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Remote Health Monitoring System using Non-Invasive Mobile Technology

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***Abstract*:-** Keeping track of a patient's vitals at home is a difficult task. Especially senior citizens have to be constantly monitored and their family needs to be alerted about their health status regularly, while at work. We propose a unique system that automates this task. The system we propose, uses sensors and Bluetooth technology which helps achieve this task. The system uses temperature as well as heart beat sensors to keep track of the patient's vitals.
If the temperature or heart beat of the patient increases above a safe value, the system automatically sends an alert message to the doctor and the family members about the patient and also shows the live heartbeat and temperature of the patient. Our remote health monitoring system effectively uses an Android application to monitor the patient's vitals and helps in saving precious time in terms of life and death.

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I. INTRODUCTION

As the universal elderly population increases, demands for monitoring of health also increases. In hospitals in ICUs we need to continuously monitor the patient's health conditions. In many cases patients released from the hospital are advised to take rest and be under observation for some period of time. However while the family members are at work, any mishap may happen which can be fatal in terms of life and death. Calling up the ill patient is also not an option since there may be times when the patient is not near his or her mobile phone. Because of this, one always has to be present at home due to which a person's work is affected.

The system that is proposed focuses on collection of patient's vital health parameters using sensors and generates an alert to the family members and doctors of the patient, so that immediate action can be taken in cases of emergencies. The system consists of three major parts: the sensors, the microcontroller and the Android application. Instead of attaching sensors to medical equipments, wearable sensors are attached to the body of the patient which constantly monitors the heartbeat, SPO2 levels and body temperature. The acquired readings are transmitted to the patient's smart phone using Bluetooth and a micro controller. The system makes use of Bluetooth enabled smart phones which has an Android application. The application then sends an SMS to the doctor and family members.

II. LITERATURE REVIEW

Margadu Anil Kumar et al focused on measuring and monitoring various parameters of the patient's body like heart rate, oxygen saturation level in blood and temperature using a web server and an android application, where doctor can continuously monitor the patient's condition on his smart phone using an Android application. [1]. On the other hand Meria M George et al,focused on continuously monitoring using different sensors which is connected to the Arduino board. And the acquired data is send to the server using Ethernet shield attached to the Arduino board. They used An ECG Sensor,Accelerometer and a Temperature sensor.[2].Soumya S. Kenganal et al suggested a s system based on ZigBee.The system mainly consists of hardware like sensors, microcontroller (LPC2148) ZigBee, LCD display etc. and software'slike keil u vision 3, flash magic, visual studio, eclipse etc. [3].T. Baranidharan et al Using Internet of Things (IOT), patient conditions are obtained and stored for further analysis. In this project the heart rate and blood pressure of patient are monitored. From this project it is expected to monitor the whole body of the patient from remote location[4].Paola Pierleoni et al suggested a novel system. This work proposes a method based on the Support Vector Machine technique and it is addressed to low-cost smartphones.This method starts from the data that is acquired from accelerometer and magnetometer, which is now available in all the low-end devices,. After an initial training, the classification of fall events and non-fall events is performed by the Support Vector Machine algorithm[5].Priyanka Kakria, et al a system which has system architect is three-tier comprising (1) a patient interface, that is, wearable biosensors' tier, (2) Android handheld device, that is, a smart phone, and (3) a web portal. The system is designed to provide an interface between the doctor and the patients for communication.[6].M.N Hani et al,developed a system,they proposed a two-stage fundamental. In the first stage, the sensors gather the particle

measurements of an android application. Then, in the second stage, the collected data are sent over a Femto-LTE network following a new scheduling technique. The scheduling strategy that was proposed, is used to send the data according to the application's priority. [7]. Antonio J. Jara et al,suggested a system where there was wireless transmission of vital signs through LoWPAN, and patient identification was done using RFID. This paper presents the architecture and evaluates its capability to provide continuous monitoring, ubiquitous connectivity, extended device integration, reliability, and security and privacy support. [8].Ramin Fallahzadeh et al suggested a useful system. The system keeps track of changes in subject's ankle circumference as well as current body posture. . While wearable systems utilize the same micro-electromechanical sensors (MEMs) as smart phones, their power resource is far more limited due to their miniature form factor. Despite such stringent limitations, these systems are expected to have relatively longer battery lifetime in order to boost the user compliance as one of the key factors in success of wearable technologies [9].Ravi Pathak et al proposed a unique system.This system has Bio- sensors which are kept in the chest strap that is worn by the patient and it collects heart rate, respiration rate, ECG as the vital parameters. The smartphone provides the location information of the patient [10].

III. PROPOSED SYSTEM

The system we suggest has a patient health tracking system that uses sensors to keep track of the patient's health and uses SMS to alert their family. The system uses temperature as well as heartbeat sensors.

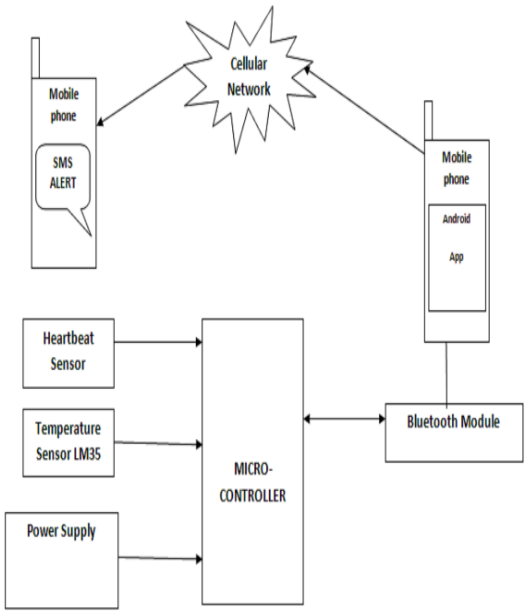

FIG 1: Block Diagram

The system consists of three major parts as shown in Fig 1.The sensors, the microcontroller and the Android application.The system uses temperature sensor (LM35) as well as a heart rate sensor which can also measure SPO2 levels. The sensors are wearable devices which the patient can wear onto his fingers. The sensors will be connected to a Microcontroller which will transmit the heart rate and body temperature readings wirelessly to the patient's smart phone using Bluetooth technology. Before the signal is received by the microcontroller an Analog to Digital Converter as well as an amplifer to amplify the weak signal will be used.The live data is received by the Android application, which will alert the relatives of the patient using GPRS in case of any abrupt changes in the vitals. The mobile numbers to which the alert would be sent can be set by each patient. If any abnormal changes in heart rate or body temperature is detected by the system, the system automatically sends an alert message to the family members about the patients' status and also shows details of heartbeat and temperature of the patient . Thus the system effectively uses Bluetooth to monitor the patient's health status and helps in saving precious minutes in emergency situations.

The android application has, the threshold values for temperature, heart beat stored in its database. The values received from the sensors are compared with the threshold value by the android application, if the value is equal to threshold. If the value is greater than threshold the smsManager class object is invoked which sends the text message: "Patient temperature is high." Or "Heart rate is high".

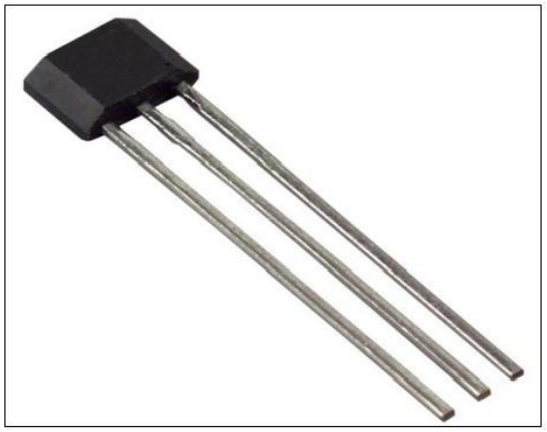

FIG 2: Temperature Sensor (LM35)

LM35 is calibrated in Celsius, and is suitable for remote applications. LM35 (As shown in FIG 2) operates from 4 to 30 volts. Its main application is detection of heat,and hence can be used as a temperature sensor in our system.

FIG 3: Heart beat Sensor

The Heart Beat sensor as shown in FIG 3.The sensor gives a convenient way to keep track of the heart beat. This sensor monitors the flow of blood through the index finger. As the heart forces blood through the blood vessels in the finger, the amount of blood in the finger changes with time, due to which we can accurately measure the heart rate.

IV. DESIGN

From the Use Case Diagram (FIG 4) shown below it is clearly visible that the system is not only accessible to the family members of the patient but also to the doctor of the patient. The doctor however is the only actor in the system who can change the predefined parameter values.

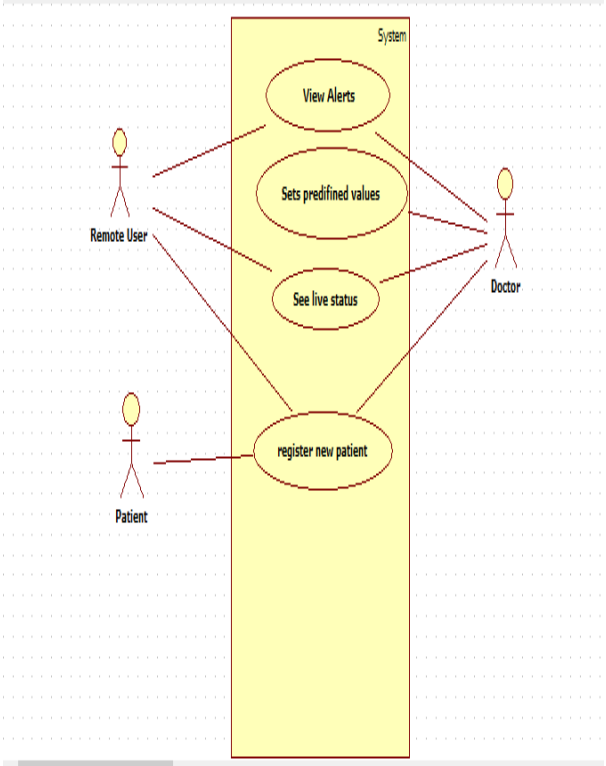

FIG 4: Use Case Diagram

CONCLUSION

In this paper, a remote health monitoring system using wireless technology and Android application is considered. This technology has the potential to offer a wide range of useful services to patients, medical personnels, and the general society through continuous monitoring of the patient's vitals.

This remote health monitoring system has high flexibility and a wide range application in the medical service system, intensive care unit and at home. A bigger, more widely used remote monitoring system can be built by connecting the system to the Internet.

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