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Advanced IoT based combined remote health monitoring and alarm system

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ABSTRACT

The world is changed nowadays by automation and internet of things. Our lives is made easier and automated day by day with the development and revolution in modern technology caused by the Internet of Things. In recent era, health hazard is not an age dependent factor due to irregular lifestyle and busy schedule. Patients' health is acquired by various sensors and then the data which is stored by the Internet of Things is displayed through the website that helps to access the remote monitoring. Thus, with the use of sensors, we can reduce human errors as well as the occupied space in the room is also reduced due to the size of the system. The alarm generation is used in such a manner that the patient is not devoid of taking medicines in time. In case the health parameters cross the threshold value, a notification is sent through email or SMS alert. An optimum surrounding is also created as per the patients' health requirement. The discussion of heart rate, blood pressure, respiration rate, body temperature, body movement and saline levels is done in this paper.

Keywords: *Raspberry Pi, Alarm, Heart Rate Sensor, Blood Pressure Sensor, Respiration Sensor, Body Temperature Sensor, Accelerometer Sensor, Appliance Control.*

1. INTRODUCTION

Vast potential is acquired by internet connected devices by pushing our lives towards automation and the rapid decrease in prices is motivating people to do new innovations. A combination of embedded system, software and sensors is referred as Internet of Things. Since everyone is prone to health issues, a continuous health monitoring system in name of IoT can be used. Remote observation is possible now as the internet is available throughout. The relatives of the patient are anxious about his/her health condition when he/she is admitted in the hospital. The anxiousness can be removed by the use of Raspberry Pi and IoT used in new innovative technologies to monitor the health condition of the patients. The patients' heart rate, body temperature, respiratory rate, blood pressure and body movement are measured in this purposed system. The hospitable management will be more liable and responsible to the patients' relatives. Huge machines are used to measure the health data of the patient by the hospital management. By using e-health sensor platform, the health data can be measured according to the health of the patient, the appliances are automatically controlled by Raspberry Pi.

2. METHODOLOGY

In Fig.1. The block diagram of the proposed system using Raspberry Pi is shown.

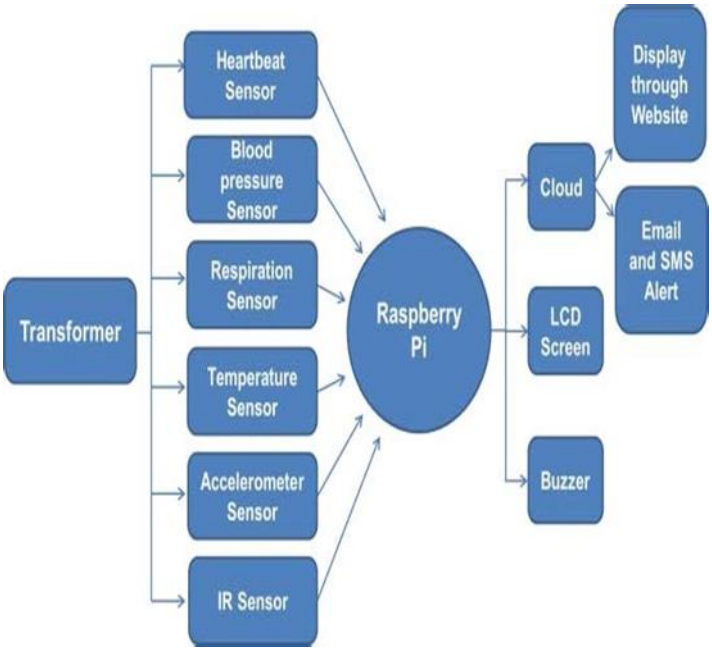

Fig.1. Block Diagram of Appliance controlled remote Health monitoring system using Raspberry Pi

The proposed system is divided into following four modules:

A. Health Monitoring and Data Collection

Monitored sensors are present in the health monitoring system to collect the data i.e. the health parameters from the patient.

Within the proposed system, the sensors are present to monitor the critical health parameters like blood pressure, heart rate, blood sugar level etc. sensors send the signals to the Raspberry Pi which runs on Linux based operating system which works like a small PC on Raspibian.

Fig.2. shows the heart of the system i.e. Raspberry Pi 3 Model B. Programming can be done according to the project's requirement and the screen can display the patients' health parameters with pi. More than this, the system can be accessed from any part of the world through internet. The health data which is displayed on the website will be stored in the cloud.

Fig.2. Raspberry Pi 3 Model B

To operate the sensors, a step down transformer is used since the power requirement is different for different sensors in this system. A 230 V power supply is converted to 0-9V and 15-0-15V which is received by switched mode power supply (SMPS). AC voltages are converted to DC voltages with the help of diodes. The ripples will be observed in the converted DC voltages. A connection of sensors with a capacitor of 1000µF will be used for power supply.

An ECG sensor will measure the heartbeat of the patient in the system. Bioelectrical signals of low amplitude are used to trigger the heartbeats generated by a special set of cells in the SA node of the heart. Electrical signals are converted into various numerical values through electrocardiography (ECG) by which the signals could be used in wide range of applications. Fig.3. shows a normal heart rate chart of a patient. When a finger will be placed on the sensor then it will provide a digital heartbeat of the person. With every individual heartbeat detected by the heart detector, the uppermost LED will start flashing. For the measurement of heartbeat per minute (BPM), the microcontroller is connected to the heart detector. At every single pulse, the microcontroller will function according to the principle of the light modulation by blood flow.

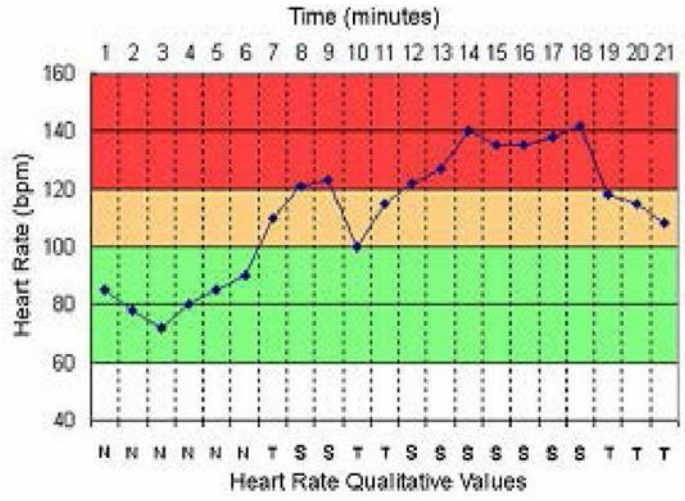

Fig.3. Heart Rate Chart of a Patient

Blood pressure is also one of the health parameter to which most of the people are prone to. As the heart pumps, the pressure of the blood circulating in the arteries is called blood pressure. Blood pressure has two common medical terms-

Systolic pressure which is the maximum pressure during a heartbeat and diastolic pressure is the minimum pressure between two heartbeats. This pressure is measured in millimetres of mercury above the surrounding atmospheric pressure. 120 mm of mercury is the systolic pressure and 80mm is the diastolic pressure of a full grown human being. The systolic and diastolic pressure charts are shown in fig.4. This sensor will automatically store the date and time of 80 readings of blood pressure.

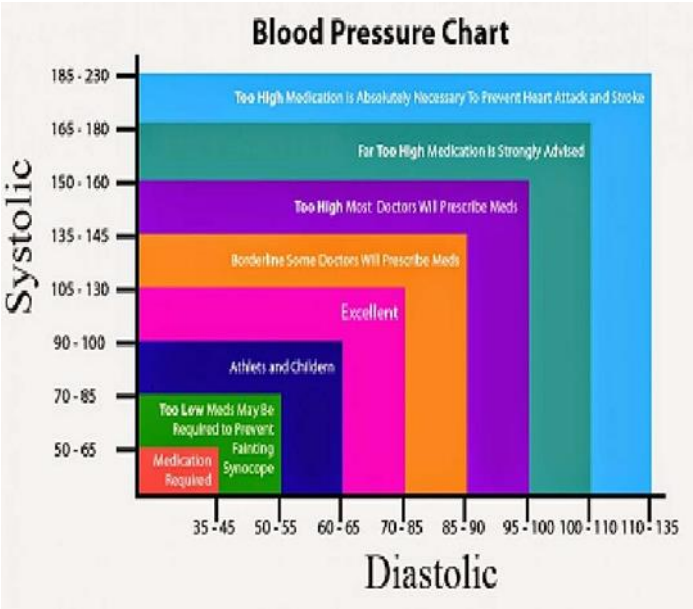

Fig.4. Systolic vs. Diastolic Blood pressure chart

For respiration measurement, two thermistors are connected to resistor bridge network in the system. Respiration will be measured by one thermistor and room temperature will be measured by another thermistor. The connection of the bridge terminals will be made to the inverting and non-inverting terminals of the operational amplifier LM741 as shown in Fig.5. The respiration monitoring will be done by the received final TTL pulse.

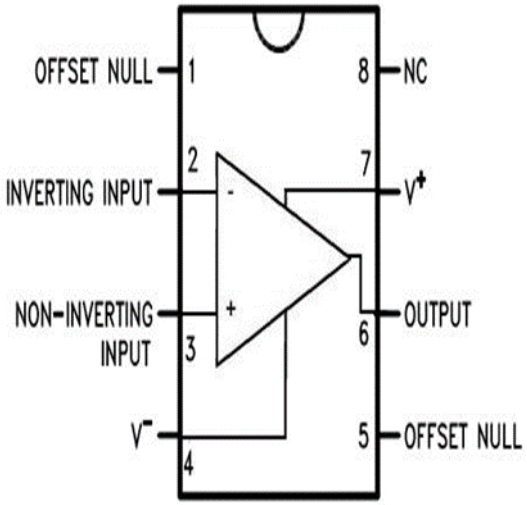

Fig.5. LM741 Pin Configuration

LM35, a temperature sensor, will sense the body temperature of a person with an accuracy level of +/-0.4℃. According to thermocouple principle, the sensors will work. This device is of analog form. To convert it into DC, a ADC will be used. Due to complete sealing of LM35, it does not undergoes any oxidation and has more accuracy than thermistor. In this case, amplification is not required. It provides the output voltage which is proportional to the sensed temperature.

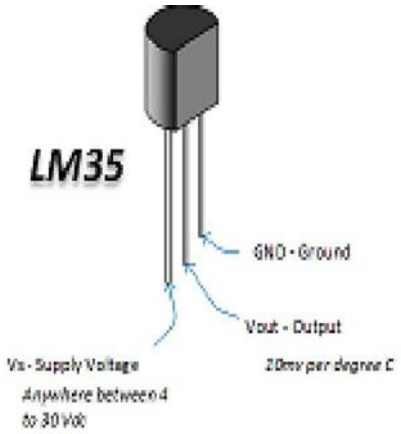

Fig.6. Pin Configuration of LM35

MMA7260QT is used to sense the body movement of the patient. This sensor, shown in Fig.7 is fit to the patients' bed. Using X, Y, Z axis, each movement of the patient can be sensed. This sensor is a micro-machined integrated-circuit accelerometer. Two surfaces are there in the module. G-cells and a signal conditioning ASIC are present in a single board. Beaming from two back to back capacitors, the g-cells are a mechanical arrangement of semiconductor materials using semiconductor processes. To measure g-cell capacitance, switched capacitors are used by ASIC, which also measures the acceleration difference between two capacitors.

Fig.7. Accelerometer sensor MMA7260QT

At the salient level of threshold bottle, IR sensors will be placed for saline level detection. Logic 1 will be sent to the Raspberry Pi when the solution will be reduced from the threshold value. Thus, the doctor and medical assistant will receive an e-mail or a SMS. So with an alert, there would be no backflow of blood as the saline water finishes from the bottle.

B. Medication and precaution according to the degree to which the patient needs attention and appliance control

Two cases can arise regarding patients' health

Major ailment- Wherever a better human monitored health monitoring system will be available, the patient would be attended quickly as per the alarm in case of a major health issue and he/she can be moved to the hospital quickly. The appliance control part would not be required in this case. Nonetheless, in other cases, appliance control part plays a major role in patients' need of optimum surrounding to cater his/her conditions. By transmitting the monitored data to Raspberry Pi module to convert it to a coding script which would communicate the appliances of a patients' room to make the conditions normal, fast responses can be achieved. For an instance, the fans will be switched on when the patient will feel hot and perspiring if his blood pressure is high. In this case, the fans will be switched on at a fast pace or the air conditioner would be switched on to normalise the condition. In opposite conditions, when the patient will feel feverish or cold, then the room heater will be switched on and the fan and air conditioner will be switched off apparently till the patient feels normal. Thus, in the same manner, through sensors, a patient friendly environment will be formed so that the patient does not feel uncomfortable in any circumstance. In the case of major ailment, an input will be asked by automatically activation of the alarm through monitoring system which will save the energy and the unnecessary use of appliance module.

Semi-major ailment- The response would not be severe in this case as compared to major health ailment. The Raspberry Pi module will display the medicine to be taken and the precautions to be provided and the room temperatures will be altered according to the patients' need. For both the cases, IoT based room control part of project is essential.

To provide the prescribed medicine on time, the alarm will be activated in both major and semi-major ailments. Through the Raspberry Pi module, the medicine and the dose of it to be taken will be displayed on the LCD display which would help the attendant or any responsible person to take care of the patient more effectively and any dose will not slip off from the mind of the attendant.

C. Database preparation from the acquired data

For future use, it is necessary to keep the medical data of a patient who was a patient earlier. This record would help the patient to take certain decisions like if they need to lose/gain weight, which drug would suit the patient, which disease are they more affected to and other information. The doctor would also be benefitted from the database recorded which would interpret the physical problems associated with the patient. The faster the doctor is able to diagnose, the easier ways he can find to cure the patients' illness in case of major health issues. The data is stored in the cloud in the Raspberry Pi module.

D. Sending alerts and medical reports to the paients' family members and concerned doctors

The doctors, medical attendants and the relatives get an email or a SMS alert which is the main purpose of the project if any of the measured physiological parameters cross the threshold value. This alert would enable the doctor to do better diagnosis and help the relatives and family members to take good care of the patient. This would also enable the patient to monitor their health and take care of it. Keeping people on right track for better health, which was earlier neglected, will now be a transforming factor in their life.

3. CONCLUSION AND FUTURE WORK

Alarm notification and prescribed medicine name along with the dosage to be taken is displayed which has been proposed in this paper. This has advanced IoT based automated remote health monitoring system. Human error is reduced in this case. Necessary actions can be taken during semi-major ailment and the health of the patient can be monitored at home as well as by the doctor. The usage of sensors for health data measurement reduces the probability of human error while taking the data.

In future, the data of all external sensors can be managed by a fully formed mobile app and other devices. Thus, the patient will get the notification regarding their current status and cloud stores their compact data. Strict security protocols like fingerprint scans and password protection can make the system more reliable so that it may not create any confusion. For better communication of the patient with the doctor, managing assistant and family members, a video call can be also provided in this system.

4. REFERENCES

[1] Ananda Mohon Ghosh; Debashish Halder; S K Alamgir Hossain, Remote health monitoring system through IoT, 5th International Conference on Informatics, Electronics and Vision (ICIEV).
[2] R. Kumar; M. Pallikonda Rajasekaran, An IoT based patient monitoring system using raspberry Pi, 2016 International Conference on Computing Technologies and Intelligent Data Engineering (ICCTIDE'16)
[3] Sarfraz Fayaz Khan, Health care monitoring system in Internet of Things (IoT) by using RFID, 2017 6th International Conference on Industrial Technology and Management (ICITM)

[4] Freddy Jimenez, Romina Torres; Building an IoT – aware healthcare monitoring system, 2015 34th International Conference of the Chilean Computer Science Society (SCCC)

[5] S. Siva1, P. Suresh, S. Seeba Merlin and R. Punidha; A Smart heart rate sensing system in the internet of Internet of Things, IJCTA, 9(9), 2016, pp. 3659-3663

[6] Felipe Fernandez and George C. Pallis, Opportunities and challenges of the Internet of Things for healthcare Systems engineering perspective, International Conference on Wireless Mobile Communication and Healthcare (Mobihealth), 2014, pp 263-266

[7] Boyi Xu, Li Da Xu, Hongming Cai, Cheng Xie, Jingyuan Hu and Fenglin Bu, Ubiquitous Data Accessing Method in IoT- Based Information System for Emergency Medical Services, IEEE Transactions on Industrial informatics, 2014, Volume:10 , Issue: 2 ,pp 1578 – 1586.

[8] Danilo F. S. Santos, Angelo Perkusich and Hyggo O. Almeida, Standard based and Distributed Health Information Sharing for mHealth IoT Systems , IEEE 16th International Conference on e-Health Networking, Applications and Services (Healthcom), 2014 ,pp 94-98.

[9] Himadri Nath Saha; Debasmita Paul; Shreyaasha Chaudhury; Siddhartha Haldar; Ruptirtha Mukherjee, Internet of Thing based healthcare monitoring system, 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON)

[10]Abhishek Kumar Verma; Saurabh Kumar; Suramya Prakash; Ashish Singh; Chandan Chatterjee; Bikash Ghosh; Arnab Patra; Himadri Nath Saha; Somen Nayak; Shopan Dey; Ratul Dey, Multi-operational home automation system using IOT, An approach, 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON)

[11] Himadri Nath Saha; Supratim Auddy; Subrata Pal; Shubham Kumar; Shivesh Pandey; Rocky Singh; Amrendra Kumar Singh; Priyanshu Sharan; Debmalya Ghosh; Sanhita Saha, Health monitoring using Internet of Things (IoT), 2017 8th Annual Industrial Automation and Electromechanical Engineering Conference (IEMECON).

