Development the Software Applications for Mobile Medical Systems Based on OS Android

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Abstract - **In this paper the methods and tools to develop specialized software for mobile medicine (m-health navigator) on the base OS Android are given. The results of test studies using the developed software are shown.**

Keywords – **m-health, OC Android, software, Integrated Development Environment Android Studio.**

I. INTRODUCTION

Identification, monitoring and analysis of human health is an important task of personalized medicine at all levels: prevention, diagnosis, treatment and rehabilitation (recovery or improvement of health).

During the diagnostic and therapeutic care, patients usually require direct contact with doctors in a medical institution. In contrast, when you restore or improve their health, patients can perform medical advice at home and attending physicians in smaller hospitals (for example, just on time control).

Modern information and telecommunications technology (IT) can realize a new approach to the doctor- patient interaction at the stage of prevention and rehabilitation of health. This approach is based on the organization of virtual connection between them (through the creation of mobile resources with appropriate content). In this case, the user (the patient) can independently measure and monitor the vital physiological parameters using body biosensors, medical gadgets or electronic medical devices, available for it (heart rate, blood pressure monitors, blood glucose meters and other gadgets). This data can be stored in digital memory of device, then transferred to the memory of the smartphone, tablet PC via a special interface and via telecommunication lines, and can be entered into a computer database manually.

We need to develop and use specialized software, taking into account the type operation systems (Windows, Linux, Android, etc).

With this software, users can set status "patient" and

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periodically replenish virtual "blog of their own health" for a long time. Family doctors can monitor physiological or emotional state of his patients in remote access, periodically visiting their pages with "Diary of health" and, if necessary, corecting measures intended for the prevention or rehabilitation. In this system, which has a modular structure, should be provided access rights for patients and doctors. Doctors have access with advanced features. They can monitor the performance of "Health diary" and carry out their analysis; carry out the calculation of the necessary integrated assessments using the built-in analytical calculation modules. To registration, control and express - analysis using specialized mobile applications, that you can download for smartphones (some free). Additional features comprehensive professional analysis can be obtained in the transmission of data and rapid analysis of the client side (mobile device) to the backend m-health complex.

For systems of personalized medicine as an important task is to develop mobile devices with programmable multi-parameter adaptation, that will for a long time to control vital physiological parameters of human health (heart rate, blood pressure, etc.) To form integrated indicators (indexes), it is necessary save parameters in the mobile device memory or database for further analysis and recommendations on the formation of individual correction of health [1].

For example, currently, there are many medical biosensors and gadgets that measure the heart rate and displays the data on the smartphone (Pulsometers, fitness bracelets, smart watches, etc.) [1]. It is possible to specify multiple ranges of measuring and record the changes of the heart rate during long time (Fig.1). As the Integrated indicator in this case, we can choose the heart rate variability (HRV), which describes the state of the autonomic nervous system (sympathetic and parasympathetic its components). The HRV analysis in the time or spectral parameters, or using non-linear methods and fractal analysis, can identify negative changes HRV (autonomic imbalance of equilibrium between the two divisions of the autonomic nervous system). This factor (marker) can be used to predict the risk of possible pathological changes in the human body and diseases of different nature [2].

Based on the analysis of integrated indicators can be developed algorithmic and software to build smart mobile health navigator.
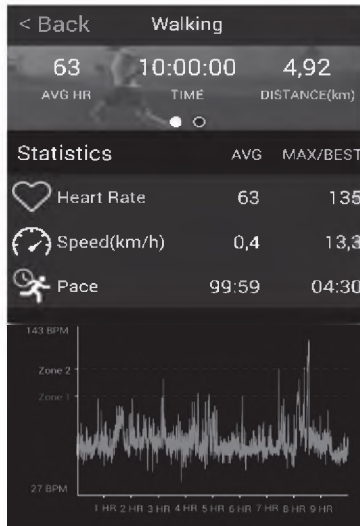
Fig.1. Registration of the heart rate variations of using fitness bracelet MioFuse

In addition it is important to consider the impact of negative factors (stress, sedentary lifestyle, sleep disorders, etc.) on the human health and the health of various population groups. Also actual problem is the development of mobile applications - apps for screening studies using questionnaires (for example, to assess stress). This will provide an opportunity to compare the subjective evaluation of health under the influence of stress factors on the results of the survey with the objective measurements of physiological parameters using biosensors - stressometrs to optimize treatment or rehabilitation.

The algorithm of the multifunctional analysis of human health parameters is shown on the Fig.2

II. SOFTWARE DEVELOPMENT

Software implementation of the system can be organized using a client-server architecture based on Google Web Toolkit (GWT).

Communication between client and server - through RPC (Remote Procedure Call, RPC). This provides the customer data, as soon as, they are designed, facilitating the work of many users. Communication database - through Open Library MySQL-JDBC-connector.

The system may also include evaluation methods the level of anxiety, aggression and depression. These factors can determine the predictors many psychosomatic diseases (eg, hypertension, migraine, diabetes) and implement the best methods of prevention. For this survey may include test methods such as the MMPI, questionnaires Spielberg-Heineken, Bas-Dark and Assinger.

To write applications for mobile devices based on Android operating system can use Integrated Development Environment Android studio [3]. It can create a new project (File-New Project) and select the

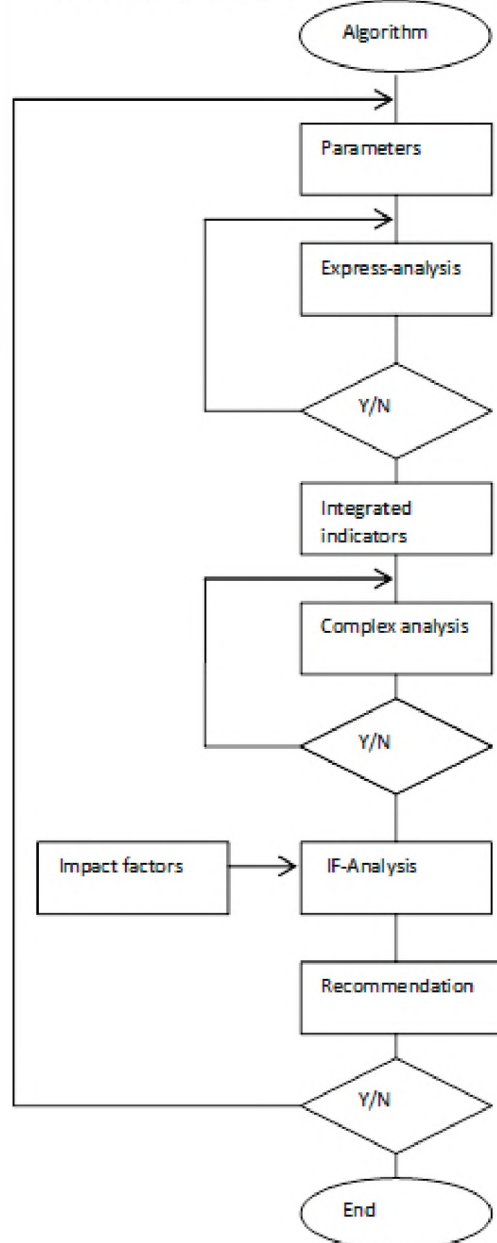version of the operating system Android..Next you need

Fig. 2. Algorithm of the multifunctional analysis

to set the look of the windows of the target application. The default view of the program is given in the file «activity_main.xml». There you can add items and place them in the same way as it does on the Web page.

The Integrated Development Environment Android studio includes a built-in designer for this (Fig. 3).

Processing all events (launch program, press the button, gesture, etc.) is in Java code. Event Program 'Download' handled by protected void on Create (BundlesavedInstanceState), generated automatically. It should build upon all the events that must occur when downloading an application. All text variables taken out to make the file code strings.xml project to facilitate

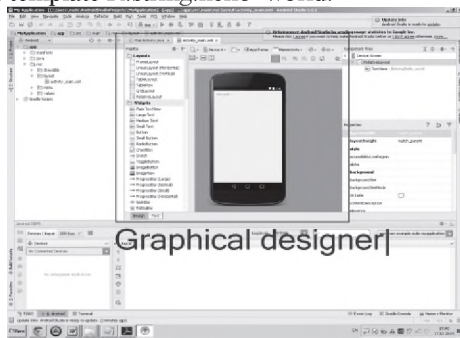translation into foreign languages. Call to text variables occurs template R.string.hello_world.

Fig.3. Graphical designer

III. SOFTWARE: TESTING RESULTS

The results of the test and experimental research: one of the test cases developed software for m-health systems is the program "Your nerves" for smartphones and tablets with OC Android. It includes three components: File activity_main.xml gives a view of the screen, file strings.xml - shapes list of test questions, File MainActivity.java - designed to handle the results (counting the number of "yes" or "no" according to the pattern-key. In the simplest case, each answer is "yes" increases the number of points, and when you answer "no" added 0 points). Depending on the number of points typed response-formed result. To install the application on your mobile device (smartphone, tablet), it is required to copy 'nerves.apk' file and run it. Then will be the generation installation file .

In order to be able to withdraw values of physiological parameters from the on-screen keyboard phone added three text boxes class EditText. Captions are objects of class TextView.

To realize the connection with the database system used classes: SQLiteDatabase, Cursor. The first is used to create a local database sqlite method execSQL, the second is used to store the database objects in the program memory. Search for it - is through the method moveToNext (). To implement authentication via FaceBook imported library FacebookSDK. We used the internal logic of the library. To implement authentication through Google + library is imported Google Play services. Used Class GoogleApiClient. Data on the screens authentication is done via class SharedPreferences.

For identification and data entry of medical devices manually using the keyboard. The results of specific measurements are available as (Fig. 4a.), or in graphical form (Fig. 4b).
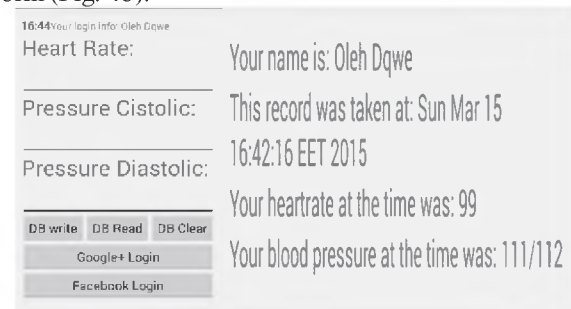
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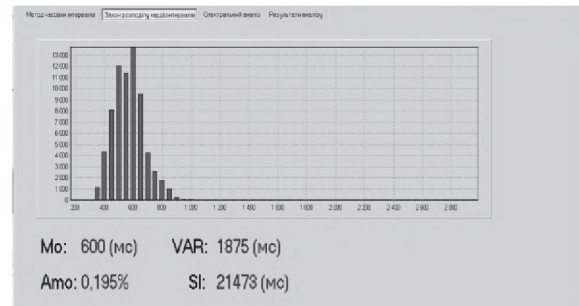
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Fig.4. Results of the test and Pilot studies

IV. CONCLUSION

In this paper methods and tools to develop specialized software for mobile medical systems using integrated development environment Android Studio are given. Results of the test and Pilot studies using the developed programs and modern medical gadgets have shown the effectiveness of developed software applications and prospects of multifunctional "smart mobile health navigator " creation .

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