Chronic Health Patient Monitoring System Using IOT

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***Abstract*—**In the recent technology, Internet of Things (IoT) makes all objects interconnected and it has been recognized as the technical revolution. Some of the applications of Internet of Things are smart parking, smart home, smart city , smart environment, industrial places, agricultural fields and health monitoring process. One such application is in healthcare to monitor the patient health status Internet of Things makes medical equipment's more effective by allowing real time monitoring of patient health. We have a designed a system which is very helpful in monitoring & updating the patient health status in a graph report format to the doctor via PC or desktop. We have implemented a pulse monitoring for continuous pulse rate measurement for an hour/day is done by blood pulse sensor. Likewise body temperature, pressure, moisture, obesity has been noted using temperature sensor, pressure sensor, moisture sensor, flex sensor with the help of ADC converter. A Raspberry PI module picks up the sensor data and sends it to the network through WI-FI and hence provides real time monitoring of the healthcare parameters for doctors. These data can be accessed anytime by the doctor. The proposed system of the project is to report a clear notification of patient database health status in graphical form to the doctor side.

Keywords*-Internet of Things, health monitoring process, ADC converter,Raspberry PI,WI-FI.*

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I. INTRODUCTION

In today's era, health problems are increasing day-by-day at a high pace. The death rate of 55.3 million people dying each year or 151,600 people dying each day or 6316 people dying each hour is a big issue for all over the world. Hence it is the need of hour to overcome such problems. We, therefore, proposing a change in wireless sensors technology by designing a system which included different wireless sensors to receive information with respective human body temperature, blood pressure, moisture, obesity, heart rate etc. that will be undoubtedly further transmitted on an IoT platform which is accessible by the user via internet. An accessible database is created about patient's health history which can be further monitored & analyzed by the doctor if necessary. The data storage can be saved on the server permanently or can be reset via the software. This paper proposes a health monitoring system which is capable of detecting multiple parameters of our body such as blood pressure, temperature, heart rate & further transmitting this information on an IoT server through 2G/3G/4G technologies. Also in case of emergency, automatically generating alerts will be sent to doctors if any unusual activity is detected by or near the patient. Satisfactory work is done in health monitoring by using raspberry pi as well as IoT, but this paper gives embedded concept of both the platform. By using combination of these, the proposed structure will be more effective. In this paper, we investigated recent papers related to health monitoring systems & IoT.

Challenges in IOT:

Managing device diversity and interoperability: In the connected health domain, a variety of devices, instruments and equipment from device vendors andOEMs, located in homes and clinics, will connect to backend databases via aggregation devices located at the site. Aggregation devices are dedicated device gateways, home routers, smartphones and PCs, and their network is often referred to as the Peripheral Area Network (PAN). Commonly accepted standards of network interface are required between the devices and the aggregation device. Similarly, the interface between the aggregation device and backend medical records will be governed by regulations that mandate the use of certain approved standards and certification. Examples of standards in use in PANs include Continua Alliance Bluetooth Profiles and the ISO/IEEE 11703-20601 Optimized Exchange protocol[1]. An emerging problem today is that there are still many vendors who do not support these standards in their products, thus leading to significant interoperability issues and increased system integration costs.

Data integration: In order to build intelligent, context-aware health and wellness applications that generate relevantpatient-specific cues and alerts, there is a need to integrate data from multiple sources. These sources include differenttypes of medical devices such as blood pressure monitors, weighing scales, thermometers, pulse-oximeter, glucose meters, ECG monitors, imaging systems as well as equipment such as fitness and strength machines.

Scale, data volume and performance: As the quality and accuracy of medical devices improve, more applications will be developed for an expanding user base. The amount of data that needs to be ingested, stored and analyzed will also increase exponentially. Some medical devices will need to store high resolution data, and some will generate multimedia output such as high resolution images and videos. This will lead to a typical 'Big Data' problem where the sheer volume and velocity of data ingested will make standard architectures and platforms inadequate. In other cases, some applications may demand more stringent real-time performance than what are ordinarily possible using standard internet technologies. Applications and the database backend must be seamlessly scaled up as operations become more complex.

Flexibility and evolution of applications: As newer analytics, techniques, algorithms, use cases and business models evolve; advanced medical devices with improved capabilities will be created. Newer applications and software components need constant upgrades by specialists with specific technology and medical domain skills. Many of the applications will be in the form of dedicated purpose-built 'apps' that are developed using acrowdsourcedmodel and downloaded by end users from an app marketplace. The ability to quickly develop and deliver appswith minimal effort is a key requirement. There is a need to create ecosystems and platforms that sustain such a crowd sourcedapplication development and consumption model.

II. LITERATRURE SURVEY

[1] In this paper, they reviewed the current state and projected future directions for integration of remote health monitoring technologies into the clinical practice of medicine. Wearable sensors, particularly those equipped with IoT intelligence, Offer attractive options for enabling observation and recording of data in home and work environments, over much longer durations than are currently done at office and laboratory visits. This treasure trove of data, when analyzed and presented to physicians in easy-to-assimilate visualizations has the potential for radically improving healthcare and reducing costs. We highlighted several of the challenges in sensing, analytics, and visualization that need to be addressed before systems can be designed for seamless integration into clinical practice. [2] Health related issue and parameters are most important to man, and is essential to his existence and influence and thus he has sought for an improved system that would be able to capture and monitor the changes in the health parameter. This work presents a system that is capable of providing real time remote monitoring of the heartbeat with improving alert. In their project they monitor the heart beat rate of the user by pulse sensor and when the pulse rate reach above or below the given threshold value. Then Heart rate is displayed in the LCD it then proceeds to alert by an alarm and SMS sent to the mobile phone of the medical expert or health personnel, if and only if the threshold value of the heartbeat rate is maximally exceeded. This system designed and developed a reliable, energy efficient for sending alert message to the concern person when person in coma. The system used smart sensors like flex sensor, MEMS body sensor and eye blink sensor.Whenever person moves any finger, any eye lid and tilt the body towards right or left side, the flex sensor, eye blink sensor and MEMS sensor detects the movement respectively, and alert to the concern person through GSM. It send message through the GSM modem to the concern person showing the status of the body detection at a different parametric values of a graphical notation format by performance analysis of body condition. The system monitor physically 24*7 for getting the improvement of comatose patient for further treatment.Persistent aberration of heart rate may be an indication of serious health complication such as coronary Artery Diseases,Tachycardia and Hypertension.Hence heart rate monitoring is extremely essential in order to keep track of one's heath. Unlike traditional method like Electro-cardiogram which are complicated and non-portable ,there is a need for a simple and affordable heart rate measuring device. This paper expounds the design and working of a device based on principle of Photoplethysmography.It is an economical user friendly and low power consuming device. The performance of the device was evaluated and their results were compared with the reports of conventional heart rate monitor, deviation was absorbed minimal.Technology plays the major role in healthcare not only for sensory devices but also in communication, recording and display device. It is very important to monitor various medical parameters and post operational days. Hence the latest trend in Healthcare communication method using IOT is adapted. Internet of things serves as a catalyst for the healthcare and plays prominent role in wide range of healthcare applications. The sensors such as temperature sensor and pulse oximeter sensor are connected to the microcontroller picks up the sensor data and send it to the network through Wi-Fi and hence provide real time monitoring of the health care parameters for doctors. The data can be accessed anytime by the doctor. But the major issue in remote patient monitoring system is that the data as to be

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114 – 119

securely transmitted to the destination end and provision is made to allow only authorized user to access the data. The security issue is been addressed by transmitting the datathrough the password protected Wi-Fi module ESP8266 which will be encrypted by standard AES128 and the doctor can access the data by logging to the html webpage. At the time of extremity situation alert message is sent to the doctor through GSM module connected to the controller. Hence quick provisional medication can be easily done by this system. This system is efficient with low power consumption capability, easy setup, high performance and time to time response. Wireless remote patient monitoring has the scope to improve patient experience while enabling data transmission to support effective patient care. Dash7 and ZigBee are potential wireless technologies which can facilitate this. Dash7 or ZigBee, when integrated with a mobile phone accompanied by the patient, Can overcome the problem of range, limitation imposed by traditional wireless patient monitoring solutions. A wireless remote monitoring system using integrated Dash7 or ZigBee and mobile phone technologies is proposed. Reliability is a key requirement in patient monitoring systems. Signal interference can affect the reliability of wireless systems. This paper investigates signal interference on Dash7 and ZigBee in a multi-technology environment.

III. EXISTING SYSTEM

The personal health monitoring of each individual is considered very important because of rise in health problems in today's world increasing stressful lifestyle is taking maximum toll on the public health. With the ever increasing queues at hospitals and ever increasing number of patients, the doctor fees have sky-rocketed which is affecting especially those patients who cannot afford the fee or who are not suffering from major alignments but get to know so only after paying a hefty fee to the doctor. The researchers and surveys often demonstrate that most of the major aliments are the result of careless attitude towards the minor health aliments. Majority of these issues can be solved by just following a good diet, proper sleep pattern and regular exercising.

The needs of both patients and health care providers must be addressed. This is essential, challenging, and achievable. Information privacy in health involves optimizing individual rights and public good. The benefits expected include:

- Improved clinical decision making.
- Reduced duplication of diagnostic testing, imaging and history taking.
- Better medication management.
- Increased adoption of screening programs and preventive health measures.
- Communication between all healthcare providers involved in care of patients will be via electronic means.
- Healthcare providers will still be allowed to maintain detailed and confidential paper medical records.

IV. PROPOSED SYSTEM

In the advanced development of technology, IoT makes all objects interconnected and it's been recognized as the next technical revolution .One such application in healthcare to monitor the patients' health status. Internet of things makes medical pieces of equipment more efficient by allowing real-time monitoring of patients health in which sensor acquire data of patient and reduces human error. The significant challenges in implementation of internet of things for health applications are monitoring data of all patients from various places. Thus internet of things in the medical field brings out the solution for effective patient monitoring at reduced cost and also reduces the trade-off between patient outcome and disease management.From the analysis of results using raspberry pi platform efficiency of this system is high and also time reduces while measuring medical parameters of patient with help of internet of things.

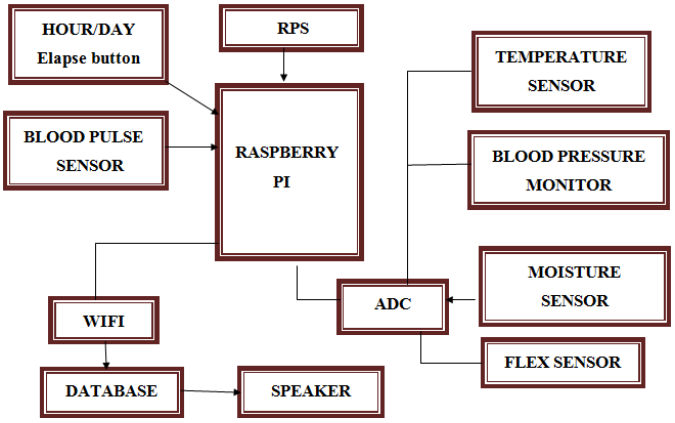

Figure 1: Block diagram of proposed system

The system has been designed for health monitoring process. One such application is in healthcare to monitor the patient health status Internet of Thingsmakes medical equipment's more efficient by allowing real time monitoring of patient health. We have a designed a system which is very helpful in monitoring & updating the patient health status in a graph report format to the doctor via PC or Desktop. We have implemented a WLAN Technology for the faster communication. Thus we have implemented a PULSE MONITORING for continuous pulse rate measurement for an Hour's/Day is done by Blood pulse sensor. Likewise Body Temperature has been noted by using Temperature Sensor with help of ADC converter. A Raspberry PI module picks up

the sensor data and sends it to the network through Wi-Fi and hence provides real time monitoring of the health care parameters for doctors. These data can be accessed anytime by the doctor. The proposed system of the Project is to report a clear notification of patient database health status in graphical form to the doctor side.

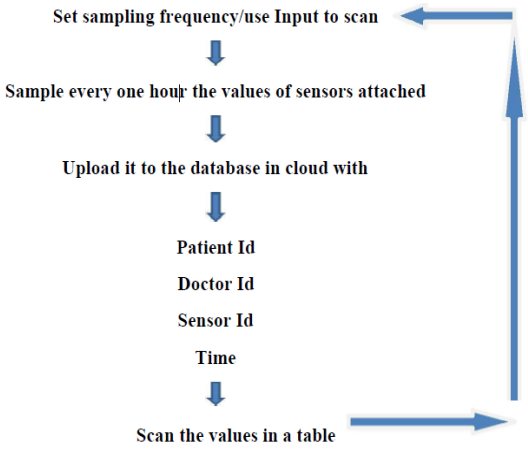

Figure 2: Hardware Algorithm

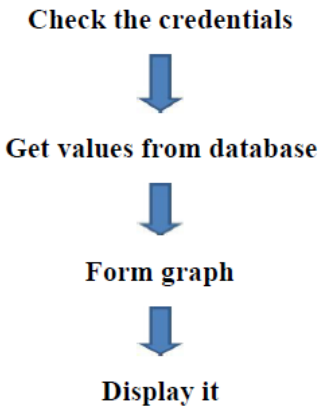

Figure 3: Software Algorithm

V. HARDWARE DESCRIPTION

RASPBERRY PI 3:

The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications andsupersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B.

Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings a more powerful processor, 10x faster than the first generation Raspberry Pi. Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.

Newer versions of the firmware contain the option to choose between five over clock ("turbo") presets that when turned on try to get the most performance out of the SoC without impairing the lifetime of the Pi. This is done by monitoring the core temperature of the chip, and the CPU load, and dynamically adjusting clock speeds and the core voltage. The Raspberry Pi may be operated with any generic USB computer keyboard and mouse. The Raspberry Pi does not come with a real-time clock, which means it cannot keep track of the time of day while it is not powered on.

Figure 4:Raspberry Pi

Temperature Sensor:

Thermistor is used to measure the temperature. Thermistor is nothing but temperature sensitive resistor. There are two type of thermistor available such as positive temperature co-efficient and negative temperature co- efficient. Here we are using negative temperature co-efficient in which the resistance value is decreased when the temperature is increased.

Pulse Sensor:

The pulse oximeter used detect the pulse rate is based on the red and infrared light absorption characteristics of oxygenated and deoxygenated hemoglobin. Oxygenated hemoglobin absorbs more infrared light and allows more red lights to pass through. Deoxygenated (or reduced) hemoglobin absorbs more red light and allows more infrared light to pass-through. Red light is in the 600-750 nm wavelength light band. Infrared light is in the 850-1000 nm wavelength light band. Pulse oximeter uses a light emitter with red and infrared LEDs that shines through a reasonably translucent site with good blood flow.

Flex Sensor:

This flex sensor is a variable resistor like no other. The resistance of the flex sensor increases as the body of the component bends. Sensors like these were used in the Nintendo Power Glove. They can also be used as door sensors, robot whisker sensors, or a primary component in creating sentient stuffed animals.

Loudspeakers:

Loudspeakers have been used for many years to convert electrical signals into audio sound waves. Although the basic

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114 – 119

principles of the loudspeaker are relatively easy to grasp, the actual design of a high quality unit is not simple: designing one and optimizing it for the best sound is a difficult process.

VI. RESULTSAND DISCUSSIONS

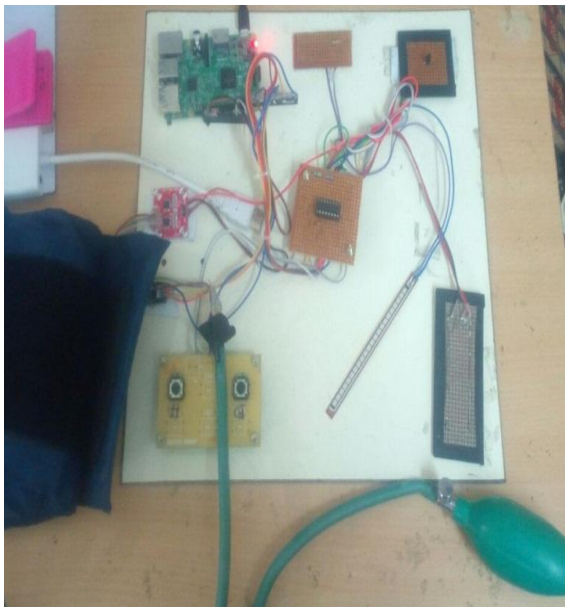

Figure5:Prototype Circuit Setup

The above shown diagram is the prototype of our proposed system.The proposed system of theProject is to report a clear notification of patient database health status in graphical form to the doctor side. Thus the following designed system which is very helpful in monitoring & updating the patient health status in a graph report format to the doctor via PC or Desktop. We have implemented a WLAN Technology for the faster communication. Thus we have implemented a PULSE MONITORING for continuous pulse rate measurement for an Hours/Day is done by Blood pulse sensor. Likewise Body Temperature has been noted. Since it has been recognized as the next technical revolution of the applications of Internet of Things are smart parking, smart home, smart city, smart environment, industrial places, agriculture fields andhealth monitoring process.

The following resulted output to get is to carry two processes:

Initially web server link will be provided. By clicking that the corresponding login page will be displayed this is shown below, in that we must give the username and password to proceed for the next page.

The following output in the graph format i.e. pulse sensor, temperature sensor from the corresponding sensors which is shown below. It consists of daily sheet management and monthly sheet management.

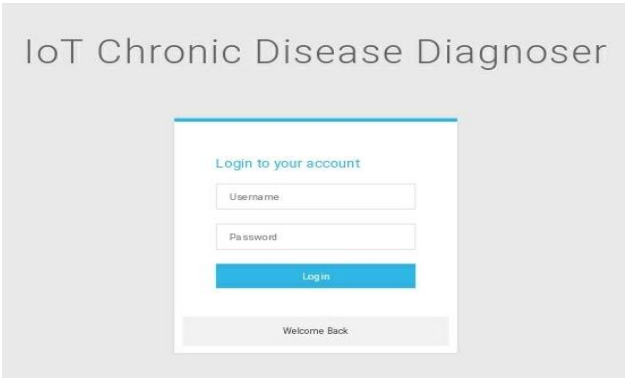

Figure 6: Login page

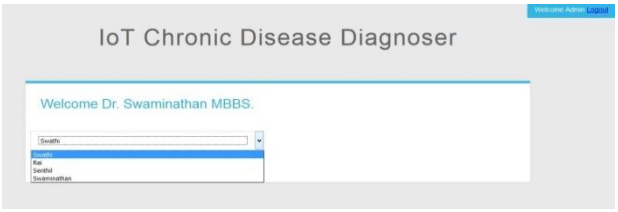

Figure 7: Webpage for doctor choosing patient's details

In graph, X axis says that no. of time readings has been taken, y axis says range for that sensors i.e., in terms of bpm(beats per minute) for blood pulse, degree for body temperature,mm Hg for blood pressure,w-wet basis moisture and obesity.

Figure 8: Graph of patient details obtained using IOT

VI. CONCLUSION

After connecting these sensors to the Raspberry Pi board, adding Raspberry Pi MAC address and Programs to the website. After connecting internet to the Raspberry Pi, it act as a server. Then the server is automatically sends patient's health status to the website. Using this website link anybody can monitor patient's health status anywhere in the world. So it is very useful for patient's to give first aid at anytime and to report a clear notification of patient database health status in graphical form to the doctor side.In future, by sending an alert message to the blood bank in the emergency situation, the patient's life can be saved without delay. So it is very useful for patient's to give first aid at any time. Similarly other Device like ECG, EEG can be made connected to gather additional information about patient health status.

VII. ACKNOWLEDGMENT

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