Patient Monitoring and Control System using Internet of Thing

V. Vikram Gnanaraj, P.Ranjana, P. Thenmozhi

Abstract— The health of the patients in the hospital will be severely affected if they are not treated properly on time and there is a high risk of causing more diseases. Patients monitoring is a challenging factor in the past years. Even in hospitals it is very difficult for doctors to attend the patients, because doctors cannot not be available all the time in the hospital because of their busy schedule. Hence there is a need for a solution to monitor the patients any time for the doctors from any place. With the development of Internet of Things (IoT) devices in the recent years a solution is proposed for this. An IoT device which can be used for real time application in homes, hospitals and other places were developed as a gadget. With this gadget, the human man power can be reduced using Wi-Fi system. The patient monitoring and control system checks the pulse rate, air quality, temperature of the patients especially in hospital's using the sensors attached for collecting the data and send it to the Arduino microcontroller for processing the data. This gadget can also be used by the every one even at home, hospitals or any other places.

Keywords: Arduino, Ehternet, Internet Of Things(IoT) ,LAN , sensors.

I. INTRODUCTION

Monitoring patients has become a challenge in the past years. It is impossible for doctors to attend all patients at once especially in hospitals where many doctors are not available. Hence there is a need to use imperative solutions and keep up monitoring easy. The quality of air degraded the surroundings in recent years. Because of this issues people in India are exposed to dangerous issues. So there is a need to keep the environment clean and safe for breathing. Many sensors have been innovated in recent years. The one important sensor is the gas sensor. IoT based applications were used in recent years in many applications like hospitals, offices, homes, industries . These IoTs are used in real time applications This device can be used in real time with the sensors and useful in many applications.

II. OVERVIEW OF IOT MONITORING SYSTEMS.

The system with low cost based on IoT is used in several areas especially in the safety of environment. This IoT device is a integrated network architecture and has a mechanism for inter connecting various other sensors and transmission IoT data with the use of internet, The sensing of the environment is done by sensors with a local sensors. This system is provide with the security inputs. This system uses Zigbee for communication between the sensors in wireless and gateway. Zigbee is used as a networking devices in wireless sensor networks for many indoor applications [1]. IoT device is used in many health care and monitoring systems. The IoT devices are used in many application of the network architecture. The IoT devices also has the security features with the security requirements. Since it deals with the health care and important sensible data the device is equipped with threat models .Though they are used in many applications there are many challenges in this applications. IoT devices uses the mobile computing, sensor and used wireless communication technologies and applies the 4G mobile communication technology in health care service [2].

The IoT technology has the opportunities and challenges in accessing the medical data. The computing resources is a challenges since the data used is huge and that is Big Data, so the data need to be decentralized. More over the data is of heterogeneous in nature Since the data is distributed data the software approach to deal this data is with the cloud computing platform. These are designed to coordinate with the hybrid data. A cloud platform is developed to deal the heterogeneous data [3]. An IoT for health care data is used for industrial applications. Data collections is used using sensors [4]. Data collection is done using a hard wired in assessing the operational performance. The data collected is correlated with the technician's readings and thus the performance is check and decide on the usage of data [5]. Many conventional data analytical approach were done and there is a need to extend this approach in terms of scalability, diversity and distribution of the data. The data collection on the sensor is high voluminous and there is a need for continuous generation of data[6][7].The reliability of the IoT is often limited by the energy supply. So the devices are deployed in the location where energy is scare and human intervention is not possible. So to regenerate the power energy harvesting is needed. Energy harvesting is hunting energy from the environment like solar and wind[8[.IoT with a smart connected elements and with appropriate infrastructure is represented as a technology stack for IoT. It is used in the manufacturing industry can also be used as a smart factory to assist government with the cyber physical platform which helps the IoT developement of the country[9]. Security is the important factor that has to be considered in the data. Many wireless technologies could be used in the transmission of data like RFID, Bluetooth, Wi-Fi. So there is a need for reliability and availability of the IoT system[10].

Revised Manuscript Received on April 12, 2019.

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III. III.PROBLEMS IDENTIFIED

The data coming from the IoT devices are unstructured and it is difficult to analyse the data with traditional analytics tools. The data that comes from the iot are noisy if oxygen is monitored it comes with temperature, or sound. These data can have corrupted messages and false readings and there must be cleaned up. The IoT data will be a meaningful only if the data with it gives the meaningful input to the user. So to overcome this the data collected is processed through the AWS. The AWS IoT Analytics transforms the data and store it in the time series data storage for analysis.

A. Objectives of Patient monitoring systems

1. Compute the activities of the patient life like temperature, oxygen and pulse using sensors
2. Depending on the value of the sensors, notification will be sent to the doctors mobile
3. The doctor is alerted with the patient details for immediate action. .

IV. DIMENSIONS OF IOT PATIENT MONITORING SYSTEM

The Patient monitoring system is a IoT framework used to society . It alerts the user if the oxygen level is very low by giving alarm to the user. The main dimension of the IoT oxygen monitoring system is shown in Figure 1.
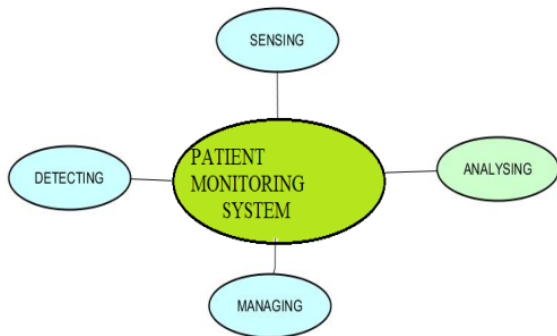

Figure 1: Dimensions of IoT Patient Monitoring system

The Dimensions of the IoT monitoring system consists of the sensors that sense the appropriate location and collect a history of information. The anomalies detected do not indicate the failure. The changes in conditions like weather can influence the anomaly behaviour. But anomaly behaviour is used to identify the quantity of damage that has occurred. Analysing the data from the sensor signal is taken and applied to the algorithm to predict the hazardous that will happen . Management is from the analysis it predicts the situation in a particular area. The management if to get the information for the analysis of data and compare it with the past data collected. It also identifies the frauds .The detection is used for appropriate decision making, it helps in preventing failures and to increase the availability. This provides the data by comparing the data with the past history and alert the user.

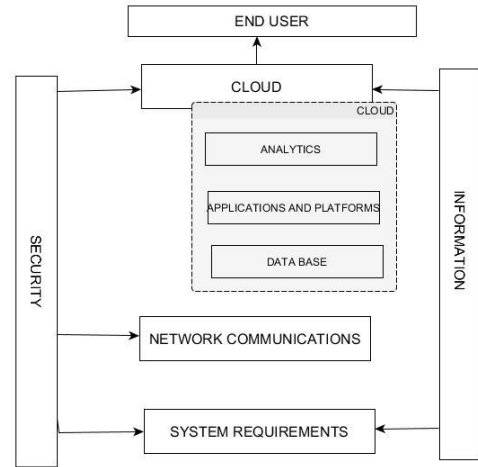## V. TECHNOLOGY SUPPORTING IOT

Figure 2:Technology Supporting IoT Patient Monitoring system

The IoT Patient monitoring system is requires an appropriate technology to support it. The infrastructure to support the IoT is shown in Figure 2. The technology enables the IoT device to exchange the data between the IoT stack and the users. It integrates the data from the external sources and serves as a platform for storing the data and analysing the data. This also ensures security for the data flowing to and from the system. The system requirements deals the software and hardware configuration of the device in addition to that it also has the sensors , RFID tags, and the processors.

The Network communication takes care of the data to be transmitted. The data collected and transmitted needs a data storage that is taken care by the database. The database processes the data in a efficient manner and interprets the data. The cloud computing services makes use of this data. The and users are the people makes use of the data through their device like mobile phones.

A. Data Analytics Process

The gather data is analyse using the machine learning algorithm. The process involved in data Analytics is represented in Figure 3.
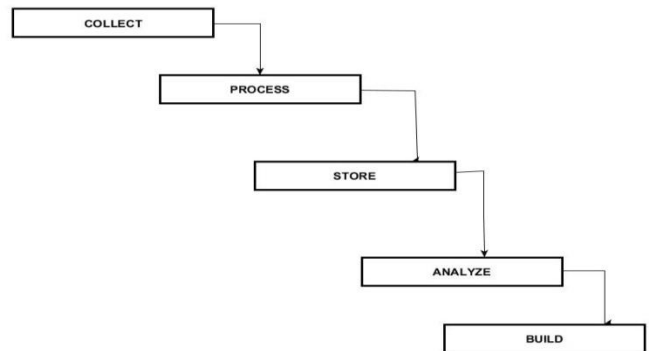

Figure 3: Steps in Data Analytics

The data collected form the sensors can be connected directly to the computer and train the system . The machine learning algorithm on the device takes the air monitoring system data. The IoT data can also be used in other fields like the manufacturing of a vehicle and alert the customer about the break and engine conditions by monitoring the data through the sensors fixed in their vehicles.

VI. EXPERIMENTAL SETUP

The proposed air monitoring and control system is planned to use IoT device with the sensors. The sensor devices are transmitted to the server through the cloud. The sensors are kept in the hospitals and collects the details of the patient health through sensor. The sensors periodically monitor the patients and transmit the data. The monitored data can be accessed anywhere using the mobile of pc with the help of internet.
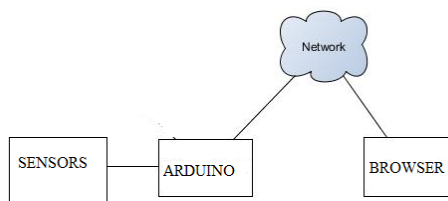

Figure 4: Block diagram of Patient Monitoring system

The block diagram of the patient monitoring system is shown in Figure 4.The monitoring sensors are connected to the Arudino microcontroller.. The wifi module connected to the Arudino sends the data about the sensors contents to the health centre through the server kept on the health centre. The data collected through these sensors are analyzed and visualized. The data is analyzed using the machine learning algorithms and we can predict the disease that will affect the persons living in that area. The machine learning algorithms are used to find data in patterns. A model is applied on that data which gives a prediction of the data.A prototype is developed that draws the air through the unit measurements are taken from the indoor data and it is applied on the home , the data is collected from the indoor air and the quality of health factors is monitored and informed to the persons in the house through their mobile phone. The system can also be applied in hospital environment. It could be scaled further to apply on the outdoor environment. The same setup can be used with different sensors and could be applied in other areas also. Some of the applications in other areas are:

- Can be used to use other areas like sensor data to predict the rainfall
- Can be used to collect the data from the farm land the optimize the water efficiency of the automated irrigation system
- In real time the food and beverages company analyze the data in the veneering machine and correct the food supply
- It can be used by the auto manufacture to alert the customer above wearing their brake pads

VII. WORKING PRINCIPLE PATIENT MONITORING SYSTEM

The patient monitoring system is connected with the following steps for working.

1. The sensors are connected with the arduino and Ethernet shield.
2. The program is type on the IDE.
3. The arduino is connected with the computer using USB cable.
4. The Ethernet shield is ensured that it is connected using an Ethernet cable to a LAN.
5. DHCP address printer program from the Ethernet library is uploaded into the arduino.
6. The IP address of the LAN is obtained from the serial monitor.
7. The IP address of the LAN is used for the main program of the arduino.
8. The program is compiled, verified and uploaded.
9. The output is viewed in the serial monitor.
10. The IP address that was generated is used to get the information form the serial monitor to any system that is connected with the particular LAN.
11. The data from the serial monitor can be viewed in the computer connected with the LAN.

The overall working model of the system is represented in figure 5
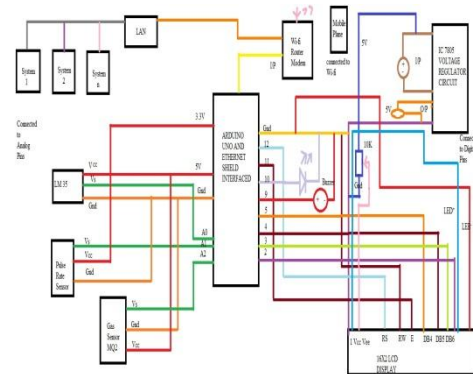

Figure 5.Circuit diagram

The system after assembly and implementation is shown in figure 6.

Figure 6. System Model

VIII. RESULTS AND DISCUSSIONS

The program is written in the IDE as shown in Figure 7. The program is the compiled using the verify option. After verifying and when there are no errors the program is uploaded to the arduino using the upload option next to the verify option provided the arduino is connected to the system using USB. When the IDE shows the programming is done it is possible to view the real time output in the arduino.
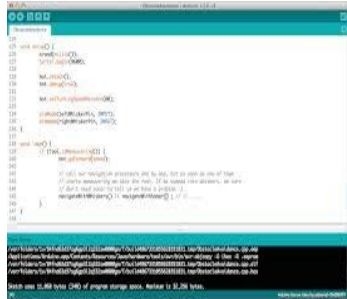

Figure 7. IDE Software

From the experiment the following results were obtained

i. Serial monitor displayed the data collected from sensors;

ii. Serial monitor displayed the IP address of the LAN;

iii. Using the IP address the data was viewed through google chrome browser from a system connected to a LAN.

IX. CONCLUSION

The gadget designed is used to establish connection using internet anywhere, it is advantageous compared to zigbee or Bluetooth, in real time doctors can monitor the patients from any where. The IoT based patient monitoring system is an innovative technology that brings benefits to the society. It brings the biomedical application into the users mobile .This system can be applied in areas where there is a lot of people. This is a real time IoT application systems in mobile environment of IoT applications. The Big data collected in the IoT devices are also handled through the data analytics process. This system provides an improved efficiency in real time. These techniques can also be applied for all health care services and its applications like disease supervision and elderly care. The system can be modified to the industrial needs and could be used for industrial applications and many other applications.

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