

Health Care Monitoring System using Internet of Things

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ABSTRACT

The Health Care Monitoring Systems has emerged as one of the most vital system and became technology oriented from the past decade. Humans are facing a problem of unexpected death due to various illnesses which is because of lack of medical care to the patients at right time. Nowadays Health-care Environment has developed science and knowledge based on Wireless-Sensing node Technology oriented. Patients are facing a problematic situation of unforeseen demise due to the specific reason of heart problems and attack which is because of nonexistence of good medical maintenance to patients at the needed time. The primary goal was to develop a reliable patient monitoring system using IoT so that the healthcare professionals can monitor their patients, who are either hospitalized or at home using an IoT based integrated healthcare system with the view of ensuring patients are cared for better. A mobile device based wireless healthcare monitoring system was developed which can provide real time online information about physiological conditions of a patient mainly consists of sensors, the data acquisition unit, microcontroller, and programmed with a software. The patient's temperature, heart beat rate, EEG data are monitored, displayed and stored by the system and sent to the doctor's mobile containing the application. Thus, IoT based patient monitoring system effectively monitors patient's health status and save life on time.

Keywords: IoT, data acquisition unit, mobile application, EEG etc.

I. INTRODUCTION

In traditional method, doctors play an important role in health check up. For this process requires a lot of time for registration, appointment and then check up. Also reports are generated later. Due to this lengthy process working people tend to ignore the checkups or postpone it. This modern approach reduces time consumption in the process.

Medical scientists are trying in the field of innovation and research since many decades to get better health services and happiness in human lives. In the recent years use of wireless technology is increasing for the need of upholding various sectors. In these recent years IoT groped the most of industrial area specially automation and control.

The body temperature, heart rate, blood pressure, respiration rate are prime parameters to diagnose the disease. This paper gives temperature and heart rate values using IoT.

The IoT Based Health Care System for the Elderly is cheapest healthcare device based on the IoT platform for the patients and doctors[1]. It provides a solution for measurement of body parameters like ECG, Temperature, Moisture, and Heartbeat. It also detects the body condition and location of the patients. The mobile application for the patient and doctors contain a very simple GUI Interface for reading all the parameters in the mobile or at anywhere in the world by using internet connectivity. In this paper we are using various sensors and modules for performing a different type of functions. Cloud service is used for storing all the data in the cloud, it

provides security and facility of accessing all the parameters at any time which is very useful for the doctors at the time of treatment. This system also generates an alert when it required that means at the time of any critical conditions and notifications about the medicines, location change, conditions etc.

II. MOTIVATION

In rural hospitals, the facilities for health caring are limited. The poor quality of health management enables issues in health care system. Everyone should get the knowledge of own health as easy and early as possible. In developing countries there is lack of resources and management to reach out the problems of individuals. A common man cannot afford the expensive and daily check up for his health. For this purpose various systems which give easy and assured caring unit have been developed. These system reduces time with safely handled equipment.

III. RELATED WORK

Modern health care system introduces new technologies like wearable devices or cloud of things. It provides flexibility in terms of recording patients monitored data and send it remotely via IoT. For this connection, there is need of secure data transmission. To transmit the data with privacy is the Moto of this paper. The proposed system introduces security of health care and cloud of things. System works in two major parts viz. storage stage and data retrieving stage. In storage stage, data is stored, updated for future use. In data retrieving stage, retrieve data from cloud. The cloud server can share with authenticated user as per request. A patient with wearable devices continually updates his record every 5 or 10 min. In

emergency mode, it updates for every 1min. The wearied device will send results to phone using Bluetooth connection or NFC technology. This can able to give to cloud server using GSM and 3G.

A number of researchers have proposed various models for IoT in Healthcare and the prediction of various types of diseases using various techniques. This part focuses on the work done in the same area. Ahn et al. [2] implemented a system for measuring the physiological signals in sitting position such as ECG and BCG by using a smart chair that senses the non-constrained bio-signals and can be monitored using a monitoring system such as the one they had developed providing a classic example of the application of IoT in healthcare.

Almotiri et al. [3] proposed a system of m-health that uses mobile devices to collect real-time data from patients in and store it on network servers connected to internet enabling access only to a certain specific clients. This data can be used for the medical diagnosis of patients and is achieved by using a number of wearable devices and body sensor network.

Barger et al. [4] made a smart house facility using a sensor network to monitor and track the movements of the patient in home and a prototype of the same is also being tested. The primary objective of their work is to check if their system is capable to outsmart the behavioral patterns and have discussed about the same in their work.

Chiuchisan et al. [5] proposed a framework to prevent the threats to patient in smart ICUs. The proposed system intimates the patient's relatives and doctors about any inconsistency in their health status or their body movements and also about the atmosphere of the room so that the necessary precautionary measures can be taken.

Dwivedi et al. [6] developed a framework in order to secure the clinical

information that has to be transmitted over the internet for Electronic Patient Record (EPR) systems in which they propose a multi-layered healthcare information system framework which is a combination of Public Key Infrastructure, Smartcard and Biometrics technologies.

Gupta et al. [7] proposed a model which measures and records ECG and other vital health parameters of the patient using Raspberry Pi and can be of a great use for the hospitals and patients as well as their family members.

Gupta et al. [8] present an approach using Intel Galeleo development board that collects the various data and uploads it to the database from where it can be used by the doctors and also reduce the pain born by the patients to visit hospital each and every time to check their health arameters.

Lopes et al. [9] proposed a framework based on IoT for the disabled people so as to study and find the IoT technologies in healthcare segment that can benefit them and their community. They took two use cases to study the latest IoT technologies and its application that can be used mainly for the disabled people.

Nagavelli and Rao [10] proposed a novel method to predict the severity of the sickness from the patient's medical record using mining based statistical approach which they said as degree of disease probability threshold. And in order to meet their goal they have revamped an0 algorithm that is mostly needed to derive the hyperlink weight of the websites.

Sahoo et al. [11] studied the healthcare management system and about the large amount of patient data that is generated from various reports. They further analyzed the health parameters to predict the future health conditions of thepatient or the said subject. They use a cloud based big data analytic platform to achieve the same using the means of probability.

Tyagi et al. [12] explored the role of IoT in healthcare and studied its technical aspects to make it reality and identify the opportunities for which they propose a cloud based conceptual framework in which the patients' medical data and information can be securely transferred, with the permission of patient and their family by building a network among patient, hospital, doctors, Labs etc. The primary reason behind this is to relieve patient from the expensive clinical aid, overcome the shortage of doctors and therefore providing enhanced care and service to patients.

Xu et al. [13] presented a data model to record and use the IoT data. They designed and developed a resource-based Ubiquitous Data accessing method to collect and publish IoT data globally to so that it can be accessed anywhere, anytime. They also present an emergency medical service based on IoT and how to collect and use the IoT data on different platforms.

IV. PROPOSED METHODOLOGY

In this paper, we propose an automatic system to monitor patient's body temperature, heart rate, body movements and blood pressure. Further we extend the existing system to predict if the patient is suffering from any chronic disorder or disease using the various health parameter and various other symptoms that are obtained by the system.

Block Digram of IOT based health care monitoring system



Fig 1 shows the proposed system. The health monitoring sensors are used to collect health related data i.e. for data acquisition. Communication can be done by controller for sending data on internet wirelessly. Data processing has been done at server. All data collected and aggregated at server point. To get health related information in understandable format it can be shown on web page i.e. data management.

Arduino uno:

Arduino uno is microcontroller based on ATmega 328. Simulation is done on Arduino IDE software. The ATmega 16U2 provides serial data to the main processor and has a built-in USB peripheral. Arduino Uno power cable Standard A-B USB cable. It has 14 digital I/O pins.

Temperature Sensor:

Temperature sensor is used for measurement of body temperature. Sensor is put in contact with body and it senses body temperature. It is calibrated linearly in Celsius. It has low self heating capability. Also it doesn't require external calibration.

Wifi Module:

The wifi module is a self contained SOC with incorporated TCP/IP protocol stack that can offer any controller access to wifi network.

IoT Platform:

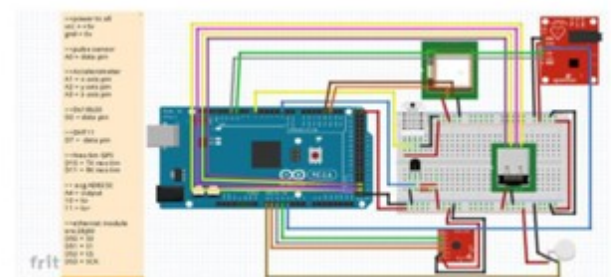
a) Use the Think speak platform to send data to the cloud from any Internet-enabled device.

b) You can then configure actions and alerts based on your real-time data and unlock the value of your data through visual tools.

c) Use the Think speak offers a platform for developers that enable them to easily capture sensors data and turn it into useful information.

Circuitry and Working

In this paper, we have used Arduino mega as microcontroller unit. All the components and modules are connected as give in a circuit diagram.



similar to a utility (like the electricity grid) over a network.

Cloud storage:

Cloud storage is a model of data storage in which the digital data is stored in logical pools, the physical storage spans multiple servers (and often locations), and the physical environment is typically owned and managed by a hosting company. These cloud storage providers are responsible for keeping the data available and accessible, and the physical environment protected and running. People and organizations buy or lease storage capacity from the providers to store user, organization, or application data.

V. SYSTEM MODULES

- 1) Health Monitoring Section
- 2) Emergency Alert Section
- 3) Health Status Prediction System

Health Monitoring Section

This module comprises of the hardware components of the system that makes it IoT enabled and is used to record the health parameters of the patient using various sensors. Here, Raspberry pi acts as a central server to which all the sensors are connected through the GPIO pins or using MCP3008 analog-to-digital convertor if their output is in the analog form as raspberry pi works only on digital signals. The pi reads the real-time values and updates them to mySQL db which is then used to display them on the web interface.

Emergency Alert Section

This module in particular deals with the steps to be taken after an abnormality is

detected in the health of patient such as notifying his/her family member as well as the hospital. We have set up certain threshold values in our program which if crossed will trigger an alert in the form of email/SMS to the patients family/doctor

Health Status Prediction System

This is one of the most promising modules of our system. In this module, we use the patients' health data as recorded by our system along with any symptoms they may be feeling by asking a few simple questions and compare it with the existing knowledge base to predict if any disease/disorder the patient may have thus making it an efficient Expert System with proper data mining techniques.

VI. Advantages

- 1) IOT Monitoring proves really helpful when we need to monitor and record and keep track of changes in the health parameters of the patient over the period of time. So with the IOT health monitoring, we can have the database of these changes in the health parameters. Doctors can take the reference of these changes or the history of the patient while suggesting the treatment or the medicines to the patient.
- 2) Hospital stays are minimized due to Remote Patient Monitoring.
- 3) Hospital visits for normal routine checkups are Minimized.
- 4) Patient health parameter data is stored over the cloud. So it is more beneficial than maintaining the records on printed papers kept in the files. Or even the digital records which are kept in a particular computer or laptop or memory device like a pen- drive. Because there are chances that these devices can get corrupt

and data might be lost. Whereas, in the case of IOT, the cloud storage is more reliable and does have minimal chances of data loss.

Benefits

Simultaneous reporting and monitoring

Real-time monitoring via connected devices can save lives in event of a medical emergency like heart failure, diabetes, asthma attacks, etc.

With real-time monitoring of the condition in place by means of a smart medical device connected to a smartphone app, connected devices can collect medical and other required health data and use the data connection of the smartphone to transfer collected information to a physician.

End-to-end connectivity and affordability

IoT can automate patient care workflow with the help healthcare mobility solution and other new technologies, and next-gen healthcare facilities.

IoT in healthcare enables interoperability, machine-to-machine communication, information exchange, and data movement that makes healthcare service delivery effective.

Data assortment and analysis

Vast amount of data that a healthcare device sends in a very short time owing to their real-time application is hard to store and manage if the access to cloud is unavailable.

Even for healthcare providers to acquire data originating from multiple devices and sources and analyze it manually is a tough bet.

IoT devices can collect, report and analyses the data in real-time and cut the need to store the raw data.

Tracking and alerts

On-time alert is critical in event of life-threatening circumstances. Medical IoT devices gather vital data and transfer that data to doctors for real-time tracking, while dropping notifications to people about critical parts via mobile apps and other linked devices.

Reports and alerts give a firm opinion about a patient's condition, irrespective of place and time.

It also helps make well-versed decisions and provide on-time treatment.

Thus, IoT enables real-time alerting, tracking, and monitoring, which permits hands-on treatments, better accuracy, apt intervention by doctors and improve complete patient care delivery results.

Remote medical assistance

In event of an emergency, patients can contact a doctor who is many kilometers away with a smart mobile apps.

With mobility solutions in healthcare, the medics can instantly check the patients and identify the ailments on-the-go.

Also, numerous healthcare delivery chains that are forecasting to build machines that can distribute drugs on the basis of patient's prescription and ailment-related data available via linked devices.

IoT will Improve the patient's care In hospital. This in turn, will cut on people's expanse on healthcare

VII. Research

IoT for healthcare can also be used for research purposes. It's because IoT enables us to collect a massive amount of data about the patient's illness which would have taken many years if we collected it manually.

This data thus collected can be used for statistical study that would support the medical research.

Thus, IoT don't only saves time but also our money which would go in the research.

Thus, IoT has a great impact in the field of medical research. It enables the introduction of bigger and better medical treatments.

IoT is used in a variety of devices that enhance the quality of the healthcare services received by the patients.

Even the existing devices are now being updated by IoT by simply using embedding chips of a smart devices. This chip enhances the assistance and care that a patient requires.



VIII. CONCLUSION

The proposed system of patient health monitoring can be highly used in emergency situations as it can be daily monitored, recorded and stored as a database. In future the IOT device can be combined with the cloud computing so that the database can be shared in all the hospitals for the intensive care and treatment.

IOT platform provides a simple environment to connect the hardware devices through the cloud and users. Then by using IOT we can make any type of devices by different type of sensors and modules. This paper is useful for Patient who required regular check the parameters. The previous data storage facility provides to the doctors to better treatment environment by this friendly device. The simpler working and Mobile app GUI provides the friendly connection between the devices to users. As device also provides the location updates, body condition status and medicine alerts, it is very useful for take care the patients by doctors and relatives.

Finally we can say, this is a complete healthcare device.

Future development

IoT patient monitoring using Arduino Uno and WiFi module project. This GPS module will find out the position or the location of the patient using the longitude and latitude received. Then it will send this location to the cloud that is the IoT using the Wi-Fi module. Then doctors can find out the position of the patient in case they have to take some preventive action. For more reliable and low

complexity of the system the controller section can be replaced by other Advanced Microcontrollers. The applications can be added by adding the more modules and sensors. Accuracy can be increased by using high sensitive sensors and more reliable modules. For more security and functionality in the cloud can be increased by using paid clouds or won cloud. Using the X-bee Module we can create a wireless zone and this device may communicate with the other devices also in big hospitals. Ethernet Module can be replaced by Wi-Fi module and GSM module for Internet Connectivity. For simpler GUI we can draw Sketches and Graphs in the Mobile applications.

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