Journal of Advances and Scholarly Researches in Allied Education
Vol. 16, Issue No. 6, May-2019, ISSN 2230-7540

Internet of Things Based Real Time Health Monitoring System

Vartika Shukla[1]* Ruchita[2]

[1] Department of Electronics and Communication Engineering, Rameshwaram Institute of Technology and Management, Govind Puram, Lucknow, Uttar Pradesh

[2] Department of Electronics and Communication Engineering, Rameshwaram Institute of Technology and Management, Govind Puram, Lucknow, Uttar Pradesh

Abstract – Health attains a major importance in our everyday life. It is necessary to have sound health so as to perform everyday tasks effectively. Good health is the need of human welfare along with the aim of developing a sustained economy. Today, the electronic sensors as used in the medical field are seen to play a vital role in all centers of healthcare. Monitoring E-health of the patient is a crucial advancement in the field of research. Since the prevalence of mankind monitoring the health, the same has emerged to be a concerning issue. Earlier, we saw the existence Ayurveda therapy for medication where medication were extracted directly from herbs and also natural resources with the technique of health monitoring confined to only the nerves inspection by human yet with technological advancement, the technique of medication has turned precise. IoT or Internet of Things is the ecosystem having objects connected physically which are accessible via Internet. These devices of IoT has been used in several fields of application that turn everyday life of users extremely confortable. Such devices have been used for temperature collection, sugar level, and blood pressure, etc., that has been used for evaluation of the patients health condition. The IoT popularity is seen to rise every day in the domain of monitoring remote system. The system of remote monitoring consists of, assets or vehicle, kids or pets monitoring, parking management, fleet management, energy grid management, water and oil leakage etc. Currently Indian hospitals have units of ICU and ICCU units yet because of rising population, facilities given by the hospital isn't enough, hence we draft a system where the individual's health can be remotely monitored using IoT in real time.

Key Words: ICU, Ayurvedic Therapy, Interymet of Things, ICCU, and Real Time Monitoring.

----------X----------

1. INTRODUCTION

In the current years, there has been a rise in the wireless technology for upholding different sectors .In the given years, IoT has graped majority of the industrial area mainly control and automation. Biomedical is a recent trend that helps provide better care of health. Both in hospitals and the facility of personal health care has been by the technology of IoT. So inducing parameters of smart system help in observing that consumes cost, power, and leveraging efficiency. Tracking the beloved ones is now a difficult task in everyday life. Monitoring the patients' health status is not an easy task. Mainly, for the patients of old age is required for monitoring periodically along with loved ones to stay informed on the health status time and again when they are at work. Hence, we have laid an innovative system which can automate the task. Our system is seen to lay out the tracking system for the patients' health which would use sensors for tracking and then keep the health care providers updated on the same. The system would use heartbeat sensing and temperature to track the health of the patient. These sensors have been connected to the microcontroller for tracking the status, and this is then displayed via an LCD using the Wi-Fi connection for transmitting alerts. If there occurs any change that is abnormal, the system would notify over IOT of the patient's status, showing the details of patient temperature and heartbeat across internet. So, IOT based system for tackling the health of the patient is seen to use effectively the internet for monitoring the patient health status and saving their life on time.

1.1 Internet of Things

The paradigm of Internet of Things (IoT) suggests the interconnection of things that are consistent and has been possibly outfitted with the intelligence inescapable. This will then provoke a system that is significantly scattered of providing gadgets. By the virtue of speedy advancement in all basic

developments, it is seen that IoT would open huge entryways for several applications that assures to better lives of all. Further, IoT is linked to several ideas of technology of data, and communication:

- Ubiquitous communication: specific capacity of different items to transmit, this is the process using which several operators communicate to make things happen simultaneously and does not need time confinements.

- Pervasive registering: upgrading articles with the power of handling (winding up of the environment around us and ready to be processed). Back in the year 1991, a dream was depicted by Mark Weiser, for processing of 21st century which would counter the PCs pervasiveness. "Of all, the most important innovations are the ones which would vanish. They are seen to mesh among themselves in a texture of everyday existence till the time they turn vague."

- Intelligence: the articles ability to be part of the changes in any physical environment and effectively then interface.

Till 2016, the IoT vision evolved because of the rising of multiple technologies, along with the communication of ubiquitous wirelessly, analytics of real-time, commodity sensors, machine learning, and embedded systems. The above suggests that the conventional field of wireless networks, embedded systems, automation and control systems, along with others, contribute to allow the application of IoT. The idea of Internet of things has been popular since 1999, via the MITs Auto-ID Center and corresponding publications of market analysis. The technology of Radio-frequency identification as seen by Kevin Ashton falls among the IoT prerequisite at that time. The phrase preferred by Ashton was "Internet for Things. “In case all people and objects in daily life got equipped with computers, identifiers, they can then be managed and inventoried. Apart from the RFID usage, the things tagging can be attained via different technologies like barcode, near field communication, digital watermarking, and QR codes. Given the original interpretation, a major impact of IoT implementation is objects equipped in a world having devices for minuscule identifying or identifiers that are machine-readable and can transform everyday life. For example, ceaseless and instant inventory controls have turned ubiquitous. The ability of a person to connect with objects can be remotely altered on the basis of present or immediate needs, according to the agreement existing with end-user.

1.2 Origin of IoT

Internet of Things, as a term was coined first by Auto-ID center founder at Massachusetts Institute of Technology. As a term, Auto-ID has been used for describing different kinds of methods to both improve and identify applications like automation of work, error reduction, efficiency enhancement, etc. Back in 2003, the EPC network was released by Auto-ID centre. This EPC helps tracking objects which moves from one particular location to another. The above gives the idea to implement IoT, where the microchips could be used for creation of network for the means of mainstream commercial. The implementation of radio frequency identification further adds to the opportunities of IoT development as the new paradigm of IT in environment both industrial and academic. In the report of 2005 by International Communication Union, it was said that IoT is a collaboration of technologies of computing and oc sensor-based like wireless networks, sensors, object identifiers, embedded systems, and nanotechnologies. Such a combination help tagging of the objects, sensed and then controlled across the networks. Further, IoT is thought to be the fusion of technologies which aim to lay communication and interaction among all devices Interlinked. Developing nations appear to be interested keenly in IoT. The ex-President of China inaugurated in 2009, the national research centre of IOT and delivered a speech on the need of having a thorough research and development in IoT field.

1.3 Applications in Healthcare Sector

Medical devices are seen to go through various changes, starting from the traditional equipment’s that were unconnected to devices that are wirelessly reprogrammable. Such advancements consist of the IoT emergence in medical systems which are connected to mobile phones. The IoT in medical field is primarily the system having devices for health-monitoring. Health parameters of the Patients" are recorded remotely by back-end system. Then, analysis of a back- end system data recorded, giving significant feedback to clinical staff. This feedback helps determining the patient health status by specialist and react promptly to critical cases.

IoT vital application has been in the healthcare sector. Here, IoT plays a significant owl by improving the quality of service and at the same time reduces costs. Using IoT driven machines, one can keep track of blood glucose, BP, body temperature and few more with the help of wireless sensors in real time. The improved sensors development along with the technology of effective processing of data and wireless communications has accounted for the rise of IoT. The wearable sensors development for remote monitoring of the patient is a huge milestone. Using a medical device, the health parameters of a patient can be monitored. Different devices like mobile phone, smart phone are excellent substitutes. Further, one aloud considers that the recorded dataset has

immense importance as it fills up the patients' health record. Such a system is useful in hospitals, healthcare clinics, or outpatient clinics. The IoT medical system is a setup highly sophisticated having varied system and mechanisms like smart sensors, medical equipment, cloud computing, network gateways, system of clinical information, big data, which effectively cooperate to better control the environment of healthcare.

The potential application widespread variety in varied fields are reported like services that are location based; updating the status of user's social networks, detection of fall down of elderly and for the people that are physically handicapped, system for healthcare monitoring etc. The sensors of smartphone accelerometer has been for the user activity detection where sensors of gyroscopes used to detect the speed rotational in addition to the activity of user's and the sensors of orientation used to detect the direction and position of users smartphone.

Human: a major role is played by IoT in tracking the human activities both normal and abnormal, for position capturing, taking help of placed smartphone in varying posture of body. Owing to the said advanced features, the IoT has immense application in the monitoring system of human health care along with application of emergency alarm. Example: smartphone, smart watch, smart glasses, and activity tracker. Such systems are successfully implemented in the environment of real time using star, broadcast, scanning, mesh, and the point to point topology of network using devices as used in our everyday life like health devices, smartphones, fitness devices, heater, home automation, Ac, Ventilator, Human Interface (HID) devices, remote control system, payment, smart meters, etc so as to track the system both effectively and suitably in future environment.

1.4 Challenges in Using IoT in Healthcare Sector

The healthcare sector based on IoT is seen to grow tremendously. The usage of IoT sensors and devices in medical sector is the basis of the system of e-health. People are using such devices for remote monitoring of health stats. In the same time, these devices uses network of transmission for sending and receiving the patient data those are health-related. The above accounts for threats by potential hackers. So, it is necessary to secure totally the healthcare IoT-based system. These systems of medical IoT face threats as:

- **Mobility**: A prime requirement for the healthcare IoT-based system is permitting patient mobility along with the devices to make the system always functional, disregarding the location. The above feature enables connecting environment of heterogeneous patient. Network type: at time, selecting the network is a prime issue. There exist three kinds of the same: service centric, data centric and patient centric. The first network segments the structure of healthcare based on the captured data of health. The structure that is service-centric relies on the formed structures by the services assembly given vg system. And the patient-centric structure has been created using the formed structure by the individual's involvement under treatment.

- **Scalability**: Multitude of IoT interconnected devices is seen to generate huge data for storage and processing. The system of IoT which handles such devices is scalable. The generated data in large amount by the given system has been stored using big data across the cloud. The Interoperability: few manufacturers give varying service, products, and devices which have been used in IoT systems. But, these firms fail to follow the manufacturing standard protocol and devices usage. The above turns interoperability issues major cause. The prevalence of a huge amount of diverse devices along with the management of services that are value-added act as key standardization issues.

- Security: Several people are seen to wear the devices of sensors continuously to track their health statistics. Given such a scenario, a major breach is security as this, could be life threatening. So, the information security as obtained from different devices and sensors in medical IoT is indispensable. Security Physically: The IoT based devices used in healthcare system needs to be in tamper-resistant packaging. This becomes possible for the attacker to take device control and modify crucial data. In addition to the, the algorithm of routing needs to be controlled properly to safeguard the data transmitted. The nodes of network are susceptible to intruder's attacks. So, there is a need of protocols for secure routing in the data transmission. Medical devices of IoT are stuffed with cloud access procedures. These services need proper monitoring to get easily the data of patients". Effective policies and measured of technical security is important to enable sharing of data among organization and authorized users. Varied characteristics, like integrity confidentiality, and availability of personal data has to guarantee in the healthcare system of IoT healthcare.

1.5 IoT Services in Healthcare Sector

An IoT-based healthcare architecture has three main layers: information perception, network transmission and application service. The information perception layer primarily consists of sensors that are used to continuously monitor people's health statistics. The collected data is transmitted over the networks and stored in cloud data centers. Wireless technologies, such as Wi-Fi, ZigBee, and EnOcean and so on, are utilized to transmit data over the networks. The application service layer involves the IoT applied in a medical center, providing a remote healthcare service.

- **Heart Rate:** Today, we see smartphones being the major part of the IoT medical field. All sort of electronic devices today are moved by smartphones. Few of the hardware products are related to health care are integrated into bundle of software applications that are developed for various smartphones. They are at present equipped with range of healthcare applications. Few sensors of noncontact measuring which is seen to work based on algorithm of image analysis has been used for various healthcare applications. Any smartphone is capable to diagnose diseases like chronic disease pulmonary, asthma, allergic rhinitis, cystic fibrosis, and respiratory tract symptoms that are nose-related BP, HR, SpO2, and others.

- **Glucose-Level Monitoring**: Most people are seen to be diabetic, and hence they lies the need to monitor levels of glucose continually. The system of medical IoT can continuously monitor the level of glucose in a non-invasive manner. Wearable sensors are used by patients that can track the health parameters, along with transfer of the collected data through internet protocol (IPV6) network. This kind of tracking device has the collector of blood glucose, an acquisition detector that is based on IoT and a mobile phone. The monitoring of glucose-level gives patterns of glucose level modifications which are used to determine meals, medication times and physical activities.

- **Wheelchair Management**: Various studies have been conducted for developing the smart wheelchairs for disabled people that can use the application of IoT. The healthcare system that is IoT-based help disabled persons. This system consists of the WBAN technology (Wireless Body Area Networks/ for coordinating and controlling various sensors. The wheelchair vibrations are system controlled which helps track the person status by tracking the position of sitting and also laid information on the surrounding.

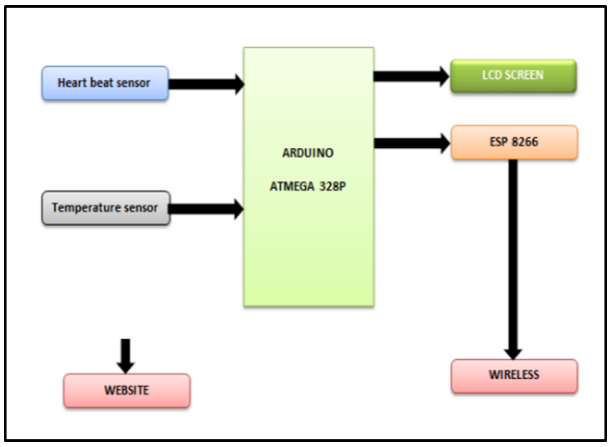
- **Electrocardiogram Monitoring:** In monitoring of electrocardiogram (ECG), the system is capable of tracking the basic rhythm, the HR, and identifying the multifaceted arrhythmias, intervals of QT and myocardial ischemia by recording heart's electrical activity. The monitor of ECG has a receiver and wireless transmitter. The automated application is capable of identifying abnormality in heart activity. Transfer of data done in real time both to the clinic of doctor and mobile phones through network. The system of IoT uses algorithms for monitoring ECG continuously.

- **Body Temperature Monitoring:** The body temperature change can be used for identification of homeostasis, which is the prime part of varied healthcare services. Mote of TelosB used by medical IoT consists of the embedded sensor for recording the body temperature. One of the systems which use the home gateway for body temperature monitoring in medical IoT uses infrared detection for transmitting the recorded temperatures of body. This system has the RFID module which works in with monitoring body temperature device.

- **Blood Pressure Monitoring:** The BP of a patient is monitored continuously using the device of wearable sensor. This machine has the BP apparatus with communication network-based abilities. Blip care is one device using the Wi-Fi network of home for recording and data uploading. This has the display for showing BP. Proposal of the device for remote monitoring given.

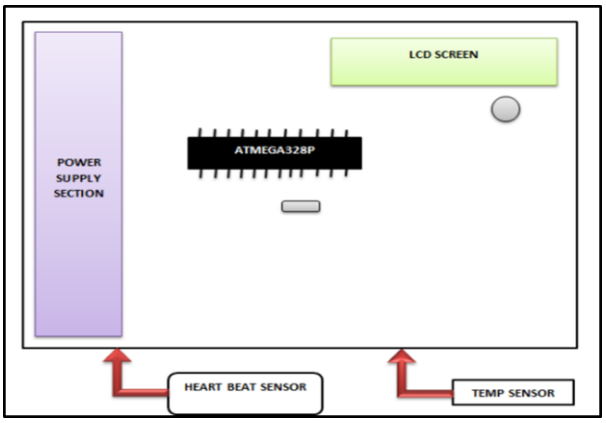
2. DESIGNING AND IMPLEMENTATION:

2.1 Mapping:

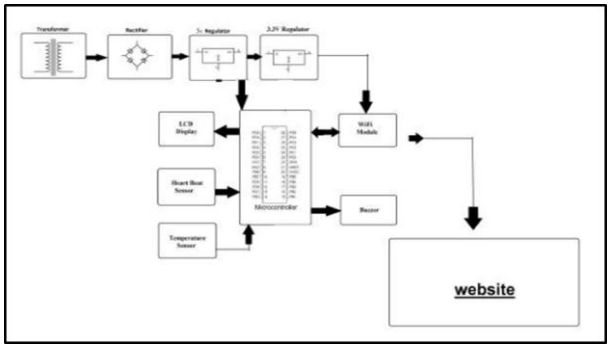


The given mapping diagram shows basic components used for the system functioning. Every component is linked to the arduino that is also referred to as the circuit's heart. The used coding can be used to help the component function rightly.

2.2 PCB Layout:



2.3 Circuit Diagram:



The diagram of circuit shown above is the entire system working. At first, there is the circuit of power supply having LPF, Transformer, and Bridge rectifier, Indicator. There we use the power supply of 220 V AC and convert it to 12V AC with the help of transformer. After this, we use the rectifier to convert the 12V AC to 12V DC and pass them through the low pass filter that eliminates noise from the signal of input. Then the microcontroller, is used Arduino Atmega 328P. It has a total of 13 digital Pin with 6 analog pins and pins of PWM signals. The program given below is fed to microprocessor with the help of a burner and Arduino IDE. Then, temperature sensor namely LM 35 is used as 3 pin transistor which can convert temperature ie physical signal to the electrical signal as fed in microprocessor. There, we use the sensor oc heart beat pulse to read pulse of heart and convert it to the electrical impulse. Then, the system has a Wi-Fi module which sends microcontroller's input information to the connected WIFI and then the information is passed to website using which health of the patients' get monitored.

3. COMPONENTS

3.1 Heart Beat Sensor

Modern monitors of Heart rate commonly use either one or two methods for detection of heart rates. These methods lay the data of heart rate same. The technology original is based on the electrical sensors which are by default used in medical devices. The technology that is newer technology relies on optical sensors. The sensors of ECG (Electrocardiography) are capable of measuring electrical signals generating bio-potential which controls the contraction and expansion of chambers of heart. The sensors of PPG (Photoplethysmography) use the technology of light-based to sense the blood flow rate as controlled by the action of hearts pumping. There are two elements in electrical monitors: monitor or transmitter that is worn on the chest strap along with the receiver. On detection of heartbeat, transmission of a radio signal done, that is, used by the receiver to determine and display the rate. The New technology prevents receiver of a user to use the signals from nearby transmitters or simply eaves drop.

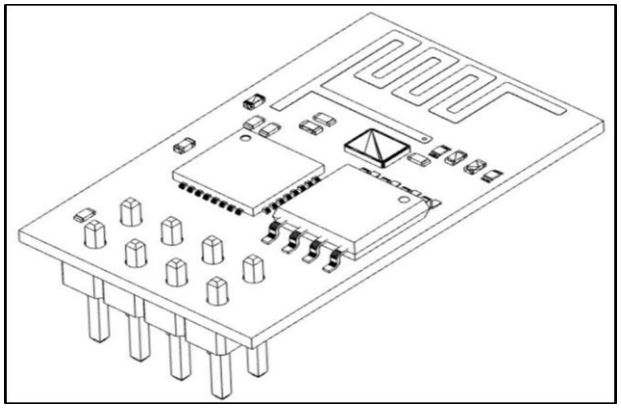
3.2 Temperature Sensor

Generally, the sensors of temperature are the devices that are specifically designed to map the coldness or hotness of the object. The temperature sensor of precision IC, LM35 has an output directly proportional to temperature. Using LM35, measurements of temperature done accurately in comparison to the compared. This further possesses heating at low temperature and prevents the same from rising to 0.1 °C temperature. The range of operating temperature lies between -55°C - 150°C. The output impedance of LM35's is low, with output of tin ear, and the calibration of precise inherent turns interfacing to the readout or the controlled circuitry easy.

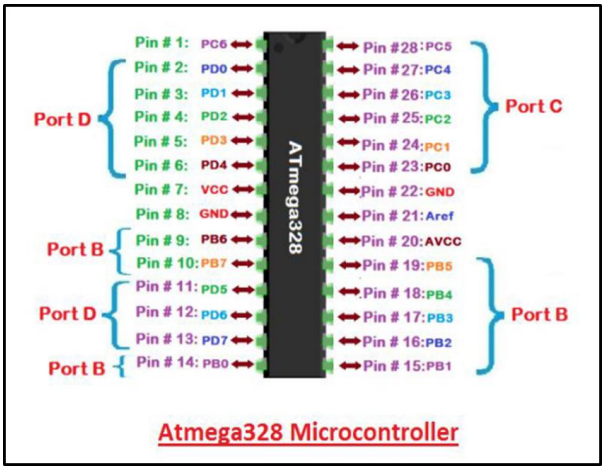
3.3 ESP 8266

Pinout:

4. VCC, Voltage (+3.3 V; can handle up to 3.6 V)
5. GND, Ground (0 V)
6. RX, Receive data bit X
7. TX, Transmit data bit X
8. CH_PD, Chip power-down
9. RST, Reset
10. GPIO 0, General-purpose input/output No. 0
11. GPIO 2, General-purpose input/output No. 2
12. Processor: L106 32-bit RISC, core of microprocessor based o Tensilica Xtensa Diamond Standard running at 106Micro 80 MHz
13. Memory:
14. 32 KiB RAM instruction
15. 32 KiB RAM instruction cache
16. 80 KiB RAM user-data
17. 16 KiB - RAM ETS system-data



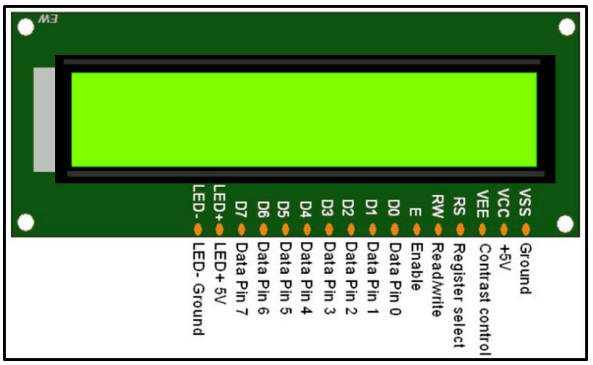
3.4 Atmega 328P

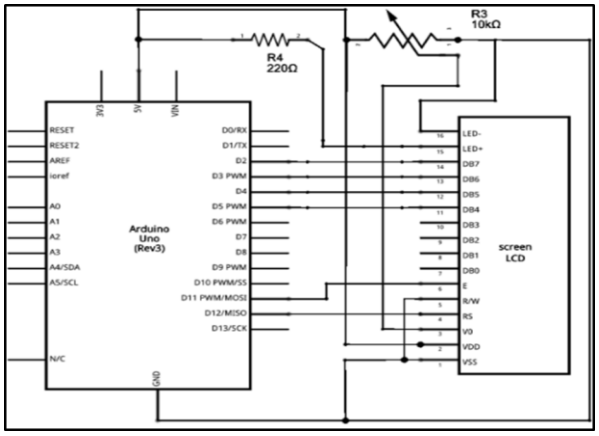


Arduino Uno is the board of microcontroller, and based on the data sheet of ATmega328P. This is seen to have a total of 14 digital pins for input as well as output (of these 6 are used as outputs of PWM), total of 6 in out of analog, a quartz crystal of 16 MHz, USB connection, a reset button power jack, and an ICSP header. This has everything required to provide support to the microcontroller. All you need to do is, connect the board to other computer using USB cable or give power using the battery or adapter of AC-to-DC adapter to start

Speed (MHz)	Power Supply	Ordering Code	Package	Operational Range
20	1.8-5.5	ATmega 328P-AU ATmega 328P-MU ATmega 328P-PU	32A 32M1-A 28P3	Industrial (-40°Cto 85° C)

4. LCD SCREEN





5. CODING

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(9, 8, 7, 6, 5, 4);
String NUMBER = "\"7503600905\"";
#define PULSE_READ_TIMEOUT 30
#define LCD
#define PULSE_SENSOR 2
#define TEMP_SENSOR A0
#define BUZZER 3
#define SW A3
String str="";
void setup()
{
Serial.begin(9600);
pinMode(PULSE_SENSOR, INPUT);
pinMode(SW, INPUT);
pinMode(BUZZER, OUTPUT);
lcd.begin(16, 2);
lcd.print("Health Monitor");
delay(2000);
digitalWrite(BUZZER, HIGH);
gsm_init();
systemReady();
}
void loop()
{
if (digitalRead(SW) == LOW)
{
lcd.clear();
lcd.print("Please wait");
while (digitalRead(SW) == LOW);
int fl_pulse_count = 0;
int fl_remain_sec = 0;
long fl_stt = millis() / 1000;
while (millis() / 1000 < fl_stt +
PULSE_READ_TIMEOUT)
{
if (digitalRead(PULSE_SENSOR) == LOW)
{
fl_pulse_count++;
fl_remain_sec = PULSE_READ_TIMEOUT - (millis()
/ 1000 - fl_stt);
lcd.setCursor(0, 1);
lcd.print(fl_remain_sec);
lcd.print(" Sec ");
while (digitalRead(PULSE_SENSOR) == LOW);
}
}
int fl_pulse_rate = fl_pulse_count * 60 /
PULSE_READ_TIMEOUT;
lcd.clear();
lcd.print("Pulse:");
lcd.println(fl_pulse_rate);
lcd.print(" ");
float fl_ana_val = analogRead(TEMP_SENSOR);
float fl_temperature_c = fl_ana_val * (5.0 / 1024.0) *
100.0;
float fl_temperature_f = (fl_temperature_c * 9 / 5) +
32;
lcd.setCursor(0, 1);
lcd.print("Temp:");
lcd.print(fl_temperature_f);
lcd.print(" F ");
if (fl_pulse_rate > 75 or fl_temperature_f > 100)
{
digitalWrite(BUZZER, LOW);
}
else
{
digitalWrite(BUZZER, HIGH);
}
sendSMS(fl_pulse_rate, fl_temperature_f);
digitalWrite(BUZZER, LOW);
}
else
{
lcd.setCursor(0, 0);
lcd.print("Press Button to ");
lcd.setCursor(0, 1);
lcd.print("Start ");
delay(200);
}
}
int sendCommand(String cmd, String res, int
timeout)
{
while(1)
{
str="";
Serial.println(cmd);
void gsm_init()
{
lcd.clear();
```

```
delay(1000);
serialEvent();
if(str.indexOf(res)>=0)
{
return 0;
}
delay(timeout);
}
}
void serialEvent()
{
while(Serial.available())
{
char ch=Serial.read();
str+=ch;
}
}
void systemReady()
{
Serial.println("AT+CMGF=1");
delay(1000);
Serial.print("AT+CMGS=");
Serial.println(NUMBER);
Serial.print("System Ready");
Serial.write(26);
delay(4000);
}
Serial.print("AT+CMGS=");
Serial.println(NUMBER);
Serial.println("Health Alert");
delay(1000);
Serial.print("Pulse:");
Serial.println(fl_pulse);
delay(1000);
Serial.print("Temp :");
Serial.print(fl_temp);
Serial.write(26);
delay(4000);
}
```

6. APPLICATION

This is used in all major hospitals and by people at their personal level to regularly monitor heath in real time.

7. CONCLUSION

After project completion, we conclude that the proposed device is today's need and as the elderly, pregnant women, patients, require regular checkup of health, we can then work towards this to aid healthcare monitoring in real time.

8. ACKNOWLEDGEMENT

We, the authors, wish to thank the managements of our colleges and institution for their support in carrying out the experiments and providing all kind of support wherever possible. We are also thankful to all the people who have been a moral support during the experiment.

REFERENCES

Juan Felipe Corso Arias, Yeison Julian Camargo Barajas, Juan Leonardo Ramirez Lopez (2014). Wireless Sensor System According to the Concept of IoT -Internet of Things, International Journal of Advanced Computer Science and Information Technology (IJACSIT), Vol. 3, No. 3, Page: 327-343, ISSN: 2296-1739.

R. Venkatesha Prasad, Stefan Aust, Advances in Wireless M2M and IoT: Rapid SDR-prototyping of IEEE 802.11ah.

Arias Fern´andez, Jos´e Bahers, Quentin Bl´azquez Rodr´ıguez, Alberto Blomberg, M˚arten (2014). IoT-Framework Product Report, February 20, 2014.

Xiao Jing Meng, Huan Qing Cui*, Rong Hua (2014). An Iot-Based Remote Health Monitoring and Management System, Applied Mechanics and Materials, Vols. 571-572, pp. 1176-1179.

Somayya Madakam, R. Ramaswamy (2015). Siddharth Tripathi, Internet of Things (IoT): A Literature Review, Journal of Computer and Communications, 3, pp. 164-173.

Sarfraz Fayaz Khan (2017). Health care monitoring system in Internet of Things (IoT) by using RFID, IEEE, 04 May 2017.

B. Rao (2017). “The role of medical data analytics in reducing health fraud and improving clinical and financial outcomes,” in Computer-Based Medical Systems (CBMS), 2013 IEEE 26th International Symposium on, June 2017

F. Hu, D. Xie, and S. Shen (2013). “On the application of the internet of things in the field of medical and health care,” in IEEE Int. Conf. on and IEEE Cyber, Physical and Social Computing Green Computing and Communications(GreenCom),(iThings/CPS Com), Aug 2013, pp. 2053–2058

F. M. Hani, I. V. Paputungan, M. F. Hassan, V. S. Asirvadam, and M. Daharus (2014). “Development of private cloud storage for medical image research data,” in Int.Conf. on Computer and Inf. Sciences (ICCOINS), pp.1–6

T. Soyata, R. Muraleedharan, C. Funai, M. Kwon, and W. Heinzelman (2012). Cloud-Vision: Real-Time face recognition using a Mobile-Cloudlet- Cloud acceleration architecture,” in Proceedings of the 17th IEEE

Symposium on Computers and Communications (IEEE ISCC 2012), Cappadocia, Turkey, pp. 59–66.

Corresponding Author

Vartika Shukla*

Department of Electronics and Communication Engineering, Rameshwaram Institute of Technology and Management, Govind Puram, Lucknow, Uttar Pradesh

vartika.shukla17@gmail.com