Intelligent System "Family Doctor": Project Approach

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Abstract

Innovative technologies are increasingly included in aspects of our lives. One of these aspects is a medicine. In recent years, medical institutions have increasingly switched to electronic reporting, and software products have helped to make life easier for both patients and doctors. Such information systems should be further developed. Information systems of online doctors are not yet sufficiently developed so the current project is innovative and has significant differences from analogues. The development of procedure and the main functionality of an innovative mobile application for remote treatment of patients is considered. The project of mobile application that would give user opportunity to communicate with their family doctor, or a doctor of another specialty, and also contain additional functionality, such as setting up a cure reminder, and an appointment was created.

Keywords 1

Mobile application project, information system, software, online-advice, schedule of treatment.

1. Introduction

Recently, mobile technology has grown rapidly, smartphones have changed many aspects of our lives, including medicine. Smartphones with medical applications carry revolutionary content for medicine. As a result, a doctor can not become a central figure, but a patient. There are a number of mobile applications that can be somewhat replaced by qualified doctors. According to this role of doctors will change.

Today, there is a number of software products that allow people to stay healthy without spending time going to medical facilities. Mobile applications have a special niche among medical software, as they allow you to take care of your health without location bindings. There is a need to create a mobile application that will help the user to monitor the timely administration of drugs, as well as provide an opportunity to find an experienced doctor who can for the user to consult online and prescribe the necessary treatment.

Telemedicine and virtual software can reduce emergency room visits, protect healthcare resources and reduce the spread of COVID-19 by treating patients remotely during and after the COVID-19 pandemic [1].

Boyko A. considers that the use of telemedicine and virtual software provides promising potential in the fight against COVID-19. Virtual software can reduce emergency room visits, protect medical resources, and reduce the spread of COVID-19 by remotely treating patients during and after a COVID-19 pandemic [2].

Many people do not have a physical opportunity to visit a doctor, especially with very worrying symptoms and in most cases self-medication that can lead to health problems. That is why it was decided to create a program that would help people communicate with their doctor online. That will

help improve the general state of medicine. The works of L. Nweke, M. A. Al-Sharafi [3], A. Bokolo [4], J. Hollander, B. Carr [5], L. Marin, G. Ambrosini, F. Fanto, M. Vella, A. Massaro, F. Dessole, G. Capobianco, A. Andrisani [6], S. Bushuyev, I. Babayev, V. Bushuieva, N. Bushuyeva, J. Babayev, D. Bushuiev, S. Onyshchenko, A. Bondar[7,8], were analyzed.

In each of these sources the basic idea of how innovative technology helps in the medical sector is expressed.

The goal of this project is to create a mobile application for self-scheduling treatment or obtaining such a schedule from registered doctors. The application must also have an API designed to communicate with the alarm system in the smartphone and notify the user about the reception of drugs, procedures.

2. Stating of the problem

A large number of applications for smartphones and other miniature devices are endowed with functions from diagnosing infections to monitoring heart pressure and mental health analysis, can reduce the need for doctors, reduce treatment costs, speed up medical care and provide more opportunities for patients. Of course, doctors will not disappear anywhere, but their relationship with patients may change. Suppose you have a dermatological rash.

The application on your smartphone will give you the ability to take a picture of this rash and upload it to a special program that will analyze this photo and in a short period of time (a few seconds, maybe minutes) inform you about your diagnosis and treatment. Only in a complex case, which is not in the database of the application, the smartphone will give you advice to contact a skin dispensary or advise a qualified dermatologist.

Many doctors also use smartphones as part of their medical services. Here are some statistics on what sources of information doctors find using smartphones and other devices: 73% of doctors search for information about medications; 64% of doctors have access to medical examinations; 45% of doctors communicate with nurses and other staff. This may seem fantastic now, but many consulting companies, such as Deloitte and PricewaterhouseCoopers, predict that visits to a "virtual" doctor may later become the norm.

Deloitte claims that in 2014, one in seven doctor's consultations was virtual. Mobile gadgets have the necessary applications that allow the user to calculate the cost of treatment, as well as reduce the cost of some tests, as the user is able to do them themselves. Using wrist, wireless sensors in a few years will allow patients to constantly monitor health indicators such as blood sugar and oxygen levels, blood pressure and heart rate, even without having to press the start button.

Other applications allow you to quickly examine the eardrum and make a diagnosis without visiting a pediatrician [9]. Mobile devices are used not only to quickly find information, but also to communicate with the patient and the collection of medical data. In most cases, such communication takes place through a special application.

In the HIMSS Mobile Technology Survey, out of 200 respondents, 90% use mobile technology to attract patients to clinics for medical care. With the help of smartphones, patients will be able to collect the necessary data on some diseases, which was previously difficult. Doctors will also be able to analyze the condition of patients and the type of exercise.

For example, Fitbit and Jawbone's Up24 bracelets are quite popular with users because they can easily track exercise, nutrition and even sleep. Some other devices, such as the iHealth meter, allow users to measure blood sugar levels and send this data to their doctor. Over the past ten years, the condition of people with diabetes has improved significantly. There is much more information about the disease and ways to detect it.

A new generation of patients has been able to monitor their condition on their own. Today in the world there are no applications that have all the necessary recommendations of physicians. Existing programs can be divided into only three classes according to functionality. It should also be noted that the creation of mobile applications for patients with diabetes continues. The US National Science Foundation has allocated $ 1.2 million to create a new mobile application for diabetics. In the field of medicine, mobile devices can be a source of a lot of data. This data can be collected from fitness trackers and other devices [9].

The main problem of most medical institutions is the large queues for doctors and the impossibility to combine the schedule of the doctor and the patient. Therefore, in order to reduce these problems, it was decided to develop a mobile application designed to allow the patient to contact a doctor online with this mobile application, regardless of place and time.

Relevant software can solve many of the problems that still exist in the public medical institutions of our country, such as the lack of organization of patient care, lack of monitoring of drug receipt and others.

3. Analysis of similar software systems

Analysis of similar software systems is an important stage in the development of a future software product, as it allows to understand which aspects of design and solutions are appropriate for the concept of this product, and which, conversely, can reduce its relevance and functionality. In terms of functional and ergonomic analysis is necessary to analyze the software analogues to perform the functions involved in its design. In the case when analyzing the software product, it is necessary to pay attention to the structure of its windows, scope of functionality, adaptability and ease of use of these tools, etc. In this aspect, the analysis of software is not very different from the analysis of, for example, the interior, where you need to pay attention to the division of the room into functional zones.

The ergonomic part of this section should be analyzed compliance of the environment with anthropometric indicators. That is, the study of analogues is an extensive stage of development, the task of which is to obtain as much information as possible for the successful design and subsequent launch of the product on the software market.

Since the field for which the information system is developed is the field of health care, then attention should be paid to the structural sections of analog solutions. It is necessary to analyze the design of the database, to understand the actualization of the types of data used in these products, to analyze the structure of the interface, as well as to pay attention to computerization of business processes of the control object. software modules. To understand the need for automation in health care, five software will be used as an example. As part of this stage, an analysis of the functional requirements that presented to the information system [10-12].

Medisafe is a convenient free mobile application for the Android platform that helps people always on time. Its main purpose is to take medication on time, monitor weight, blood pressure, blood glucose levels and other health indicators. Medisafe is suitable for people suffering from diabetes, heart and cancer. And it is also a convenient way to remind about taking vitamins.

Med Helper is a prescription application that allows you to schedule treatment from very simple to very complex regimens. The application is available on platforms such as Android and iOS. You can log in and export or print detailed reports for your doctor, nurse or caregiver. Several profiles allow you to help others.

MedSimple is a mobile application for Android and iOS operating systems. Contains the functionality not only of medication reminders, but also some financial transactions. Allows the user to determine the price of drugs, as well as find cheaper analogues, pharmacies with lower prices and the opportunity to receive discounts. Contains a collection of information about drugs and their dosage.

MedCoach Medication Reminder is an easy-to-use mobile app for iOS and Android operating systems that allows you to not only create medication reminders, but also connect to specific pharmacies to book a medication list.

Table 2.

Comparison of the project with analogues

Specifications	Products				
	IT-StartUp	Medisafe	Med Helper	Med Simple	MedCoach Medication Reminder

Boolean evaluation					
Multilingualism	Yeas	Yeas	Yeas	No	No
Multiplayer interface	Yeas	No	Yeas	No	No
The presence of advertising	Yeas	No	No	Yeas	No
Evaluation of benefits					
Novelty	5	3	3	2	4
Ease of use	5	4	4	4	3
Versatility	5	2	3	3	3
Accessibility	5	4	1	4	3
Quantitative evaluation					
Number of platforms	1-2	1-2	1	1-2	1
Qualitative evaluation					
Functionality	8	10	10	10	10
Tolerability	8	8	10	8	10
Versatility	10	8	8	8	8
Simplicity	10	10	8	10	6

4. Presentation of main results

This project should be developed as a mobile application that resembles people with certain illnesses, when exactly and to what extent they need to take medication with an online consultation with a physician. The application should have features such as creating a treatment schedule and finding a specialist for counseling. In addition, you need to create a registration and logon system to ensure the confidentiality of data. Additionally, administrators need to be able to view user information and approvals by physicians. The name of this application is "Medicine".

This app is designed for people who appreciate their time and use the app, both to adhere to the treatment schedule and to stay in the long queues, and to consult with a doctor online.

Creating this app is cost-effective because it saves time for its users without spending much effort on it. One of the types of earnings of this application is the distribution of advertising.

The innovation of this IT startup is that the user, in addition to being able to create a schedule of treatment, can be able to consult a physician who will also be able to create a treatment schedule for the patient.

This mobile application would give the user the opportunity to communicate with their family doctor, or a doctor of another specialty, and also contain additional functionality, such as setting up a drug reminder, and an appointment (Figure 1).
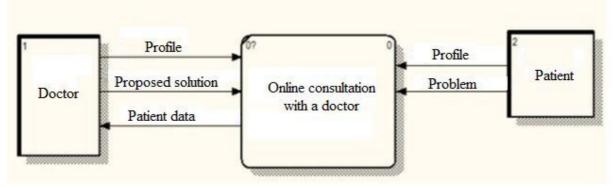

Figure1: General view of the system

The main functions that will be implemented in the program:

- Creating a description of medication.
- Creating a medication reminder.
- View and edit information about created medication descriptions.
- View and edit created reminders.
- Go to the user's page.
- Search for doctors.
- Ask a doctor.
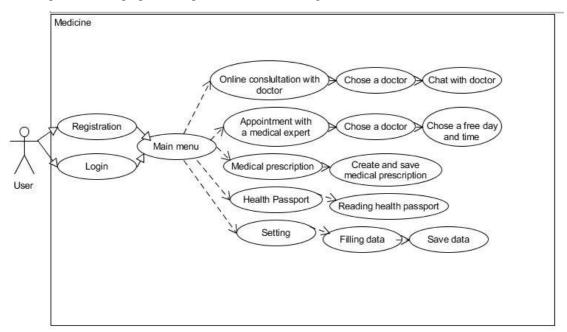- Acceptance of the prepared recipes from the doctor (Figure 2).

Figure 2: Diagram of patient use options

When logging in, the patient registers with his personal data, such as his last name, first name, patronymic, telephone number, email, gender, date of birth, and password.

When logged in, the user goes to the main menu, which can select the following items: consultation with a doctor, a doctor's note, medical prescription, medical passport, settings (Figure 3).
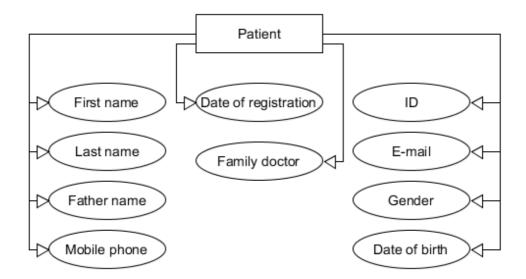

Figure 3: The essence of the patient

In the "Doctor Consultation" menu item, the user can choose a family doctor or a doctor of another medical specialty who can chat with him. This saves the time of the doctor and the patient.

For example, patients who do not have time to constantly visit a doctor with a minor cold can consult without difficulty, or patients with certain diseases can inform the doctor about the course of the disease.

The doctor in turn, in addition to the consultation, may prescribe a protocol for treatment, or record a patient for admission, these records, in turn, appear in the application as a reminder.

The next menu item is Recording Reception.

At this point in the menu, the patient has the opportunity to sign up for a doctor, choosing the doctor himself, a convenient day and time.

The day before the reception and on the day of reception, the mobile application uses the standard reminder functions to alert the patient.

The next function of the mobile application is the "Medical recipe".

In this menu item, the user can fill in the names of the doctor appointed by the doctor and the time of their admission, or receive such a protocol from the doctor during an online consultation.

A mobile application will notify the patient about the need for medication, as many of them through employment can forget about this procedure and do not adhere to regularity.

This menu item provides an overview of existing ones, or creating new reminders, detailing the dosage of medication per day, the number of days, the type of drug, the name, acceptance recommendations and contraindications (Figure 4).
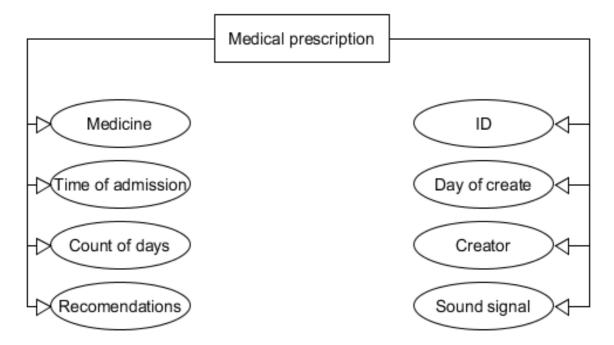

Figure 4: The essence of the medical recipe

In the menu item of the Mobile Application "Medical Passport", the user has the opportunity to view his electronic passport in which doctors make entries.

The last item in the menu is the "setting". With it, the user can change information about himself, as well as change the notification setting (Figure 5).
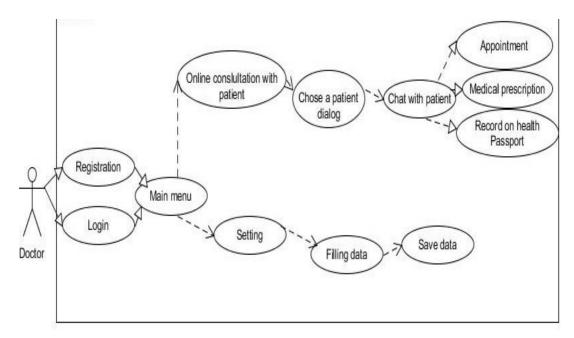
Figure 5: Diagram of use options for a doctor

For the actor-doctor in the mobile application, there are two menu options that provide communication with patients who access it through an application-based arrangement and "setting" that allows you to change the settings, including the protocol for treatment. But to chat with a patient, he has the option of "Recording on reception", "Patient's protocol" and "Entering a medical passport".

The application provides for the implementation of a module that would provide the function of video consultation with the doctor in an online mode (Figure 6).

This mobile application is implemented through interaction with the server, which stores all the necessary information.
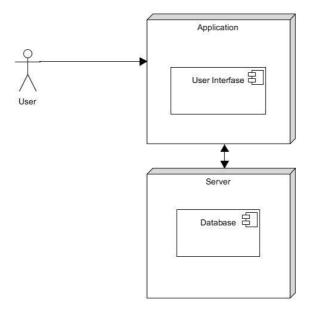

Figure 6: Component Diagram

Many people do not have enough free time to visit a doctor, especially for symptoms that are not too bothersome, and in most cases self-medicate, which can lead to health problems. That's why it was decided to create a program (Figure 7) that would help people communicate with a doctor online. What will help to improve the general condition of medicine. It was decided to create a mobile application that will give the user the opportunity to communicate with his family doctor or a doctor

specialty, and also contain additional functionality, such as creating reminders about taking medications, as well as making an appointment.

Figure 7: Initial diagram of activity

In the "Medical passport" menu item, the user has the opportunity to view his electronic passport in which doctors make entries (Figure 8). The last menu item is "settings". Here, the user can change information about himself, as well as set up notifications.
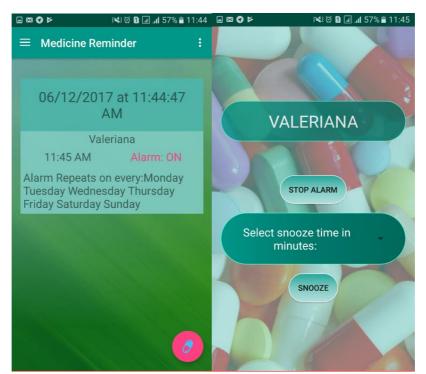

Figure 8: List of doctors and their specialization

In turn, the doctor in the program has only two menu items: communication with patients who contact him and changing settings. But in the chat with the patient, he can make an appointment, write a treatment prescription for the patient, and make an entry in the medical passport (Figure 9). In future, the program may implement online video consultation with the doctor in his free time for a small fee.
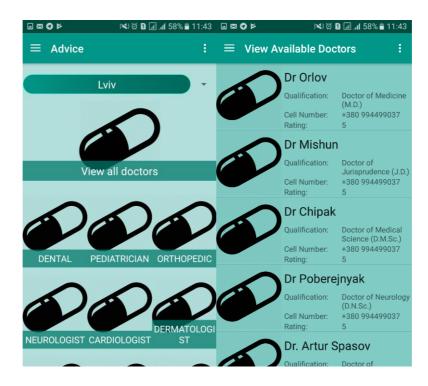
Figure 9: The history of all treatment reminders

Medicines do not always treat, but most often they treat one, but they cause a large number of side effects that break other properties of the body. Therefore, it is necessary first of all to prevent the emergence of illness, with available opportunities (Figure 10).

Figure 10: Create reminders

There is a situation with loop, which should be solved with modern IT-means. The software of intellectual information system for patient registration, will cover a sufficiently wide range, which in sum will be aimed at solving the found problems. From this there are already other, more serious consequences, the solution of which can be organized through the implementation of the software complex. Summarizing the results of our research, we can confidently say that the analysis of the subject area of design has been done correctly. An online consultation with a doctor was developed using firebase, a provider of cloud services and programs. The main focus is a cloud-based NoSQL database for real-time applications, which provides an API that allows developers to store and

synchronize data between clients without having to create their own server. The most popular Firebase service is Simple Login - it allows users to authenticate using program code only on the client side. Developers have the ability to authenticate users using data stored in the cloud. Firebase UI has a user-friendly class Firebase List Adapter, which uses data that is in the Firebase database to populate listViev. Firebase List Adapter is an abstract class and has an abstract populate View () method that needs to be overridden. Populate View () is used to populate the views of each list item.

5. Conclusions

The analysis of analogue programs was also performed and a table with comparative characteristics was compiled. Strengths and weaknesses were identified. The mobile application will give the user the opportunity to communicate with his family doctor, or a doctor of another specialty, and also contain additional functionality, such as creating reminders about taking medications, as well as recording on reception. The creation of this product can be successful, because the problem solved by this project is relevant, and the approach to its solution is innovative. The application combines features that have analogues and offers new ones, which makes it universal.

6. References

[1] A. Bokolo, Use of Telemedicine and Virtual Care for Remote Treatment in Response to COVID-19 Pandemic. Journal of Medical Systems 44 (2020). URL: https://pubmed.ncbi.nlm.nih.gov/32542571/.

[2] A. Bokolo, Exploring the adoption of telemedicine and virtual software for care of outpatients during and after COVID-19 pandemic. Irish Journal of Medical Science 190(1) (2021) 1–10.

[3] Bokolo Anthony Jnr, Livinus Obiora Nweke, Mohammed A. Al-Sharafi, Applying software-defined networking to support telemedicine health consultation during and post Covid-19 era. Health and Technology 11 (2021) 395–403.

[4] Bokolo Anthony Jnr, Application of telemedicine and eHealth technology for clinical services in response to COVID‑19 pandemic. Health and Technology 11 (2021) 359–366.

[5] J. Hollander, B. Carr, Virtually Perfect? Telemedicine for Covid-19. Medicine, Computer Science 382 (2020) 1679–1681.

[6] L. Marin, G. Ambrosini, F. Fanto, M. Della Vella, A. Massaro, F. Dessole, G. Capobianco, A. Andrisani, Telemedicine for Virtual Consultations During COVID-19 Pandemic in a Medically Assisted Reproduction Center: Patients' Perspective. Telemedicine journal and e-health (2022). URL: https://www.liebertpub.com/doi/10.1089/tmj.2021.0509

[7] S. Bushuyev, I. Babayev, V. Bushuieva, N. Bushuyeva, J. Babayev, D. Bushuiev, Managing Project Success with Infodemic vs Pandemic Environment on the COVID - 19 Pandemic Case, in: 2021 IEEE International Conference on Smart Information Systems and Technologies (SIST). URL: https://ieeexplore.ieee.org/document/9465939

[8] S. Bushuyev, V. Bushuieva, S. Onyshchenko, A. Bondar, Modelling the dynamics of information panic in society. COVID-19 case. CEUR Workshop Proceedings 2864 (2021) 400-408.

[9] The future of medicine in your smartphone. URL: https://zbruc.eu/node/32050

[10] A. Kazarian, N. Kunanets, R. Holoshchuk, V. Pasichnik, A. Rzheuskyi, Information support of the virtual research community activities based on cloud computing, in: International Scientific and Technical Conference on Computer Sciences and Information Technologies, CSIT 2018, 2018, pp. 199–202.

[11] V. Lytvyn, V. Vysotska, V. Mykhailyshyn, A. Rzheuskyi, S. Semianchuk, System Development for Video Stream Data Analyzing. Advances in Intelligent Systems and Computing 1020 (2019) 315–331.

[12] I. Izonin, R. Tkachenko, L. Ryvak, K. Zub, M. Rashkevych, O. Pavliuk, Addressing medical diagnostics issues: Essential aspects of the PNN-based approach. CEUR Workshop Proceedings 2753 (2020) 209–218.