E-GOVERNANCE

SUPPORTING M-HEALTH THROUGH ANDROID APPLICATION FOR STORING ANAMNESIS DATA

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Abstract:
In recent years in our country, there are tendencies for using advantages which information and mobile technologies provide in all areas of human activity. We are witnessing the expansion in terms of e-government services, as well as the progress in terms of health and medicine through introduction of health booklets which can be computer-read. It goes in the direction of electrification of medical record cards, which will greatly facilitate the search of data, reduce the amount of paperwork, and make it easier to draw conclusions on the basis of daily saved data in electronic form. In addition, e-health and m-health enables portability of services and decentralization of the health system. This paper describes the application for m-health, intended for medical workers, with the aim to make easier taking and recording of anamnesis data and to alow their storage in a format suitable for further processing.

Key words:
e-health, m-health, medical informatics, storing patient data.

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1. INTRODUCTION

Modern health care has become multi-disciplinary in the sense that it is expected that the medical staff, in addition to possession of medical knowledge, also has the appropriate technical knowledge and computer skills. Thus, medical fields such as surgery where robots assist, methods of three-dimensional recording of internal organs, electronic card and telemedicine, automated laboratory research, artificial organs, nano-medicine and others, require much knowledge and skills in the fields of engineering (computer, software, electrical engineering, biomedical and others in the field of technical sciences) and bioinformatics, information and communication technologies [1, 2].

Also, in order to objectively determine the health conditions of the patient and to make the appropriate medical decisions based on the analysis of a multitude of relevant data, it is necessary that the medical data is accurate, understandable, unambiguous and affordable. Therefore, there

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is a need for the simultaneous analysis and integration of different types of medical data (for example: images, text, numerical analysis and results) that were occurred in various stages of testing and therapy. This collection of relevant data needs to be archived and organized with the aim to allow easy data accessing, searching and manipulation for health workers. The data should be in a form that complies with all relevant standards and which allows easy transfer, in order to enable data exchange between different medical systems. The young scientific field, that combines medical and engineering knowledge - Biomedical Engineering (BMI), deals with this problems [3].

E-health is a relatively new term that emrged in the late nineties of the last century that marks a new, more efficient way to provide health services based on modern technologies with a very high degree of integration of the system, increasing the mobility of doctors and patients. The application of e-health in health care systems incorporates ICT processes in order to improve performances of classical medical systems.

More and more countries are introducing information and communication technologies in the health care system through electronic health records, telemedicine, health knowledge management, virtual healthcare teams, mobile health and managing the specialized medical data. E-health includes a range of services that are achieved by using medical and information technology. The aim is to enable easier and more effective treatment of patients and better medical services without administrative restrictions [4].

Benefits of e-health in the strictest sense are: electronic monitoring and recording of medical history of the patient during his life, an access to the patient data anywhere and anytime, bearing in mind the data protection, and rapid transfer of the data to patients using online services and telemedicine.

M-health is part of e-health in the strict sense, which relies on the use of mobile and ubiquitous computing in health care and medicine [5, 6].

Mark Weiser is regarded as the concept creator ubiquitous computing (in the vision of computers embedded in everyday objects in our environment). In his vision, the people at the same time interact with hundreds of computers through wireless communication [7].

Ubiquitous computing is a set of several new elements of IT technologies. It includes computers and sensors in appliances, tools, equipment in homes, workplaces, factories and the clothing items. Devices and sensors can be mobile (wireless PDAs or smart phones), or they can be nested into the environment (sensors and computer chips), walls or equipment. This includes communication between devices and sensors through an ubiquitous infrastructure of wired or wireless connection.

One of the main features of ubiquitous computing is that the devices are mostly small and contain miniaturized components and also nested on or in the device so that eg., multimedia communication device with a camera, Internet and satellite locating (GPS) can be placed in a mobile phone.

Wireless devices are the basic devices in ubiquitous computing systems. The term wireless refers to a form of telecommunications when the signal is transmitted through electromagnetic waves, ie. using a wireless connection.

Wireless devices that are used in ubiquitous computing can be: mobile phone - provides connectivity of portable and mobile, both personal as well as business applications, PDA - includes a variety of mobile and handheld devices for the storage and retrieval of personal and / or business data. They can be combined with telephone systems and wireless networks, tablet PC - the wireless computer that allows the user to record data using the digital pen to write on the touch screen. The data recorded on the tablet PC can be further edited, searched, indexed or sent using email or mobile phone [8].

This paper describes the mobile application that is intended for wireless devices such as smart mobile phones and tablet devices running an Android operating system.

The paper is organized as follows. The following chapter gives an overview of related research in the field of m-health. Further, technologies which were necessary for the development of the application have been described. After that, there is a description of the application for dynamic creating of templates for anamnesis by using mobile devices. Finally, the conclusion and directions for further research on this topic are given.

2. RELATED WORK

The review of the use of smartphones in medicine has been thoroughly exposed in [9]. The paper [10] describes the limitations and best practices in creating web applications and applications for smart devices for medical purposes. In the same work as an example of an application which allows for random assignment of patients into groups for the purposes of clinical tests. A mobile application for making a management list for transporting patients intended to the medical personnel is described in [11].

The paper [12] shows MobiCare application that describes the importance of the application of wireless networks in order to allow the use of mobile medical applications in the patient's home and outdoors. Then, the paper [13] refers to mobile applications that use some additional devices with sensors that measure body temperature, blood sugar and pressure, as described in the example of application eCAALYX. Mobile applications designed to help the patients with diabetes are described in the papers [14, 15].

Bearing in mind that the data used in applications for m-health are highly sensitive, in the paper [16], applications are divided into two groups, one consists of applications that need to meet the appropriate regulations, while the other consists of applications that are not required to meet those appropriate conditions.

Domestic authors have also dealt with the importance of the medical information systems, so their application in education is described in [17]. The use of mobile applications is describes in [18] in order to improve health care in the region.

The details about the e-government and e-health software requirements in Serbia, in terms of data security, are given in [19, 20].

3. DESCRPTION OF TEHNOLOGIES USED

The Android application Medis is implemented in Eclipse development environment. For its development, knowledge of Java and XML technology was necessary, in addition to Android. The application supports the new version of the Android operating system 4.0 (API 14) to 5.0 (API 21), which makes up about 85% of the total number of Android devices [21].

The operating system Android is based on Linux 2.6 x 3.x version for system services. Android operating system was officially released as an open source under the Apache Software Foundation license.

XML stands for eXtensible Markup Language, and the W3C Consortium has accepted it as a standard for marking documents. XML is simply the most robust, most reliable and most flexible ever invented syntax for documents. XML does not have a fixed set of tags and elements that should satisfy everyone's needs in all areas and for all. Chemists can use elements that describe molecules, atoms, bonds, reactions, and other entities that are encountered in chemistry. Real estate agents can use elements that describe apartments, rents, fees, locations, and other entities needed for real estates. The letter X in the name comes from the word XML Extensible (expandable), which means that the language can be expanded and adapted to meet different needs [22].

4. DESCRIPTION OF MOBILE APPLICATION FOR STORING ANAMNESIS DATA

The aim of the application is to facilitate the work of taking anamnesis to medical professionals. With the help of this application, medical workers have the ability to create and fill out the corresponding questionnaire using the mobile device. The forms in this way are not fixed, and they can, depending on the need, have the appropriate number of questions which are different types, thereby significantly reducing data redundancy.

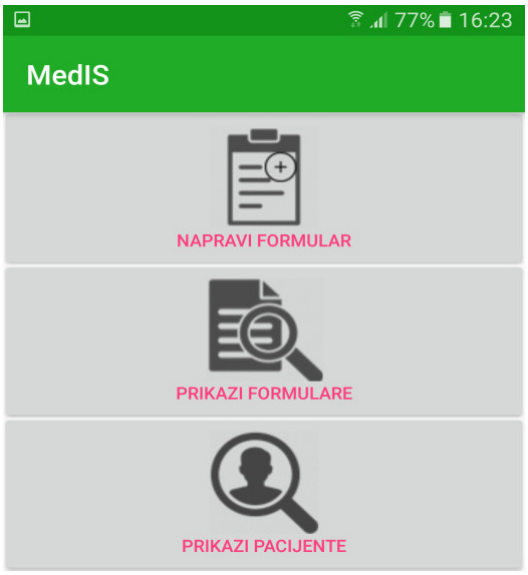
Application users are medical workers. Under templates is meant a series of questions of a certain type (text answer, one of several possible responses, more than more than one answer). When creating the templates, some things should be specified, such as the text of the question, type of questions and possible answers. Based on the template, a document can be created, which is a special case of the template. On this occasion, it is necessary to give answers to the questions. Documents and templates are stored as XML documents.

Thus, the medical worker who uses the application can create the corresponding questionnaire with the questions and save it under a certain template, or fill in the template and save it as document with LBO (personal patient number) number. Search operation can be performed as searching patterns or patients numbers.

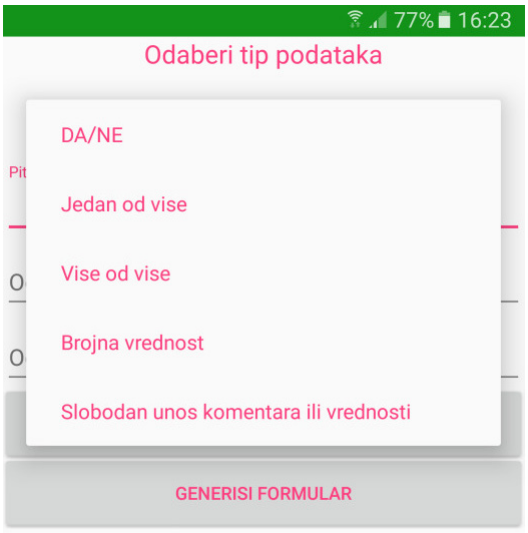
Medis (Medical Information System) questionnaire provides to the user the following options:

- creating a new template/document;
- reviewing of an existing templates/document;
- editing a template/document;
- deletion of a template/document;
- search for the template/document;
- the number of questions in the template is determined during design, dynamically;
- the questions within the template are divided into three types (with the text reply, the choice of one unit within a group of choices and the choice of several units within a group of choices).

Some of the possibilities of applications as well as their description are shown in Figures 1 and 2. The appearance of a template is shown in Figure 2, as well as the completed concrete instance of that template.

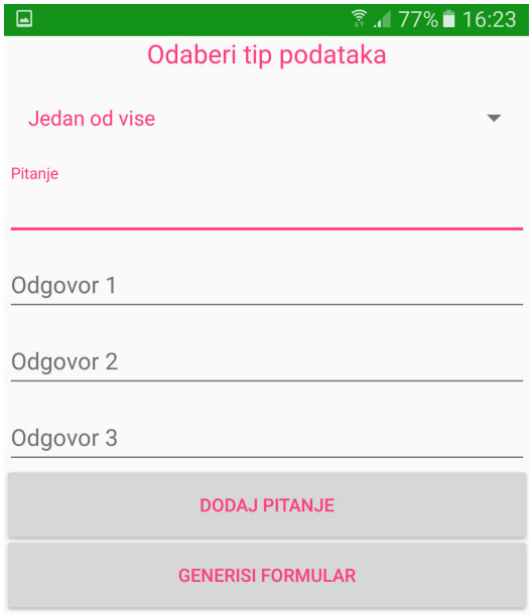


a) Start screen

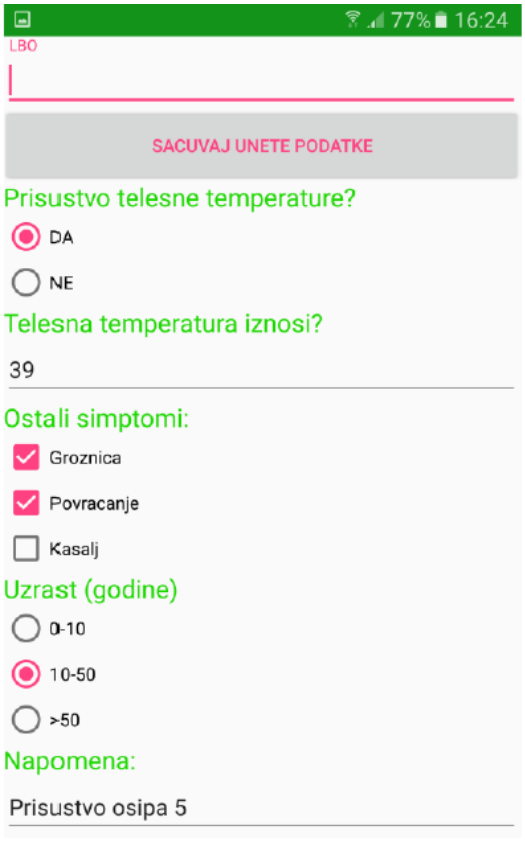


b) Adding a question to the template

Figure 1. A subset of application feautures



a) Creating one question in template



b) Filling the template and saving under patients number

Figure 2. Adding questions and filling the template

A part of XML document that stores the templates and the documents is shown in Figure 3.

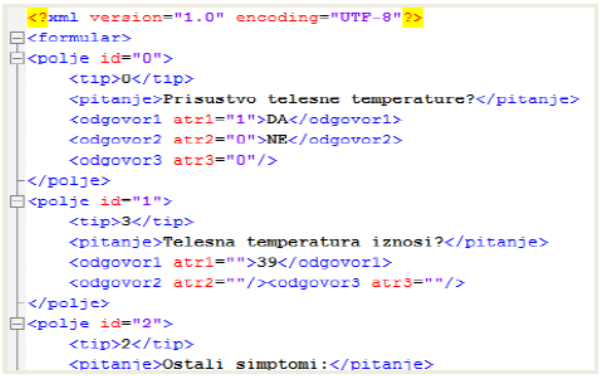


Figure 3. A part of XML representation of the completed template

5. CONCLUSIONS AND FUTURE WORK

Mobile computing is becoming more widespread in all areas of human activity. However, we should not leave unexplored the opportunities of its application in medicine.

The paper describes the application made for Android devices which provides easy creation, filling out and saving an electronic questionnaire about the patient health. The advantages of using this application are in the template flexibility to be filled and which are made to meet the needs of the patients. Another advantage is the possibility of multiple use of a template, bearing in mind that users can create a number of documents based on a template. Also, the ability to search documents is facilitated. This application data are stored in XML format so that they can later be easily transformed and used in the context of other software subsystems that are used in a given medical institution.

In the future, having in mind the increasing accessibility and integration of sensors into mobile devices, features of the application could be extended by reading sensor results and their recording.

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