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Proteus Simulation Based Smart Healthcare Monitoring System in Internet of Things (IOT)

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ABSTRACT: A smart healthcare system in an IOT environment can monitor a patient's basic health signs as well as the room condition where the patient is, in real-time. Sensors are used to capture the data from the hospital environment. A few of the sensors used are heart beat sensor, body temperature sensor, room temperature sensor and blood pressure sensor. Healthcare professionals play a major role in collecting data from the patient's ward for necessary diagnosis and advise. In the current medical practice , the patient needs to remain in the hospital where biomedical instruments can be used to gather vital data from the patient. Secondly, healthcare professionals should be with the patient at all times. Our automated system is aimed at overcoming these challenges and ensuring continuous and remote monitoring of patient.

The main objective of proposed system is to transmit the patient's health monitoring parameters using wireless communication. Arduino Board, an IOT device that interfaces five sensors and reads the patient health parameters is used for the purpose. The health parameters are wirelessly transmitted to Cloud. Doctors and caretakers can access the data from the Cloud.

The proposed outcome of the project is to deliver proper and efficient medical services to patients by connecting, collecting, recording, analysing and sharing data such as patient's heart rate, blood pressure, body temperature, room temperature using health status monitors. The system is designed to send emergency alerts to the patient's doctor with the current status and full medical information.

KEYWORDS: IOT, Internet, Arduino, Sensors

I. INTRODUCTION

Many lives are affected even during the course of a medical treatment because patients are not provided timely and proper treatment. It's difficult to deliver timely treatment as real time parameter values are not efficiently measured in healthcare centres. Due to various situations, it can be difficult for healthcare professionals to continuously check a patient's conditions. In many cases, continuous monitoring of ICU patients is also difficult.

In order to deal with such situations, a system needs to be devised that helps measure and monitor various parameters such as temperature, ECG, heartbeat etc. The results can be recorded using Arduino as a microcontroller and displayed on an LCD display. The results can also be manually uploaded into a web-based server, which will enable healthcare providers to access the data from anywhere and at any time. The system currently used in most healthcare centres are based on manual methods and don't have 100% accuracy.Automated system is designed to provide real-time data and with 100% accuracy. The system is also designed to send an automated SMS to pre-configured mobile numbers using a standard IOT module interfaced to the Ardunio microcontroller, if a particular patient's health parameter(s) falls below the threshold value.

Cyber physical systems for healthcare applications use wireless sensor networks (WSN) or Cloud Computing that are based on a comprehensive taxonomy, which involves eight perspectives such as application, architecture, sensing, data management, computation, communication, security, and control/actuation. The systems allow real-time ECG monitoring and arrhythmia detection using Android-based mobile devices, but with the application available only on download. A system for telemonitoring patients, where the sensor data is relayed to the server using a smart device or a base station in close proximity is also available. Doctors and caregivers can remotely monitor patients in real time through the data received from the system. There is also a system that uses a wireless sensor network to observe the

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after effects of medicine on patient suffering from chronic heart diseases, in their home. This remote monitoring system helps reduce the risks of patients relapsing after a treatment is provided.

Wireless sensor network for health monitoring system by using IOT module can be used in a healthcare centre and in remote. The Programmable Interface Controller with low cost implementation can be efficiently used for recording and transmitting bio-medical signals by wireless technology. An IP-enabled internet and visualization module can be used to graphically demonstrate the recorded biomedical signals, enabling healthcare providers to respond quickly. Effective deployment of android mobile using Machine to Machine devices ensure fast data transmission. Moreover, the tele-medical systems focus on the measurement of health care parameters based on two different designs of a Body Area Network connected to Android Smartphone, which enables global access and versatile applications.

II. LITERATURE REVIEW

Alok Kulkarni et.al (2014), has discussed about Healthcare delivery as an emerging patient-centric model of health information exchange, which is often outsourced to be stored at a third party, such as Cloud providers. However, there have been wide privacy concerns as personal health information could be exposed to those third party servers and to unauthorized parties. To assure the patients' control over access to their own healthcare data, it is necessary to encrypt the data before outsourcing. Yet, issues such as risks of privacy exposure, scalability in key management, flexible access and efficient user revocation, have remained the most important challenges toward achieving fine-grained, cryptographically enforced data access control [1].

Mir Sajjad, Hussain Talpuret.al (2015), has presented a novel patient-centric framework and a suite of mechanisms for data access control of healthcare data stored in semi-trusted servers. To achieve fine-grained and scalable data access control, it's necessary to leverage attribute-based encryption (ABE) techniques to encrypt each patient's healthcare file. Different from previous works in secure data outsourcing, it focuses on the multiple data owner scenario, and divides the users in the healthcare system into multiple security domains that greatly reduces the key management complexity for owners and users. A high degree of patient privacy is guaranteed simultaneously by exploiting multi-authority ABE [2].

K. Natarajan et.al (2016), has presented a scheme that enables dynamic modification of access policies or file attributes, supports efficient on-demand user/attribute revocation and enables break-glass access under emergency scenarios. Extensive analytical and experimental results are presented to show the security, scalability and efficiency of our proposed scheme [3].

Gaurav Sharma et.al (2015), has discussed about a project that is initiated to address a wide spectrum of security issues within Healthcare by the European AIM/SEISMED (Advanced Informatics in Medicine/Secure Environment for Information Systems in Medicine). It also provides practical guidelines for secure healthcare establishment. [4].

In a literature published by Cosmin Gabriel et.al (2017), the author has discussed the vital signs or physiological parameters which are the critical factors to determine an individual's health status. These measurements, which are very vital for assessments, include counting the number of pulses in one minute and checking forehead palpation for body temperature manually. Monitoring them become critical procedure to gain information about the health status of patients in any given scenario. That is why there have been continuous improvements and enhancements of the vital signs collection equipment, transmission protocols and graphical presentation for the doctors in an informative and easy to understand approach. The values of all the bio-signals taken from different sensors of e-health platforms influence the medical professional's interpretation of a patient's overall condition and affect the course of treatment for each patient individually. Pulse is defined as the palpable rhythmic expansion of an artery produced by the increased volume of blood pushed into the vessel by the beating of the heart. In most clinical circumstances, pulse rate is very similar to heart rate. Some other factors such as irregular pulse or low body temperature, play a significant role in the inaccuracy of reading t for Information Systems in Medicine). It also provides practical guidelines for secure healthcare establishment. [5].

Mehmet Aktaset.al (2018), has presented "An Overview on Heartrate Monitoring and Pulse Oximeter System". A device is described that measures the heart rate of a patient by placing sensors on the fingers. The result is displayed on an LCD. This designed system can be used by untrained people as well. The change in heart rate can be graphically displayed using graphical LCD. Over a period of time, maximum and minimum heart rate can be displayed using the

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designed system. Abnormalities are displayed on LCD and indicated by buzzer. In order to send heart rate to PC, output should be attached.

Gonzalo Mateoset.al (2016), has presented "Heart rate Measurement from the Finger Using Microcontroller". IOT has a wide range of applications. IoT has been developed for Wireless Sensor Network (WSN). Using IOT, health monitoring designs are presented. There are some problems that are related to health monitoring and IOT. New technologies help to deliver better quality and improve security. Aurdino board, Wi- Fi modules, temperature, pulse oximeter, blood pressure, heartbeat rate sensors are used in IoT [Information Systems in Medicine]. It also provides practical guidelines for secure healthcare establishment[6].

III. PROPOSED SYSTEM

The proposed system consists an Arduino microcontroller with Wireless Body Area Sensor Network. Figure 1 represents that Architecture of proposed work.The sensors used here are, Temperature sensor, Blood pressure sensor, Heart beat sensor. These sensors are placed on a human body to monitor the health condition without disturbing the daily routine of the patients. These health related parameters are communicated to the physician's server using long range wireless technology.

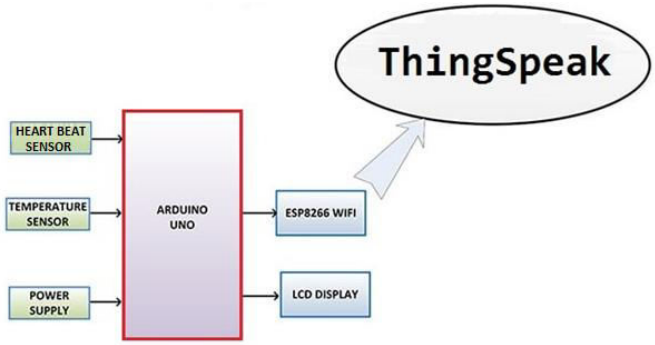

Fig 1: Architecture of Proposed work

The sensor senses the physical parameter of the patient.This physical parameter or non- electrical form is converted into electrical form.The electrical data is sent to the micro-controller which analyses the data and transmits it to the server or PC/ mobile and saves as files.Check the condition. If all the data are in normal levels, no message is sent. However, if the data deviates from the normal value, then a message is sent to the family member or healthcare professional.

3.1 HARDWARE USED

Arduino: The Arduino Uno, as the name suggests is a compact, complete and bread-board friendly microcontroller board, and easy to use programmable open source micro controller board that can be integrated into a variety of electronic components. The components of Arduino are:

- Blood pressure sensor
- Temperature Sensor
- Heartbeat Sensor
- Potentiometer
- Ardunio
- LED Display

Blood pressure sensor: The blood pressure sensor is a non-invasive sensor designed to measure human blood pressure

Temperature Sensor: Temperature sensors enable accurate non-contact temperature measurement in medical applications. The most common applications for this type of temperature sensor is measuring human body temperature.

Heart Pulse Rate Sensor: The heart sensor measures the pulse wave, which are changes in the volume of a blood vessel that occur when the heart pumps blood.

Potentiometer: A potentiometer is a three terminal resister with a sliding or rotating contact that forms an adjustable voltage divider.

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Ardunio: Arduino uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins. Commonly used in many projects and autonomous systems.
LED Display: A liquid crystal display has liquid crystal material sandwiched between two sheets of glass .LCDs are commonly used for portable electronics devices.

3.2.Cloud server

Some of the benefits of using an online server and operating it as a proxy for routing messages between users and the devices are:

Fig 2: Cloud Server interfacing

Enables users on one network to control devices on another network. For example, figure 2 cloud server interfacing a device connected to a home network can be controlled via a smartphone connected to a cellular network.Devices operate as network (TCP/IP) clients, thus no router port forwarding or other tricks are required for gaining access to the devices via the online server.Devices acting as network clients operate in stealth mode, thus greatly improving the security of the devices. Small devices typically do not have the resources for providing a direct web interface. The online server manages all the heavy lifting of providing a web interface for the devices, thus greatly minimizing the code complexity in the devices.

IV. EXPERIMENTAL RESULTS

The Internet of Things (IoT) is an interconnection of uniquely identifiable embedded computing devices within an existing Internet infrastructure. Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to machine communications (M2M) and covers a variety of protocols, domains, and applications. M2M refers to direct communication between devices such as machines, smart phones and appliances.

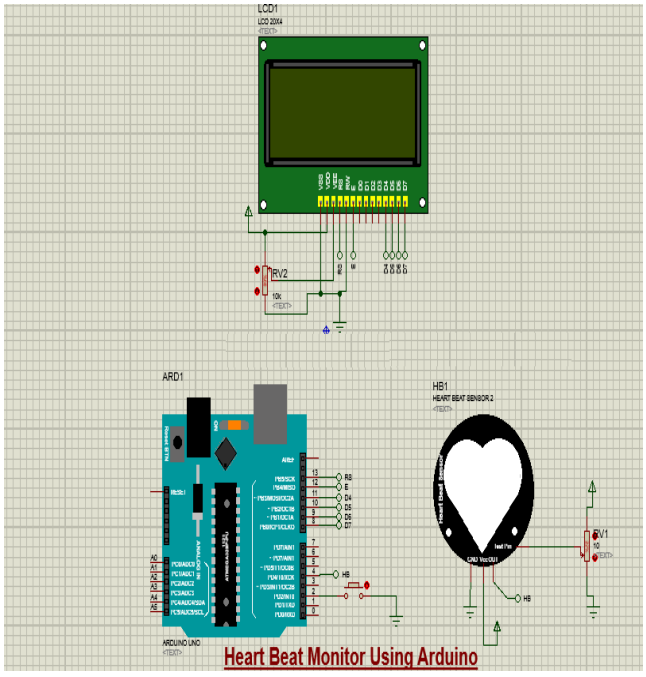

Fig 3: Initial condition

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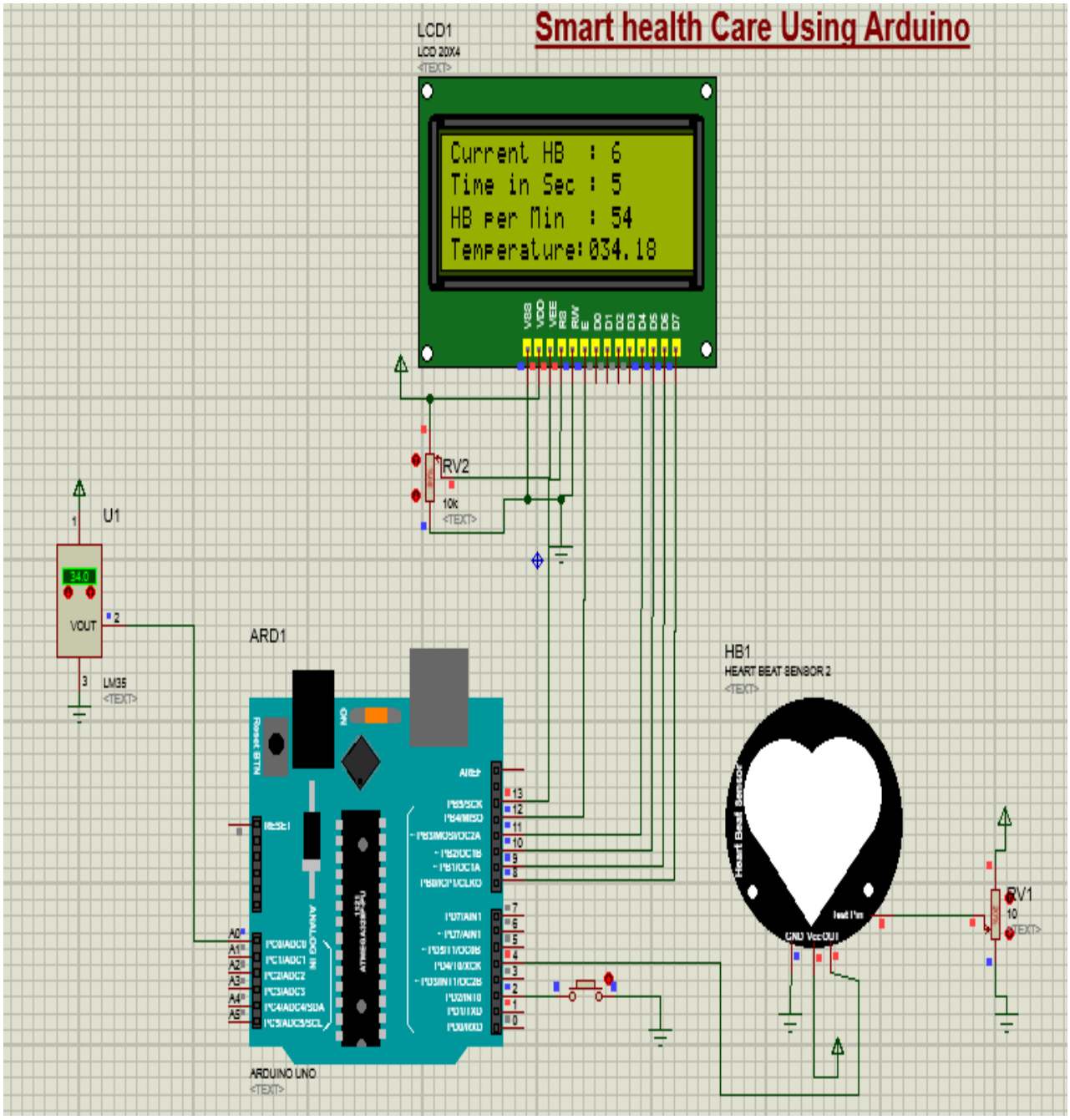

Fig 4: Experimental results

Proteus is used to simulate, design and draw electronic circuits. It was invented by the Labcenter Electronic.By using Proteus, you can make two-dimensional circuits designs.With the use of this engineering software, you can construct and simulate different electrical and electronic circuits on your personal computers or laptops. Figure 3 illustrate the first state of working and figure 4 is the experimental snapshot of results,There are numerous benefits to simulating circuits on Proteus before building them.Designing circuits on Proteus takes less time than constructing the circuit.The possibility of error is less in software simulation such as loose connection, which takes a lot of time to identify connection problems in a practical circuit.Circuit simulations provide the main feature that if some components of circuits are not practical, then you can construct your circuit on Proteus.

In the existing system, active network technology to network various sensors with one way communication to a single PMS. Patients' various critical parameters are continuously monitored via single PMS and reported to the Doctors or Nurses in attendance for timely response in case of critical situations. The sensors are attached to the body of the

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patients without causing any discomfort to them. In this PMS, we monitor important physical parameters like body temperature, ECG and blood pressure using the sensors.
The main objective is to design a Patient Monitoring System with two-way communication i.e. not only the patient's data is sent to the doctor through IOT and email on emergencies, but also the doctor can send required suggestions to the patient or guardians through IOT, Call or Emails. Patient or guardian can track patient's location at any point in time through Google Maps which enables sending medical services in case of an emergency for non-bed ridden patients.

V. CONCLUSION

The main idea of the proposed system is to provide better and efficient health services to patients by implementing a networked information Cloud that enables experts and doctors to make use of vital data and provide a fast and efficient healthcare solution. The final model will be well equipped with the features where a doctor can examine patient from anywhere and at any time. We can also have an emergency scenario option to send an emergency mail or message to the doctor with patient's current status and full medical information.

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