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A Modern Approach for Smart Healthcare Monitoring System Remotely Using Iot and Raspberry Pi

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Abstract: *Internet of Things (IOT) makes changes in the world in recent days. IOT is now well developing and reduces a human effort a IOT. Nowadays, People don't care about their health due their busy schedule lifestyle. In that case of situation, IOT plays a major role to provide an effective solution through monitoring the health of the patient in hospital as well as from home. Sensors are used here to acquire the data from various health parameters and these data's are sent into the Raspberry Pi for further analysis and it is to be stored into the cloud. Stored data can be viewed through website from anywhere. This proposed system having alarm system to provide the prescribed medicine in time. It having additional features like sent an SMS or Email to the take care of the patient In order to avoid a critical situation and it also creates an optimum surroundings depending upon the patients' health. In this paper, we have discussed the monitoring of heart rate, blood pressure, respiration rate, body temperature, IR sensors.*

Keywords: *IOT, Raspberry Pi, Sensors, Alarm, Cloud*

I. INTRODUCTION

The Internet of things is the network of physical devices, vehicles, home embedded with electronics, software, sensors, actuators, and connectivity which enables these object to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities.

Fig.1 Structure of IOT

Internet of Things (IOT) evolved the world and it moves the day-to-day life of people towards automation. IOT means the interconnectivity of network with embedded software, hardware, sensors and actuators. It can be accessed by anyone, anywhere and anytime. As health is one of the major issues in recent days, so it could be handled remotely by using IOT. This is we called remote health monitoring system. Moreover, internet is widely

used across the world and can be accessed easily by using mobile phones as well. Consider the case that, when a patient is going too admitted in a hospital, then there will be always some take care person must be with that patient throughout all the time. So it is quite difficult at all the time. So this problem can be solved by using Raspberry Pi and IOT. These are going to monitoring the health condition of patients. 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.

Components of IoT

- Sensor
- Connectivity
- People and Process

Layers of IoT

- Integrated application layer
- Management layer
- Network construction layer

II. LITERATURE SURVEY

Ananda Mohan Ghosh et al. [1] has proposed a health monitoring system for managing the hospital to allow family members and consultant doctors to remotely monitoring the patients health condition through the internet with E-health sensor shield kit and Phidgets interface kit. But it does not send any notification such as email and SMS alert to the respective family members and doctors.

P Kumar et al. [2] has demonstrated a patient monitoring healthcare system which is controlled by a raspberry pi such as the heartbeat rate, respiration level, and temperature and body movement of the patient is monitored and data is collected by using sensors and displayed it on the screen using the putty software. However, it does not provide the alarm notification for insisting the family members or doctors to give the prescribed drugs to the patient which is included in our proposed solution.

Sarfraz Fayaz Khan [3] has demonstrated an effective patients healthcare monitoring system with the help of IoT and RFID tags. In this system, for monitoring the health condition of the patient and improving the power of IoT, by using the combination of microcontroller and sensors. But, it does not contain preventive measures with respect to the patient health condition by controlling the appliances and providing the prescribed drugs to the patient which is included in our paper.

Freddy Jimenez et al. [4] have considered only on monitoring the patient's health condition and sending the necessary information and notification to doctors, family members.Moreover, it does not contain the appliance control , which is included in our project, it only focused on Monitoring and provide notification to the respective people on time.

S. Siva [5] et al. have demonstrated to monitor patient's health condition by using the smart hospital system. The health condition of patient's can be monitored by using the spark kit. It gathers information about the temperature and heartbeat rate of the patient and sent an alert notification if any of the obtained parameter crosses the predefined threshold value.

Felipe Fernandez et al. [6] discussed the problem which we will be happening if we already go ahead to make an IoT based health care system. It also discussed about the reliability of an IoT based systems, which is an essential concern in the emergency of the healthcare.

Boyi Xu et al. [7] discussed the challenge of gathering and storing the data in the IoT platform and also provide the ways to solve the problem. As we know that several IoT based systems includes the behavior of reading the real time data in regular interval of time and health care is one among such cases.Due to the gathering of various data and regular input of data it becomes more complicate to analyse and store the data sequentially in a proper manner. Hence this paper provides a way to do that.

Danilo F. S. Santos et al. [8] tells about the use of connected Personal Health Devices (PHD) through which the correct data can be retrieved from the sensors. This paper actually gives a standard architecture that actually helps in sharing the data between the systems like out of our mobile phones and cloud databases.

III. SYSTEM ARCHITECTURE

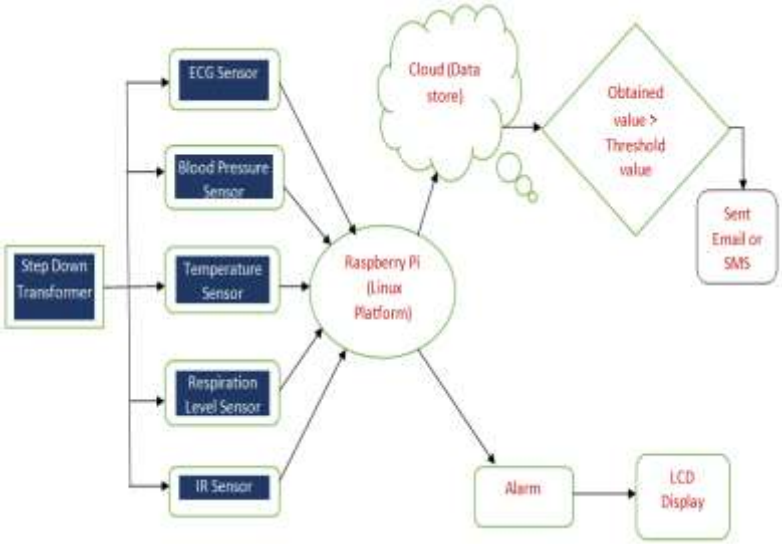

Fig.2 System Architecture

IV. SYSTEM MODULES

4.1. *Health Monitoring and Data Acquisition*

The health of the patient is monitored by using various health parameter sensors like ECG Sensor, blood pressure sensor, IR sensor, LM35 sensor .The data which is collected from these respective sensors is to be sent into the Raspberry Pi. The Raspberry Pi is a Linux based OS known as Raspbian, which looks similar to a small pc.

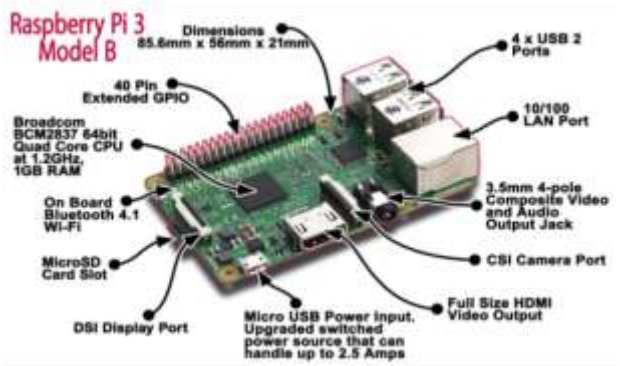

Fig.3 Raspberry Pi 3 model

1. ECG Sensor

The patient's heartbeat rate is measured with the help of an ECG sensor. Electrocardiography (ECG) makes record of the electrical activity of the heart over a regular interval of time with the help of an electrode that is fixed on the skin. Heartbeats are stimulated by bioelectrical signals which are induced in the SA (sinoatrial) node of the heart. ECG converts these signals into a range of numerical data, which is used in several applications. The sensor provides a heartbeat measurement as a output, which is in digital format.

2. Blood Pressure Sensor

It is used to measure the blood pressure of a patient. Blood Pressure means the pressure in the large arteries of circulating the blood in walls of the blood vessels. It is denoted as two terms, one is Systolic Pressure (means that maximum during the period of one heartbeat) and the other is Diastolic pressure(means that minimum in duration between the two heartbeats).The blood pressure sensor measures 80 measurements and store the data automatically.

Fig.4 *Blood Pressure sensor*

3. Temperature Sensor

The temperature of the sensor is measured accurately by using LM35 sensor. The accuracy level is +/- 0.4c.It works on the principle of thermocouple.

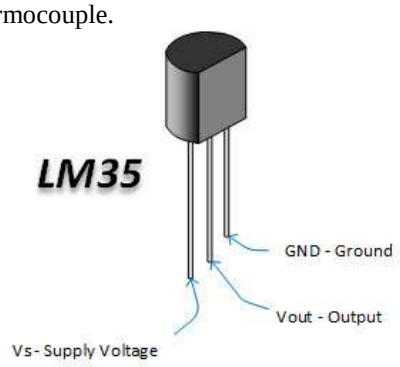

Fig.5 pin configuration

It converts analog signal into digital form. It has better accuracy when compare with thermistors.

4. Respiration level *Sensor*

The respiration level of the patient is to be measured by two thermistors. One measures the respiration level of patient and another one thermistor measures the room temperature.

5. IR Sensor

IR sensor is used to measure the saline level. The sensor is placed at the desired threshold level of the saline bottle. The sensor will sense the solution in the saline bottle continuously; if the solution level reaches below the threshold value then it sent logic 1 to the Raspberry Pi. Then an SMS or an Email alert will send to the patient relatives or consultant doctor. This also helps to avoid the risk of backflow of blood from patient to the saline bottle when the saline bottle is finished.

4.2. Precaution to the degree of patient needs and attention

The acquired data is sent by the sensors into the Raspberry Pi which translates into the language of script which communicate to the appliances which is present in the patient's room to provide an environment with the optimal and sufficient room condition. Consider that, when a patient's heart beat rate is high and he/she feels hot, then the fan/air conditioner is automatically switched on, similarly when he/she feels very cool, then the fan/air conditioner is automatically switched off.

4.3. Preparing a Database with acquired data

All the information about the patients is stored into the cloud data store. It is used for further future analysis of medical reports. It also enables to keep track of patient reports and provide a better treatment.

4.4. Sending alerts to patient's family and consultant doctor

It is the process of sending the notification as SMS or Email by using the python script to the patient's family or doctor [3][4]. When they obtained health parameters reaches above the threshold value in order to avoid the critical situation. The patient's health can also be monitored through the website. The alarm used in this proposed system to provide a prescribed medicine in time to the patient's which is displayed in the LCD screen.

V. APPLICATION & CHALLENGES OF IOT

Applications

- Retail
- Education
- Pharmaceuticals
- Management
- Logistics

Challenges

- Privacy
- Standards
- Regulation
- Development

VI. CONCLUSION

In our paper, we proposed a remotely monitoring healthcare system by using IOT and Raspberry pi successfully by means of providing notification (sms or email) and alarm generation. Through this we can reduce the possibility of a human error. Through this we can monitor the health condition of patient from home and as from hospital. In future we formed the special kind of mobile application which will sent the notification faster when compared to the present system. Furthermore, it provides a better security like fingerprint scans and password to avoid accessing the medical reports by unauthorized person. In addition to that in future, if any critical situation happens to the patient, automatically a call will be connected to the patient's family and consultant doctor immediately.

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