DESIGN OF HEALTH INTERNET OF THINGS FOR FUTURE APPLICATIONS

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***Abstract*—Design of health based internet of things for future medical applications.In the design process,the input senors are interfaced with raspberry pi 3 using phython language.In this , we have discussed the monitoring of heart rate, body temperature, body movement and saline levels.In this SPI plays important role in these sensors.In this proposed system, SPI Analog to digital converter module is used with three wire commands.With use of sensor reduces human error, and the size of the system reduces the oocupied space of the room.Another significant area of proposed solution is to create the optimum surroundings as per the requirement of patient's health condition.**

Keywords—Raspberry PI;Heart rate Sensor;Body Temperature;Accelerometer Meter;Ultrasonic Sensor;Appliance COntrol

I.INTRODUCTION

Inter-Connected devices plays crucial role our daily life forward towards automation, and the decreasing in price for typical IoT components allows people to innovate new products. IoT is the combination of embedded systems, sensors, software and this can be also referred to as internet of everything. As health is one of the most important issues nowadays, IoT could be utilized in the health industry as a continuous health monitoring system. At the same time, the internet is now easily available for mobile technologies, which makes remote observance in everything more popular. When a patient gets admitted to a hospital or in other location under observation of medical assistant, the relatives of the patients are anxious about his/her health situation throughout all the time. The combination of Raspberry Pi and IoT has solved this situation by a new innovative technology in healthcare system through which it is also possible to monitor the health condition of the patient remotely. Raspberry Pi is a platform which offers a complete Linux environment on a tiny platform at a very low cost, and it also permits interfacing services and actuators through the general purpose I/O pins. In this proposed system, patient's heart rate, body temperature,body movement and saline levels are measured. Instant conveyance of the health information of the patient to the relatives will make the hospital management more responsible and liable for their works.

Hospital management typically uses huge machines to measure the health data of the patients. On the other hand, we can be able to measure the health data using e-Health Sensor Platform in Raspberry Pi. This might be employed in the hospitals yet as home. Moreover, it will additionally decrease the cost of health observance and the space of the room. We have tried to develop a health monitoring system to acquire the data and share the information with the health units and relatives by remotely monitoring through the internet. In order to do this, Raspberry Pi collects the health data of the patients from the sensors and stores in the cloud and it is displayed on the website. For the security and safety issues, a role-based user authentication system is also available in the system to access the information. Also, the Raspberry Pi automatically controls the appliances according to the health condition of the patient.

II.LITERATURE SURVEY

Freddy Jimenez [1] have focused on monitoring the health of a patient and sending relevant updates and alerts to doctors, family members and other important people. However,it does not include the appliance control part, which has been added in our project, it only deals with the Monitoring part and informing the relevant people about it.

Ananda Mohan Ghosh et al. [2] has demonstrated a health care system for hospital management to allow relatives and doctors to remotely monitor the health condition of a patient via internet using Arduino Uno connected with E-health sensor shield kit and Phidgets interface kit.

Boyi Xu et al. [3] put forward the challenge of reading and storing data in the IoT platform and ways to solve it. As we know most of the IoT based systems include reading real-time data in regular intervals and health care is one of such cases. Under this scenario due to the different kinds of data and regular input of data it becomes more difficult to interpret and sequentially store the data in proper format. Hence this paper gives us a method to do that

Danilo F. S. Santos [4] have discussed the use of connected Personal Health Devices (PHD) using which proper data can be retrieved from the actual sensors. This paper actually provides a standard architecture that actually helps in sharing of data between the systems like out mobile phones and cloud databases.

Sarfraz Fayaz Khan [5] has proposed a complete and effective healthcare monitoring system using IoT and RFID tags. In this system, for supervising and weighing the health condition of the patient and for increasing the power of IoT, a combination of microcontroller and sensors have been used. But, it does not include medication and precaution according to the patient health condition by controlling the

appliances and providing the prescribed medicine which is present in our paper.

The newly proposed area, in this paper, is the activation of system and to display the varing sensed data is on time, which will be displayed in the LCD display. This alarm notification will reduce the human error and help the medical assistant or responsible person to take care of the patient more efficiently. Another unique part of the proposed solution is to create the optimum surroundings as per the requirement of patient's health condition which can be achieved by sending the measured data to the control unit of the system which in turn, commensurate to a coding script will communicate to the appliances of the patient room to create optimal room conditions.

III.METHOLODOGY

Figure 1 shows the Block diagram of the proposed system using Raspberry Pi

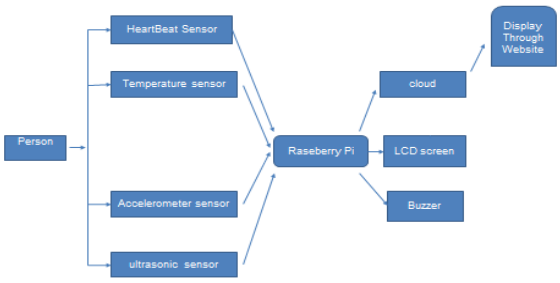


Fig. 1. Block diagram of the appliance controlled remote Health monitoring system using Raspberry Pi

In the present work, our proposed solution is divided into four basic modules as follows:

A.Health Monitoring and Data Collection:

The Health Monitoring and data collection module consists of all the below-mentioned sensors that would collect the data i.e. the health parameters from the patient.

Critical health parameters like heart rate, temperature, movement of the patient's and saline level could be monitored by various sensors available within the proposed system. After receiving the signals from these sensors, it will be sent to the Raspberry Pi. Raspberry Pi runs on a Linux based operating system named as Raspbian and it can work like a small PC.

Figure 2 shows the Raspberry Pi 3 Model B which will be used as the heart of the system. It can be programmed as per the project requirement, and also patient's health parameters can be displayed on a screen connected with pi. Moreover, one can access the system from any part of the world using the internet. The health data will be sent and stored in the cloud, and it will also be displayed on the website.

Fig. 2. Raspberry Pi 3 Model B

In the proposed system, the input senors are interfaced with raspberry pi 3 using phython language.In this , we have discussed the monitoring of heart rate, body temperature, body movement and saline levels.In this SPI plays important role in these sensors.In this proposed system, SPI Analog to digital converter module is used with three wire commands.

The heartbeat of the patient will be measured by an pulse sensor in our proposed system. A normal heart rate chart of a patient is mentioned in Figure 3. The sensor used in this proposed system will be designed to provide a digital output of heartbeat when a finger will be placed on it. When the heart detector will start working, the uppermost LED will start flashing with every individual heartbeat. The output of this sensor will be connected to the microcontroller to measure the heart beats per minute (BPM) rate. It will function according to the principle of light modulation by blood flow through the nerves of the finger at every single pulse.

Fig. 3 Heart beat sensor

The body movement of a patient will be monitored by using MMA7260QT (Figure 4 shows) which will be fit to the bed of the patient, and the sensor will detect every small movement using X, Y, Z axis. MMA7260QT is a micromachined integrated-circuit accelerometer. This module contains two surfaces.

These are micromachined capacitive sensing cells (g-cell) and a signal conditioning ASIC contained in a single board. The g-cell is a mechanical arrangement made of semiconductor materials using semiconductor process which beams from two back to back capacitors. ASIC uses switched capacitor to measure the g-cell capacitance, and it will also measure the difference in the acceleration data between two capacitors.

Fig. 4 Accelerometer sensor MMA7260QT

For saline level detection, ultrasonicsensor will be placed at the threshold level of the saline bottle. When the solution in the bottle will drop below the threshold level, it will be sensed by the sensor and the logic 1 will be sent to the Raspberry Pi. As a result, an email, as well as an SMS alert, will be received by a doctor and medical assistant. So this would help to avoid the risk of backflow of the blood to the saline bottle when it is finished.

Fig. 5 Ultrasonic sensor

The normal human body temperature range is 36.5 - 37.5 in Celsius (97.7 - 99.5 in Fahrenheit). The DS18B20 is used as temperature sensor shown in Fig. 3(d). communicates overa Wire bus with a micro-controller. It measures temperaturesfrom -55 to +125 in Celsius with accuracy of 0.5C .

Body Temperature work according to the principle of the thermocouple. It is an analog type of device and an ADC converter will be used to convert it in digital form. This sensor has better accuracy than that of the thermistor and it does not undergo any oxidation as it is completely sealed. Amplification of the output voltage is not required in this case. It could provide the output voltage, which would be proportional to the sensed temperature. DB18B20can convert 12-bit temperature to digital word in 750 ms.

Fig. 6 Body Temperature sensor

Body Temperature Chart:

Classed as:	In Celusis	In Faharenhit
Hypohermia	*<35.0*	*95.0*
Normal	***36.5-37.5***	***97.7-99.5***
Hyperthermia	*>37.50r38.3*	*99.5or100.9*
Hperpyrexia	*>40.0 or41.5*	*104.or06.7*

B.Database preparation from the acquired data:

It is important to keep the records of the medical data of a patient as it can be immensely useful in future. The storage of data will enable the patient to take several decisions like whether they need to lose weight or not, which drugs are the specifically allergic for the patient, which disease are they more prone to and much other necessary information. This database could also help the doctor to interpret the physical problem of the patient and its origin, which will lead to better diagnosis and faster recovery in case of a major health issue. This could be achieved by storing the data in a script in the cloud through Raspberry Pi module [7][8].

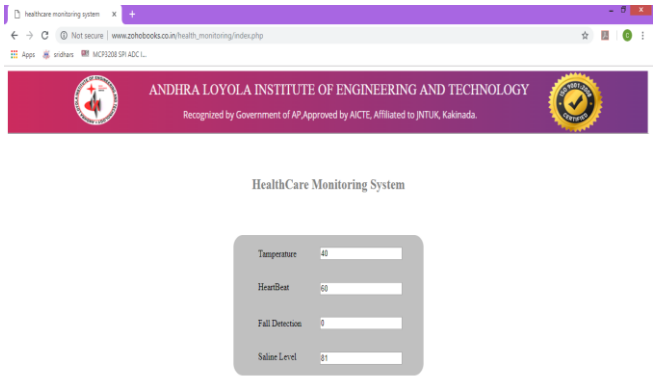
C.*Sending alerts and Medical reports to the patient's Family Members and Concerned Doctors:*

The additional feature and the most beneficial part of the proposed system is the process of sending email and SMS alert to the doctor, medical assistant, and relatives of the patient[3][4] using python script if any of the measured physiological parameters cross the threshold value. They can also monitor the patient's health condition through website login. These would enable better diagnosis from the doctor's side as well as the family members could also take good care of their patient. The patient himself/herself would be able to monitor their health and take the right decisions regarding their health. This is very important because people tend to neglect their health very often and such notifications would keep them on track for a better health.

IV.*RESULTS AND DISCUSSION*

The target of the proposed system is to determine the acceptance, validity and usability. The experimental result are shown below with picture that is taken during experiment. The acceptance, validity and usability test are evaluated by some questionnaires. Also data transfer and response time of the system are analyzed.

As we have used different types of sensor and storing them in remote database so response time of the sensor plays a vital role here.



V. CONCLUSION AND FUTURE WORK

In this paper, we have successfully proposed an advanced IOT based automated remote health monitoring system by offering the varing sensed data is on time, which will be displayed in the LCD display and through the website. It could reduce the human error. The most important feature in this system is that the health condition of the patient could be monitored from the home as well and necessary action could be taken during any changes in the patient .

The probability of human error while acquiring the data could be effectively reduced as sensors are used for health data measurement. The proposed system would also provide automatic appliance control which makes the environment comfortable for the patient. authority of the patient, and health data monitoring through the website which allows performing their regular task.

This system needs an appropriate bandwidth since website visit for remote data monitoring through internet depends on the proper bandwidth of internet connection.

In future, a fully formed mobile app can be made to manage the data of all the external sensors and other hooked up devices. This will help to send the notification in a faster and efficient way to the patient regarding their current status, and also help to make a compact data storage in the cloud. The reliability of the system can be further improved by the addition of strict security protocols like fingerprint scans and password protection so that no confusion and hassle occurs. Further, a phone call or a video call service can be included to inform doctor, medical assistant and family members about the condition of the patient and the patient could be also able to communicate with them.

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