

Real Time Analysis of Patient Health Monitoring and Home Automation using IoT

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Abstract - These days we can see that technology is being so advanced that almost all our daily problems are being solved day by day. Thus in this paper we have proposed a prototype to support the healthcare sector by introducing it to the IoT technology (Internet of Things). In this design we have used a credit card sized microcontroller to read in physiological data's of a patient using multiple sensors and transfer them to a database which can be viewed by authorized persons and adding up to it a threshold level is set in order to send message to the related people in case of an emergency. Apart from this there is home automation added up to it that is helpful to the caretaker or the hospital assistant to operate the appliances in a room easily. Using this system the amount of man power used in hospitals to take care of patients can be reduced and also human errors are avoided. This also reduces the amount of issues created in filing the medical documents of each patient as it is securely stored time to time in a database automatically.

Keywords- IoT, Tachycardia, Bradycardia, Home automation, Threshold value.

1. INTRODUCTION

Health care has become one of the major sectors to be considered in today's world. This sector is under the scan, since it requires high accuracy and reliability. Due to increase in the number of diseases in this generation there is a need of periodic monitoring in order to provide fastest cure and support to the victim. Thus many discoveries and theories are being brought up in this field to facilitate a comfortable environment in the hospital premises as well as at home.

1.1 Internet of Things

The Internet of things (IoT) is the supreme technology in the industry now since it connects every device to the Internet making it accessible from anywhere around the world. This has caused a revolution in the field of healthcare and hospitality. Firstly this technology was brought to light with the usage of RFID tags for each individual in an office or an institution. This provided a code for each individual that links to the server containing every information about the very person. This

technology skyrocketed after usage in QR codes, Bar code technology. Thus we have used the very same technology in this prototype with a microcontroller in order to get medical data directly from the patients and transfer them to the server for future reference, which can be viewed directly also. This system has some additional features supporting the need to provide a comfortable environment for the patient and also reduce the probability of human errors.

2. RELATED WORK

Many theories related to biotelemetry were published of which some findings related to this paper are described:

[1]SiriwanKajornkasirat, NapatChanapai and BenjawanHnusuwan proposed a model of Remote health monitoring system that uses IoT. This prototype mostly concentrates in the storage section of the data. The data mining technology is used where huge number of data can be stored. This technology is also used in business organization to save records of executives and carry out decision making algorithms in arranging them. In comparison with our proposal there is a drawback in this system as it doesn't include the home automation part and also the warning notification in case of any emergency situation.

[2] A Healthcare Monitoring System using Wi-Fi module by Mrs. SonalChakole, RuchitaR.Jibhkate, AnjuV.Choudhari. In this paper the health monitoring system is made up by interfacing an Arduino Uno microcontroller with different sensors and it is thereby connected to a Wi-Fi module (ESP8266) to send the data to the server. It also doesn't include the warning system that is implemented in our prototype. And the usage of arduino makes it basic since an additional wifi module has to be installed in it.

[3] Remote Health Monitoring through IoT by AnandaMohonGhosh, DebashishHalder and SK AlamgirHossain. This paper suggested the usage of a microcontroller and sensors with Phidgets Interface kit which reads the values from the patient and sends it to the internet where the data is stored in the database.

This model is not quite efficient since it occupies the same space as of the available equipment's.

Apart from the health monitoring some findings in home automation phase is also described:

[4] A ZigBee-Based Home Automation System by Khusvinder Gill, Shing-Hun Yang, Fang Yao and Xiu Lu .This system proposed uses Zigbee to connect devices used mostly at home to the local server which is connected through a Wi-Fi module to form a gateway. Though home automation is carried out quite efficiently here still there is a drawback that the area of coverage of a Zigbee is just around 10-20m which makes it almost the same as of the previous versions. In comparison to our system the range of coverage is quite small.

[5] Bluetooth Based Home automation system using Cell phone by R.Piyare, M.Tazil. This paper presents the design and implementation of a low cost but yet flexible and secure cell phone based home automation system. The design is based on a standalone Arduino BT board and the home appliances are connected to the input/output ports of this board via relays. An Arduino BT microcontroller is used which sometimes becomes less responsive due to its low clock speed and as mentioned earlier the usage of Bluetooth provides a small area of connection.

3. PROPOSED SYSTEM

In this paper we propose a module to carry out various applications based on IoT. Firstly, we divide the whole architecture into two phases one is the health monitoring section and other is home automation section. The health monitoring section is the essential part of this system, here we use a credit card sized microcontroller “Raspberry Pi 3 Model B”, this is used to interface the physiological sensors to the system. The values from the heart rate sensor and LM35 temperature sensor are analog values hence they are converted to digital values using proper Analog to Digital converters. Here we use MCP3008 IC to convert the values from LM35 to digital values and are fed into the microcontroller and further operation is carried out. Whereas in the home automation part we use two relays and these relays are connected to home appliances of our choice. The overall operation of it is done by sending commands to this relay by the user using a webpage. Thus the raspberry pi receives the data and sends commands to the relay in accordance to the received command.

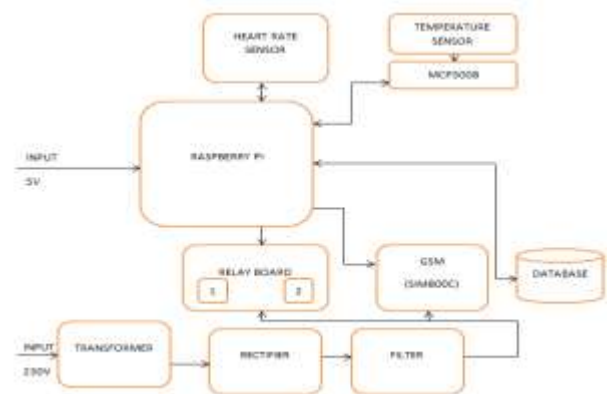
The data sent to the database from the sensors are passed through an algorithm wherein we set threshold values for emergency conditions based on heart rate we can describe as follows:

TABLE -1: Heart Rate of an Average Human

CASES	CONDITION	THRESHOLD
CASE 1	BRADYCARDIA	Less than 60bpm
CASE 2	NORMAL	60-100bpm
CASE 3	TACHYCARDIA	Greater than 100bpm

In accordance to these conditions the algorithm is made and in case of any variation in the values there is an alert notification sent through message to the required people. These values can be seen directly too since it sends real time values to the database time to time.

4. BLOCK DIAGRAM



4.1 RASPBERRY PI

Raspberry Pi® is an ARM based credit card sized SBC (Single Board Computer) created by Raspberry Pi Foundation. Raspberry Pi runs Debianbased GNU/Linux OS(Operatingsystem) Raspbian and ports of many other OSes exist for this SBC.



Raspberry Pi 3 - Model B Technical

Specification

- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 100 Base Ethernet
- 40-pin extended GPIO
- 4 USB 2 ports
- 4 Pole stereo output and composite video port
- Full size HDMI

In this prototype we use Raspberry pi because it has a better architecture including a Wi-Fi module and a Bluetooth connection. It is also efficient enough to carry out multiple programs at a time which makes us demonstrate multiple applications of IoT.

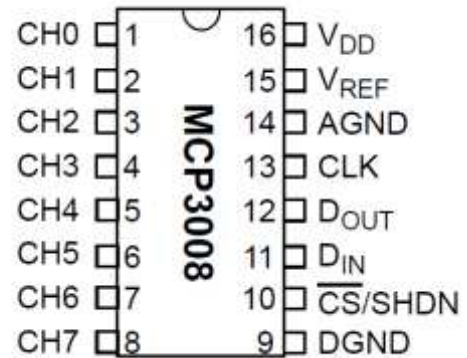
4.2 LM35 (Temperature sensor)



Specification

- Minimum and Maximum Input Voltage is 35V and -2V respectively. Typically 5V.
- Can measure temperature ranging from -55°C to 150°C.
- Output voltage is directly proportional (Linear) to temperature (i.e.) there will be a rise of 10mV (0.01V) for every 1°C rise in temperature.
- ±0.5°C Accuracy.

4.3 MCP3008



This is 8 channels ADC that converts the value from the temperature sensor and converts them to the digital value. These values are sent to the microcontroller to carry out further processing. The supply for this is taken from the Raspberry Pi.

4.4 SIM800C



Specification:

- Quad-band 850/900/1800/1900MHz
- GPRS mobile station class B
- Control via AT commands
- Supply voltage range 3.4 ~ 4.4V

5. ADVANTAGES

- It avoids Human error which increases the probability of patient's survival in the case of emergencies.
- It reduces space as the equipment's are smaller comparatively.

- Manpower to be reduced that is the number of caretakers or hospital assistants can be reduced.

6. RESULTS & OBSERVATIONS

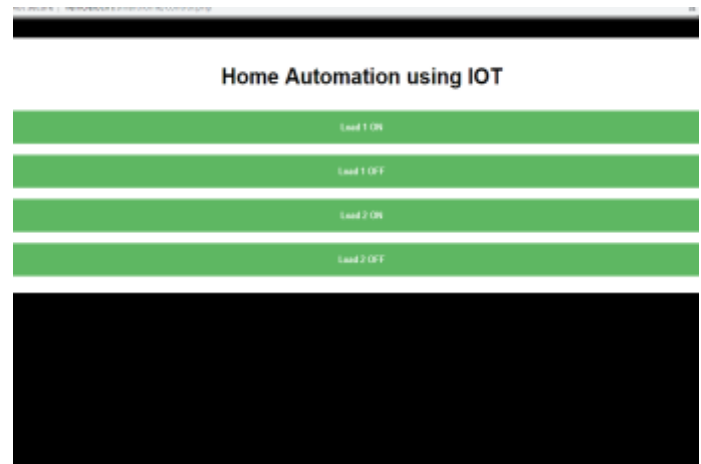
The preliminary results obtained in the health monitoring part are shown as follows:

S.No	Date	Heart Beat	Temperature
1	2019-03-04 01:17:54pm		
2	2019-03-04 01:38:47pm	60	11
3	2019-03-04 01:48:22pm		
4	2019-03-04 02:19:28pm	60	
5	2019-03-04 02:22:49pm		
6	2019-03-04 02:25:49pm		
7	2019-03-04 02:27:54pm		
8	2019-03-04 02:32:54pm	11	
9	2019-03-04 02:34:03pm	117-9	
10	2019-03-04 02:35:25pm	21	8
11	2019-03-04 02:36:22pm	21	120
12	2019-03-04 02:36:28pm	21	150
13	2019-03-04 02:36:25pm	21	147
14	2019-03-04 02:37:16pm	21	161
15	2019-03-04 02:38:27pm	5	128
16	2019-03-04 02:40:57pm	5	128
17	2019-03-04 02:48:56pm	6	148

The alert provided using the message signals is obtained as follows:



The home automation part is controlled using the following webpage:



7. FUTURE SCOPE

- Since the model demonstrated is just a mere approach to bud a new kind of environment in hospitals by including other sensors that will provide data related to Respiration, EEG, etc.
- The home automation systems can be improvised by adding gesture or voice control so that the patient or caretaker can manage the appliances in the room easily.

8. CONCLUSION

Thus by using this prototype we can solve multiple problems taking place in the very existing methodology followed. From the observations it is quite evident that this system can be used to facilitate better environment for the patient in hospitals. The alert system used can be quite beneficial to supervise the patient more effectively.

9. REFERENCES

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