Albanian Mobile Assistant for Chronic Diseases

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Abstract

The purpose of this paper is to present alMED, a mobile application designed to improve the self –management of chronic diseases by the patients themselves. Since the number of chronic disease patient is increasing every day worldwide, monitoring and management of chronic diseases is becoming a major concern even for the Albanian Healthcare System. The current state of alMED provides intelligent, user-friendly and secure application to keep track of the user medical records. It also works as a reminder for patients' medicine dosage and timings for multiple diseases. Patients are notified by the application each time they need to take a medicine, preventing them from forgetting to take them. In the future our goal is to make this application part of a larger system which includes the interaction between the patients, health care providers and pharmaceutical providers.

1 Introduction

The healthcare system all around the world is facing rising costs with the rising of the number of chronic diseases in the population [APG13]. It is a fact that nowadays people neglect their healthcare because of their busy life, responsibilities, every day stress etc. Usage of smartphones has increased rapidly reaching an approximate number of 2082.7 million users. Mobile technology has become an important part of everyday life even in the developing counties, and people are gradually becoming aware of the benefits gained using mobile biosensor-based application in improving their health care [SS12]. Mobile health promises to improve patient care through early disease diagnosis and early disease testing. The cost of healthcare system will be reduced by using smartphones to monitor chronical diseases and reduce this way the number of hospitalized patients. Our goal is to give Albanian smartphone users a solution to improve their quality of life by managing their medical records and medicine timetables. The main problem concerning patient drugs treatment is that most of them forget to take their medicines in the right time or dosage, or even confuse treatment of one disease with another. This causes medication adherence [AAJKL15], which refers to the degree or extent to which a patient takes the right medication at the right time according to a doctor's prescription.

Many studies have reported that non-adherence may critically affect the patient, thereby raising medical costs [PL12]. Our system gives a solution for this problem from the combination of sophisticated data analytics and mobile technologies. **[**SN12**]**. Using the mobile health application the patients will be able to manage their health and the professionals will be able to deliver the best care possible away from doctors and hospitals, closer to where patients live work and travel [ECL15]. alMED notifies the patients for the time and dosage of the medication they have to take for every disease. Except this it also provides a 'Diary' interface to keep track of daily measurable health components.

2 Related Work

There are many mobile health applications in use around the world, especially in the developed countries which provide different types of health assistance to their users, being those patients or healthcare providers. In this paragraph we will discuss some of the most used mobile systems of this type. Some of these new mobile applications are specifically targeted to assisting individuals in their own health and wellness management. Other mobile applications are targeted to healthcare providers as tools to improve and facilitate the delivery of patient care [FDA15]. According to Research2Guidance there are more then 100 000 mobile health application offered by IOS and Android. It also values that at least 50% of 3.4 milliard mobile users all over the world will download mobile health

applications of some kind by 2018. Further are listed some of the best mobile application in Android and IOS platforms **[**S15**]**.

1. **MyChart** allow you to access your medical records on your phone at any time. You can quickly see which vaccinations you've had and when at a glance, along with the last time you visited the doctor and which prescriptions you're taking. You can even send a non-urgent message to your clinic and receive a response within a couple days, schedule visits from directly within the app, and request prescription refills. Best of all, you can see all your information online if you can't access it due to cellular outages.
2. **CareZone** Managing medication can be a chore (and confusing). Thankfully, CareZone lets you curate a list of medications, dosages, and schedules directly from your photo library. The application also allows you to document and share symptoms with your family or doctor, while giving you the means to store vital insurance information and schedule reminders for upcoming appointments. The personalized health tips and ability to assign to-do lists and store important documents for future reference are only a plus.
3. **WebMD** When people think of WebMD, it's probably just to make fun of how it's often the first place people go when they need to figure out what illness or condition they have. The iOS application offers the same thing, but alongside that, it also allows people to set medication schedules, create a process with which they can use to meet a personal health goal, and check for local physicians and pharmacies you may not be aware of. And if you find yourself in need of a first aid advice or instructions, the application has that too, and it doesn't require an internet connection.

After reviewing the features that each one of the above applications offers we will study the possibilities of integrating and adopting the best of them in our system considering all the challenges and conditions of the Albanian healthcare system and users.

3 Proposed System and Implementation

This application is named alMED, where 'al' stands for Albania and 'MED' stands for medication and medicals.

Figure 1: Application Logo

Overall, this is a medical mobile application that assists the users in planning their medical timetables. The application is developed in Eclipse using Java for Android as programming language, internal (SQLite) **[**SQLITE16] and external libraries (Google Play Services, MPAndroidCharts and A.C.R.A.).When the application launches, the first interface is the 'Diary' interface which contains a list of daily measurable components.

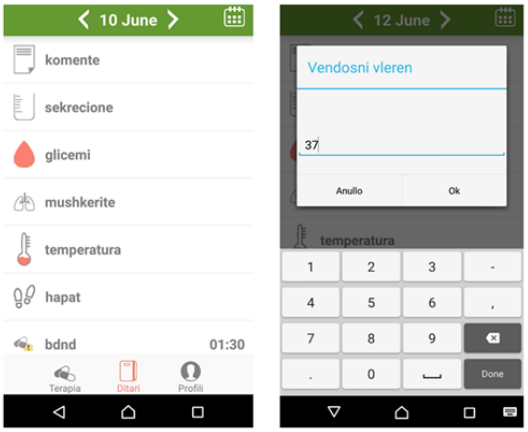

Figure 2: 'Diary' Interface

After daily check-up (this check-up is done by the user itself or according to his doctor's analysis) the user can fill each of these components with the right data. Also, the user can access his data for the previous or future days from the calendar or from navigation buttons in the action bar.

The 'Calendar' interface of the application gives the user a brief historical look to his own daily data, which

are saved in the local database. Clicking in a specific date of the calendar sends the user to 'Daily' interface on that date to display those data in detail.

Another interface (which is also the core of this application) is the 'Therapy' interface, which consists in a list of all the therapies created by the user.

Figure 3: 'Therapy' Interface

In the main menu there is also the profile icon, which by clicking on it sends the user to the 'Profile' interface. In this interface the user can see his own private data like his first name, last name and his photo. In the profile it is also displays the types of diseases from which the user suffers. The diseases are to be chosen from a default list. The reason of choosing the disease from a default list is that its name will be used by BLE (Bluetooth Low Energy) to find other users nearby which suffer from the same disease.

Another feature of this application is the implementation of Google Fit.

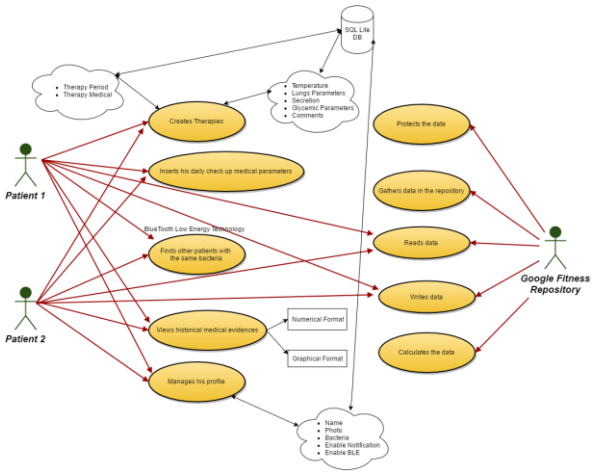

Figure 4: System Use Case

Google Fit does not offer just the service of the steps management, but also the other services from the fitness repository **[**FIT16**]**. These services are:

- Heartbeats
- Sleep

Number of steps is calculated by Google based on users' physical activities, like walking or running.

GPS technology included in all Smartphone models available in the market nowadays, offers the possibility to obtain a good precision in performance analysis through position and velocity of a motion body using

Satellite triangulation methods.

alMED takes advantage of this technology in order to monitor data related to workout session of the patient:

- Distance/route taken in the workout session

- Instant and average speed of the session

alMED can make use of an array of sensors already contained in modern, such as cameras, microphones, GPS receivers, accelerometers, etc.

In our application, beside the number of steps which are shown in real time, the user can also access his historical data. The historical data are displayed on two forms:

- Numerical, which can be accessed from the diary for the current date or the previous dates

- Graphical, which are overall data shown in graphical view

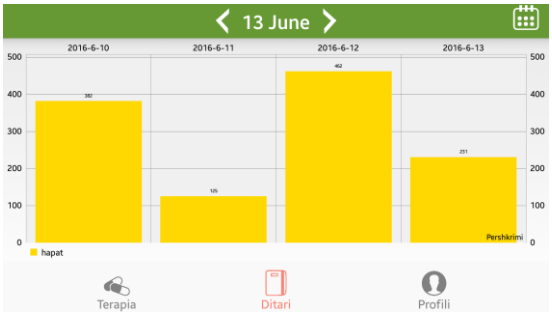

Figure 5: Graphical presentation of the number of steps performed during 5 days

To display the graphical view for the number of steps, we have implemented an external library named MPAndroidChart **[**GITHUB16**]**. Using its methods and features we can provide to the user a very user friendly graphical view. In our application we have chosen the column chart. The graphical view displays the user's data since the installation until actual day. To make it more interesting, the chart is also animated.

The application is in Albanian because it is intended for the Albanian market, and makes it user-friendly.

4 Future Challenges for an Integrated Albanian Healthcare System

A future challenge in the application development process is the inclusion in a cloud-based architecture. Mobile health application combined with cloud based technologies are becoming very handy to physicians who will be able not only to access patients data, but also to combine them with geolocation information about bacteria, pattern of resistance, available drugs, etc., all of which is stored in cloud.

As mentioned in the beginning of this paper, our future goal is to make this application part of a larger system which includes several actors like patient, healthcare providers and pharmaceutical providers. In this section we will present some future ideas of the system architecture and the roles of each actor in it.

Some of the main components of this large architecture are:

- Patient: is a person with some kind of health problem.
- Clinician: is a healthcare professional who is treating or helping the Patient with the health problem, i.e. a nurse, a General Practitioner, or a specialized physician.
- HealthCare Provider (HCP): is the entity that is utilizing a mobile health Service in the monitoring, diagnosis and treatment of the Patient.
- Mobile Health Service (mHS): is the service that connects the Patient to the Clinician, and ensures data measures, transport and protection.
- Mobile Health Service provider (mHSP): is the entity providing the mHS through a mobile health Platform (mHP).
- Mobile Health Platform (mHP): is the IT system connected to the mobile network to provide all necessary functionality.
- Mobile Health Device (mHD): is a device needed to use the mHS and to connect to the mHP.
- Pharmacy: is the drugstore where the patient can get the prescribed medicine.

Another key-feature of this architecture, which also represents an innovation in Albania, is the inclusion of the pharmaceutical providers in this architecture. Here is a simple use case for this actor as part of the system:

1. A Patient gets a medical prescription from the Clinician
2. The mobile Health Service system platform (which consists in centralized databases)
   2.1 Returns a list of pharmacies matching the request.
   2.2 Makes this medical prescription available for the pharmacies to review in case of the patient request.
3. A map is available for the patient to view the nearest pharmacies.
4. The patient can make electronic, online or cash payment.

5. The patient goes to the nearest pharmacy to get the prescription medicine.

   ***In some cases pharmacies may provide Home Delivery.*

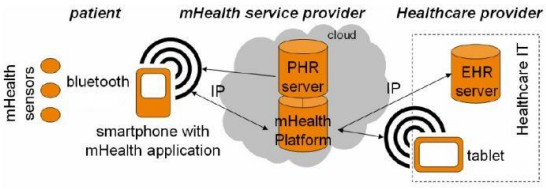

Figure 6: Future System Proposed Architecture

Security requirements are also an important aspect of mobile health system:

1. Device and data security (a) In memory (b) Processing (c) Transmission
2. Confidentiality and integrity of information
3. User authentication
4. System availability and access to resources
5. Non repudiation (useful in case of medical prescription)

For widespread success, the development of m-health must move away from small applications toward large-scale platform solutions **[**ATKEARNY13**]**.

5 Conclusions

As in the developed countries, also in Albania the use of health related mobile applications is expected to increase in various healthcare settings. These applications are thought to be a valuable tool for patients, healthcare providers and other actors involved in this schema, but not all use cases can be easily integrated. Such systems and applications can be particularly beneficial in developing countries like Albania, where the health care system faces significant challenges. For example, for various reasons, health care workers struggle to provide satisfactory care for their patients.

Cultural factors such as language differences and traditional healing practices may also present greater obstacles to rural care than urban healthcare. Meshing m-health interventions with these factors is critical for promoting healthy behavior. Such reasons include the cost of communication and transportation, lack of scheduling, recording, and appropriate reminders, and poor technology and infrastructure.

Rural areas also usually have fewer health workers and less infrastructure per person or square kilometer, reducing the health system‘s ability to provide high-quality medical products and services.

Mobile technology can aid in providing access to information, helping to lower costs [KKV14], facilitating remote care and increasing efficiencies by connecting patients to their providers virtually anywhere. Using a smartphone application is a novel approach to improving adherence and patient behavior [LSPPB13]; it is constantly accessible, involves and educates the patient, and provides a repository for patient- and medication-specific information. Health providers of the patients who take complex medication regimens may value having the ability to input patients’ prescribed regimens and then “pushing” them directly to patients’ smartphones. Interoperability with existing prescription and medical records systems represents a vital frontier for future application development. This interoperability would shift the current orientation of adherence applications to a more provider-focused technology and thereby provide pharmacists a potentially valuable tool to improve medication adherence.

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