Digital Maps and Blockchain, Simplification of Information Sharing

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Abstract

Our ICT age is coming with high complexity of information sharing due to the complex natures of the technologies and due to the dependencies related to the varieties of sources companies. This paper will use Mixed Research Methods to prove that Simplification of Information Sharing can be highly achieved by using these new 2 technologies: Programming of ESRI digital maps; programming of smart contracts of Ethereum blockchain. Multistage Cluster Sampling method will be used to choose samples of academic, public and private projects related to these 2 technologies. Then we can examine the level of simplification of information sharing that we can achieve for each project one after another. Using programming methodologies of these 2 technologies will give huge opportunities for humanity to build very transparent policies at the global and the national levels in all fields like business, politics, environmental management and natural resources management. We have chosen ESRI digital maps company and Ethereum blockchain company because of their highly support for sustainable development and for the global sharing mechanism. Also, these 2 companies highly support all types of programmers. These 2 example companies show that there are 3 target goals can be integrated together: 1) Sustainable development goals; 2) Business economical added value; 3)Simplification of Information Sharing.

Keywords

ESRI, Digital maps, Blockchain, Ethereum, Smart contracts, Programming

1. Introduction

Business of today is so far dependent on the way of visualization and securing the data. Digital maps are way of data visualization and blockchains are way of securing the data, but the more important thing that programming of these 2 technologies will help so far in simplifying the data sharing. We have chosen ESRI digital maps because of possibilities of full programming with many languages at the desktop and network levels, in addition ESRI company strongly supports sustainable development. Also, we have chosen Ethereum blockchain because it has very strong language Solidity for Ethereum Smart Contracts programming, in addition Solidity does not has any dependencies to start programming smart contracts for business.

This paper will concentrate on the tremendous amont of transparency and simplicity of data sharing and management that digital maps and blockchain programming can provide for the sustainable development and for the sustainable business.

The paper will contain: explicit and Tacit knowledge (Fig. 1); SRI Digital maps programming 3 examples projects; Ethereum Blockchain network; Integration of the 2 technologies for future projects.

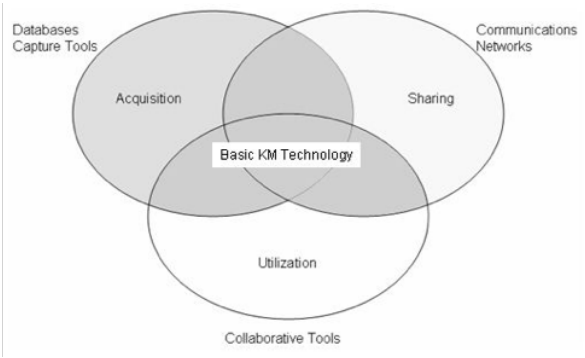

Figure 1: Fundamental processes of knowledge management.

2. Explicit and Tacit Knowledge

Data, information and knowledge: Data is facts about events but without judgments; Information is data organized for specific special purpose (Fig. 2). Data needs these 5 processes to become information: contextualized, calculated, categorized, corrected, condensed. Knowledge: is the specialized information which always interact with the human experience. It comes from human experience and it generates new experi-

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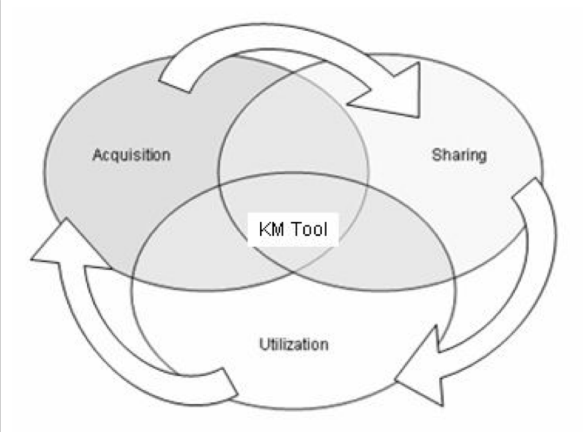

Figure 2: knowledge management tool.

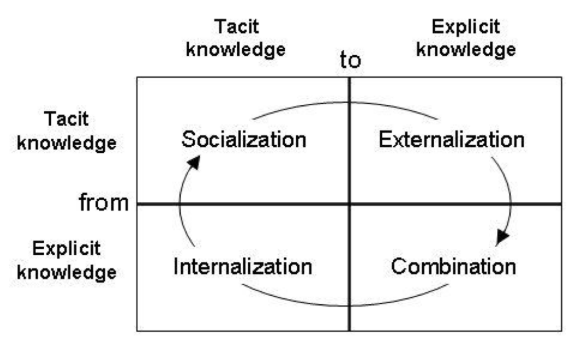

Figure 3: Keep Knowledge Conversion Process.

ence, a process similar to what happens in the learning process of neural networks [1, 2, 3, 4, 5]. It is included in the organizations standards. Information needs these 4 processes to become knowledge: comparison, consequences, connections, conversion. Knowledge Management (KM). Knowledge Management is the systematic actions that are applied to get the best added value from the knowledge that the organization has. Fundamental processes of knowledge management: knowledge Acquisition; Knowledge Sharing; knowledge Utilization.

Tacit and Explicit knowledge: Explicit knowledge is the knowledge that can be transferred and shared within a systematic language. Tacit knowledge is personal, specific and complex which make it very hard to be standardized for sharing (Fig. 3). Human gains knowledge by having new experience and developing those experiences to gain another experience, so that the explicit knowledge only the visible part of the iceberg. Keep Knowledge Conversion Process: Externalization (tacit to explicit); Combination: (explicit to explicit); Internalization: (explicit to tacit); Socialization: (tacit to tacit).

Implicit Knowledge: Implicit rule-based knowledge is the knowledge that can be explicit transformed to explicit if more efforts and time are given. Implicit Know-how is the knowledge which can be shared but needs experience because it is complex. Deep tacit knowledge is the knowledge related to beliefs, cultures and traditions. It is very difficult to be shared because it related to specific practices.

Knowledge as social issue: Transformation from tacit to explicit knowledge can be done by sharing the knowledge in between social networks which contain human and non-human actors.

Social networks: Social Network Analysis (SNA) science can map and describe the relationships between the members of the organization which will achieve excellent and the best added value to the organization performance.

Computer networks as social networks: Actually, the computers networks are social networks because they are the connections between humans and their communities, organizations and others human institutes.

Knowledge Management Systems (KMS): In the information systems there is no differences in between information and knowledge, so humans can do limited customizations and simple categorizations. But in KMS there is involvement for the humans in the continuous interactions to achieve all the processes. With KMS, the human-computer interaction is more complex with target to share not only the information but also the meaning and the knowledge.

A successful KMS gives high importance for data. Learning processes are highly dependent on the data. We are learning from gathering information which is highly dependent on the data. Because of this, we find that we can learn computer programming language by examples faster than learning it from its theoretical instructions, or we can learn new language by practicing it directly instead of learning its grammars and vocabularies.

3. ESRI Digital maps programing

ESRI (Environmental Systems Research Institute) is an international supplier of geographic information system (GIS) software, web GIS and geodatabase management applications. ESRI has strong strategy to be main partner for United Nation, national governments and other decision makers in achieving the sustainable de-

velopments goals. ESRI ArcGIS has over 200 available geoprocessing tools. For full control of desktop digital maps ESRI provides full support for these languages: JAVA, C SHARP, VISUAL BASIC (VB), PYTHON. ESRI's strong supports for programmers and its global sustainable development partnerships has been giving the environmental experts the ability to customize the digital maps applications for full automation for the digital maps' projects [6].

3.1. ESRI digital maps programming software

Due to the huge complexity of the digital maps' projects most of people who need this technology consider that there are huge needs to transform digital maps knowledge from tacit knowledge to explicit knowledge.

The software will focus on the most complex concepts of the digital maps which is related to full programming of the digital maps and transfer it from tacit to explicit knowledge. For this purpose, the software is developed that can simplify to excellent level the full programing of ESRI digital maps. It will shows how and how much can the software methodology achieve and simplify the full programming of ESRI digital maps.

The most important thing in the software is the extracting of the normal data types (text, date, numbers) from the geodatabase. Because this will lead for full automation for the data of the maps such as making any calculations programming or any deep searches on this data.

The software is about programming of ESRI ArcGIS digital maps by using of VB programming language and Oracle, SQL-Server, Access and XML databases. To run the software, you need ArcGIS installed on your computer. The main idea of this software is to show:

1. How to extract the data from the data tables of ArcGIS feature classes (points, lines, polygon layers). The software can extract the data from Oracle, SQL-Server, Access and XML (Shape files) databases. The importance of extracting the maps data is that: Any programming, calculation or searching process can be done for this data.
2. Programming of any sequence of ArcGIS Geo Processing Tools can be done with same methodology used in this software.
3. Any connection to Oracle, SQL-Server, Access, XML databases or to folders can be created and opened with this software.

ESRI ArcGIS digital maps software has good but limited database search options by using SQL language searching options. Attached is a screenshot for the software for very deep unlimited search in the databases using SQL language. This software can be integrated with my digital maps' software. This software can reduce the dependencies by using XML and JSON files.

ESRI has 200 essential geo-processing tools. The ESRI Geo-processing tool is a specialized processing tool to edit the maps attributes that targeting the graphical components of the maps and its related geodatabase attributes.

It will use the 3 geo-processing tools in the software:

The first tool is the buffering tool, the input can be any type of layer such as points layer, lines layer or polygons layer and the output is always polygon layer. Buffering is the process to make new layer of polygons surrounding the selected targets shapes in the same input layer with polygons in a specific thickness in the 2 directions. If user does not select any shapes in the input layer then the buffer will be made for the all members shapes of the layer.

The second tool is the clipping tool, the input is two layers of polygons where the first layer polygons will cut the second layer polygons to have new third layer whose polygons are a copy from the first one but it has the layer attributes of the second layer polygons.

The third geo processing tool is used in the software is the tool that make connections to enterprise geodatabase such as Oracle and Microsoft SQL Server. The inputs are data required to connect to the geo-database as administrator and the output is a file which enable you to connect to the geo-database and to all its contents of digital maps.

Almost l explained all the resources are used in the software and in the following l will explain the mechanism of work flow and how l made its processes types of geodatabase in the same way by just browsing to the Access geodatabase or to the folder that contains the XML.

For explaining the user interface of the software for full programming of ESRI digital maps: Let us start from the top of the software interface. On the top there are 6 input controls to input the data required for connecting to Oracle (server, instance, user name, password) or Microsoft SQL Server (server, instance, user name, password, the database) in addition to complete the path and the name to the connection file SDE which will be generated. Then we will see the two buttons which they are responsible on the generating of the required files SDE to connect to the enterprise geodatabase Oracle or Microsoft SQL Server. After entering the database connection information and clicking one of these 2 buttons the generation of connection file SDE will start with all processes messages are shown

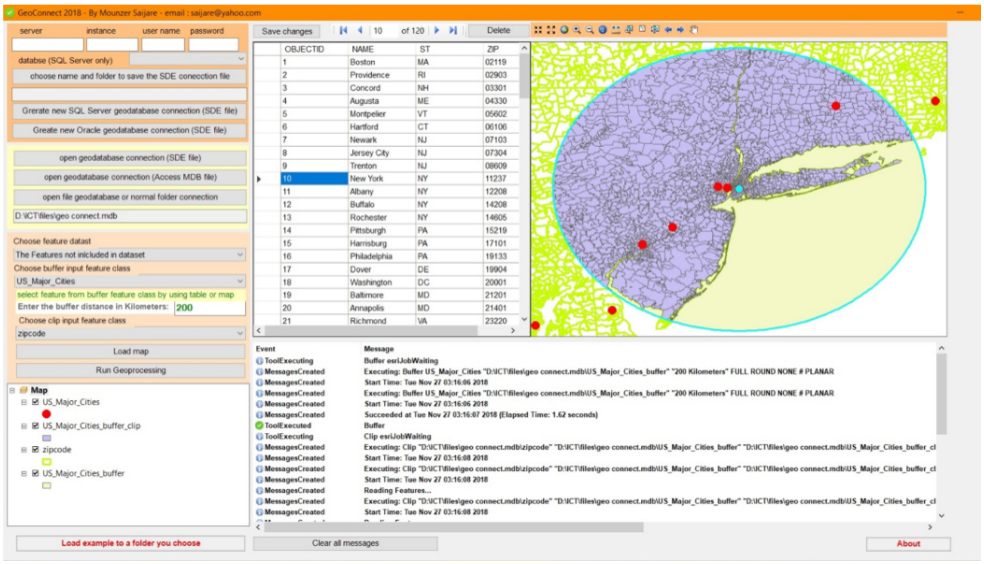

Figure 4: Screenshot for the software for full programming of ESRI digital maps.

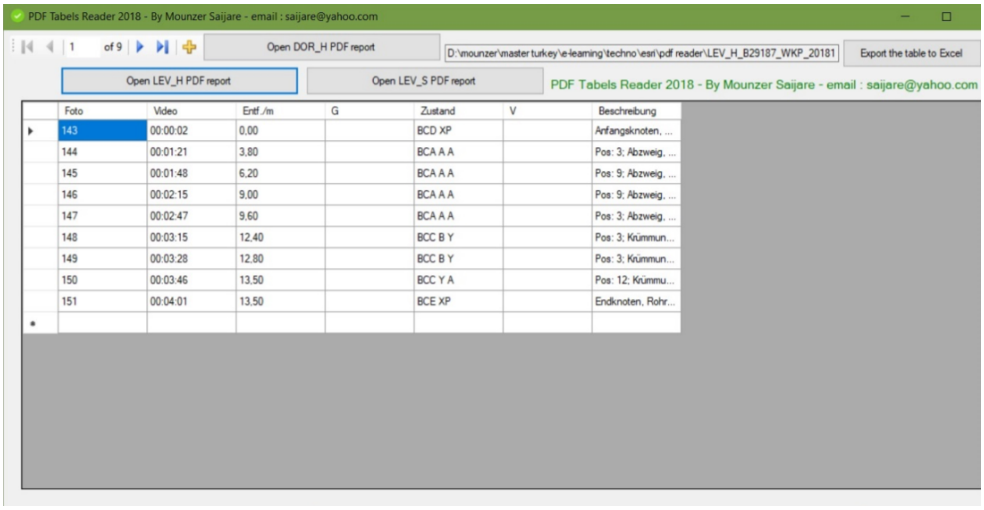

Figure 5: Screenshot for software that transfer the PDF format reports, come from Bayer wastewater network pipes monitoring companies, to database format data. Then this data will be sent to the digital maps' software.

in the software. After finishing we will see that there is generated SDE file with the name and path of the folder we chose before.

We have now the required files to connect to one of the enterprise geodatabases Oracle or SQL Server, we can see in the next section of the software that there are 3 buttons to connect to the Geodatabases. The first one is responsible to connect to enterprise geodatabase by browsing to the generated SDE file in the previous step. By choosing the SDE file the connecting process will start then the software will list all the layers and datasets in the enterprise geodatabase.

We saw in the last step how to connect to an enterprise geodatabase wither it is Oracle or SQL Server. But ESRI has other 2 local geodatabase types: Microsoft Access geodatabase and XML files geodatabase (file geodatabase or the normal folder geodatabase). We can connect to these 2 files geodatabase. Then the connecting process will start and the software will list all the layers and datasets in the geodatabase.

The last section of the software is related to load the digital maps after we connected to one of the 4 types of ESRI geodatabases; and finally running the geoprocessing. The software shows how we can make

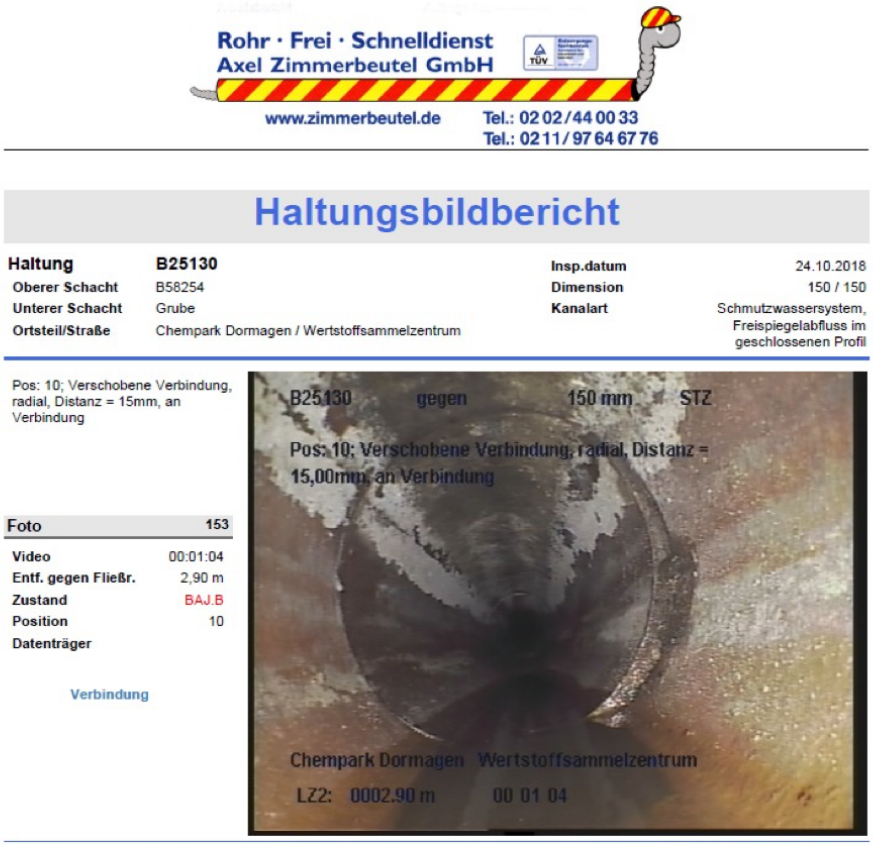

Figure 6: Screenshot for sample report for the PDF format reports come from Bayer wastewater network pipes monitoring companies.

sequence of 2 geoprocessing tools which are buffering and clipping. So, we need 2 layers as inputs which we will load from the connected geodatabase. We can choose these 2 layers directly from the geodatabase or from a dataset inside the connected geodatabase. The selected layer for buffering will provide the software with the one item as input as the software just allows one item to be selected. Whereas the selected layer for clipping will provide the software with the items which will be clipped (cut) by the output of the buffering process.

We will see by example how we load the maps and running the geoprocessing. The software provides an example of folder xml files geodatabase which is a part from USA map including New York city. By clicking the load example geodatabase, you will be promoted to select the bath for where the file geodatabase will be saved. Then the software will select the cities layer as the buffering layer and the zip code layer as the clipped layer. Now you can load the map. When we start loading the map the most important thing in the software will happen which is the extracting of the normal geodatabase data type (text, dates, numbers) which can lead for full automation for digital maps (calculations programming and deep searches). After the map is loaded you can choose a city for buffering wither by choosing from the map or from the table of items and their attributes; let us say that we chose New York city. Finally, you should enter the buffering distance in kilometers; for example: 50 kilometers. Now everything is ready to start the sequence of the 2 geoprocessing tools (buffering and clipping). When we click on run geoprocessing the software will make new layer which is a circle shape around New York with diameter of 100 kilometer(2x50=100). After finishing the buffering geoprocessing, the software will continue with clipping geoprocessing tool with 2 input layers; the first one the circle output of the buffering tool and the second one is the zip code layer was chosen before. The generated circle layer will clip from the zip code to generate new layer which is a copy of the circle but just has the attributes of the zip codes layer; this means

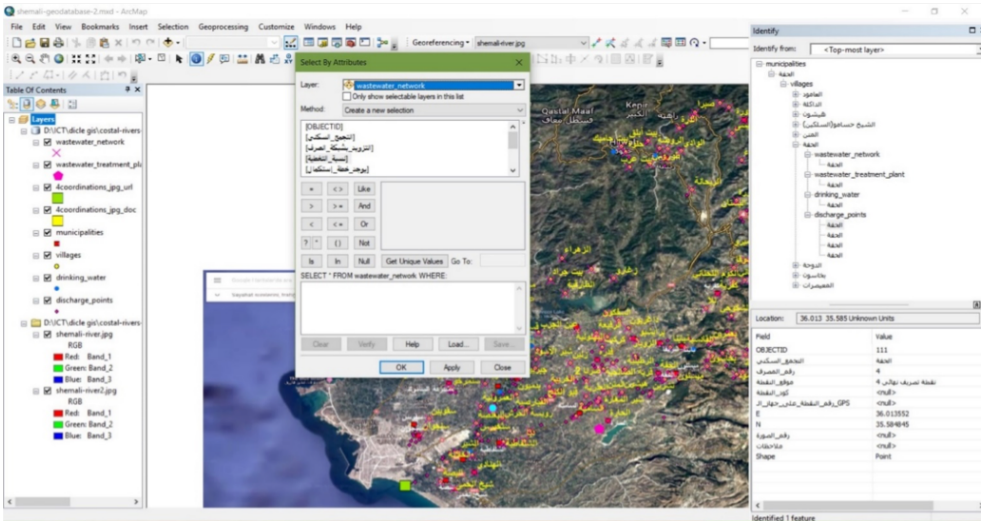

Figure 7: ESRI ArcGIS digital maps software has good but limited database search options by using SQL language searching options..

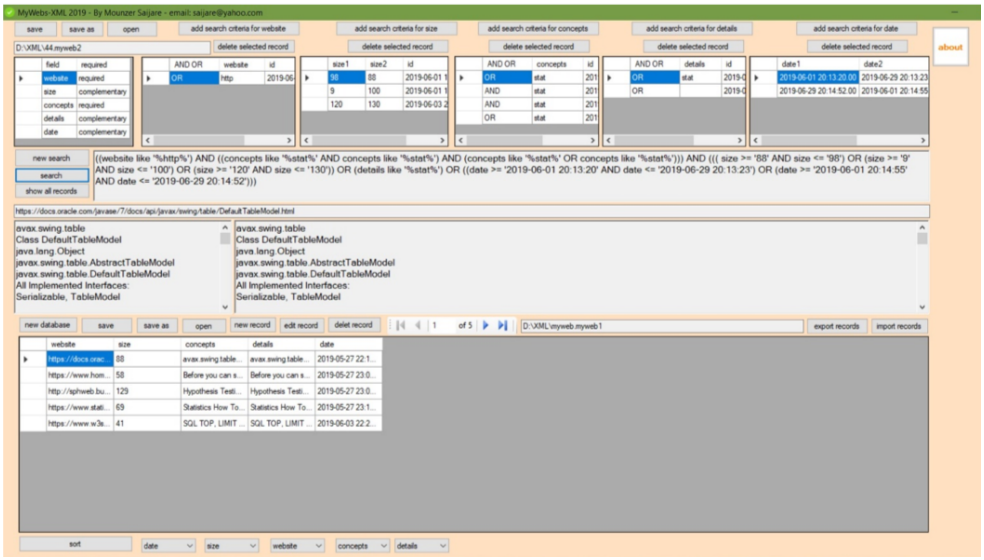

Figure 8: Screenshot for software for very deep unlimited search in the databases using SQL language. This software can be integrated with the digital maps' software. This software can reduce the dependencies by using XML and JSON files.

the final result new layer will be a 100 kilometers circle is cut from the zip code layer around New York city.

3.2. Syrian coastal rivers environmental management by using digital maps

This project was between United Nation Mediterranean Pollution Monitoring Program UNEP/MAP-MEDPOL, the Syrian Environment Ministry and Syrian Ministry of Communication and Remote Sensing (2010-2012). The project was about digital maps using ESRI ArcGIS software for pollution monitoring and environmental management for the biggest coastal river in Syria. In that time Mr. Mounzer Saijare was the Syrian coordinator for the UN MEDPOL Mediterranean Sea Program. A database and a Geo-database were designed for this project. This digital map project helped us to visualize all data gathered in a single application for the support of decision making. Before gathering the information of the river basin, we designed the survey after many long meetings with the related authorities in the Syrian government. We used many qualitative

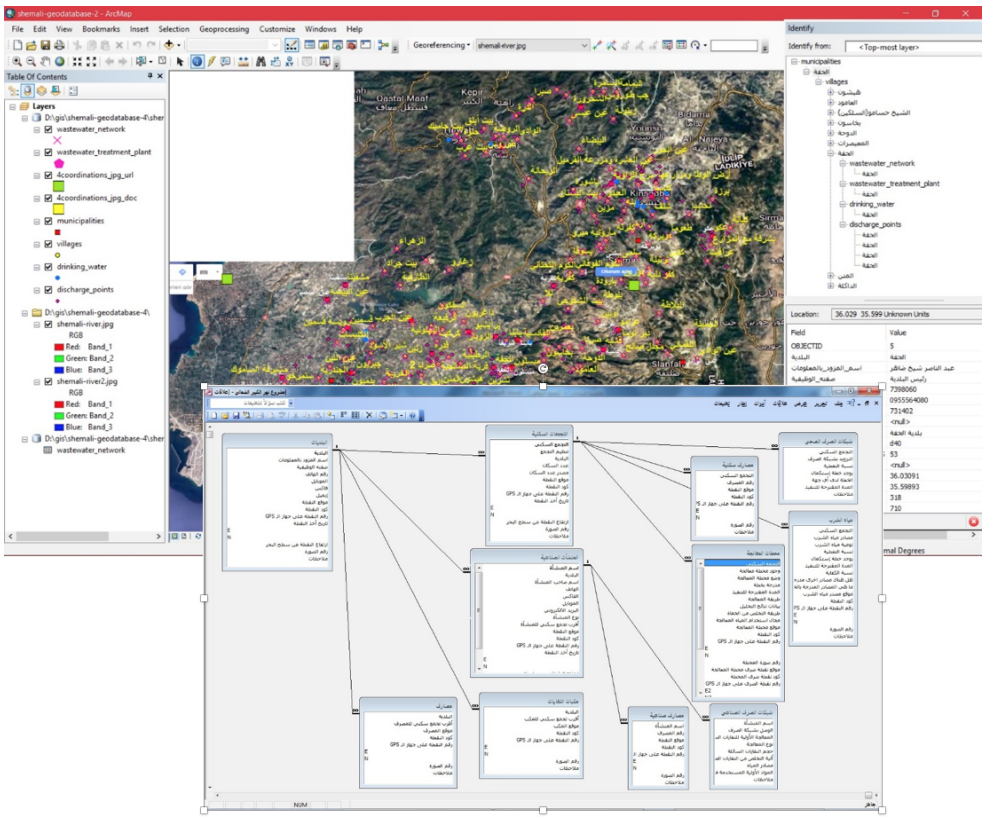

Figure 9: Digital maps and geodatabse of the project of costal revers monitoring in Syria.

and quantitative research methods and tools to find the suitable important indicators to be included in the survey. After finishing the survey, Mr. Mounzer and 2 other GIS specialists doctors had visited all places along the river basin to collect the required data. We used GPS technology to specify all locations of municipalities, villages, industrial activities, agriculture activities and tourism activities in addition to collect all required data. Also, we used interviews and observations to collect the data.

The final maps, after the filtering step performed in order to remove the noise [7, 8], were shown to related 2 minsters with 3D video includes information about all discharge points along the river whether the source was municipal wastewater, industrial wastewater, tourism activities wastewater or agriculture activities wastewater. This project shows the importance of digital maps in rivers basin management and in water and environmental management.

3.3. African Parks Project, GIS Tracking to Combat Poaching and Protect Animals

As mentioned in the introduction about ESRI the digital maps company, it has 2 very strong strategies for supporting all programmers and for supporting all environmental projects and experts.

These 2 strategies were applied in Garamba National Park reserve in Democratic Republic of the Congo.

When African Parks control room was updated with new GIS visualization and analysis options, the operators found themselves face to face with new technologies that is somehow difficult to deal with [9].

Evan Trotzuk, the cyber infrastructure officer in the park has used the capabilities of ESRI ArcGIS developers kit in C# programming language to customize the applications. Although Evan did not code in C# before but within a short time, he made applications interfaces for park digital maps. These interfaces were simplification for the digital maps' applications in the park which leaded to reducing the training required for rangers and ground patrols. Also, it leaded to that

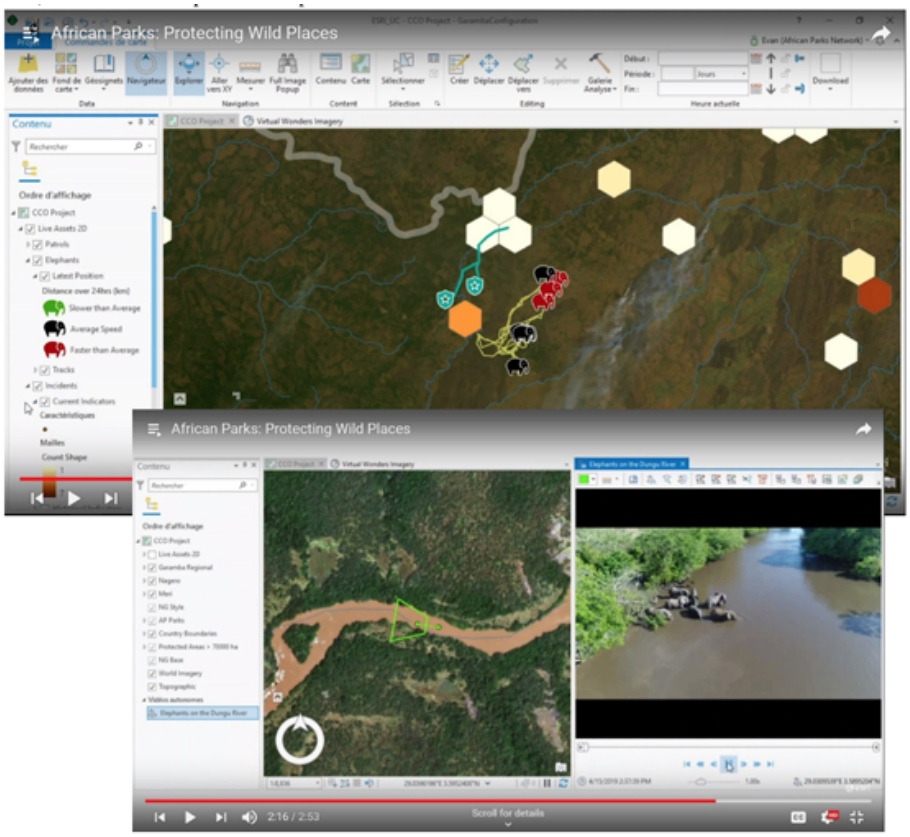

Figure 10: Using ESRI digital maps programming in the African Park project.

the operators in the park control room can collect and analyze the data from seniors in real time, can visualize the data and track specific parts like locations and speeds of elephants and locations of rangers and patrols.

In the control room of the Garamba park all data of the sensors are streamed together where they are manipulated and analyzed in near-real time which provides a comprehensive image for the park management staff. Hence all type of threats will be shown in the GIS screen like fires and shootings, making more support for the human resources management of the rangers and patrols. Elephants have clever remote sensing for threats like poachers and others, The GIS actually helps to get use of this cleverness in the protection of these clever animals themselves.

GIS helps the park authorities in dealing with local farmers population and distinguishing poachers from refugees coming along with borders of Sudan.

As more data are gathered from the park, the artificial intelligence will reveal patterns and all together with GIS will help fighting against poachers. Also, machine learning and GIS will support the park future planning.

4. Istanbul Ethereum Blockchain

Blockchain Ethereum network does not need any dependencies for your computer, you can start directly writing Solidity smart contracts programs with online Remix IDE and Chrome extension MetaMask.

In Ethereum Blockchain you can program transferring and sharing all type of transaction in the same way

1. transferring Ethereum (money)
2. transferring data
3. transferring contract software
   (will have address the same as web services)

Blockchain Ethereum network is suitable for Business-to-Consumer (B2C) marketing. No needs for servers. Ethereum network will share your database, your data, your applications and your Ethereum accounts (money) directly. This will give huge opportunities to sell small

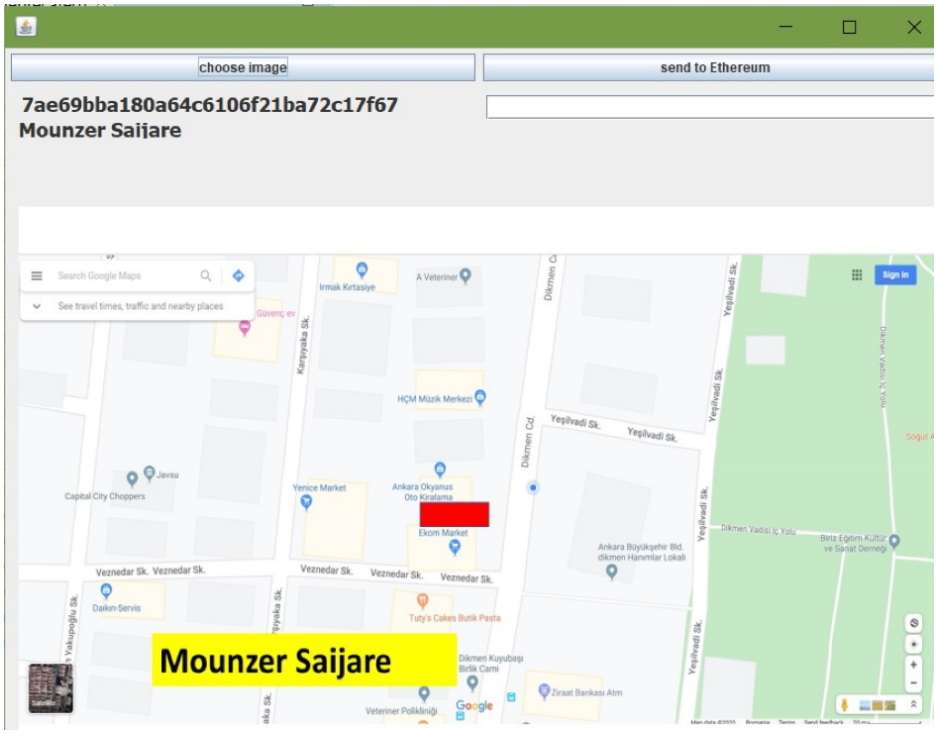

Figure 11: Software for documents verification with Ethereum.

personal software because each software will have to work with private Ethereum wallet and private contract software address. Ethereum blockchain will be perfect solution to share, store and search information. Because it reduces a lot of dependencies (Human and Technology). Ethereum blockchain will be perfect solution to share, store and search information for digital maps application. Transparency of Blockchain will make it the perfect solution for sharing global information about environmental pollutants regardless of national and international political issues and policies. Environmental Economics science is the best way to achieve the Sustainable Development and the Sustainable Economic Growth. Transparency of Blockchain is very necessary to share sensitive national information that are needed in calculation with Environmental Economics projects. The performance of Ethereum blockchain network depends on the gas price specified for the transaction to smart contract. It is between 1 billion gas and 50 million gas for one Ether. An Ethereum database sample is developed with tracking of all blocks and transactions for all actions in the smart contract. With this database sample we can measure the economic efficiency of Ethereum blockchain network. For example, the costs of 1000 records are in between 0.11 and 0.15 Ether. Instead of storing the files on Ethereum, we store the MD5 hash code of these files. Like on the Ethereum documents verification [10, 11]: We need 20 k gas to store 256 bit (32 bytes) word. This means 1 k bytes = 32 word 1 k bytes = 640 k gas. This means 1 mega bytes =640 million gas= 0.64 Ether at gas price (1/billion) Ether. Instead of storing the files on Ethereum, we store the MD5 hash code of these files. Like on the Ethereum documents verification software.

5. The integration of digital maps software and Istanbul Ethereum

The new very fast Istanbul Ethereum with ESRI digital maps programming can be integrated in an application for the real estate business. Also, another example that these 2 technologies transparency can be used in pollution monitoring of international water like revers and seas.

The developer who will made integrated Esri digital maps-Ethereum blockchain software can give users free software, then the developer can get percentage from each transaction will be made via the software

transferred from the users' wallets to the developer' wallet, these processes and the percentage should be declared very clearly in the software information. This methodology will give huge opportunities for all developers whether they work as individuals or as they work in companies.

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