Smart Health Care System using IOT

K.R.R. Mohan Rao, V. Anil Reddy, Ch. Vijay Shankar, K. Venu Gopal Reddy

Abstract: ***Present days IoT brings the gadgets and a fundamental part in different methodologies like smart home, savvy urban areas, vehicle parking, traffic control, smart environment, agribusiness fields and health monitoring system of an individual etc. Here Patient health monitoring is difficult in every hospital and individual in modern world. one the approach to monitor the health of everyone by the hospital and individual through the IOT. Here the patient health condition like Pulse rate, Respiratory rate, Body Temperature, Position of the body, Blood glucose, ECG, etc. can be measured by utilizing the Non-invasive sensors. These sensors are integrated with an embedded device like raspberry pi, Arduino board. These gathers the information like biomedical data from the sensors and biomedical information can be transmitted to the server and Mobile app in a smart phone. From this server the information can be monitored by the specialists and other paramedical staff by web application or mobile application. health care system using IOT diminishes the exertion of specialists and paramedical staffs to screen the patient for 24 hours and furthermore the time and cost of support. This Smart Healthcare using IoT is a combination of different applications like Heartbeat monitoring, Blood Pressure, Temperature and steps count which uses pulse sensor, respiratory rate sensors, Body Temperature Sensor, Blood Pressure to build whole Healthcare Monitoring.***

Index Terms: Arduino board, health monitoring system, IOT, Non-invasive sensors, raspberry pi.

I. INTRODUCTION

A.iot: The basic definition of Internet of things is "It is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect, collect and exchange data". Simply we can say "Machine to Machine communication**".**

B. Internet of things health care: Iot can be used for remote monitoring the non-critical patients, for old people which will be difficult for them to go for regular checkups. Patients' health information is collected by the iot devices which are supplied to the patients and the collected data can be saved in the iot server. This data can be analyzed by the concerned doctors and treat the patients.

A wide research is going on **"**Assisted Ambient Living" (AAL) mainly for handicapped and old people.

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Dr.K.R.R. Mohan Rao, ECE, K L deemed to be University, Vijayawada, India.
V.Anil Reddy, ECE, K L deemed to be University, Vijayawada, India.
Ch. Vijay Shankar, ECE, K L deemed to be University, Vijayawada, India.
K. Venu Gopal Reddy, ECE, K L deemed to be University, Vijayawada, India.

American Researchers are working on an iot based system called **"***SPHERE***"**. This a remote health monitoring system for chronically ill and senior citizens. Where they are allowed to in there comfort at home and their health is continuously monitored by the wearable sensors which are connected to a help desk at the nearby hospital. If the doctors see any abnormalities in the health patterns of the patients then concerned patients are asked beat to come to a hospital for treatment.

II. PROPOSED HEALTH CARE SYSTEM

Idea: The idea is users are attached with the wearable sensors that can collect data which helps us to detect heart rate, temperature, fall detection, and step counter. These are connected to a central node which processes the data and sends this to a remote server, where this data is further used by doctors to estimate the condition of the patient.This can be divided into 2 parts.1)Wearable Sensors and Central Node. 2)IoT Remote Server

Wearable Sensors and Central Node: These wearable sensor nodes help us to measure some critical parameters to determine the health condition of a person. These wearable sensors are non-intrusive sensors that can be easily and comfortably wearable on the body. This proposed system uses four main sensors for determining the health condition of a person. These sensors are mainly classified on the basis of the parameters they are measuring

Measuring of Heart Rate:Heart Beat**:** It is the sound of valves in his/her's heart contracting or expanding as they force blood from one region to another. The number of times the heart beats per minute (BPM), is the heartbeat rate and the of the heart that can be felt in an artery that lies close to the skin is the pulse.

There are sensors based which can measure the heart rate basing in the variation of pressure of blood in the veins and other sensors are based on the principle called *"photoplethysmography".*

Photoplethysmography principle helps us to measure the heart rate based on the change of blood volume in the veins. This change in volume can be identified by looking at the variation of light intensity. The heart pulse is determined by the volume of the blood.

Sensor works on the reflection of light by the blood. The led will emit light, this light will be reflected by the blood and it is detected by a special ldr that gives output based on the intensity of light, the intensity will be less when the volume of blood is high and vice-versa.
The detector output is in an electrical form which is proportional to heart rate.

The output of this sensor is given to a central node where the electrical data is converted into digital and stored.

*beats per minute (b)=60*f*

f=frequency of pulses.

Measuring of Temperature:The temperature of the body is mostly due to Metabolism in the body. There are many temperature sensors.

Non-contact Temperature Sensor Types : This type of temperature sensor uses convection and radiation to monitor changes in temperature. They can be used to detect liquids and gases that emit radiant energy as heat rises and cold settles to the bottom in convection currents or detect the radiant energy being transmitted from an object in the form of infra-red radiation.

***Contact temperature sensor types*:** This type of temperature sensor is required to be in physical contact with the object being sensed and use conduction to monitor changes in temperature.

MPU6050 is used for sensing the temperature. The output given b this sensor is electrical data. This data is proportional to the body temperature.

Temperature in ^{o}C = ((sensor data)/340 + 36.53).

Step counter*:* This parameter will help to count the number of steps walked by a person. With this data, we can calculate the number of calories he spent on walking or running or by climbing stairs.

The same sensor *MPU6050* is also used a **"***Pedometer***"**.This has an accelerometer and a Gyroscope in it. When a person walks or runs there will be a certain tilt in the body. This tilt is identified with the help of Accelerometer and Gyroscope axes values. By processing this data through an algorithm we can count the number of steps walked by a person.

Central node: Node MCU is used as a "*Central Node*". This has an inbuilt wifi module. Thus microcontroller unit has **"***ESP8266 WIFI-SOC***"**. All the sensors all connected to this MCU where this does all the processing and sending the data to remote Iot server.

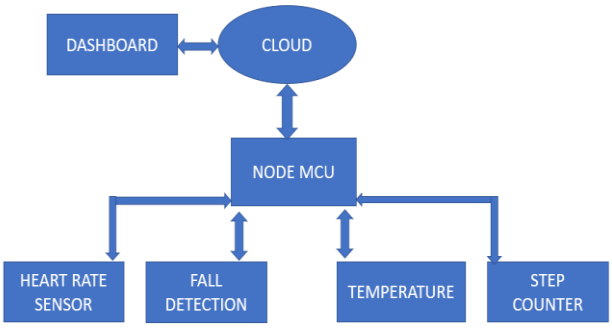

Fig 1 Block Diagram

This nodemcu is sends the data to a remote iot server through wifi. This uses *"MQTT protocol"* for sending the data to the server.

Mqtt(message queuing telemetry transport) protocol:

This is an ISO standard protocol which uses TCP/IP for transferring the data. This uses a publish-subscribe model of transfer. This protocol was designed for sending data from the aremote location where the bandwidth and the data transfer rates are very slow.

B.Remote Server(CAYENNE): The data from all the sensors is stored in a remote iot server where we can use this data for further analysis. There are many iot servers which provide different tools. In this project, we are making use of *"Cayenne iot Cloud Platform"*. This a free iot cloud platform. This cloud platform provides many cloud services like data visualization, alerts and etc.

This server provides the facility to any number of sensors and devices. We can see the data on the dashboard in any format. This server also has a mobile application which can also be used for seeing the data using mobile.

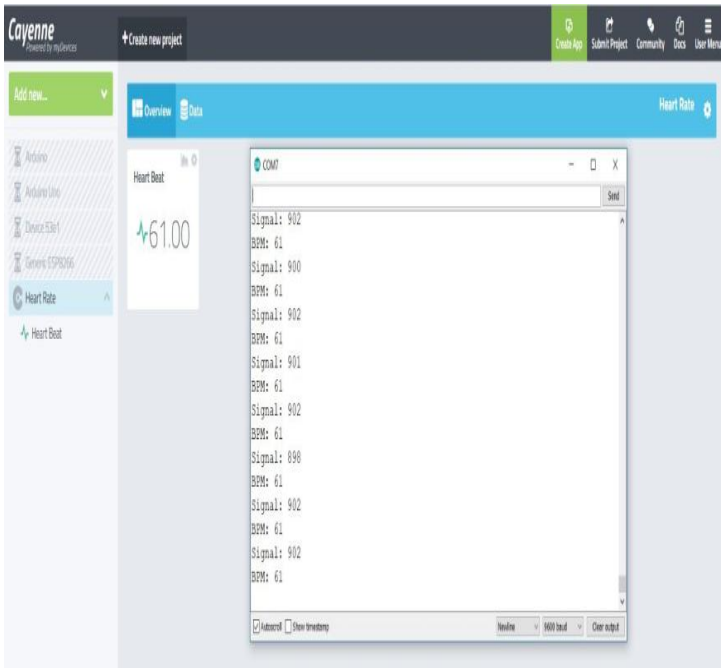

Fig 2 The dashboard of cayenne showing Heart Rate.

III. METHODOLGY

Heart Rate: Heart rate can be defined as, the rate of the heart referred as number of contractions of the heart per minute also called as beats per minute (bpm). The heart beat changes from individual to individual depending on the physical body needs. The heart rate of an individual has an effect on the rate depending on the physical and mental condition of an individual. Some of them are sleep, anxiety, illness, physical exercise, stress, and drugs inside the body.As per statistics, the normal heart rate of a resting adult human is 60bpm to 100bpm. If a person is above 100bpm while he/she was in resting position is known as Tachycardia which is a fast heart rate. If a person is below 60bpm while he/she was in resting position is known as Bradycardia which is a slow heart rate. By not considering when a person is

sleeping because a slow heart rate is measured when a person is sleeping which is around 40 - 50bpm and it is common and vary casual. If the heart is not beating in regular pattern in normal conditions is referred as arrhythmia.

Steps Counter: Step counter is used to calculate the number of steps taken by an individual during a period of time. This is done with the help of accelerometer interfacing with microcontroller along with wireless communication.While coming to step counter algorithm, the device can be kept on wrist or on legs moreover the accuracy of the device changes with respect to position. While also considering the usability to the user we decided to keep it on the wrist and designed the algorithm which is not so accurate.Accelerometer has three axis x, y, z. Since the position of the sensor accelerometer is kept constant in the sense making one of the three axes as a constant and analysing the values, we choose to keep z axis as constant. we can also calculate how many calories we have burned at stipulated time depending on our height and weight.In the next step, the steps are recorded on the basis of movements in hands. Generally, when we are walking or running our hand movements changes accordingly. From this we calculated the threshold value to be used to increase the accuracy of the device.

Body Temperature: Ordinary human body temperature, otherwise called normothermia or euthermia, is the normal temperature found in people. The ordinary human body temperature range is normally expressed as 36.5– 37.5 °C (97.7– 99.5 °F).Body Temperature of an individual is measured with the help of MPU-6050 which has inbuild accelerometer, gyroscope, temperature sensor interfacing with microcontroller along with wirelesscommunication.The body temperature of a person relies on the age, effort, contamination, sex, and regenerative status of the subject, the season of day, the place in the body at which the estimation is made, and the subject's condition of cognizance (waking, dozing or calmed), movement level, and enthusiastic state. It is regularly kept up inside this range by thermoregulation.

IV. EXPERIMENTAL ANALYSIS

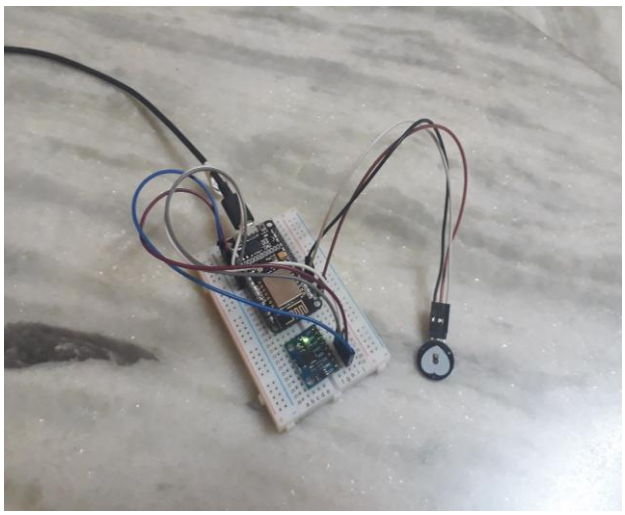

Fig 3 Hardware Setup

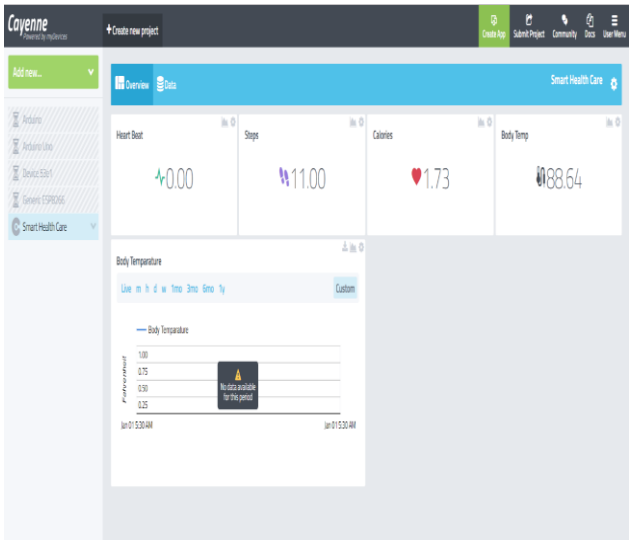

Fig 4 Cayenne Output

In this project the data like heart rate, temperature, steps count will receive from the sensors and stored in the database where it can access by both user and doctor simulteously.the protocol used in project is MQTT(Message Queuing Telemetry Transport.

V. ADVANTAGES AND DISADVANTAGES

Advantages: Communication: IoT framework increments and urges machine to machine correspondence (otherwise called M2M). Due to this astute advancement, physical gadgets keep in contact with each other prompting more noteworthy productivity and higher quality. It likewise permits full straightforwardness.

Automated and control: Because of physical items getting associated and controlled carefully and midway with remote framework, there is a lot of computerization and control in the workings. Without human mediation, the machines can speak with one another prompting quicker and opportune yield.

Heart beat: The device is useful to monitor heart rate of an individual, when crossed the threshold it can be intimated to the doctors and family members automatically. We can save millions of lives using this device.

Step Counter: The device lets you count the number of steps taken by an individual, so that they can exercise daily to meet their goals. It also helps to calculate how many calories that we have burned in a period.

Dis-Advantages: Compatibility: As gadgets from various makers will be interconnected, the issue of similarity in labelling and checking manifests. In spite of the fact that this disservice may drop off if every one of the makers consents to a typical standard, even from that point forward, specialized issues will endure. Today, we have Bluetooth-empowered gadgets and similarity issues exist even in this innovation! Similarity issues may result in individuals purchasing machines from a specific maker, prompting its imposing business model in the market.

Complexity: IoT is a complex system. Any failure or errors in the software or hardware will cost serious troubles. Not only that power cut also makes us uncomfortable Privacy/Security: With the majority of this IoT information being transmitted, the danger of losing security increments.

In-accurate data: Even though the device can give you huge amounts of information in regard to the activity and wellness, numerous tests demonstrates that the information isn't 100% precise and not by any means 80% once in a while. The means adding machine and pulse sensors are not known for exactness in a smartwatch. Ideally the brands are taking a shot at improving the sensor input and dissecting the information.

V.CONCLUSION

A prototype of health care system using IOT has been achived ,offerings a system implemented database that able to collect the data from various sensors and able to send data to database and remote caretaker does not require any technical intervention because it offers the auto set up through a remote Server. Also, this is a robust system because any of its update features does not interfere with the vital sign measurements in progress.Modern software architecture allows easy organization when creating applications, modification of system components, and adding new extensions to the system. The system supports any type of measurement of signs , it is easy to develop sensor bundles using other communication protocols, as long the gateway have the necessary hardware.

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AUTHORS PROFILE

Dr.K.R.R. Mohan Rao, currently working as the professor in Department of Electronics and Communication Engineering, **Koneru Lakshmaiah Education Foundation (KLEF**)

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Challa Vijaya Shankar, currently pursuing Bachelor of Technology in Department of Electronics and Communication Engineering, **Koneru Lakshmaiah Education Foundation (KLEF**)

.

V Anil Kumar Reddy, currently pursuing Bachelor of Technology in Department of Electronics and Communication Engineering, **Koneru Lakshmaiah Education Foundation (KLEF**)

Kalakota Venu Gopal Reddy, currently pursuing Bachelor of Technology in Department of Electronics and Communication Engineering, **Koneru Lakshmaiah Education Foundation (KLEF**).