INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 4, Issue 3)
Available online at: www.ijariit.com

Wireless patient health- Care system

Harshi Gala
harshigala18@gmail.com
Veermata Jijabai Technological Institute, Mumbai, Maharashtra

Amutha Jeyakumar
amuthajaykumar@vjti.org.in
Veermata Jijabai Technological Institute, Mumbai, Maharashtra

ABSTRACT

Monitoring patients has become the prime concern these days. Wireless Patient Health-Care System is developed for monitoring body temperature and heart rate of a patient constantly. The main objective of this application is real-time monitoring of the patient without being physically present in the doctor's clinic. In this system, heart sensor and temperature sensor are connected to Arduino MEGA. Arduino MEGA processes the data and uploads the data on the website using ESP 8266. If any irregularities are noticed by the microcontroller, then it sends an alarm as an SMS to the doctor and the patient's relative giving a warning that the patient needs immediate care. With this, the doctor can also view the patient's history with the help of the data uploaded on the website for treating him later or to change the treatment if the earlier treatment doesn't work on the patient.

Keywords- *ESP 8266, Temperature sensor, Heart sensor*

1. INTRODUCTION

In this polluted environment, people suffer from numerous diseases. Once the patient gets treated, it is important for the doctor to observe the patient's recovery. But staying in the hospital until the patient completely recovers can be very costly and monotonous for the patient. Heart rate, blood pressure, and body temperature are the general things which need to be monitored after the treatment for observing the recovery process of the patient. Congestion in the hospital could also be reduced. If the patient is not that critical and is discharged from the hospital, but the patient still needs to visit the doctor for follow-up. This follow-up process is too tedious for the patient as he needs to wait for hours in the line just for a few minutes' consultations with the doctor. Thus, if the patient can be remotely monitored may reduce congestion in the hospital and also the patient's follow-up visit.

The body temperature of a human varies with various factors like age, exertion, sex, infection, reproductive status, time and place of measurement and also to the state of consciousness. Body temperature monitoring is very important for various diseases like swine flu, malaria, viral fever, dengue, etc. [1].

Heart rate helps to monitor the fitness level of a human. Normal human heart rate ranges from 60 to 100 beats per minute. Heart rate varies with physical exercise, stress, illness, sleep, anxiety, etc. Changes in heart rate help the doctor to rectify the diseases. Diseases like coronary artery diseases, congenital heart disease, heart attack, cholesterol, etc. are diseases in which heart monitoring is important [2].

Hasmah Mansor et al. [3] in 2013 developed a system to monitor body temperature and upload the value on the website using Arduino with Ethernet shield. In this paper, the sensor data is sent to the PC using Zigbee module and then uploaded on the website.

Reddy & Damodhar [4] in 2012 developed a multi-sensors network for determining temperature, heart rate and blood pressure from the human body. Authors used ZigBee to send signals to the PC via the RS-232 serial port communication interface. They also sent a short message using GSM.

This paper focuses on monitoring heart rate and body temperature of the patient and uploading these values on the website for the doctor to keep a routine check on the recovery of the patient. Monitoring heart rate and body temperature in real-time can help alarm the doctor in case of any discrepancy. As the values are recorded on the website, the doctor can provide proper medication by observing the previous history of the patient. This recorded values will also reduce the doctor's work of tracing the medication history of the patient.

2. MEASUREMENT UNIT

2.1. Temperature Measurement Device

The normal body temperature of a human generally ranges from 36.5–37.5 °C. The body temperature of every individual depends on various factors such as age, sex, time of the day, health, etc. It also depends on the state of consciousness of the individual, activity and emotional status of a human.

LM35 and TMP36 are the two temperature sensors available for measuring human body temperature. However, LM35 is more accurate than TMP36. The accuracy of TMP36 is around +-2°C, whereas that of LM35 is +-0.5°C. LM35 also provides higher range as compared to TMP36. The range of LM35 is -55°C to 150°C and that of TMP36 is -40°C to 125°C. Operating voltage of TMP36 is 2.7V to 5.5V whereas LM35 is 4V to 30V. Both these sensors have linear output. In this project, LM35 is being used [5-6].

2.2. Pulse Sensor

The heart rate of a normal adult ranges from 60 to 100 beats per seconds. During sleep, heart rate of an adult is between 50-60 beats per seconds. Factors like activity level, fitness level, air temperature, body position, the emotion of the human, body size and medication affect the heart rate of a human [7].

Pulse sensor can be just clipped to the earlobe or the fingertip. Operating voltage of pulse sensor is 3V to 5V.

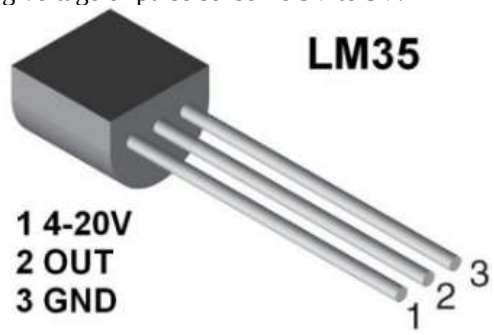

Fig. 1: LM35 Temperature Sensor

Fig. 2: Heart sensor

3. METHODOLOGY

The microcontroller used in this paper is Arduino MEGA which has 54 digital input-output pins of which 15 are used for PWM. It contains 16 analog input pins. It works on 16 MHz crystal frequency. There are 4 serial ports available on the board [8].

ESP8266 works on 802.11 b/g/n protocol. It can directly upload data on a website using an internet provider. It has integrated TCP/IP protocol. ESP 8266 can handle up to 3.6V. ESP 8266 contains 8 pins. It can be configured as an access point to collect data from various stations. It works on AT commands [9].

Table - 1: ESP 8266 Pin Description

Pins	Descriptions
Vcc	3.3V - 3.6V
Gnd	Ground (0V)
RX	Receive data bits
TX	Transmit data bits
CH_PD	Chip power down
RST	Reset
GPIO 0	General Purpose Input-Output No 0
GPIO 2	General Purpose Input-Output No 2

Fig. 3: ESP 8266

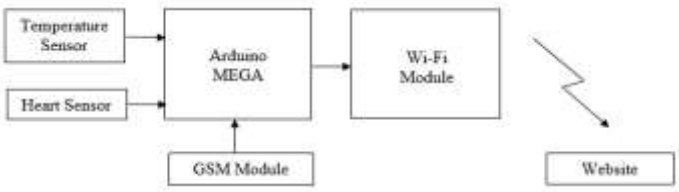

Fig. 4: Block Diagram

GSM SIM900A is a dual-band GSM/GPRS module. It works on 900/1800 MHz frequency. Using RS232 GSM SIM 900A can also be connected to PC. It consumes low power in performing voice, SMS or data activity. It is controlled using AT commands at baud rate between 9600 and 115200. It also has TCP/IP stack to enable to connect internet [10].

In this project, the temperature and heart parameters are captures using the sensors. This data will be will be processed in Arduino MEGA. The processed data is then saved on the website. The data is sent to the website via ESP 8266 Wi-Fi module. The processed data would also be examined in the Arduino MEGA. In case of any irregularities obtained in the data, an SMS will be sent using GSM module indicating the patient needs immediate care. For the doctor to monitor the patient the doctor can log in with the email ID and the password. The doctor can keep a check of the patient's health using this. He can also check the patient's history using this for further treatment.

4. EXPERIMENT SETUP

Temperature sensor and heart sensor are attached to the analog pins of the Arduino MEGA for measuring the patient's temperature and heart rate. The serial transmitter of ESP8266 is connected to the serial receiver of Arduino MEGA and similarly, serial receiver of ESP8266 is connected to the serial transmitter of Arduino MEGA. This is done to that the data transmitted by the microcontroller is received by ESP8266 and vice versa. GSM Module SIM 900A is also connected to the serial pins of the microcontroller like ESP8266.

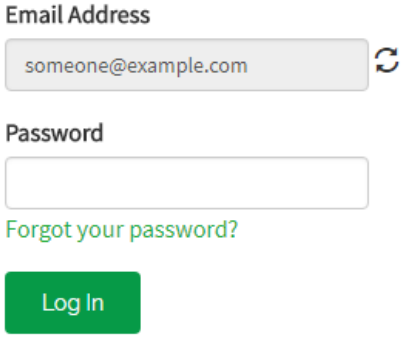

Fig. 5: Login page

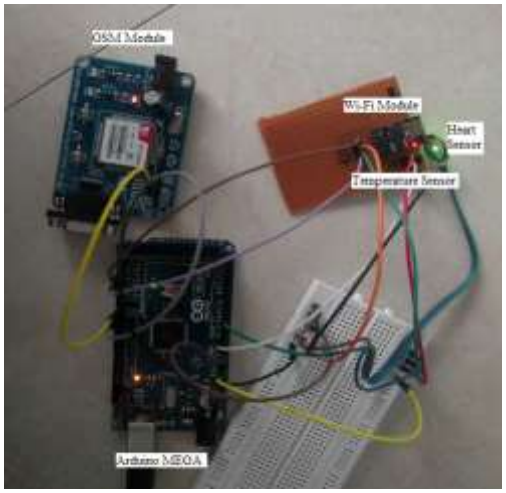

Fig. 6: Experiment Setup

5. RESULT VALIDATION

Table 2: Temperature comparison

Methods	Temperature (°C)			
Hand – Digital Thermometer	37	36	37	38
Hand – LM35	37.4	36	36.9	37.5

Fig. 7: Temperature sensor results uploaded on the website

Table 3: Heart rate comparison

Methods	Heart rate (bpm)			
Hand – Digital Heart Measuring	90	67	90	85
Hand – Heart Sensor	93	72	88	82

Fig. 8: Heart sensor results uploaded on the website

As seen in the graph the body temperature and the heart rate are constantly uploaded without having a PC interface. The values are recorded every 25-30 seconds i.e. in a minute at least 2 values are recorded. This helps the doctor monitor the patient remotely. This would be useful for the patients to take rest at home and be continuously monitored.

6. FUTURE SCOPE

This can be integrated with an android app so that the doctor doesn't need to login to the website to check the patient's condition. Using the application, it can be very handy.

7. REFERENCE

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