ANDROID BASED PATIENT MONITORING SYSTEM

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Abstract: For smart living, interactive applications are increasingly important especially on interaction of people and the environment. The aim of this paper is to develop an android based application which will help the doctor to diagnose the diseases using their smart phone. Wireless technologies are bringing about dramatic improvements in the quality of patient care by allowing unprecedented mobility while providing medical staff with easy and real-time access to patient data. In this research, a new wireless patient monitoring system is developed from concept to a reality. After receiving the raw signal we can use digital filtering for extraction of wanted signal. After filtering it is processed for detecting diseases and thus output is display on the screen. The web module also connects the microcontroller and android OS together. Since this application is made on android platform which is an open source and independent of any platform, it can be installed on any smart phone. Using this new system, medical staff can track patients' vital signs from any place, allowing them to monitor more patients. The accessibility of this application is simple and easy. By developing this application, we can say that, it can be cost effective, compact and user friendly.
Index Terms: Multiparameter Monitor System, Smart Phone, Web server, Web database.

I. INTRODUCTION

Patient monitoring system is a process where a surgeon can continuously monitor more than one patient, for more than one parameter at a time in a remote place [1]. With the development of Smartphone, it has performed a Smartphone based body monitoring system with a combination of the advantages of network technology and multiple sensor fusion technology. Body monitoring system greatly improves the operational capability of health care, such as remote operations, wireless health care so on [2]. There has been a growing concern with technology of medical care which has developed rapidly and plays an increasingly important role in our life [2].

The advances in information and communication technologies enable technically, the continuous monitoring of health related parameters with wireless sensor, wherever the user happens to be. They provide valuable real time information enabling the physicians to monitor and analyze a patient's current and previous state of health. Now days there are several efforts towards the development of system that carry out remote monitoring of patients [1].

Traditional healthcare technologies mostly are confined to hospitals and other specific place, which is not convenient for the user's movement. It may also take lots of money. At present, several proposals, have been used to concentrate to this issue. But they also suffer from some limitations mainly. Concerning single function of equipment and the potential radiation hazards by mobile phone direct contacting with the body. In order to solve the purpose of mobile medical care, we can use android Smartphone as a component of this system. Android mobile phone can not only receive the data collected by our hardware device but also can transmit these data to remote server in time [2]. This method not only simplifies and speeds up the process of information acquisition, processing and analysis, but also declines costs of equipment; therefore, researchers have become more interested in wireless health care [2].

Although many wireless standards can be used, there are important considerations such as range, throughput, security, ease of implementation and cost. The patient monitoring involves handling of sensitive data. These data should be transmitted securely without any intrusion [1].

The web-database is a system where the web server will store the data in table format where the digital data are filled in column and then it is plotted against the time to get ECG graph and other parameters. There are n-numbers of database available in the market but for this system we have choose MySQL since it's an open source relational database management system. It also widely used by web application developers, together with PHP and APACHE. MySQL is a three layer model Application layer, Logical layer and Physical layer [15].

In present paper, we report on development of patient monitoring system an android platform which is an open source, to display five parameter such as E.C.G., Heart Beat, Temperature, Pulse Oximeter, and Blood Pressure. With this module, the doctors who are not present in hospital at time of emergency, they can also operate looking at the different parameters on his or her smart phone or laptop.

The reset of this paper is organized as follows. In section 2, we discuss the problem definition. In section 3 we discuss system architecture and implementation. In section 4 we discuss about the working system of an android based patient monitoring system. In section 5 demonstrates about the procedure to access the android application. In section 6 we discuss about the experimental results. Lastly, we conclude this paper in section 7.

II. PROBLEM DEFINATION

The problem found in most hospitals is that continuous monitoring of vital parameters is done for ICU patients, but the monitors are local to the room in which the patient is admitted. Physician has to frequently visit the patient and asses his/her condition by analyzing the measured parameter such as temperature, blood pressure, pulse oximeter, E.C.G. and heart rate. In case of emergencies, the nurse intimates the Doctor through some means of communication like mobile phone. A growing selection of innovative electronic monitoring devices is available, but meaningful communication and decision supports are also needed for both patients and clinicians. There has to be a mechanism by which the physician can remotely measure the vital parameters himself at any instant of time and update himself of patient's health status and also take control action remotely if he desires.

III. SYSTEM DESCRIPTION

Our aim is to develop patient monitoring system which has telemetry included in that system. The system also includes the web server and web database system from where the data of patient is transmitted all over the world. The block diagram of proposed system is shown in figure.

Fig. 1. Block Diagram of Proposed System.

The block diagram consists of Hardware and Software. This system helps the doctor to work from outside of hospital premises. The hardware consists of 3 blocks sensors, microcontroller and display system. Since its patient monitoring system, multiple parameters are acquired and for proper signal acquisition, the placement of electrodes is utmost important factor. Thus placing the electrodes on the body for acquiring the different signal at a time is a main task. After acquiring the data from the sensor, it is amplified since the bio-signals have very low amplitude in micro-volts. So for proper diagnostic bio-amplifier is used which will amplify the signal and display it on display system. The amplified analog signal is given to microcontroller where the digitization takes place using A-D converter. The microcontroller used here is pic 18fXXXX which has in build A-D converter and thus this helps in making instrument more compact. The digitized signals are then given to display system. In proposed system the PC is used as display system since the data has to transfer to web server which very easy with PC. LABVIEW displays the analog signal and in back it will store the digital data in .csv file which is fetch by the web server for further processing. The software consists of 4 blocks web server and web database, mobile (android OS), local database, GUI. The web server and web database is the heart of the whole system. Since it connects the hardware with the software i.e. it connects the existing system with the proposed system. The web server understands HTTP (Hyper Text Transfer protocol) protocol and generates appropriate responses.

Fig. 2. Flow Diagram of Web Server.

The above diagram depicts the flow diagram of web server, where clients ask for the appropriate file to the server, the server will find the file in web database and will send the response to the generated query by the client, and also stops the cycle. This flow is repeated for n-number of times to generate a real time response.

Fig. 3 MySQL Database format.

For GUI, Android is used, since its open source and very cheaply available in market which fulfils the criteria of low cost system. Also now days, Android is available to each and every person, including Doctors, since they have started using the Smartphone.

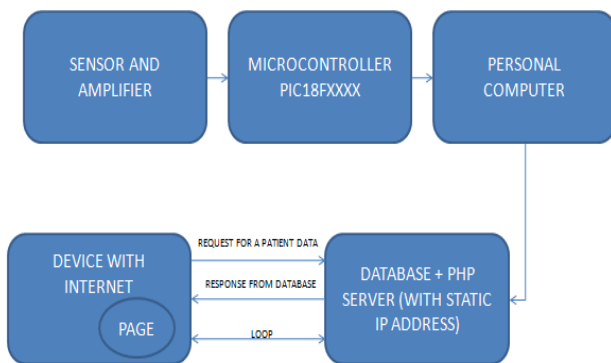### IV. WORKING SYSTEM OF A ANDROID BASED PATIENT MONITORING SYSTEM

Fig. 5 Working System of a Android Based Patient Monitoring System

1. The sensor is placed on the patient, which will sense the signal and give it to an amplifier.
2. The amplifier, amplify the signal and signal is given to the microcontroller.
3. The microcontroller converts the analog signal to digital and then sends the digitized signal to a pc which is placed in hospital.
4. Now the PC sends the digital signal to web server, where digital signal is stored in web database i.e. MySQL.
5. Now when doctor wants to check the status of the patient, he/she will send the request to the web server through the mobile device.
6. To this request the web server will send the response which will see in the application.
7. Now the doctor wants to check the live data then the request is send at regular interval and thus the respond is generated.
8. And thus the doctor can check the live status of their patient.

V. PROCEDURE TO ACCESS AN ANDROID APPLICATION

1. Unlock the keypad
2. Drag towards the application symbol
3. Click on application
4. Enter the register hospital
5. Enter the registered patient
6. Click on 'Done'. A new window will opened, which has the vital parameter shown
7. After noting the vital parameter click on 'Show ECG'

8. A new window will open, which will call the web browser for plotting the ECG graph
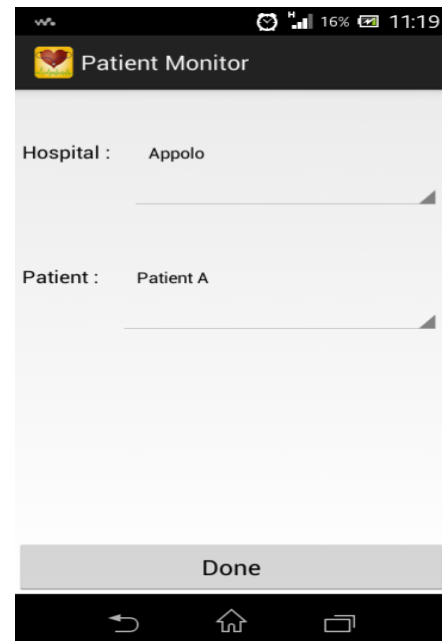
VI. RESULTS

Fig. 6 GUI for Doctor-Login Page

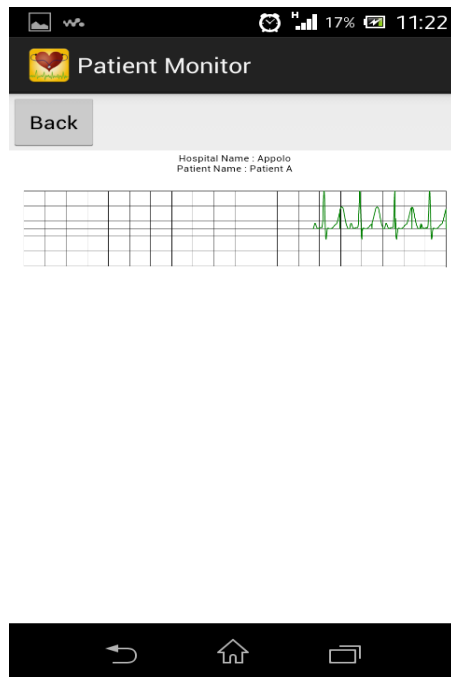Fig. 7 GUI for Doctor-Informative Page

Fig. 8 GUI for Doctor-ECG Graph Page

VII. CONCLUSION

Having worked on a Multi-Parameter Monitor System, our proposed idea in designing Android based patient monitoring system for hospitals with features of storing the data in web database is viable. Android based patient monitoring system may be a better solution for a doctor to work from offline in case of emergency. With this system we can detect multi parameter of the body such as ECG, heart rate, blood pressure, temperature and pulse oximeter. The advantages of this system are the system is portable, mobility, compact, low power consumption, storing the data in database and is very simple application. In this study, we report the frame work for implementation of multipara monitor. This system can be a powerful tool for doctors and nurse.

VIII. FUTURE WORK

The preprocessing of the signal can be done by programming in MySQL while storing the data in database. We can set the alarm, if doctor does not respond in particular range of time. Many more features can be added on android side.

IX. ACKNOWLEDGEMENT

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