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Tracking of in Need of Care Patient via Mobile Devices

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Abstract: Mobile phones and tablets have become an indispensable part of our lives because of advance in computer hardware and software. We use these devices in order to make it easier to work in many sectors like banking, tourism, and education and besides our daily life. The health sector is also one of the sectors which is open the development. In this study, the main subject is to be able to monitor patients in need of care as mobile by doctors. So, patient will be able to make their own measurements and send it to their doctors. The most important feature is that it is individual. For example, blood pressure values are a medical condition that changes from person to person and according to the disease. Specific limit values which are determined by doctors are defined in our model system. If the measurement is out of these values are sent to the doctor by an automated notification system. In addition, the patient's daily measurements or earlier measurements can display both the patients and the doctors. Moreover, for any purpose both patient and doctor can contact through the message system.

Keywords: Health mobile tracking, biometric sensor, home care services, in need of care patient

1. HOME CARE SERVICE

Patients in need of care means people who cannot fulfil a part or all of their daily living needs, a certain time or permanently without any support[1]. For these patients, both public and private institutions are given by home health services. Regulations and circulars have been prepared in 2005 for home health care services in Turkey and consequently, applications were initiated by the private sector. However, the guidelines for starting the service of institutions and organizations attached to the Ministry of Health have put into effect in 2010[2]. Duty of team officials is to visit these people at regular intervals and to provide new diagnosis, treatment and medical needs according to the needs resulting from the situation assessment[3]. Home health services in Turkey are provided by hospitals, family doctors and mobile teams established within provincial health directorates. Service are provided to patients such as newborn, bedridden and COPD and in need of palliative care. Some medical devices are given to patients who are benefiting from this service as follows[2].

- Glucometer
- Mechanical Ventilator
- House Type Aspirator
- Pulse Oximetry
- Respirometer
- Oxygen Concentration
- Nebulizer

2. ARDUINO SENSOR PLATFORM

2.1 Arduino Yun Platform

Arduino is an open source programming physical platform. There are a lot of different types of Arduino for different applications. But in this study Arduino Yun is used. Arduino Yun has Atmega32u4 and Atherosar9331 microprocessor as shown in Fig. 1. Atheros processor supports Linux. At the same time, the purpose of using Arduino Yun is that there is Wi-Fi and Ethernet port on the device. In this way, communication with web services created under the project is provided in an easier way. The project was written with the Arduino IDE and install the card has been performed.

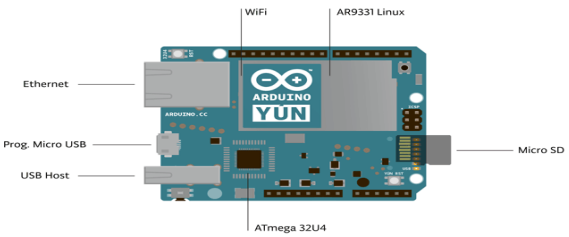

Fig. 1. Arduino Yun

2.2 Arduino Sensor Platform

Arduino sensor platform is enabled the development of various biometric applications such as in medical applications. With this platform, we can enable to monitoring some kind of sensors. And these are listed below, also is shown Fig. 2.

- Airflow
- Glucometer
- Spo2
- Blood Pressure
- Temperature
- Electrocardiogram (Ecg)
- Electromyogram (Emg)
- Galvanic Skin Response
- Accelerometer
- Body Position

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Fig. 2. Arduino Sensor Platform[4]

3. DATABASE DESIGN OF MOBILE TRACKING SYSTEM

3.1 The Design of The Database Table

The EhealthDb is a central database was created with the Microsoft Access program due to both easy to use and lower cost. Database tables contain measurement values of the patients, critical values determined by doctor to the patient, the measurements are sent to the doctor, both doctors and patients information, details of the patients' relatives and the messages sent by both doctors and patients. Likewise, if the patient's measurement results go out of the critical values, notification is sent automatically by the system are also kept in the database. There are six different tables in the database. Table names in the system are as follows and they are shown at Fig. 3.

- User Login
- Message Table
- Doctors Patient
- Test History
- Patient Info
- Threshold Table

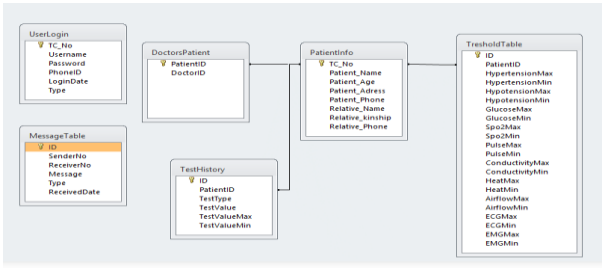

Fig. 3. Database Table in The System

3.2 Data Communication Between The Database and The Android Application

Data exchange between the Android application and the central database named E health Db was created with Microsoft Access is realized through the .Net Framework 4.5 Web Services written in the C# programming language. Get and post methods in the web services and E health Db are called by Android application. In this manner, a communication is performed based on client-server architecture. There are separate Sql codes for each function in the web service methods. And in this way, add, update, saving and measuring process are occurred. The methods used in the web service are as follows.

- User Login
- Logged User
- Doctor Patients
- Message To Doctor
- Doctor Notifications
- Message To Patient
- Send Message To Doctor
- Send Message To Patient
- Patient Information
- Patient Test History By Doctor
- Patient Test History By Patient
- Threshold Values
- Save Threshold Values

3.3 Android Application Database Operations

It is written in SQLite is the Android database. It contains only the user name, password and the phone id of the doctor or patient. We can check whether the user has previously logged in to system with these data. These three data is saved when the user first logs in and then if the user logged in to the application again in twenty-four hours, this time user name and password is not required.

4. THE DEVELOPMENT OF MOBILE TRACKING SYSTEM

4.1 Design of the Application Interface

Application of the mobile tracking system was developed by Android Studio. Connectivity between central database and Android application is provided via web services over the Internet as described section three. However, control of the data recorded in the system are reflected in the database is pursued by Android application. Application is composed of two modules. One is for the patient and another is for the doctor. Application screens are shown below with explanations. The developed system is in Turkish. For this reason, the Turkish words in the screenshots are shown in parentheses in the text.Doctors and patients use the same screen for log in the system as shown Fig. 4. User name (Kullanıcı) and password(şifre) is required on this screen.

Fig. 4. Log In Screen

4.1.1 Patient Activity Module

There is a main screen that patient can respectively measure her own values, see the messages, see the old measurement results and send message to doctor as shown Fig. 5.

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Fig. 5. Patient Main Screen

Patient can measure her values with make measurements (ölçüm yap) screen (Fig. 6.) has respectively conductivity (iletkenlik), body temperature(vücut sıcaklığı), glucose (glikoz), blood pressure(kan basıncı), pulse and oxygen (nabız ve oksijen), breath airflow (nefes), emg and ecg (ekg). For example, glucose and ecg test result are shown Fig. 7. and Fig. 8.

Fig. 6. Make Measurements Screen

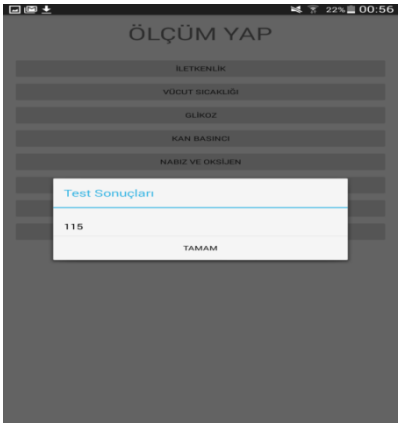

Fig. 7. Glucose Test Result

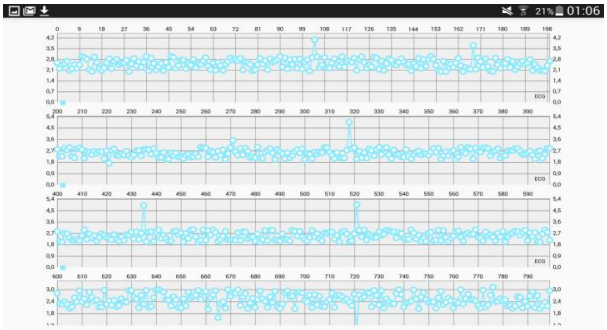
Fig. 8. Ecg Test Result

Patient can see messages from the doctor in my messages (mesajlarım) part and similarly send to the message to doctor in send message to doctor part (doktoruma mesaj). Patient can see chronologically the old measurements in my measurement screen (ölçümlerim) as shown Fig. 9.

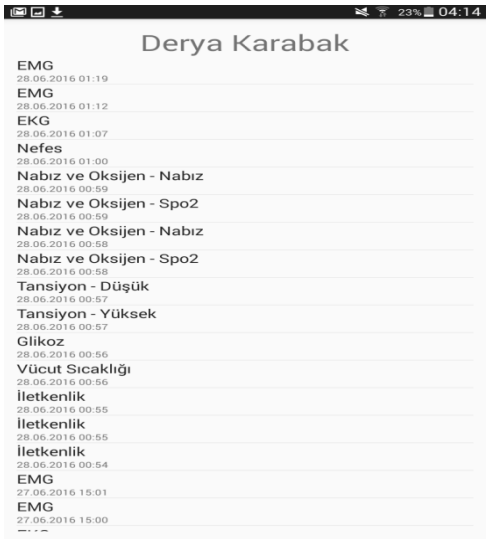

Fig. 9. My Measurements Screen

4.1.2 Doctor Activity Module

There is a main screen that doctor can see my patients (hastalarım), notifications (bildirimler) and messages from patients (mesajlar) respectively as shown Fig. 10.

Fig. 10. Doctor Main Screen

Doctor see a list of patients assigned to herself in my patient part and select the patient. After that the patient information screen appears as shown Fig. 11. In this screen, doctor can see the measurements (ölçümler), critical values (kritik değerler), patient details (hasta detay), send message to patient (hastaya mesaj).

Fig. 11 Patient Information Screen

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Measurements part shows the patient's past measured values. When the click the measurements, system directs Fig.9. Critical values determine by the doctor for each patient. The values minimum (asgari) and maximum (azami) values for each values) shown in Fig. 12. are respectively hypertension (y. tansiyon), hypotension (d. tansiyon), glucose (glikoz), Spo2(spo2), pulse (nabız), conductivity (iletkenlik), body temperature (sıcaklık), breath airflow (nefes), ecg..

Fig. 12 Critical Values Screen

According to the measurements results, values are considered as normal, low and high. And consequently notification is sent to the doctor automatically as shown Fig. 13. For example, Emg is the firt value and low (düşük) from values which is determinate by doctor. And the other value is conductivity (iletkenlik)and it is high (yüksek).

Fig.13. Notifications Screen

Patient detail (hasta detay) screen has the patient personal information like name, surname, age and address of patient, name, surname, relatives degree and phone number of patient's relatives. And lastly the main purpose of send message to patient screen is to send message to patient.

5. CONCLUSIONS AND SUGGESTIONS

In this study is aimed that remote monitoring of patients' health status. So, it will be easier to reach more patients. Moreover, it will become easier and more practical way to make their own measurement of patients and be treated in more comfortable conditions in a home environment without having to depend on hospital.

The system created in this study is a model property can be developed and enhanced in many ways, such as video cameras or photography. It can be used to be integrated into currently available systems. This work has been prepared with the thought would be an example to other applications for facilitating the work of patients and doctors.

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