Patient Health Monitoring using IoT

N. Deepak, Ch. Rajendra Prasad, S.Sanjay Kumar

Abstract :   At present in hospitals, based on patient health condition they need to check regularly. If there is sudden change in their patient health condition, it is not immediately known to the healthcare professional. So, to overcome that we are using health sensors and with the help of these sensors gradually changes occurring in patient health condition are known. These sensors are attached to human body and that sensors will monitor patient health condition from time to time. In this paper, we are proposing how patient gradually changing health condition is monitored by healthcare professional who is nearer to the patient and who is distant from the patient also.

Keywords: Sensors (Pulse sensor, Temperature sensor, MEMS sensor), Wireless modules (Bluetooth module and GPRS module), Cloud computing, IoT.

I.   INTRODUCTION

Health should be given more importance in person's life. Health monitoring systems has been developed in these few years that can increase in providing better health. Several sensors are employed to monitor the human health conditions and the information from these sensors is transmitted to the cloud. A doctor or person who must know about the health of the patient can access this data from far away from the patient with the help of cloud.

Internet-of-things (IoT) is simply defined as devices that connect one another and interact using internet. IoT generates different amount of information that can be process by cloud computing. It is good and intelligent technique which reduces human effort and easy access to physical devices. This technique also has independent control feature by which any device can control without any human interaction.

II.   RELATED WORK

In [1]-3], Now-a-days the portable devices, especially smart phones became more important in people's daily life.
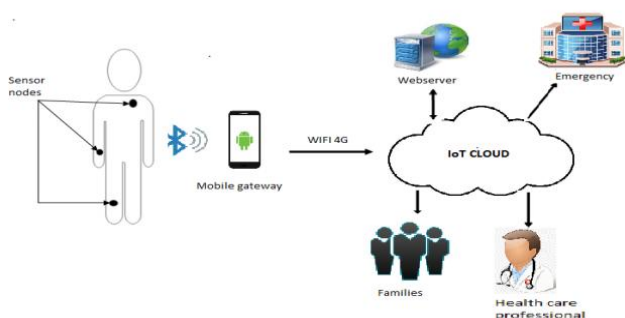

Fig. 1 Healthcare platform using WBAN with IoT

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A mobile device can be act as a gateway between the Wireless Body Area Network (WBAN) and the IoT cloud as shown in Fig. 1. In [4] the authors introduced power network monitoring using embedded Web server. The system employs LPC2148 and embedded TCP/IP Rabbit Core Module 5170. In [5] this article, the system contains a wearable sensor node with solar energy harvesting that permit for the implementation of independent Wireless Body Area Network for IoT linked applications. In this, wearable sensor nodes can be positioned on outside the body in different places in order to measure body temperature and heartbeat. Falls are detected by using Accelerometer on the node incase of emergency. A smart phone application is designed in that, we can observe the sensor nodes data and send emergency notifications. To increase the lifespan of wearable sensor node, a solar energy harvester with an output based MPPT technique is used and that output is taken as power supply. The output based MPPT technique is applied to takeout maximum power from the flexible solar panel.

In [6] this article, if the patient is in critical condition then, we can send an alert message to the health monitoring website. We can also track the patient location with the help of GPS. In [7], they proposed a system to reduce the death rates which occur due to the heart attack (or) heart related issues. One of the use of wireless patient health monitoring is if any person has occurred heart attack it is known to the person who is nearer to patient after sometime. In order to, avoid that we should continuously monitor the body parameters of patient. In [8], Real-time data gathering of patient who will provide as a support to medical staff and that is possible by completely removing the manual data collection and monitor immense number of patient's information. In [10], one of the use of IoT is to make healthcare devices more efficient by monitoring of patient health continuously, in which sensor will obtain patient's data and with that help this system we can decrease the human error.

III.   PROPOSED WORK

In Fig. 2, in the input side there are three sensors (temperature, pulse and MEMS) and at the output side there is Bluetooth module, GPRS modem and LCD.ARM7 controller accts as interface between input and output. These sensors are attached to patient body and that sensors data is sent to ARM7 controller and from that controller sensors data is transmitted to Smartphone application with the help of Bluetooth module and to cloud with the help of GPRS module.

A. Hardware Description

ARM7 CONTROLLER

The core of the system is controller, which is used to collect and process the data. In this, we are using ARM controller, which consist of 8 kilobytes to 40 kilobytes of on-chip static Random Access Memory and 32 kilobytes to 512 kilobytes of on-chip flash memory. In this the controller acts like interface between input side sensors and output side Bluetooth module, GPRS modem and LCD display.
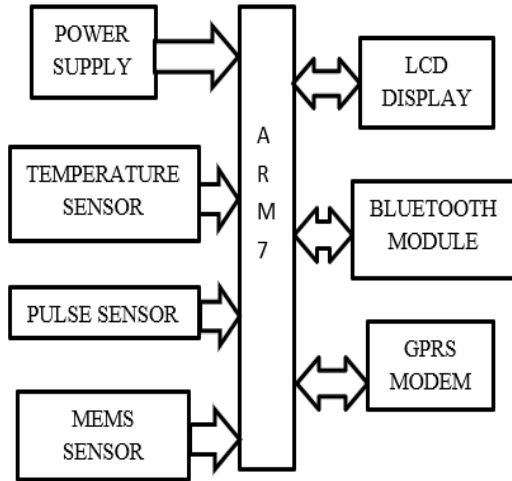

Fig. 2Proposed system block diagram

LCD:

A 16x2 LCD is used. In this, we can display all the three-sensor information all the time until the system power off.

TEMPERATURE SENSOR:

To measure the temperature, we use the sensor Thermistor (T103).This Thermistor consists of two pins that are VCC and output. The output pin value is not taken directly, this is connected to voltage divider circuit, that dividing voltage of voltage divider is taken as output value. This output is analog and it is connected to Analog to Digital Converter (ADC) pin of microcontroller.

MEMS SENSOR:

We are using MEMS SENSOR (MMA7600FC) is used for fall detection. This may arise due to low or high Blood Pressure (BP).With the help of this MMA7600FC, whether fall detection occurred or not is known.

PULSE SENSOR:

A normal heartbeat sensor is made up of a light emitting diode and a detector, the detector will function like a light detecting resistor or as photodiode. The heart beat pulses will cause a difference in blood flow in different parts of the body. When a tissue illuminates with the light source, it will either reflects or transmits the light and that is received by light detector. The blood absorbs some amount of light. Absorbed light amount will depend on volume of blood accommodated in that tissue. The output of detector is in the form of electrical signal, which is proportional to heart beat rate.

BLUETOOTH MODULE:

In this project, we are using Bluetooth module (HC-05), it has four pins that are VCC, Ground, Transmitter and Receiver. The Bluetooth module transmitter is connected to the controller receiver and the receiver of Bluetooth module is connected to controller transmitter to setup the communication among microcontroller and Bluetooth module.

A connection terminal application to used to display the sensors data with the help of Bluetooth Module. To establish connection between Bluetooth module and connection terminal application, First power on the power supply of the hardware kit and then check whether Bluetooth module is on or not. If it is on, then turn on the Bluetooth in the Smartphone and search for Bluetooth module device and if it is found then pair it. Then, open the connection terminal application in the Smartphone then, in that application select configuration option, then in that select Bluetooth option, after select paired devices and then click on HC-05.After that it displays Bluetooth module is connected and then go to home in that application in that click on terminal after that connect automatically option . Then go to network and then you will observe that patient health related health sensors data is displaying all the time in that application.

GPRS MODULE;

In this we are using SIM800L GPRS/GSM module. It consists of Red LED which is for indication of power and White LED which is for indication of Ringing. In this system, we are using GPRS module to transmit the sensors data to the cloud and with the help of this GPRS module we can view the health sensors information distant from the patient also.

CLOUD:

Cloud computing is defined as storing the data in the cloud and running the applications which are connected with it. Everything is hosted in the cloud, which is connected to many computers and servers through internet. By using cloud, it would help everyone to access the information from the cloud from different places and different locations. One of the advantage of cloud computing is if the system crashes, hopefully the data is stored in the cloud. This helps in storing data about treatments done for patients and their documents etc. Cloud computing does not equal to the internet, simply it is the best delivery platform. The cloud used in this paper can be accessed by using an IP Address (124.123.41.147:9999/automation). In this, patient connected sensors information is displayed in the cloud through GPRS SIM800L module.

B. Software implementation

In Fig. 3, initially turn on pulse, temperature and MEMS sensors. Pulse and temperature sensors values are directly sent to the controller but MEMS sensor information is only sent to the controller if fall is detected only. We need to turn on Bluetooth module and GPRS module. Transmit sensors data. If you want to repeat the process then repeat the procedure otherwise turn all the sensors and modules off.
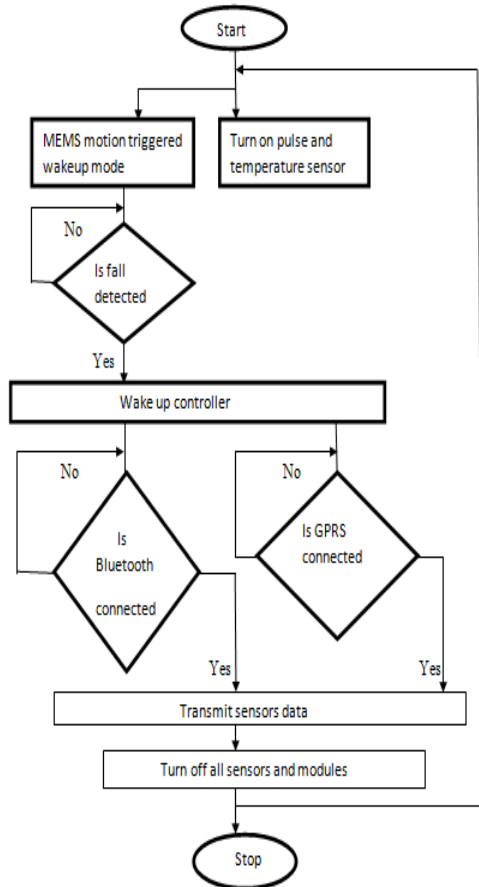
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Fig. 3 Flowchart of proposed system
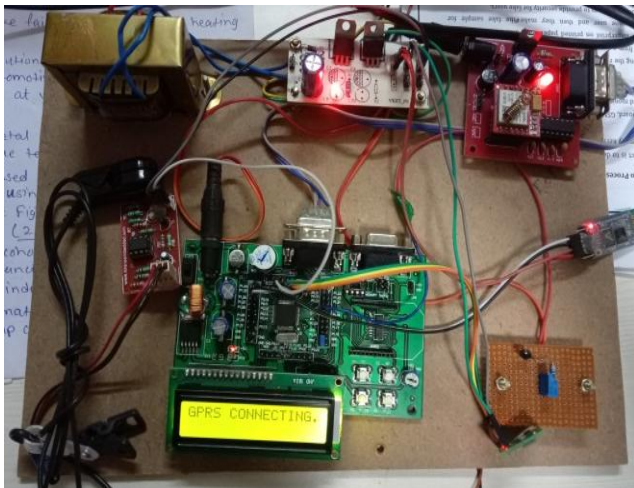
IV.   RESULTS

Fig. 4 Working model of Proposed system

In Fig. 5, the sensors data of patient is displayed in the Connection terminal application in the Smartphone is with the help of Bluetooth module (HC-05). In Fig. 5(a), 5(b), 5(c) and 5(d) we are considering normal and high conditions of pulse and temperature in possible ways.
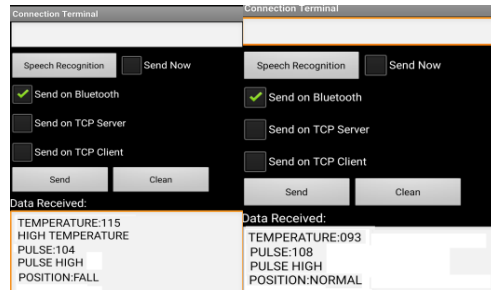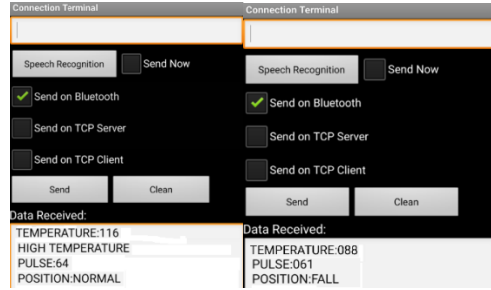

Fig. 5(a)   Fig. 5 b)

Fig. 5(c)   Fig. 5(d)

Fig.5a),5(b),5(c),5(d)Health   Sensors   information displayed in Connection terminal application.

In Fig.6, the patient attached sensors data is displayed in the cloud with the help of SIM800L GPRS module. This is an open source cloud which can be accessed with the help of IP address that is (124.123.41.147:9999/automation). In Fig 6(a), 6(b), 6(c) and 6(d) we are taking possible high and normal conditions of pulse and temperature and that data is displayed in the cloud.

Fig. 6 (a)

V. CONCLUSION

This paper presents regularly health condition is monitored by using sensors and that sensors information is displayed in Smartphone through Bluetooth (HC-05) module in one way and in another way sensors information is displayed in the cloud through GPRS SIM800L module. Wireless patient health monitoring will reduce the time consuming in gathering of patient's data. Patient data information gathered from sensors is more accurate than manually data gathering. The proposed system can be used at home and hospital. This system can be further improved to monitor more than one patient health information.

Fig . 6(b)

Fig. 6(c)

Fig. 6(d)

Fig. 6 (a), 6(b), 6(c) and 6(d) displaying sensors data in the cloud

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