Health Monitoring System Using IOT and GSM

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Abstract – **As elderly population increases day by day this automatically increases caretaking demands. Hence patient health monitoring systems are gaining importance in our day to day life. The system proposed in this paper is an advanced solution for monitoring the patients. We have designed and developed a genuine, patient monitoring system. It is capable to send parameters of a patient in a real time. It enables the doctors or a user to monitor patient's health parameters such as temperature and pulse rate in real time. The current proposed system is using different sensors which are connected to the Arduino board. And the data received is then sent to the server using Ethernet shield which is attached to the Arduino board. If any of the parameters goes beyond the threshold value an alert is given to the doctor using GSM module attached to Arduino board and the patient immediately from anywhere.**

Index Terms – **Sensors, Arduino board, Internet of Things, GSM, Health parameters.**

1. INTRODUCTION

In the new era of communication and technology, the explosive growth of electronic devices, smart phones, and tablets which can be communicated physically or wirelessly has become the fundamental tool of daily life. The next generation of connected world is Internet of Things (IoT) which connects devices, sensors, appliances, vehicles and other "things". The things or objects may include the radio-frequency identification (RFID) tag, mobile phones, sensors, actuators and much more. With the help of IoT, we connect anything, access from anywhere and anytime, efficiently access any service and information about any object. The aim of IoT is to extend the benefits of the Internet with remote control ability, data sharing, constant connectivity and so on. Using an embedded sensor which is always on and collecting data, all the devices would be tied to local and global networks. The term Riot, often called Internet of everything, was 1st introduced by Kevin Ashton in 1999 who dreams a system where every physical object is connected using the Internet via ubiquitous sensors. The IoT technology can provide a large amount of data about human, objects, time and space. While combining the current Internet technology and IoT, provides a large amount of space and innovative service based on low-cost sensors and wireless communication. IPv6 and Cloud computing promote the development of integration of Internet and IoT. It is providing more possibilities for data collecting,

data processing, port management and other new services. Every object which connects to IoT requires a unique address or identification with IPv6. There are so many people in the world whose health may suffer because they do not have proper access to hospitals and health monitoring. Due to the latest technology, small wireless solutions which are connected to IoT can make it possible to monitor patients remotely instead of visiting the physical hospital. A variety of sensors which are attached to the body of a patient can be used to get health data securely, and the collected data can be analyzed (by applying some relevant algorithms) and sent to the server using different transmission media (3G/4G with base stations or Wi-Fi which is connected to the Internet). All the medical professionals can access and view the data, take decision accordingly to provide services remotely with the passage of time and development of society; people recognize that health is the basic condition of promoting economic development. Some people say that existing public health service and its supportability have been greatly challenged with respect to time. Worldwide the Government and industry are investing billions of dollars for development of IoT computing, and some of these projects include China's National IoT Plan by Ministry of Industry and IT, European Research Cluster on IoT (IERC), Japan's u-Strategy, UK's Future Internet Initiatives and Italian National Project of Integrity. The IoT applications in the field of medical and healthcare will benefit patients to use the best medical assistance, shortest treatment time, low medical costs and most satisfactory service. Health monitoring is important to be checked regularly in order to make sure our body constantly maintain in healthiness and excellent condition. Generally, the vital parameters observed for health monitoring such as Heart Rate (HR), temperature, weight, blood pressure, glucose, and ECG. These parameters will interpret some important information regarding body health, for example, high temperatures indicate someone having fever while unstable heart rate is a sign to heart problem. One of the methods to do health monitoring is to use remote patient monitoring. This device operates remotely by collecting and sends data to a monitoring station for display, interpretation, and storage for patient history record. Such "home telehealth" applications might include using telemetry devices to capture a specific vital sign. Such services can be used to supplement the use of visiting nurses or to get medical consult from the doctor in a

time where hospital error is the 6th leading cause of preventable death, having sensors embedded in equipment could serve as a line of defense and reliability. With the diversity of wireless monitoring devices and services now available in the market, they can work together to create a complete information network. For example, various health parameter sensors can be connected to blood pressure, ultrasound, heart rate, or any kinds of devices that could automatically show the information that has been received to healthcare professionals. It will then make the equipment more effective and fruitful by allowing real-time monitoring of patient health. The internet of things is the inter-networking of various devices, connected devices, smart devices and other items which are rooted with electronics software, actuators, sensors and network connectivity that provide access to these objects to gather information and exchange data in real time. IoT is defined as "the infrastructure of the information society" by Global Standards Initiative of Things in the year 2013. IoT permits the objects to be sensed or controlled remotely across a varied network, by building additional choices leading to an improved efficiency, accuracy and economic profit.

2. RELATED WORK

The internet of things is the inter-networking of various devices, connected devices, smart devices and other items which are rooted with electronics software, actuators, sensors and network connectivity that provide access to these objects to gather information and exchange data in real time. IoT is defined as "the infrastructure of the information society" by Global Standards Initiative of Things in the year 2013. Each thing is individually identified by its embedded processing and computing system, however, is in a position to interoperate among the prevailing web infrastructure. Expert estimates that the IoT will incorporate nearly fifty billion objects by 2020. Typically, IoT provide advanced connectivity options to various devices and systems. Machine-to-machine (M2M) communications covers a wide range of domains and applications. Internet of things, refer to as large variety of devices such as heart implants, biochip transponders, automobiles with built-in sensors, DNA analysis devices for various environmental etc. Legal students suggest looking at "Things" as an "inextricable mixture of hardware, software, information and different service". The respective devices then collect various data/information regarding it with the help of currently available devices and technologies that are currently being used, and then automatically transfers the information and data between different devices. Current market examples embrace home automation (can be referred as smart home devices) such as the automation of lighting, heating (like smart thermostat), ventilation, air conditioning (HVAC) systems, and appliances such as washer/dryers, robotic vacuums, air purifiers, ovens or refrigerators/freezers that use Wi-Fi for remote monitoring there is large for the internet which uses wireless technologies to monitor the patient in a hospital as well as nursing homes due to which the wireless technology provides better treatment to patient even if they not feeling well in a hospital this system is used for elder peoples as they are more chronic disease and need continuous health monitoring. This system provides real-time information such as condition of the patient to a doctor immediately. [2] The system offers faster, reliable, effective and cost-saving solution which makes it more popular. The system requires three key aspects such as access to information which is cost effective. [3] The patient is monitoring by a system and also need to satisfy the criteria the like size and weight of the wearable devices which need to be small and should not affect on the daily activities of the patient. [4] Also radiation from the devices should be considered. Power consumption should be low as well as the lifespan of the device should be more. This system should support the security and privacy concern as patient health record is important data and it needs to be stored securely and transmitted to the remote server. Also if a patient moves away from home to other places it should not affect on monitoring process.[5]

2.2 Arduino UNO Board

The Arduino Uno is a microcontroller based computer and software board based on the ATmega328 (datasheet). It contains necessary things that support the microcontroller; it can be simply attached to the computer with a USB cable/connection or it can be powered on using an adapter (AC to DC) or a battery to help it get started. It is a microcontroller based board platform and a development environment for writing software for the devices. [1]. Arduino is a community that develops and manufactures single-board microcontrollers and their kits for the development of interactive digital objects that are capable of sensing objects in the real digitized world. The designing of Arduino Uno board comprises using a variety of microprocessors and controllers. The boards are equipped with different sets of digital and analog input/output (I/O) pins. The pins on the board are interfaced to different expansion breadboards also called shields and other circuits. The boards consist of several communications interfaces, which include Universal Serial Bus (USB), that are used to load programs from personal computers. The microcontrollers are programmed using the programming languages C and C++. Additionally, they use traditional compiler tool chains, the Uno board project also provides an integrated development environment (IDE) based on the Processing language project. [5]

2.3 Pulse Sensor Unit

A Heartbeat pulse sensor is a sensing device that allows one person to measure his/her heart rate and record it in real time for later observation. It provides a much simpler way to study heart function and allows monitoring the flow of blood through the finger tip when it is placed on the sensor. When the sensor starts working, the LED beat flashes small beam with each heartbeat rate at regular intervals. This digital output sensor can

be easily connected to the microcontroller to measure the pulse rate at Beats per Minute (BPM) rate. The blood flows through each finger tips, it works on the principle of light modulation by blood flow through finger at each pulse. [1] Heart Rate data can be used in many Electronic design and microcontroller projects for patient monitoring and biomedical implementation. However the heart rate data is difficult to read, the Pulse Sensor braced up help us to read heart rate in a simpler way. It can be used by adults, students, artists, athletes, and game & mobile developers who want to incorporate live heart-rate data into their daily life. The device combines an optical heart rate sensor with the noise cancellation and amplification circuit making it a fast and reliable pulse reading device Also; it works on a minimum power of 4mA current drawn at 5V, so it's a great platform for mobile and Gsm applications. The 24" cable on the Pulse Sensor is connected with standard male headers so there's no additional soldering required in the device. Arduino codes are available as well as a Processing sketch for visualizing the heart rate. Arduino connected to the laptop as shown in the figure above. The Arduino board is connected to the heart beat sensor, now after completing the microcontroller and sensor setup the board has to be connected to a power source. Since here we use serial communication for displaying the result or the detected heart beat we are connecting the microcontroller to the laptop through the USB port. [1]
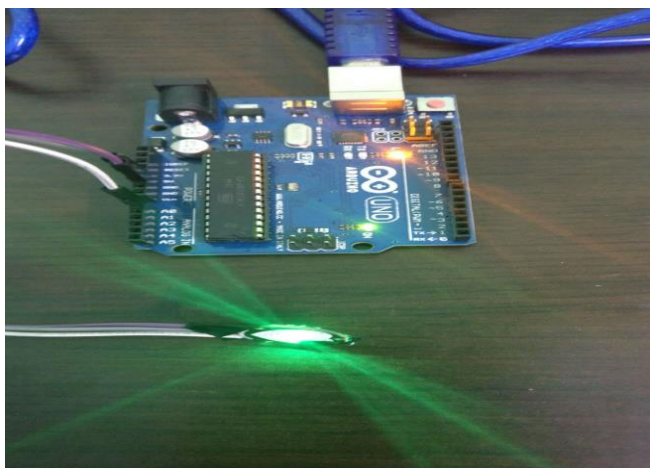

Figure 1 Arduino Connected to Pulse Sensor

2.4 GSM

A GSM modem is used to alert when there is an anonymous abrupt change in the desired parameters. GSM (Global System for Mobile communication) is an open digital cellular technology that is been widely used for the transmission of mobile and data services in all parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA). The most used telephone technologies used by GSM are (TDMA, GSM, and CDMA. GSM technology works 900 megahertz or 1,800 megahertz frequency band. [6]

3. RESULTS AND DISCUSSIONS

As we already know that the patient's heartbeat is measured in B.P.M (Bits per minute) monitoring a person's heart beat is basically examination of expansion and contraction of heart. The entire process is carried out through pulses. To check pulse in the form of reading, initially the forefinger is placed on top of the pulse sensor device and to measure the temperature a finger must be placed on the temperature sensor device respectively. The results will then be displaced on the LCD screen and then simultaneously get transferred to the Arduino. The data of any particular patient is then stored in cloud server (i.e. in database of cloud server). The database is accessed by the doctor by login on the server and the doctor can monitor the patient online from anywhere in the world via internet. The doctor can also send the patients health report to their guardian. With the help of GSM, any fluctuation in the report apart from the desired set parameter will result in a popup text message in the assigned mobile num. All the mathematical equations should be numbered as shown above.

4. CONCLUSION

In today's age, along with the increase in pollution, there is a tremendous rise in rate of cardiovascular disease. Heart attack is one of the major causes of the death in the world. Our proposed model is based on biomedical engineering combines design and problem-solving skills of engineering with medical and biological science in order to improve the healthcare of every individual. Our system helps mainly the people who suffer from heart attack or other heart diseases frequently by tracking the abnormalities of heart beat. Basically, in this approach we can track or detect heart related diseases using IOT (Internet of Things).The Doctor can access the database by login on the server and can monitor the patient from anywhere with the help of internet . The heartbeat limit or threshold value is needed to be set by doctor. This should set as low or as high depending upon the patient's age and health conditions. If the value goes more than the threshold value it will get detected and an alert will be send through text message to the respective mobile number. Big data analytics use this for analysing the proper pulse rate, temperature of the patient. The proposed system is much more easy and flexible as compared to other conventional monitoring and alerting systems. From this, we reviewed present state and future directions in order to integrate remote health monitoring technologies into clinical practice of medicine. To increase the communication range there is need to establish Wi-Fi mesh type network. Based on the survey it is possible to use mobile devices and can be implemented in a global network with further upgradation.

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