IOT Based Health Monitoring System by Using Raspberry Pi 3

Prof. Gauri Rao[1], Shikhar Tripathi[2], Prashant Suman[3], Priyanshu Singh[4], Jayshree G Jayshet[5]

[1]*Professor,* [2345]*Student (Sem-VIII)*

[1]*Associate Professor, Department of Computer Engineering BVUCOE, Pune*

[2345]*Students, Department of Computer Engineering BVUCOE, Pune*

Abstract: ***At present health is a major priority concerns of the people. Each day thousands of people die due to improper treatment, lack of awareness about the symptoms of their own disease, and unable to meet the doctor on time to find the cure of the disease for the proper diagnosis of the cause of disease within the time constraint. Technology like IOT delivers a new opportunity to the healthcare field. It is a much convenient, fast, reliable way for doctor to use patient information for finding the proper and quick diagnosis with the help of IOT to take suitable action. This tremendously improves the patient doctor communication and the patient care in the health sector. IOT as an emerging technology resource can be enhanced to improve the day to day life. The proposed health care system can be used a personal health care monitoring system within homes or workplaces to keep a track on various parameter of health. Use of embedded wearable sensors, the system monitors various health parameters dynamically. The provided information is analyzed by the Raspberry pi i.e. the processor which will process and analyses the information.***

Keywords: ECG, Heart rate sensor, Health monitoring, GSM module, Raspberry pi.

I. INTRODUCTION

This IOT based health monitoring system is a further simplification and expansion to a typical hospital medical system where, with this IOT based health monitoring system the patient's various body health parameters can be monitored remotely. Typically, the detection system was only found in large hospitals and are accompanied by huge devices and diagnosis equipment with complex circuitry.

This consumes heavy power s. With the enhancement and evolution of the semiconductor technology industry and development of various sensors, micro controller and small transistors which are very tiny in size as compare to typical devices which are used in hospitals. These micro controllers, sensors and transistors do very rapid operations and consumes very little power. The main advantage however is that these new semiconductor devices are very cheap as compare to typical hospital devices.

This IOT based health monitoring system typically detects patient's vital life. These monitoring systems can be used in the following scenarios:

1. Patients with the history of any unstable medical conditions.

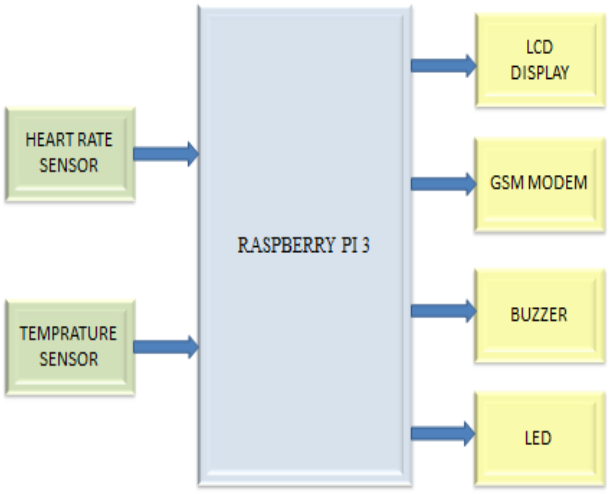
2. Patient's with the history of frequent heart problems and a further risk of heart attack.

3. It can also be used as a mobile health care device to monitor the health conditions of athlete, military person etc. on the go[1].

II. PROBLEM DEFINITIONS

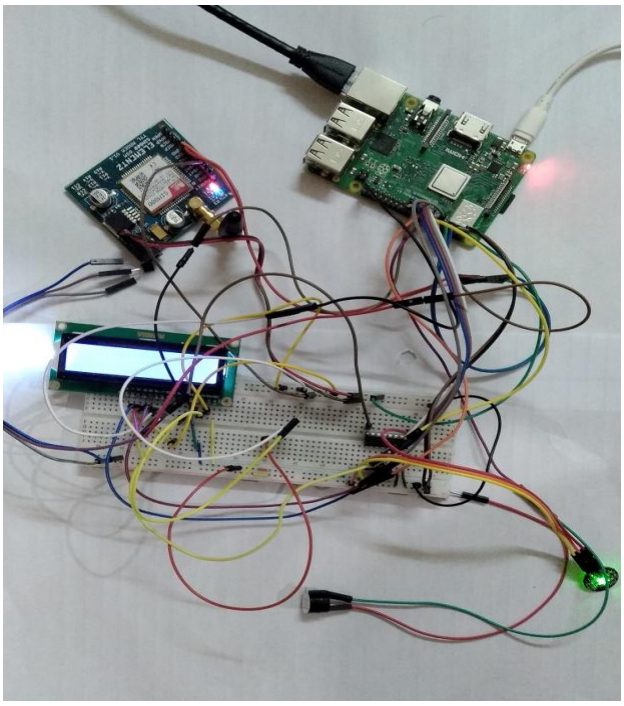
In Today's fast paced world, with the increase in various diseases at the various stages of life, nobody has time to visit the doctor on the regular basis. There arises a need of some portable, reliable, cost effective and time saving device which can monitor patient's various health parameters and regularly send this reports to the doctor for the further examinations so that any developing disease or previously detected disease can be monitored regularly and the cure for these disease can be found within the right time constraints.

III. SYSTEM ARCHITECTURE



The proposed IOT based health monitoring system works with the help of Raspberry Pi 3 as the Central Processing unit and the basic input devices that is used in this are heart rate sensor, temperature sensor. And the output devices that is used are LCD 16x2 with male header pin with blue backlight display, GSM SIM800 modem module with SMA antenna, piezoelectric buzzer and LEDs[2].

Working:



Input Devices

Heart beat is basically the minute sound of the human valves shrinking or expanding as the blood forces into one region to other. The BPM (Heart beats per minute) is the heart rate that can be felt artery closed to the skin is the pulse. To measure this heart beat there are two method

1. Manual way - by checking pulse near the location of wrist (the radial pulse) and the neck (carotid pulse) by placing index and middle finger on it.

2. Using a sensor – sensor like heart rate works on principle of photo plethysmography it measures the change in volume of blood through any organ to the body and measure the pulse rate

Pulse / pulse sensor operation is very simple. The sensor has both sides, with LEDs on one side with ambient light sensors and amplification and noise removal on the other. The LED in front of the sensor is located above the vein of the human body. It can be the tip of the finger or the tip of the ear, but it should be placed directly in the vein.

Now the LED emits light and falls directly into the vein. The vein only has blood flow when the heart is pumped, so you can control your heart rate by adjusting your blood flow. When blood flow is detected, the ambient light sensor captures more light because it is reflected in the blood.

In this health monitoring system, pulse rate sensor is used with diameter of 16mm, overall thickness 3mm, working voltage 3-5v, working current 4mA at 5v. This pulse rate sensor calculates the patient's pulse rate and send to the raspberry pi for further processing.

The AD8232 ECG module measures the Electrocardiogram of the heart of the patient. It does this by measuring the electric signals generated by the heart using the electrodes that are attached to the skin of the patients three main components that make up ECG are P waves, Q waves and QRS complex which when measures and calculated together makes up electrocardiography.

The LM35 temperature sensor maintains an exactness of 0.4 degree Celsius at indoor temperature +/- 0.8 degree Celsius over a range of 0-100-degree Celsius measure the patient's temperature level and provides this information to raspberry pi 3 for further processing.

Processing

Raspberry pi – developed in UK is a sequence of small single board computers founded by a Raspberry Pi foundation to promote teaching of computer science.

The information that has been gathered through heart rate sensor and temperature sensor is analyzed by raspberry pi 3 which is basically a 4GHz 64-bitquad core processor, dual band wireless LAN, Bluetooth 4.2/BLE, faster Ethernet and power over Ethernet (With separate PoE HAT) processor. After processing the above input information if there is any sudden change in the patient's health the raspberry pi 3 sends appropriate signals to the various output devices.

Output Devices:

LCD Display

16x2 display is used with capability of sixteen characters per line dimensions include 80.0+/- 5% mm length and 36.0 +/- 5% mm width operates with power of 7 volts is used to display the output given by the raspberry pi.

Piezoelectric Buzzer

Piezoelectric buzzer which has a piezoelectric diaphragm is used to give a sound alert when there is a sudden change in the patient's health basically piezoelectric buzzer is used to give the sound alert warning according to the certain parameters.

LED

LED Display gets lit up when there is a sudden change in the various parameters of a patient's health.

GSM Modem

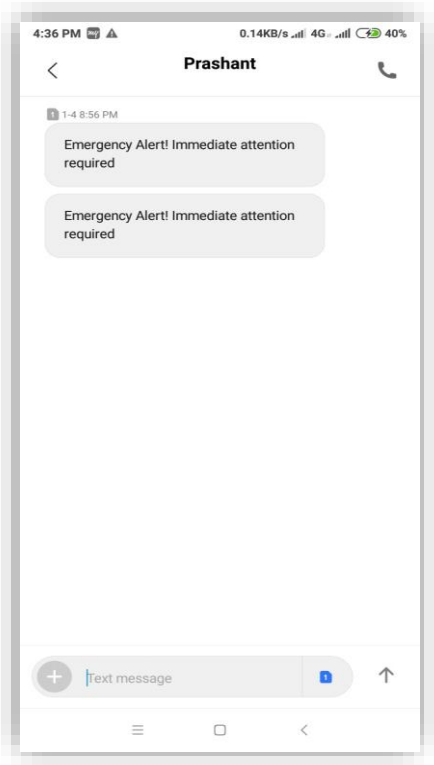
This plays a role in alert service to the nearby doctor and family members. GSM MODEM, when connected to a computer, it allows Raspberry Pi to communicate over a mobile network depending upon the SIM card in the MODEM. This enables the computer to send, receive and delete messages.

```
import serial
import RPi.GPIO as GPIO
import sys, time

def sendmsg(C):
    v = "Your Last HeartRate was "+str(C)
    port = serial.Serial("/dev/ttyS0", baudrate=9600, timeout=5)

    port.write("AT+CMGF=1\r".encode())

    print("Sending Alert")
    time.sleep(3)

    port.write('AT+CMGS="9956525459"\r'.encode())
    msg=v.encode()
    time.sleep(3)

    port.write(msg+chr(26).encode())
    time.sleep(3)
    print("Message Sent!")
```

A Tmega commands are used for this function. It is connected to the controller via serial adder circuit.

To summarise the process include, heart rate sensor and temperature sensor is attached to the required patient's and the information that has been gathered through these sensors is analyzed by raspberry pi 3 processors and if there is any sudden change is observed by the raspberry pi 3 processor the alert and message is sent with the help of the various output devices which includes LCD display, GSM Modem, piezoelectric buzzer and led to the relevant people after analysing the doctor can find the proper diagnosis.

Small changes in the received light are analyzed over time to determine the heartbeat. [3]

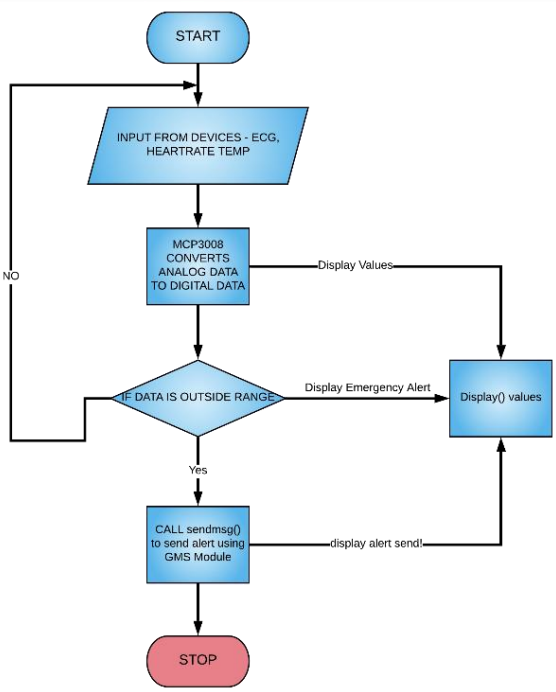


IV. DESCRIPTION OF THE SOFTWARE

Raspbian Operating System

Raspbian is an operating system aimed for Raspberry Pi single board computer. It is based on Debian Linux and uses PIXEL (Pi Improved X-Window Environment Lightweight) as its default desktop environment. Raspbian operating system was released in 2012 as an open source operating system aimed at Raspberry Pi. It was an independent project created by Mike Thompson and Peter Green. However, it was only in 2015 that it was named as the official Raspberry Pi OS provided by Raspberry Pi Foundation. Raspbian Version Builds are usually named after the characters popular animated movie Toy Story. Its first release was Buzz named after Buzz Light year. Its latest release is called Stretch which has newer Linux Kernel 4.14 as well as new releases of desktop environments such as GNOME 3.22, KDE5.9, Mate 1.16 and Xfce 4.12 as some of its new features.

V. SYSTEM FLOW



On starting the device, raspberry Pi will load the main class in the memory. It will then call the various individual classes and scripts that are responsible for controlling the different input devices such as ECG, Temperature and heart rate sensor. The signals from these devices will travel through the ADC MCP3008 which will convert the analogue signals to digital signals. These readings will get displayed in the LCD panel as regular readable readings. These scripts will return the values back to the main program which will then check the values against the predefined range set in the main program (e.g. Pulse rate should be between 40 to 70). If the values are outside the range, the Main script will display an alert in the LCD display as well as sound the buzzer. It will call the script controlling the gsm device which will send an emergency alert to 1 or more predefined individuals such as family or doctor.

VI. ADVANTAGES

Void of the portable health care monitoring device which can monitor the person health on the go can be fulfilled. With less circuitry less power consumption, more portability, with more doctor patient's communication support, with less chance of error can be achieved with this device.

This can bring the ease in monitoring the various health parameters on the go and if any uncertainty is found then the cure for the disease can be found within the limited time constraint.

VII. LIMITATION

The circuitry is little bit complex and the person which are using this device must have some prior basic knowledge of basic health term and devices such as ECG, heart rate, temperature sensor.

Since it uses basic generic sensors, it's not as accurate as the specialized devices available in the hospitals and as such is not an alternate to doctors and hospitals.

VIII. FUTURE SCOPES

As we know, India is a country of 1.3+ billion people and have one of the growing economies in the world and a potential superpower with education dominated society which is willing to work rigorously for a better tomorrow. In such a hustle and competitive environment, it is difficult for one to visit doctor on a regular basis to keep track of their health which can cause an underlying disease that may only be discovered at the critical stages which can prove to be fatal. In order to make the patient doctor communication simpler and for providing the mobile health monitoring on the go, this device is the solution. So this mobile health monitoring system can be the future to keep a track of one's health on the go.

IX. CONCLUSION

All the individual modules like Pulse detection module, Temperature Sensor module etc. are working correctly and the solder less Blue LCD viewing panel module displays the intended results.

The designed system modules can further be optimized and produced to a final single circuit. More important fact that came up during project design is that all the circuit components used in the remote health detection system are available easily.

With the development in the integrated circuit industry, Micro Electro Mechanical Systems (MEMs) and microcontrollers have become affordable, have increased processing speeds, miniaturized and power efficient. This has led to increased development of embedded systems that the healthcare specialists are adopting. These embedded systems have also been adopted in the Smartphone technology. And with increased internet penetration in most developing countries through mobile phones, and with use of Internet of things (IoT) will become adopted at a faster rate. The Remote Health Care system utilizes these concepts to come up with a system for better quality of life for people in society.

From an engineering perspective, the project has seen concepts acquired through the computer science and embedded study period being practically applied. The Electric circuit analysis knowledge was used during design and fabrication of the individual modules. Electromagnetic fields analysis used in the wireless transmission between microcontrollers and Software programming used during programming of the microcontrollers to come up with a final finished circuit system.

REFERENCES

[1] 2017 8th Annual Industrial Automation and Electromechanical Engineering Conference (IEMECON), Internet of Thing based healthcare monitoring system by Shreyaasha Chaudhury; Debasmita Paul; Ruptirtha Mukherjee; Siddhartha Haldar. Reference no.978-1-5386-2215-5/17©2017 IEEE

[2] International Journal of Research in Information Technology, Volume 1, Issue 1, November 2017, Pg.: 1-9 ISSN (Online): 2001-5569 UGC Approved Journal©Copyrights IJRIT, www.ijrit.net "An IoT based Patient Health Monitoring System using Arduino Uno" V. Akhila, Y. Vasavi, K. Nissie, P. Venkat Rao

[3] International Journal of Engineering and Manufacturing Science. ISSN 2249-3115 Volume 8, Number 1 (2018) pp. 177-182 © Research India Publications "HEALTH MONITORING SYSTEM USING IOT" Yedukondalu Udara, Srinivasarao Udara, Harish H M, Hadimani H.

AUTHOR'S PROFILE

Prof. Gauri Rao is Associate professor in Bharati Vidyapeeth (Deemed to be) university college of Engineering, Pune. She has completed her B.E. in E& TC and MTech. in Computer engineering. Her area of interest is Natural Language Programming.

Shikhar Tripathi is currently doing his Bachelor of Technology in Computer Engineering from Bharati Vidyapeeth (Deemed to Be) University, College of Engineering, Pune. Atpresent, he is in semester VIII. His area of interest is IoT, Application Development and Cloud Computing.

Prashant Suman is a computer engineering final year engineering student from college of engineering Bharati Vidyapeeth (Deemed to be) University, Pune. His area of interest is IOT, Java and application development.

Priyanshu Singh is a last year computer engineering student from college of engineering Bharati Vidyapeeth (Deemed to be)

university, Pune. His area of interest is IOT, Java and application development.

Jayshree J Jayshet is currently doing her Bachelor of Technology in Computer Engineering from Bharati Vidyapeeth (Deemed to Be) University, College of Engineering, Pune. At present he is in semester VIII. His area of interest is IoT, web designing.