Personal Health Monitoring System using Arduino and Android

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Abstract- **Telemedicine is one of the most trending and advancing application in medical field which evolved to help the patients and people to get better and faster medical assistance. For achieving the best patient health monitoring, networked sensors are either in the form of wearables or embedded in our living environments to make possible the process of gathering rich information indicative of our physical and mental health. This project elaborates the methodology adopted and highlights various design aspects to be considered for making patient health monitoring system effective. In this method, the patient's vital signs like heart rate, body temperature rate are captured and are sent to the desired smartphone application in the form of an alert. In case of emergency authorized medical staff and doctors also get a notification message about the patient's health with a medical graph if necessary. The doctors can also give advice message to patient instantly using the smart phone application which uses Wi-Fi. The proposed system in this project helps to implement the telemedicine in a much more economic and effective manner.**

Keywords: Android, Arduino, Wi-Fi module, smartphone

I. INTRODUCTION

The modern visionary of healthcare industry is to provide better healthcare to people in a more economic and patient friendly manner. . Therefore for increasing the patient care efficiency, there arises a need to improve the patient monitoring devices. The medical world today faces the most major problem that is the need of health care provider's presence near the bedside of the patient. In this busy lifestyle, monitoring our health condition is becoming hectic so everyone expects to know about their health conditions using some smart technology which can be easily accessible and is effective.

As the computers, bio instrumentation, and telecommunications technologies are being advanced, it has become feasible to design more the smart devices which help in tele monitoring systems to record data, acquire data, and display the data and to transmit the health signals from the human body to any location. Telemedicine benefits both the patients with efficient health care facility and even the doctors who can give better assistance to the people.

It is cost effective. It can increase the efficiency through better management of patient monitoring, shared health professional staffing. Tele monitoring involves remotely monitoring the patient health care. These devices keep track of blood pressure, heart rate, weight, blood glucose etc. of the patient. The Telemedicine system consists of customized hardware and software at both the patient and specialist doctor ends.

This project discusses the advantages of using android technology and Arduino for patient health monitoring system. In this technology the data is collected from a patient, to feed the same to two separate interfaces in which the patient parameters and details is displayed and sync the important information to a web based server. This can in turn be accessed by the doctor using an application installed in his android phone. He can analyse and send feedback in order to take preventive measures before he reaches the hospital in serious case. One message is also sent to their respective family members through their smartphone application.

Hence, this project can be used to help the patients monitoring and assistance by using the trending technology.

II.LITERATURE SURVEY

In the olden days the patients' health was monitored by catching his /her hand by checking their pulses. As, the time passed on and the technology for monitoring health got introduced, the quality of measuring and understanding the health conditions got better. The development in the technology grew to such an extent that now a days by wearing a small device, patient's health is getting monitored. The below figure shows the evolution of medical equipment's.

Number of different research projects explores wireless sensor networks for monitoring patient health 24 hours. Few projects are concerned with developing wearable wrist worn belt, while others have developed based for monitoring individual patients during daily activity, at home, or in hospital. Han and Yuo et.al proposed wireless sensor network based e-health system based on radio-active and radio-passive positioning [1]. Authors proposed wireless sensor network application for 24 hours constant monitoring without disturbing daily activities of elderly people and their caretakers. In this system both fixed and mobile body sensors are used. A mixed positing algorithm is proposed to determine the location of elderly person. The purpose of positing is to help the system to determine the person activities and further to make decisions about patient health condition. U. Anliker, J. A. Ward et.al has developed a

wearable medical monitoring and alert system aimed at people at risk from heart and respiratory diseases [2]. The system combines multiparameter measurement of vital signs, online analysis and emergency detection, activity analysis, and cellular link to a tele medicine centre in an unobtrusive wrist-worn device.

Fig 1: Evolution of medical equipment's

In this project the patient health monitoring is done by using a smartphone. The patient's heartbeat and vitals with body temperature is collected by using two transmission unit such as a Wi-Fi.

III.PROPOSED SYSTEM

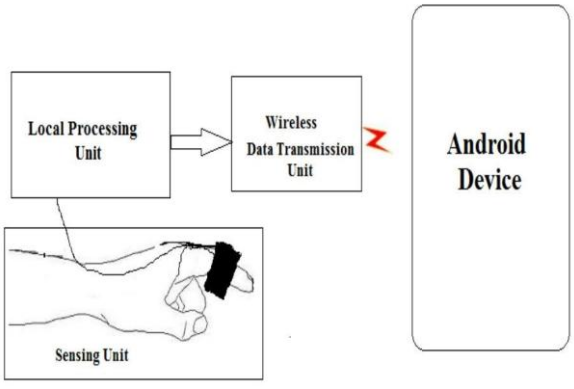


Fig 2: Proposed System

different sensors. The data collected is then processed by a processing unit like Arduino. The processed data is then transmitted via a wireless data

IV.ARCHITECTURAL DESIGN

In this paper, the patients' health monitoring system consist of hardware and software design. The hardware part deals with the mechanical and construction design, electrical and electronic circuitry. The software part deals with a programming of Arduino and smartphone application using android studio.

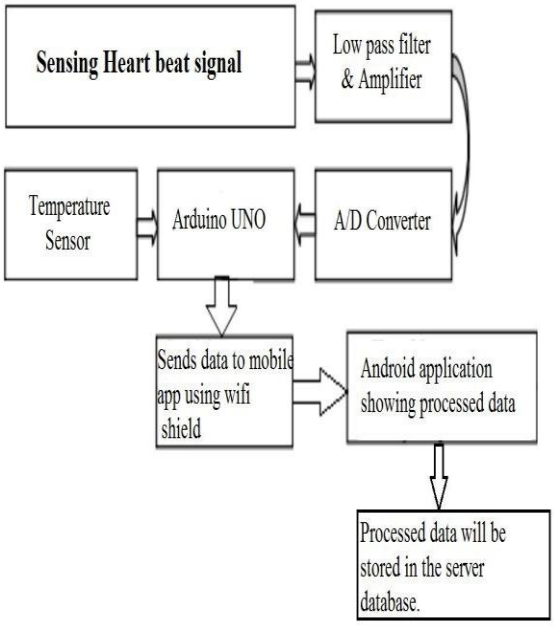


Fig 3: Architectural Design

Step 1: *Components*

1. Arduino UNO R3
2. LM 35 TEMPERATURE SENSOR
3. TCRT5000 HEART BEAT SENSOR
4. ESP 8266 WIFI MODULE
5. UART
6. 2*16 LCD DISPLAY

7. POWER SUPPLY
8. SMARTPHONE

Fig 4: Components

Step 2: *Wiring of Arduino board*

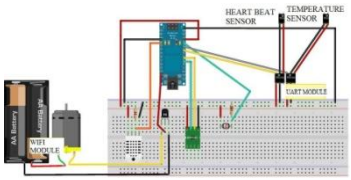


Fig 5: Wiring of Arduino board

The Arduino is connected to the two sensors namely Lm 35 temperature sensor and tcrt5000 heartbeat sensor. The signals from the sensors are processed in the Arduino and the data is transmitted to the smart phone. The data from the Arduino is transmitted to the smartphone using a Wi-Fi module or shield.

Step 3:System development tools

The above proposed system is being implemented using the following system development tools:

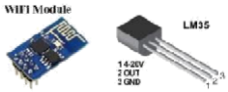
Arduino Programming

1. arduino-1.0.5-r2-windows (IDE)
2. C

Android Programming

1. Android Studio (ADT)
2. Java

V. IMPLEMENTATION



The patient health monitoring is one of the major concerns in the health care industry. The telemedicine is one which would be

Interesting to everyone because of its amazing factors. Multiple jobs can be done by a single health application with user's intervention. The system has been designed to take several inputs to measure physiological parameters of human such as temperature, heart rate and detection of any fall.

The project is divided into two parts. First the hardware design and Second the software design. The project activity must be done step by step. It begins with searching and collecting information from scientific perspective. The review is about mechanical structure design and electronic circuit design also software programming implementation. The project was begun by finding the concept and idea related to this title. The information transmitting and viewing will act according to the module programmed using the software. It should implement all the required behaviour like sensing. Research is done on the mechanical design, where how a wearable device should be made. The software designing starts when the mechanical and the electronic designs are built. The software design mainly comprises of the code/program of the application of the system.

Working Steps

1. The patient would place his/her finger on the sensing unit.
2. The sensors would sense the heartbeat and the vitals with body temperature.
3. The sensed data rates are sent to Arduino Uno in the form of signals.
4. The Arduino processes the same data and would transmit the data to the Wi-Fi module.
5. The Wi-Fi module would then retransmit the data to the smartphone application.

6. The alert message will be shown in the smartphone application if the sensed rate is more than the desired rate.

7. Processing Data through Arduino UNO

:
Temperature in degree Celsius, Temp = Output voltage * 0.48828125
tempf=(Temp*1.8)+32

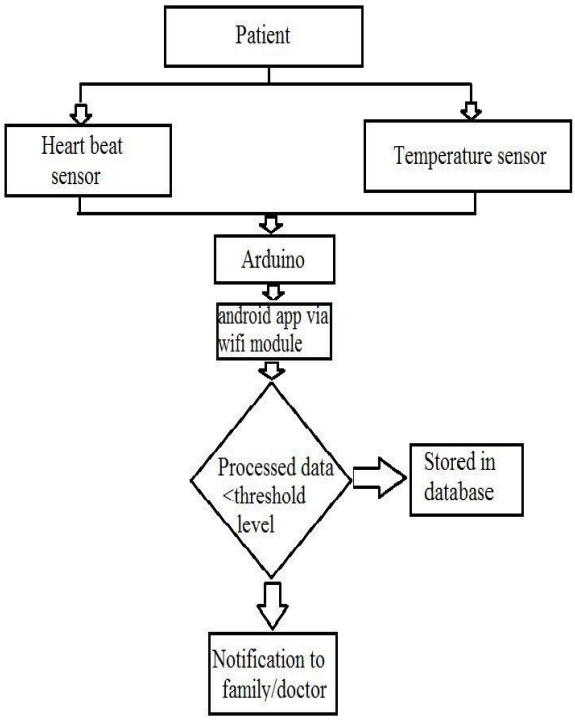


Fig 6: Working of A^{2}MIV

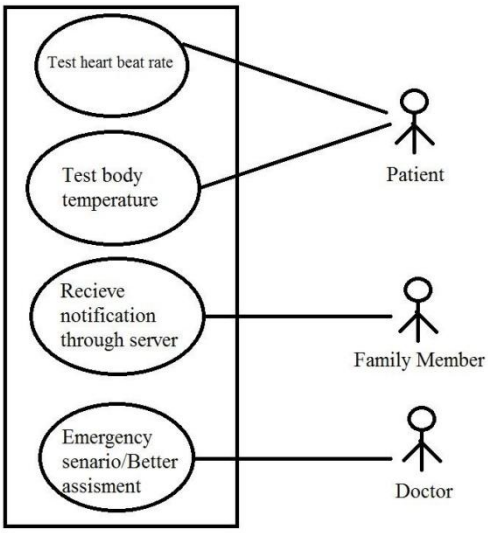


Fig 7: Use Case Diagram

8. Heart Rate Calculation:
$sum = \sum_{i=1}^{30} FreqMeasure.read()$
$frequency = F\_CPU / (sum / 30)$
BPM=frequency * 60 Body Temperature Calculation Voltage to Temperature conversion

VI. RESULT ANALYSIS

Remote patient monitoring system enables the doctor who is not in the hospital to know about the details of his patient.Then it is made available to the doctor. Notification is send in case of abnormality.In the screen the patient parameters like ECG signal, pulse rate, heart rate, temperature and SpO2 are displayed simultaneously along with the corresponding patient's name. When a patient detail is selected it gets displayed on a separate window. In this window each patient's details is particularly viewed. Here two buttons, 'save changes' and ECG are included. When a description is added to the field provided and the save changes button is clicked, the feedback is automatically updated to the feedback. When the ECG is clicked the corresponding waveform is obtained.

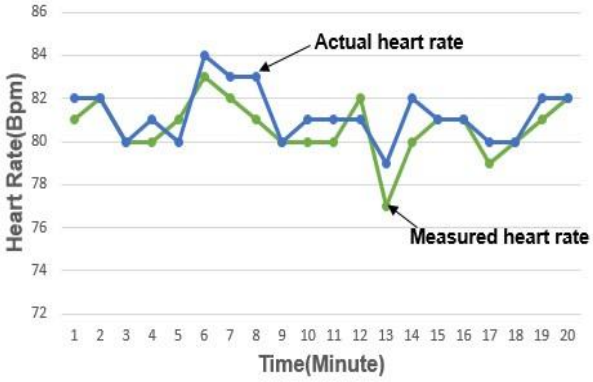


Fig8: Actual and measured heart rate for 20 mins

In the above figure it can be observed that the measured heart rate is approximately equal to the actual heart rate.

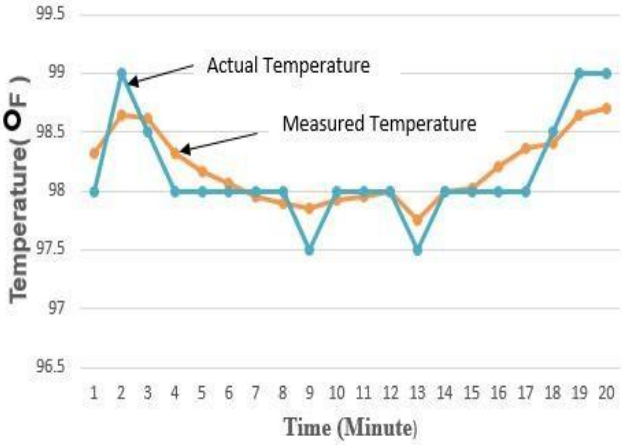


Fig9: Actual and measured body temperature for 20 mins

In the above figure it can be observed that the measured body temperature is approximately equal to the actual body temperature.

VII. CONCLUSION

Telemedicine is very useful in our dairy life. Usage of smartphone is more in many applications. Smartphone Application is used to know the heartbeat and vitals with body temperature. The information of the patient health is known by the android application via Wi-Fi communication. The A^2MIV stands on the basic idea of the telemedicine. Many improvements can be done to this project to improve the monitoring technique. A patient health monitoring system is developed, designed and tested and is found efficient, user friendly in all aspects. This project defines a patient health monitoring and alert system. The system combines measurement of vital signs, online analysis, emergency detection and notification to family members and doctors in case of emergency. Thus the project discusses the benefits of Remote patient monitoring and overcomes most of the disadvantages of quality patient care.

VIII. FUTURE ENHANCEMENTS

The A^2MIV can be improved by improvising the use of wearable devices. It can be integrated with a smart watch or a smart device. This basic idea can be integrated with the humanoid. The movement of robot can be controlled by gesture in the mere future instead of using smartphone application. The smart watch or a smart device can be integrated with the smartphone application using internet or Wi-Fi. Hence, A^2MIV is the future of telemedicine for patient health monitoring system.

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