

Measurement of ECG and Temperature and Monitoring Using Android Device

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ABSTRACT: Under emergency situations like heavy rain, traffic, rural areas, it is not possible to get urgent remedies from physician. By using present telemedicine systems real-time monitoring of such patients is possible. This synopsis proposes the development and implementation of portable, low cost and advanced emergency telemedicine system based on Android Smartphone. By using sensors and controller board, the patient's data would be monitored on Android Application. Further it can be stored on SD Card in the form of screen shot of mobile device. Stored results can be shared with concerned physician via new communication techniques using an Android App. The main aim of this system is to provide emergency provisional help to patients before they get hospitalized which can save lives of many before the contact of expert doctors.

KEYWORDS: Tele-health system, smartphones, zigbee

I. INTRODUCTION

In present scenario, the delivery of medical advice along with diagnostics and healthcare services facing two major issues, one is transportation and other time consumption. Because of these issues, the service to the needy person is not in time. Also the optimal ratio of doctor and people is 1:600 but as per the latest data in India the ratio is 1:1700. It is indeed difficult to increase the number of doctor by six times immediately in a country like India to meet medical quality. This is where telemedicine technology comes in picture. Telemedicine through hand held device becomes more appropriate, personalized and affordable because of mobile connectivity. Telemedicine deals with monitoring of patients primary health parameter like blood pressure, temperature, ECG.

Smartphones and mobile devices have rapidly become part of everyday life around the world. The availability of cheaper, faster and more capable mobile devices has led to a lot of innovations in every field where it can be applied. According to a recent Epocrates 2013 survey [1], more than 80% use smartphones today and 90% are expected to use tablets by 2014. Mobile phone use in particular is exploding across the developing world, offering the opportunity to leapfrog other applications and services on both the health and technology fronts [2]. Recent breakthroughs in communication technologies have stimulated the development and demonstration projects in telemedicine, which is therefore considered as an essential technology for reformed healthcare [3]. The success of various telehealth care methods is due to the following factors.

- a. Traffic and transport difficulties in big cities
- b. Unequal geometric distribution of physicians [4]
- c. Very low doctor to population ratio [5]
- d. Poor socio-economic conditions of rural people, and
- e. Severe shortage of trained doctors and nurses in rural areas.

All these factors can be eased to some extent by using smartphones with dedicated software. A mobile application which is known in short as 'mobile app', is a software application designed to run on smartphones, tablet computers and other mobile devices.

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They are usually available through application distribution platforms, which are typically operated by the owner of the mobile operating system, such as the Apple App Store, Google Play (Android) Windows Phone Store and BlackBerry App World [6]. Some of the general mobile apps are email, calendar, stock market, banking, GPS and location based services, order tracking, ticket purchases, mobile games, and the list is increasing as the public demand is in rise. Medical field is no exception. They are changing the traditional way of doctors and patients approach of health care. Many 'apps' are designed for the doctors themselves and others are for the patients. Most of the commercially developed 'apps' designated for doctors are ranging from handy databases about drugs and diseases to sophisticated monitors that read a person's blood pressure, glucose levels, heart rhythms or other exclusive disease symptoms which are received from the patients. Apps designated for the patients enable them to gather diagnostic data through portable devices by do-it-yourself procedure and they are transmitted to the doctor's app for further recommendations of treatments.

Indian Govt. has already initiated telemedicine programs in various States, to provide advanced medical help in rural developing areas. Organizations like (National Informatics Center) NIC, Indian Space Research Organization (ISRO), Center for Development of Advanced Computing (C-DAC) are working for Village Empowerment, Health Education, Empowerment of the disabled and Rural Connectivity with the help of Telemedicine Systems [3].

The physiological parameters like temperature, heart rate, ECG, breathing rate and SpO₂ are acquired from the patient monitoring system. The existing telemedicine devices can keep track of include blood pressure, blood glucose, heart rate, weight and hemoglobin. Telemonitoring is effective for providing information about crucial signs, before reaching the necessary monitoring equipment at target location of patient. Relying on the severity of the patient's constraint, the provider may check these enumerations on a daily or weekly basis to determine the best course of treatment [5].

II. RELATED WORK

- Java-enabled 3G mobile phone based PMS

This system was developed in year 2007. The overview of the proposed System is shown in Figure 3.1. The system is mainly composed of three parts: patients monitoring system, Remote Information Server built in hospital and a Java-enabled 3G mobile phone. They are connected by the Internet and 3G mobile networks. The patients monitoring system is composed of Bedside Monitor, Central Station Monitor and PC used by Medical staffs in hospital. Conventionally, several patients' information can be collected by the Bedside Monitors and stored in the Central Station Monitor. In the proposed system, the patients' information in the Central Station Monitor, including numeric signal data, text data and real-time waveform data can be extracted by the Remote Information

- Ubiquitous Health Monitoring System

This system was developed in a year 2008. This system was first developed by Japan people. Currently six types of biological signal data (ECG, blood pressure, glucose, temperature, weight) are monitored and collected from the U-house. Figure 3.2 shows the overall architecture of UHMS. It consists of two main servers: the U-house server and the central repository server. We named the central repository server as BIRD (Biometric Integrated Repository Database). The main role of U-house server is to compress the bio-signal data and upload it to the BIRD. The main roles of BIRD are to store the bio-signal data and provide easy-to-use interface to access the data for the health practitioners and U-house tenants[4].

They have developed a web-based biosignal monitoring system which can be used for ubiquitous health environment. The launching of the ubiquitous computing in the health domain involves multiple level technical challenges. There are some unsolved technical issues which should not be minimized at the designing level. One of them is the effective management of the biosignal data. The second issue will be the automatic interpretation of the measured data. Among the recorded data, the ubiquitous health system should detect abnormal findings and give warning messages to the responsible personnel. In order to detect abnormal findings automatically, the basic normal patterns and abnormal patterns are predefined and implemented on the ubiquitous health monitoring system. This will be the hardest step in the ubiquitous health arena [5].

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III. PROBLEM STATEMENT

In present scenario, the delivery of medical advice along with diagnostics and healthcare services facing major issues as India is characterized by low penetration of healthcare services. The issues include transportation and time consumption. Because of these issues, the service to the needy person is not in time. Also the one more major concern is very low doctor to population ratio. Thus, there is a need to design such a system that will assist patients, especially in rural are in reaching the doctors at the time they need and will help doctors to monitor the health of patients irrespective of time and **location**.

IV. OBJECTIVES

The objective of the proposed system is to develop assistive, cost effective, efficient and interactive android-based Tele-Health System that will assist doctors in accessing the patient's vital parameters at any time, diagnose and prescribe the required medication.

V. IMPLEMENTED SYSTEM

We have used Raspberry Pi microprocessor, temperature sensor LM35 and ECG sensor AD8232. The data measured from the two sensors is in analog form. Thus to convert this data into digital form we have used ADC MCP3208. The raspberry pi reads output from its GPIO pins nad sends it to the android smartphone with the help of Wi-Fi. We have used the Wi-Fi module ESP8266 for that. It send data using serial communication.

Health monitoring system

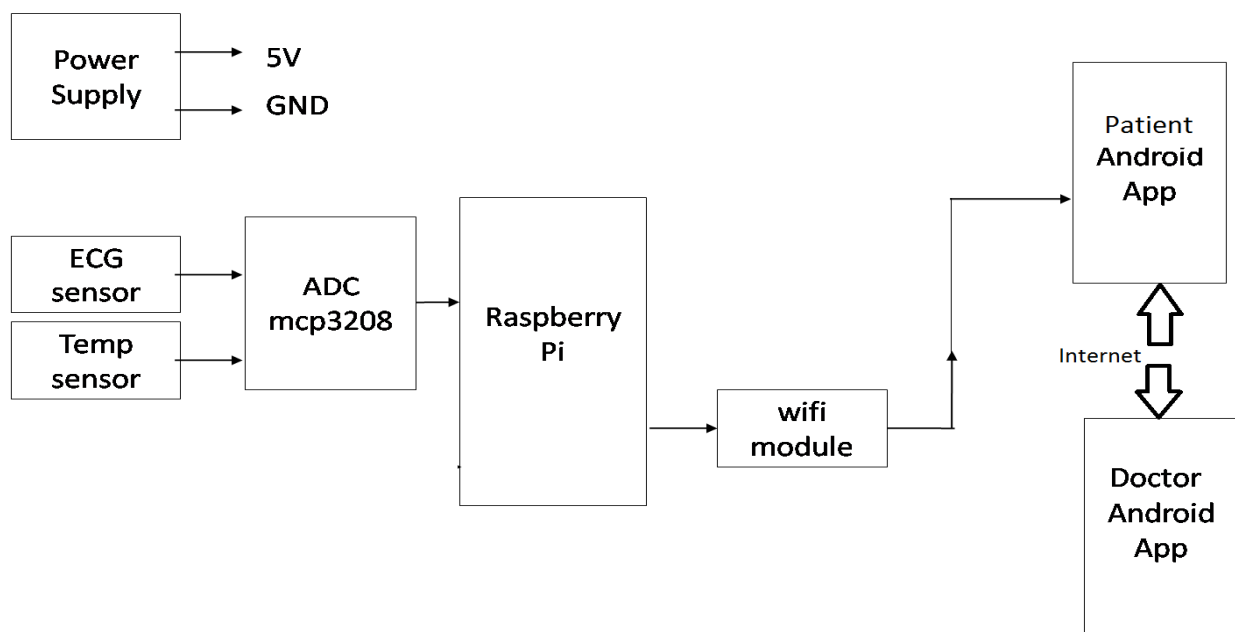


Fig. 1. Block Diagram explaining the Tele-Health system working.

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At the smartphone end, there are two apps designed. One is for patients and other is for doctors. Patients app receives data from the raspberry pin the form of a string. Then the app has the algorithm which extracts data from the string and generates report of the patient. Patient then sends the report to the doctor which is first saved onto a server. When the doctor opens the particular report, it gets downloaded from the server. Doctor then observes the report and prescribe the required medication and sends the report back to the patient.

VI. EXPERIMENTAL RESULTS

The developed unit shows satisfactory performance in ECG measurement of various age groups. The results (QRS measurements) are fairly accurate & stable and observed accuracy is more than 90 %.

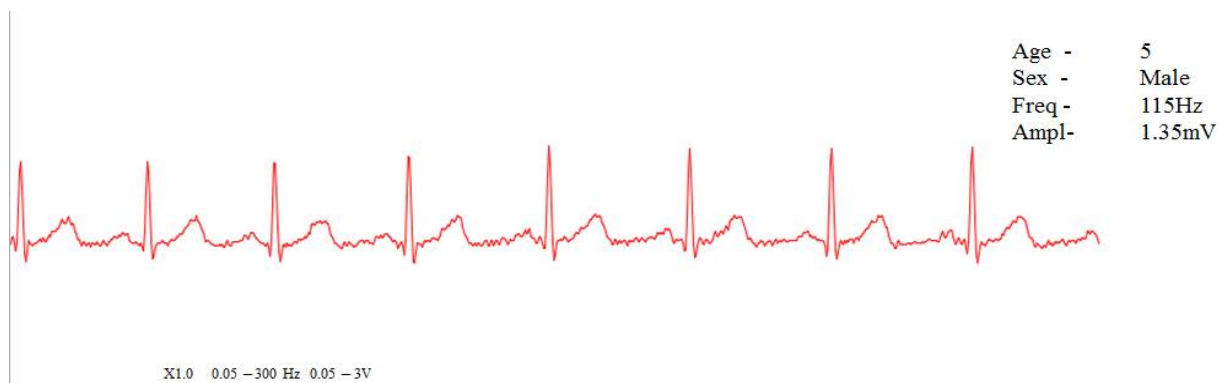


Fig. 2. ECG of Age 5



Fig. 3. ECG of Age 9

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Fig 4. ECG of Age 15



Fig 5. ECG of Age 19



Fig 6. ECG of Age 24

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Age - 30
Sex - Male
Freq - 115Hz
Ampl- 1.40mV



X1.0 0.05 - 300 Hz 0.05 - 3V

Fig 7. ECG of Age 30

Age - 35
Sex - Female
Freq - 115Hz
Ampl- 1.38mV



X1.0 0.05 - 300 Hz 0.05 - 3V

Fig 8. ECG of Age 35

Age - 44
Sex - Male
Freq - 118Hz
Ampl- 1.48mV



X1.0 0.05 - 300 Hz 0.05 - 3V

Fig 9. ECG of Age 44

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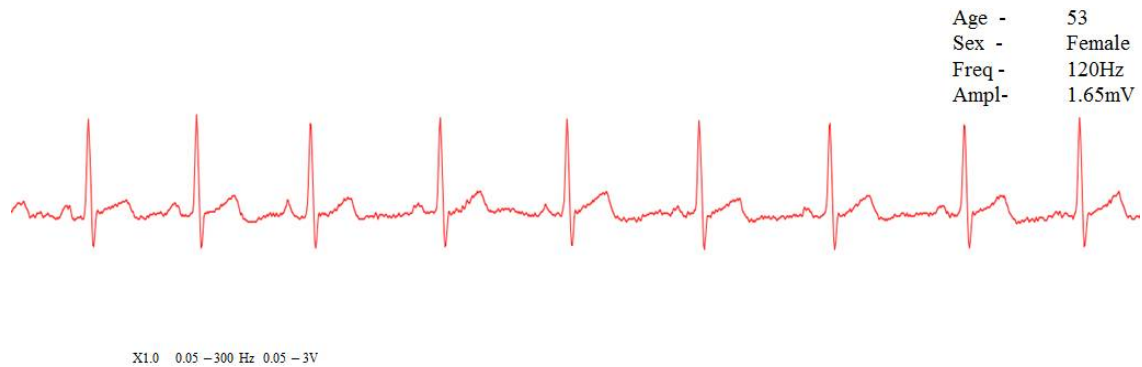


Fig 10. ECG of Age 53

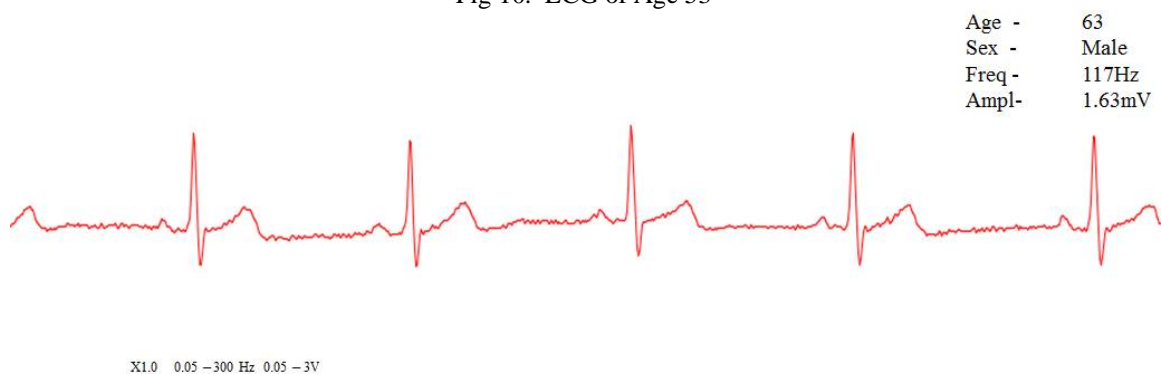


Fig 11. ECG of Age 63

Result - ECG Reading

Sr No	Age	Sex	Frequency(Hz)	Amplitude(mV)
1	5	Male	115	1.35
2	9	Female	117	1.40
3	15	Male	118	1.33
4	19	Male	119	1.75
5	24	Male	118	1.78
6	30	Male	115	1.40
7	35	Female	115	1.38
8	44	Male	118	1.48
9	53	Female	120	1.65
10	63	Male	117	1.63

Table 1 ECG Reading with different age groups

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VII. CONCLUSION

- Android based patient monitoring system can be a better solution for a doctor to work from offline in case of emergency.
- With this system we can detect multi parameters of the body such as ECG, heart rate and temperature.
- The patients can get treatment plans remotely by saving the time of travel to visit the clinic.
- Patients can get medical reports online by this application. He can get information of medicine that doctor has prescribed.
- Patient can upload his health status time to time and can make doctor aware of his patients health status.
- The advantages of this system are the system is portable, mobile, compact, interactive and having low power consumption.
- This system can be a powerful tool for doctors and patients so as to bring advanced health services in rural areas.

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