices,

239. ubiquitous computing applications for sensing wirelessly energy use and enabling users to act, and

240. value added service models to innovate a new energy and multi-utility market.

Project details

Project Acronym: BE AWARE
Project Reference: 224557
Start Date: 2008-05-01
Duration: 36 months
Project Cost: 3.97 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-04-30
Project Status: Execution
Project Funding: 2.71 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=5&CAT=PROJ&QUERY=011e8a654812:fe8d:33d0dbd1&RCN=86727

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80. Digital environment home energy management system (DEHEMS)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.dehems.eu

DEHEMS will extend the current state of the art in intelligent meters, moving beyond energy "input" models that monitor the levels of energy being used to an "energy performance model" that also looks at the way in which the energy is used. It will bring together sensor data in areas such as household heat loss and appliance performance as well as energy usage monitoring to give real time information on emissions and the energy performance of appliances and services. It will enable changes to be made to those appliances/services remotely from the mobile phone or PC and provide specific energy efficiency recommendations, for the household. The impact will be to personalize action on climate change, and so help enable new policies such as Personal Carbon Allowances as well as supporting the move towards increased localized generation and distribution of energy.

Project details

Project Acronym: DEHEMS
Project Reference: 224609
Start Date: 2008-06-01
Duration: 30 months
Project Cost: 3.73 million euro
Contract Type: Collaborative project (generic)
End Date: 2010-11-30
Project Status: Execution
Project Funding: 2.9 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a6731c1:310b:08d7b872&RCN=87608

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81. Distributed information acquisition and decision-making for environmental management (*DIADEM*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

The resulting methods and tools will support environmental management in industrial settings. In particular, the resulting system will support seamless and efficient integration of

- robust and efficient gas monitoring systems and
- advanced decision support/planning systems which facilitate rapid, high-quality decision making based on rich domain expertise and large quantities of relevant information.

The resulting systems will contribute to safer and healthier environment in industrialized areas in different, complementary ways:

- Mitigation of consequences of catastrophic chemical incidents through quick and reliable gas detection, monitoring and extremely efficient decision making processes.
- Prevention of catastrophic chemical incidents and reduction of chemical pollution through planning based on collaboration of many experts and efficient use of advanced tools.
- Prevention of chemical air pollution in industrial areas. By being able to quickly detect and discover the sources of pollution, the environmental protection agencies will able to enforce stringent regulations upon the industry.

This will be achieved through a unique combination of

- advanced approaches to information fusion and gas distribution models,
- a service oriented approach to modular information processing,
- seamless integration of human-based and automated reasoning techniques supported by multi criteria decision analysis and advanced human machine interfaces and
- different existing tools will be integrated into various processing modules.

While the project is addressing very challenging problems, a unique combination of consortium partners guarantees substantial breakthroughs within the planned time frame. The consortium consists of complementary partners, ranging from academics with excellent scientific track to SMEs and Multinationals serving the most demanding high-tech markets.

Project details

Project Acronym: DIADEM
Project Reference: 224318
Start Date: 2008-09-01
Duration: 36 months
Project Cost: 3.76 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-08-31
Project Status: Execution
Project Funding: 2.52 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a6893de:009b:2f01a0c7&RCN=87275

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82. Electronics enabling efficient energy usage (*E4U*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.e4efficiency.eu

E4U aims at fostering world-leadership in ICT enabled energy efficiency in the EU through accelerating research and development for energy-efficient ICT systems. It will achieve this through the creation of a strategic research roadmap for power electronics in alignment with the national, EU, and international policy framework. E4U will create impact through targeted interaction with the research community, leading European industry, and RTD policy makers at the national and European level. E4U will also advertise the benefits of power electronics and ICT for energy efficiency to the broad public.

Project details

Project Acronym: E4U
Project Reference: 224161
Start Date: 2008-06-01
Duration: 18 months
Project Cost: 607332.00 euro
Contract Type: Coordination and support actions
End Date: 2009-11-30
Project Status: Execution
Project Funding: 449997.00 euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a6aafc6:2d25:34f1fbd1&RCN=86719

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83. Generic European sustainable information space for environment (GENESIS)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

genesis-fp7.eu

The GENESIS Project has the objective of providing Environment management and Health actors with an innovative solution based on advanced ICT. Relying on interoperability standards and harmonization process, GENESIS helps to constitute complex information networks, by combining benefits of various information systems with a collaborative systems approach. The proposed generic solution allows easy deployment and customization to thematic needs on a wide range of applications, at regional, national or Europe levels for various thematic fields.

The main benefits of GENESIS solution are two-fold:

- to improve and facilitate actors daily practices in relation with the management of environmental data;
- to perform an essential step in the deployment of the Single Information Space for the environment in Europe.

The GENESIS solution will be validated through dedicated scenarios addressing thematic fields of Air Quality, Water Quality and their impact on Health.

For the final benefits and information of European citizens, the needs of Environment and Health stakeholders are covered through fundamental services like:

- environment monitoring,
- multi-criteria finding of the information;
- visualization and combination of static or near-real-time information;
- fusion of various sources of environmental data;
- correlation between environmental with health data;
- support of decision making processes;
- support of the risk management and response to crisis; -near-real-time information of citizens.

The GENESIS generic solution is open and sustainable as based on de facto and emerging standards (OGC, OASIS, INSPIRE,�). Moreover, the GENESIS project development integrates current state of the art and innovative researches of major EC or ESA projects. GENERIS project represents an important step in operational environmental management in Europe thus paving the way to an effective wide deployment of the solution as part of the future Single European Information Space for Environment.

Project details

Project Acronym: GENESIS
Project Reference: 223996

Start Date: 2008-09-01
Duration: 36 months
Project Cost: 13.71 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-08-31
Project Status: Execution
Project Funding: 9 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8aa557d6:c9c7:5aa672c0&RCN=87874

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84. Good practices for European developers of advanced ICT-enabled energy-efficiency systems (*GENESYS*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

So far, several EU funded projects and other initiatives have taken up the challenge of Promoting sustainable development, Ensuring security and diversity of energy supply, Improving industrial competitiveness, Enhancing economic and social cohesion; furthermore, very valuable research work has been carried out in the past, but the gap to the market(s) and to the full inclusion of the nowadays technologies is still the main obstacle hindering the deployment of its economic potential. In this context GENESYS project consortium will collect and analyse research results on efficiency and energy management systems (EMS) and identify opportunities for integration and applications to further complex or cross cutting areas.

The main aim is to provide the guidelines for economical sustainability of the industrialisation of solution based on RandD current results to be mapped through two main steps:

241. an analysis of the technical and scientific basis and
242. a further improvement of features following the cutting-edge technologies and the market requirements.

The current proposal therefore aims to improve the RandD activities on technologies to make content more intelligent and self-adaptive and therefore to improve the EMS environments by:

243. bringing together researchers and industrial partners of the EMS fields, to explore potential synergies, joint exploitation or the identification of further shared research paths among past and/or ongoing projects in the domain;
244. defining a draft agenda that will outline the envisaged steps needed to let the RandD results potentialities comply as much as possible with the real applications needs;
245. to favour the market exploitation of identified/supported technologies through the access to private capital and other available financial products.

Project details

Project Acronym: GENESYS
Project Reference: 224690
Start Date: 2008-09-01
Duration: 30 months
Project Cost: 1.62 million euro
Contract Type: CPCSA
End Date: 2011-02-28
Project Status: Execution
Project Funding: 1.08 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a6cea81:4ca0:371ccd4d&RCN=87319

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85. GEOSS Inspire and GMES an action in support (*GIGAS*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.thegigasforum.eu

The GEOSS INSPIRE and GMES an Action in Support (GIGAS) promotes the coherent and interoperable development of the GMES, INSPIRE and GEOSS initiatives through their concerted adoption of standards, protocols, and open architectures. Given the complexity and dynamics of each initiative and the large number of stakeholders involved, the key added value of GIGAS is bringing together the leading organisations in Europe who are able to make a difference and achieve a truly synergistic convergence of the initiatives. Among them, the Joint Research Centre is the technical coordinator of INSPIRE, the European Space Agency is responsible for the GMES space component, and both organisations together with a third partner, the Open Geospatial Consortium play a leading role in the development of the GEOSS architecture and components.

This core group is supported by key industrial players in the space and geographic information sectors, with the scientific leadership of the Fraunhofer Institute. This consortium will achieve the objectives set through an iterative and consensus based approach which includes: in-depth analysis of the requirements and barriers to interoperability in each of the three initiatives and strategic FP 6/FP 7 projects; comparative evaluation of this activity as input to a forum of key stakeholders at a European level; consensus building in the forum on how to update and integrate the architectures of GMES, INSPIRE and GEOSS, and influence standards development and adoption. From these recommendations follow actions to shape the direction of the initiatives and to define a roadmap for future development, including the key research topics to be addressed to sustain the convergence of the initiatives.

GIGAS thus will contribute to the emergence of a collaborative information space for accessing and sharing distributed environmental resources in Europe. This will represent a milestone towards building a Single Information Space in Europe for the Environment.

Project details

Project Acronym: GIGAS
Project Reference: 224274
Start Date: 2008-06-01
Duration: 24 months
Project Cost: 3.08 million euro
Contract Type: Coordination and support actions
End Date: 2010-05-31
Project Status: Execution
Project Funding: 2.1 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a6faa1f:9795:17a78648&RCN=87875

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86. *HYDROSYS*: advanced spatial analysis tools for on-site environmental monitoring and management (*HYDROSYS*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.hydrosysonline.eu

HYDROSYS aims at providing a system infrastructure to support teams of users in on-site monitoring events analysing natural resources. The project introduces the innovative concept of event-driven campaigns with handheld devices, potentially supported by an unmanned aerial vehicle (UAV). In these campaigns, users can setup and retrieve data from mobile sensorstations, the UAV and external sources (sensor network) generating dense information on a small area. The sensor network system gathers and stores sensor data, and processes simulations based on physical process models. To obtain rich data sets from a specific location, additionally, remotely controlled cameras are deployed, mounted on sensorstations and below the UAV. Users can analyse the environment using cell phones and handheld computers, supported by advanced user interface techniques. The system is validated in two application areas, dealing with pollution caused by storm water, and permafrost melting.

The project will improve environmental monitoring and management for environmental scientists, institutions and service providers, through its strong integration of handhelds and sensor networks. The project will progress well beyond the current state in the art, by dealing with short-term events and detailed analysis of small sites. The analysis of such events is hardly supported by current methods, but has a large impact on environmental degradation. Additionally, information is dispersed to citizens by providing mechanisms to access top-level environmental data.

Within the project, cutting edge inter-disciplinary research will be performed to develop user-centred solutions. When the data is integrated with analytical tools in a shared information space it will also aid a wide range of managers and planners in the pursue of more environmentally sensitive solutions to engineering problems. To aid the process, the research is steered by considerable end-user involvement throughout the full project.

Project details

Project Acronym: HYDROSYS

Project Reference: 224416
Start Date: 2008-06-01
Duration: 36 months
Project Cost: 4.32 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-05-31
Project Status: Execution
Project Funding: 3.26 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a714a9a:1b42:38198f56&RCN=86725

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87. European ICT environmental sustainability research (ICT-ENSURE)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

ict-ensure.tugraz.at

The internationally organized scientific community "Environmental Informatics" proposes a support action. The super ordinate goal is to promote and extend the European exchange of knowledge and information on environmental issues for a sustainable environmental development based on a well-established network.

The overall idea of the Support Action includes the following activities

- To identify relevant application areas for ICT for a sustainable development
- To expand the existing network with experts from EU27+
- To organise two enlarged EnviroInfo conferences

2008: "Environmental Informatics and Industrial Ecology" and

2009: "Environmental Management Information Systems: Accessing and Providing valuable Information for companies sustainable oriented Decision Making" (tentative)

- build a database on research literature - based on EnviroInfo proceedings

- provide a Web based information system on European environmental sustainability research
- to define requirements for a portal concept for the development of a "Single information space in Europe"

and finalize with recommendation and a roadmap for inter-/transdisciplinary research to strengthen the EUROPEAN RESEARCH AREA in the field of ICT for environmental sustainability.

The group "Environmental Informatics" provides in this Support Action long-standing experience in ICT application for communication, technology and environmental protection. While gaining additional information from other countries, an added value emerges from a growing network of experts and practitioner in research, industry, SMEs and administration linked with an in-deep interdisciplinary knowledge transfer. It is certain, that after this Support Action the current independent group will cross over again into an enlarged self-sufficient European network with a well-founded information basis.

Project details

Project Acronym: ICT-ENSURE
Project Reference: 224017
Start Date: 2008-05-01
Duration: 24 months
Project Cost: 1.51 million euro
Contract Type: Coordination and support actions
End Date: 2010-04-30
Project Status: Execution
Project Funding: 1.25 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a72f504:88c3:0fe6d4e9&RCN=87015

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88. Intelligent use of buildings' energy information (*INTUBE*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.intube.eu

The energy consumption in the operational phase of buildings is one of the major contributions to energy use in Europe. The improvement of energy efficiency only in the renewed stock (new and renovated buildings) is too slow considering the ambitious goal to improve the energy efficiency by 20% before 2020.

IntUBE will lead to increased life-cycle energy efficiency of the buildings without compromising the comfort or performance of the buildings by integrating the latest developments in ICT-field into Intelligent Building and Neighbourhood Management Systems (IBMS and NMS) and by presenting new ICT-enabled business models for energy-information related service provision.

By using the existing building stock more efficiently with the help of the new tools and business models developed in IntUBE, the potential to reach the goal is considerably increased. The solutions will also be applicable to new buildings.

The results of IntUBE will benefit many actors in the building sector like the owners, the users, the energy service providers, maintenance service providers, etc. in form of well-performing buildings that use the natural resources (especially energy) optimally, resulting in less environmental effects and reduced life-cycle costs of energy.

The IntUBE consortium consists of universities, research centres and companies from Southern to Northern Europe. They all have established dissemination channels, and the SMEs of the consortium will be able to extensively exploit the results in their business.

Project details

Project Acronym: INTUBE
Project Reference: 224286
Start Date: 2008-05-01
Duration: 36 months
Project Cost: 3.79 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-04-30
Project Status: Execution
Project Funding: 2.7 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a75e871:d015:3e587f4d&RCN=86722

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89. Integrated risk management for Africa (*IRMA*)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.irma.lu

Disaster risk reduction policies and institutional mechanism exist at various degrees of completeness in the African countries part of the consortium. Their effectiveness is however limited when having to deal with major disasters and complex emergencies. Risk management is often limited to specific hazard monitoring with limited or no consideration of the vulnerability of the area at risk neither to the systemic nature and possible domino effect between risks of different nature. It is the vulnerability of the population and of the infrastructure at risk that may transform a hazard into a major disaster.

The objective of IRMA is to demonstrate the effectiveness of ICT applications to deal with major disasters and the possibly resulting humanitarian crisis by integrating the whole disaster management chain from assessment to recovery. This will be realized by the integration of existing tools adapted to the regional specificities with new developments addressing the issue of multiple combined vulnerabilities. The general architecture of IRMA is "system of systems" based drawing from the results of the WIN and ORCHESTRA Service Oriented Architecture (SOA), it will ensure interoperability with INSPIRE and the merging UNSDI with the view to benefit from both EU and UN current and future services.

Project details

Project Acronym: IRMA
Project Reference: 224353
Start Date: 2008-06-01
Duration: 36 months
Project Cost: 3.53 million euro
Contract Type: No contract type
End Date: 2011-05-31
Project Status: Execution
Project Funding: 2.48 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a77627c:f01e:4132cb1c&RCN=87828

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90. Localised environmental and health information services for all: User-centric collaborative decision support network for water and air quality management (LENVIS)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

The main goal of the LENVIS project is to develop an innovative collaborative decision support network for exchange of location-based environmental and health services between all stakeholders, for enhanced capacity to assess population exposure and health risks and better management of the concerned ecosystems. LENVIS will include health indicators as integral part of the environmental management.

There is a growing demand for real time and integrated environmental and health risk information. Provision of such location-based services linked to the state of the environment at particular geographical locations (addresses) is necessary for improving the quality of life of all people. This is essential for mitigation of environmental-related health threats associated to water quantity and quality, and outdoor air pollutions.

LENVIS project aims to fill the existing gap between environmental management and the health management systems. This will be done by developing a generic ICT solution that combines service-oriented-architecture (SOA) and user-centric approach (peer-to-peer network, P2P) by fusion of location-based environmental and health data, information and modelling services. This novel collaborative peer-to-peer network, as an integral part of the Single Information Space for the Environment in Europe, will be validated through test cases on fresh surface water and outdoor air quality in the Netherlands, Portugal and Italy.

LENVIS project will facilitate collaboration between different stakeholders, such as environmental protection agencies, health institutions and service providers, policy makers, citizens in general and environmental communities in Europe.

Project details

Project Acronym: LENVIS
Project Reference: 223925
Start Date: 2008-09-01
Duration: 36 months
Project Cost: 3.21 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-08-31

Project Status: Execution
Project Funding: 2.29 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a78f258:8613:3af8de58&RCN=87602

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91. Mobile water quality sensor system (MOBESENS)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.mobesens.eu

Management of the environment for predictable and sustainable use of natural resources is one of the great challenges of the 21st century. Although water covers most of the planet, it is becoming increasingly difficult to ensure adequate supplies of fresh, clean water for drinking, as well as, for sports and wellness activities. The demand for water resources is increasing as the population grows. At the same time, water resources are increasingly exposed to pollutants and spills as parts of the world become ever more crowded and industrialised. Potential climate changes due to global warming may also impact water resources.

Management of water quality requires regular measurements and monitoring. Today, measurements of water quality are performed manually. The process can be slow and painstaking. Multiple point measurements are needed to cover an area. The process needs to be automated and extended to provide rapid and effective monitoring. Autonomous, mobile and self-healing solutions are needed to identify trends and to help localize and track potential problems.

MOBESENS provides a modular and scalable ICT based solution for water quality monitoring. It enables data to be gathered quickly and reported across wide areas. The low power wireless sensor network gathers data samples, which are time and location stamped and automatically entered into the grid based information system to facilitate analysis and issue alarms if needed. Mobility is a unique feature of MOBESENS, which are capable of navigation and both surface and subsurface measurements. This extends range, enables 3D area measurements and facilitates operation, even in bad weather. MOBESENS may form ad-hoc networks enabling rapid and reliable reporting as well as relative localization and tracking (e.g. of contaminants). Opportunistic communication between MOBESENS and both fixed and mobile buoys is envisioned. Renewable energy sources are studied for self-sustained MOBESENS operation.

Project details

Project Acronym: MOBESENS
Project Reference: 223975
Start Date: 2008-06-01
Duration: 36 months
Project Cost: 5.04 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-05-31
Project Status: Execution
Project Funding: 3.8 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a7ac069:c26a:0ce4aa5c&RCN=87013

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92. The European strategic research roadmap to ICT enabled energy-efficiency in buildings and construction (REEB)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.ict-reeb.eu

The aim of the REEB project is to facilitate co-creation of a Strategic Research Agenda (SRA) and a supporting Implementation Activity Plan (IAP) for sustainable and energy-efficient smart building constructions by and through the establishment of and federation of dialogue between interactive and complimentary communities of practice from energy, environment, and building construction domains. REEB will establish a community operating method that will allow these communities to act as breeding and nurturing grounds for innovation in bringing together the relevant organisations and stakeholders for the purpose of starting up "innovation cycles in ICT-based environment management and energy efficiency" in smart building constructions.

The main outcomes will be:

246. a SRA and detailed IAP for RandD and innovation in ICT supporting energy-efficient smart facilities,
247. a comprehensive coordination of information exchange and dissemination between energy-related ICT projects in various EU, national, and global programs/initiatives, in terms of on-going research, developed solutions, standardisation efforts, etc.

This will include organising events and communication channels for identifying, defining, promoting and stimulating the innovative use of ICT in the Sustainability and Energy Efficiency area to reach the widest audience and bring together all stakeholders from the enlarged EU and relevant global communities. The REEB consortium involves 8 partners with complementary expertise drawn from 6 European countries (France, Finland, Spain, Ireland, UK, Germany). Moreover, the core partners, in their effort to build up the REEB community and develop the vision, roadmap and implementation plan, are supported by this Special Interest Group (SIG) whose members (both RTD and industry) will participate in community discussions and decisions, and provide active feedback to studies and analyses.

Project details

Project Acronym: REEB
Project Reference: 224320
Start Date: 2008-05-01
Duration: 24 months
Project Cost: 2.02 million euro
Contract Type: Coordination and support actions
End Date: 2010-04-30
Project Status: Execution
Project Funding: 1.25 million euro

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93. Semantic sensor grids for rapid application development for environmental management (SEMSORGRID4ENV)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.semsorgrid4env.eu

Sensor networks promise to bridge the gap that, for too long, has separated computing applications from the physical world that they model and in which they are ultimately embedded. Sensor networks are and will continue to be important in environmental management. However, many scientific and technological challenges need to be tackled before sensor networks are exploited in their full capacity for aiding decision support for environmental applications.

This project addresses two of these challenges:

- the development of an integrated information space where new sensor networks can be easily discovered and integrated with existing ones and possibly other data sources (e.g., historical databases), and
- the rapid development of flexible and user-centric environmental decision support systems that use data from multiple, autonomous, independently deployed sensor networks and other applications.

To address this challenge, the SemsorGrid4Env project will investigate and develop technological infrastructure for the rapid prototyping and development of open, large-scale Semantic Sensor Grids for environmental management. In particular, SemsorGrid4Env will enable:

- A semantically-consistent view of several heterogeneous sensor networks as a global Grid data resource;
- Rapid development of Grid services that combine real-world real-time data, coming from autonomous, heterogeneous sensor networks, with legacy historical data;
- Rapid development of open, flexible, contextual knowledge-based thin applications (e.g., mashups) for environmental management.

As more and more sensor networks are independently developed and deployed, the SemsorGrid4Env outcomes will leverage their use of sensor networks in environmental management scenarios that were not foreseen or that transcend their original purpose. To test and demonstrate SemsorGrid4Env results, we propose two environmental monitoring and management use cases.

Project details

Project Acronym: SEMSORGRID4ENV
Project Reference: 223913
Start Date: 2008-09-01
Duration: 36 months
Project Cost: 4.36 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-08-31
Project Status: Execution
Project Funding: 3.25 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a7d86d2:6a0c:39a062bf&RCN=87366

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94. Smart houses interacting with smart grids to achieve next-generation energy efficiency and sustainability (SMARTHOUSE/SMARTGRID)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ICT-2007.6.3 ICT for environmental management and energy efficiency

www.smarthouse-smartgrid.eu

Current smart house/energy technologies treat home and working environments as effectively consisting of isolated and passive individual units. This severely limits achieved energy efficiency, as it ignores the potential delivered by homes, offices, and commercial buildings seen as intelligent networked collaborations.

Thus, the SmartHouse/SmartGrid project introduces a holistic concept for smart houses situated and intelligently managed within their broader environment. It develops intelligent networked ICT technology for collaborative technical-commercial aggregations of Smart Houses able to communicate, interact and negotiate with both customers and energy devices in the local energy grid so as to achieve maximum overall energy efficiency as a whole.

Our technology is built on

- using available open industry standards in both the ICT and energy sectors;
- employing communication and computing capabilities that are already in widespread use in mainstream home and working environments.

The SmartHouse/SmartGrid technology will be field tested in three different countries. On this basis, the project will define a roadmap to mass application. Only by considering the aggregated network level of smart houses managed by intelligent networked ICT for scale and flexibility, one is able to achieve the quantum leap in energy efficiency and sustainability that the EU's "20% by 2020" objectives call for.

Project details

Project Acronym: SMARTHOUSE/SMARTGRID
Project Reference: 224628
Start Date: 2008-09-01
Duration: 30 months
Project Cost: 3.81 million euro
Contract Type: Collaborative project (generic)
End Date: 2011-02-28
Project Status: Execution
Project Funding: 2.56 million euro

http://cordis.europa.eu/fetch?CALLER=PROJ_ICT&ACTION=D&DOC=1&CAT=PROJ&QUERY=011e8a7f7198:34aa:62b1cf72&RCN=87374

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95. Development and application of standardized methodology for the PROspective SUstaInability assessment of TEchnologies (PROSUITE)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ENV.2008.3.3.2.1. Sustainability Assessment of Technologies

Project description

The main goal of PROSUITE is to develop a framework methodology, operational methods and tools for the sustainability assessment of current and future technologies over their life cycle, applicable to different stages of maturity. The project will apply the methodology for four technology cases with close consultation of the stakeholders involved, which includes cases from biorefineries, nanotechnology, information technologies, and carbon storage and sequestration. PROSUITE will show:
* how to combine technology forecasting methods with life cycle approaches
* how to develop and possibly combine the economic, environmental and social sustainability dimensions in a standardized, comprehensive, and broadly accepted way.

PROSUITE will create a solid research basis for technology characterization, including the identification of decisive technology features, basic engineering modules for estimations of material flows and energy use, and learning curves. For the economic assessment, methods for the assessment for economic and sectoral impacts of novel technologies will be developed and combined with background data for scenario-based life-cycle inventory modelling. For the environmental assessment, state-of-the-art environment indicators will be proposed together with targeted method development for the assessment of geographically explicit land and water use impacts, metal toxicity and outdoor nanoparticle exposure. For the social assessment, a set of quantitative and qualitative social indicators will be selected via participatory approaches, setting the standard for future assessments.

The use of various multicriteria assessment methods will be explored to aggregate across indicators. The methods developed will be part of a decision support system, which will be output as open source modular software.

Project details

Project Acronym: PROSUITE
Project Reference: 227078
Start Date: 2009-11-01
Duration: 48 months
Project Cost: 6.31 million euro
Contract Type: Large-scale integrating project
End Date: 2013-10-31
Project Status: Execution

Project Funding: 4.78 million euro

http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=3&CAT=PROJ&QUERY=0125e236b428:b994:40bce1af&RCN=92592

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96. Towards zero waste in industrial networks (ZEROWIN)

Background and Objectives

Funded under 7th FWP (Seventh Framework Programme)

Research area: ENV.2008.3.1.3.1. Waste prevention: Industrial networking and zero-waste entrepreneurship

Project description

The first work package will define a common vision on zero-waste entrepreneurship within the first 6 months. The mythos Individual Producer Responsibility will be investigated if it can become the all-healing-solution in electronics industry as well as how this concept can be applied to other industrial sectors.

WP2 concentrates on new technological developments, WP3 on waste prevention methodologies and strategies and WP4 will adapt existing software tools supporting waste prevention. All this knowledge will be then formalised into an innovative production model for resource-use optimisation and waste prevention in WP5.

This preparatory work will enable the 9 industrial case studies in Work package 6 that forms the core of the ZeroWIN project with more than half of the total budget. These case studies will be used to prove that the ZeroWIN approach can meet at least 2 of the stringent targets of the call. WP7 closely monitors and validates the improvements by quantitative assessment. WP 8 investigates the implications to policy and formulates recommendations. Finally WP9 will disseminate the results of ZeroWIN as broad as possible and WP10 ensures the efficient operation of the ZeroWIN project.

By concentrating on industrial networks in the automotive, construction, electronics and photovoltaic industries ZeroWIN will address nearly 3 million companies (of which 80% are SMEs) with more than 2,8 trillion turnover and a value creation of more than 800 billion with more than 20 million employees creating about 40% or more than 400 million tons of industrial waste using as much as 50% of all materials extracted from the earth´s crust generating about 40% of all energy use and about 35% of all greenhouse gas emissions.

The ZeroWIN consortium has 29 partners from 10 countries (AT, DE, ES, FR, HU, IE, PL, PT, RO, UK), dominated by industry - 3 large companies (one of which is the electronics cluster in the Basque region) and 13 SMEs.

Project details

Project Acronym: ZEROWIN
Project Reference: 226752
Start Date: 2009-05-01
Duration: 60 months
Project Cost: 8.5 million euro
Contract Type: Large-scale integrating project
End Date: 2014-04-30
Project Status: Execution
Project Funding: 6.16 million euro

http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=2&CAT=PROJ&QUERY=0125e22adf04:80a1:38b88508&RCN=91173

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Annex D (Enabling Technologies)

1. Hydra

Background and Objectives

Hydra is an IST European project funded as part of the sixth framework programme (Contract No. IST 2005-034891). It addresses the needs of producers of embedded devices and developers of intelligent environments for a platform-independent and secure integration of various heterogeneous devices from different vendors into a consistent platform upon which Ambient Intelligence applications can be developed.

The goal is to allow developers to build cost-efficient ambient intelligence systems with optimal performance, high confidence, reduced time to market and faster deployment and still build on the enormous assets of the installed base.

Due to fast changing user environments of mobile users, ambient services and applications adapt to changing local and environmental sets of accessible sensors and actuators, and must piece together partial states of internal and situational available knowledge. When users move around interacting with any private device and public surrounding computers, it's the right information that must follow her migrating from different hosts in changing environments.

The main objective of the Hydra is to develop a secure middleware for ambient computing supporting the self-adaptive interplay of different components, not only sensors but also modeling components, controlling components implementing the application logic, and actuators. Hydra proposes to address and solve this problem in technologies and tools for developing middleware solutions based on a device-independent, model-based system.

Cultural and social issues

Supplier

The project aims at developing an Ambient Intelligence middleware which is validated in the application domains home automation, eHealth, and agriculture. In the field of home automation, intelligent environments help saving energy and increase security. In eHealth applications, patients can automatically be monitored and assisted ("Ambient Assistent Living – AAL"), thereby allowing elderly people and patients with chronical diseases to live at home where they would otherwise had to stay in clinics or nursing homes. Applied to the field of agriculture, it is possible to create intelligent food chains providing an overall monitoring and quality assurance from farms to supermarkets.

Technical issues

Supplier

The overall scientific and technological objectives of the HYDRA project is to define, develop, prototype and validate an middleware platform that allows developers of networked embedded systems to develop new, compelling, innovative products and solutions by researching and integrating the following technical aspects:

- Embedded and mobile SoABreak down the paradigm of Service-oriented computing (SOA) to embedded systems such as sensors and actuators
- Semantic MDA for AmI Leverage semantic web technologies like ontologies and semantic discovery for a model-driven approach (MDA)
- Decentralised Peer-to-Peer architecture Support a fully decentralised architecture by means of Peer-to-peer protocols and decentralised discovery mechanisms.
- Wireless devices and networks Provide unique network adapters to seamlessly integrate all kinds of different wireless network protocols
- Ambient Intelligence autonomic computing Support self-monitoring, self-adapting and self-protecting heterogeneous networks

- Trust and security Support privacy-preserving mechanisms for omnipresent intelligent environments and develop a security architecture for heterogeneous and resource-restricted platforms.

Participants

http://www.hydramiddleware.eu/articles.php?cat_id=1

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2. PrimeLife

Background and Objectives

The EU FP7-funded IST project PrimeLife, successor of the FP6-funded project PRIME, started in March 2008 and addresses the growing privacy challenges such as life-long trails of personal data cause by an increasing number of data-collecting services and unlimited storage.
According to the project members, individuals cannot sufficiently protect their autonomy anymore and cannot retain control over personal information as present information technologies does not consider these requirements enough. From this fact, new privacy challenges raise, such as the question how to protect privacy in emerging Internet applications like collaborative scenarios and virtual communities and how to maintain life-long privacy.

The main objectives of the project is to bring sustainable privacy and identity management to future networks and services:

- Fundamentally understand privacy-enhancing identity management 'for life' (practical life, throughout life & beyond)
- Bring Privacy to the Web and its Applications
- Develop and make tools for privacy friendly identity management widely available -privacy live!

In order to achieve these objectives, PrimeLife aims at advancing the state of the art in the areas of human computer interfaces, configurable policy languages, web service federations, infrastructures and privacy-enhancing cryptography.

Participants

http://www.primelife.eu/about/consortium

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3. DAIDALOS II

Background and Objectives

DAIDALOS is an FP6-funded Integrated two-phase project whose second phase, DAIDALOS II concluded by the end of 2008.

The project addresses a seamless pervasive access to services in heterogeneous all-IP networks including cellular, satellite, fixed line as well as wired and wireless sensor networks. Context and user preferences are considered by a user-centric approach of mobile networking.

DAIDALOS I and II had significant impact on successive projects like SWIFT and Hydra, amongst other things by coining the concept of "virtual identities"

Participants

http://www.ist-daidalos.org/daten/partners/partners.htm

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4. SWIFT

Background and Objectives

The EU FP7-funded IST project SWIFT, submitted as part of Call 1, started in 2008 and aims at extending identity functions and federation to the network while addressing usability and privacy concerns. The project members envision to develop privacy-enhancing technologies and new opportunities for network operators by the concept of "virtual identities".

For this, SWIFT to extend existing identity management approached that have been developed in previous research project in the following vital R&D areas:

1. Develop solutions, which use identity as a key enabling technology for convergence a) technically between networks, services, applications and content and b) business-wise between operators, service providers, micro-operators and even users as providers.
2. Design a cross-layer identity framework with major emphasis on the network to supports rather than change the user's habits and enhance experience. Include support for multiple personae and enable a strong privacy of the user's attributes and data.
3. Support identity privacy and security for the user across layers, resolving addresses and names revealing only what the user needs and accepts for the expected functionality.
4. Provide cross-layer usability features, such as ubiquitous connectivity, user-centred mobility, single sign-on and single bill.
5. Develop a model for the handling and management of user data linked to one of his identities or personae, where the user controls which info may be passed on depending on the recipient, his context and other external rules.

By these global objectives, fast entries of new business players like network operators or service providers shall be facilitated.

Technical issues

Supplier

The SWIFT project aims at covering the following technical issues:
The work covers transport and services strata (in ITU terms) and all related ISO/OSI layers, with the user's identity being intrinsic to the control, data and management plane protocols. Specifically, technological advances and breakthroughs will be targeted for the following:

1. Cross-layer integration of identity, privacy, trust and security across layers
2. User-centric Identity management techniques to support access control and privacy rules
3. Pseudonymous identification methods respecting user preferences
4. Identity-based mobility solution: Adaptation of mobility protocols to the user's "moving identities" across devices, services and networks.
5. An Identity Management Platform providing a common framework and APIs for accessing identity attributes across services and networks in a controlled way enabling user privacy mechanisms including specific APIs, such as for an Identity Broker.
6. Mapping new identity techniques to existing technology (SIM cards, etc), and eIdM and AAA solutions to accommodate Identity Management. Specification and validation of extensions / modifications of existing ones to support SWIFT vision

Participants

http://www.ist-swift.org/component/option,com_frontpage/Itemid,1/

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5. TAS³

Background and Objectives

TAS³ is an IST FP7 funded European project (Contract no. 216287) which aims to have a European- wide impact on services based upon personal information, which is typically generated over a human lifetime and therefore is collected & stored at distributed locations and used in a multitude of business processes.

TAS³ will advance the Science & Technology in several sub-topical area's but at the same time will integrate the different components (mostly being developed in their own work package) into one dependable Trust & Security Architecture which in the end intends to offer a safe and dependable business processes environment for exchanging personal identifiable information.

The overall objective of the TAS³ project is to specify a trusted services network for business processes comprising personal data for employability and healthcare applications. The resulting solution consists of checklists, workflows, controls, sample policies and a set of tools to help guide the creation of TAS³ compliant sites and technologies. These will consist of practical guidance, policy architectures, contractual frameworks, and adaptive process models that are executed by web services, and keeps in mind the governance structure and portable controls that enable compliance with data protection and related legal requirements that are relevant in developing service user-centric tools and programs related to employability and eHealth.

Technical issues

Supplier

TAS³ provides a transparent framework in which process based services can securely process and depend on personal information, regardless from the context in which this information was collected. This requires, of course, that the context of the business process is compatible with the data protection policies and that the requester has the proper authorizations to process this information, but if the service provider meets all these conditions, he becomes part of a trusted service network that guarantees that a service requester is only able to use services from a service provider that have never before been possible.

TAS³ develops an integrated service architecture comprising the following technologies to secure personal long-time data:

- Semantically interoperable & trust-driven business processes
- Sticky Policies
- Fine-grained policy tags

Participants

http://www.tas3.eu/partners

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6. PICOS

Background and Objectives

With the emergence of services for professional and private on-line collaboration via the Internet, many European citizens spend work and leisure time in on-line communities. Users consciously leave private information; they may also leave personalized traces they are unaware of. PICOS will develop and build a state-of-the-art platform for providing the trust, privacy and identity management aspects of community services and applications on the Internet and in mobile communication networks. The PICOS approach to trustworthy on-line community collaboration addresses these four questions: What are the Trust, Privacy and Identity issues in new context-rich mobile communication services, especially community-supporting services? How can information flows and privacy requirements be balanced in complex distributed service architectures (e.g., mash-ups)? How can these issues be solved in an acceptable, trustworthy, open, scalable, manner? Which supporting services and infrastructures do the stakeholders need?

The PICOS consortium includes European industry and research communities. The project will first review contemporary research in relevant disciplines. Its platform design and prototype development work will then create interoperable, open, privacy-respecting identity and trust management tools that can be demonstrated to the public. These will be used to construct community application prototypes by leading industry partners; those will be trialled with selected on-line communities. PICOS will self-evaluate usability, ergonomics, legal issues, trust and privacy. Expected PICOS results are:

- A set of interdisciplinary requirements for trustworthy, privacy-friendly community transactions,
- A platform prototype that demonstrates the provision of state-of-the-art privacy and trust technology to community applications,
- User-centric trials that validate its applicability,

Publications and a final report will disseminate the PICOS results to the public.

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