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Smart Healthcare System

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Abstract— Now a days, monitoring of various health parameters of patient at hospitals has become a widespread phenomenon. People are losing their lives in unanticipated way with heart attack by not finding symptoms of it before happening. We can decrease such unanticipated death rates by implementing the project named Patient Health Monitoring System. In this project we will design a system which monitors the patient health parameters like body temperature, heartbeat, blood pressure and so on by using Internet of Things (IoT). IoT is where data collection is done through various devices like sensors and data will be stored in Cloud where we can extract and analyze the data faster with efficiency by making interaction among them. The proposed technique screens the essential health parameters and transmits the information through a wireless communication which is additionally moved to a network by means of a wifi module. The information can be obtained anytime advancing the reception of the present status of the patient. The doctors, just as the caretaker are intimated quickly through a message service or an audio signaling device at the time of abrupt conditions or any sick indications. Moreover, complexity level, power consumption of our design System is low and is highly portable for healthcare monitoring of patients.

Keywords— Internet of Things, Arduino Uno, Wi-Fi Module, Sensors, Healthcare

I. INTRODUCTION

Nothing can stop The IOT wave as time goes on,This will pave the way for pinnacle by grouping small range mobile transceivers into wide range of gadgets,empowering different type of communication among individuals and things,as well as things among themselves. the world can no longer have the worry about connection as Iot supplies connectivity for anything. groups of connection make a dynamic network of networks. The Internet of Things is neither sci-fi nor industry publicity,also depends on strong innovative advances and dreams of neck pervasiveness that are passionately being realized.iot depicts the future of computing and communication , and its improvement relies upon dynamic specialized development in various significant fields from remote sensors to nanotechnology[1].

Quality of service in healthcare has always been under constant criticism in the modern era, as it is a very touchy subject. Nowadays everyone in house are going outside to earn money.

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In this busy life, the aged people or sick people are unable to get personal care for monitoring health from their siblings because of hectic life schedule. Keeping a nurse or housekeeper is also a very costly issue nowadays. This problem can be solved by Monitoring health of them using IoT[2][3].

IoT is giving the route by which it is conceivable to gather and investigate information remotely with no human collaboration. In this way, this shows it is conceivable to recognize and counteract any future danger with accuracy and conceivable to mindful the concerning specialist like the relative or the doctor if there is any disturbing circumstance. The fundamental two reasons IOT is significant for health monitoring is right off the bat it is computerized, so no human cooperation is required.And secondly, because of automation the process has less chance of having errors i.e. having a more efficient system indicating a better quality in service[4][5].

In this paper we would depict how we gathered and dissected information utilizing ThingSpeak server. Likewise, how it was conceivable to screen all the gathered information from ThingSpeak server. In conclusion, how we made response board to adapt if any disturbing circumstance is approaching in future so it tends to be preventable. ThingSpeak is an open-source Internet of Things (IoT) application and API for storing and retrieving information from things using the HTTP convention over the Internet or through a network of local areas. ThingSpeak enables the generation of sensor logging applications, zone following applications,and a casual association of things with takes note. ThingSpeak has collected support from MathWorks ' numerical enrolling programming MATLAB, allowing ThingSpeak customers to examine and imagine moving data using MATLAB without requiring MathWorks to purchase the MATLAB license[6].

Once the data is collected and stored it can be retrieved from anywhere in the world. If critical circumstances arise like if the temperature or heart beat of the patient exceed the threshold value then an alert message would be sent to the concerned doctor and the relatives of the patient.

II. LITERATURE SURVEY

Several researches have been done on monitoring the patient's health remotely even when they are not under proper supervision. The following are the methods that are in use for the last few years. In 2018 "A Systematic Literature Review on Devices and Systems for Ambient Assisted Living: Solutions and Trends from Different User Perspectives", This paper suggested that the objective of Ambient Assisted Living (AAL) is to assist individuals (e.g. older persons, kids) have an autonomous and controlled lives by using and assisting with technology.

Explicit technologies have been developed for this population; a substantial amount of such advances (i.e. hardware, software) use sensors and embedded devices. Despite the reality that there are countless studies addressing AAL methods, there has been no display of efficient writing studies that solve cooperating hardware and software and consider specific inability. consequently a precise writing review of essential examinations related to aal is presented, which is centered around building up programming and equipment relations cooperating so as to solve or support explicit disabilities[2][3].

In 2018 "Fog Assisted- IoT Enabled Patient Health Monitoring in Smart Homes", this paper proposes that Internet of things innovation gives an equipped and organized way to deal services redemption parts of healthcare regarding Mobile and remote monitoring of patients. Using IoT technology we can obtain very valuable information which will be handled by Cloud Computing.Still many Health monitoring systems delay will be arised because of collected data going to cloud and retrieving by applications will take more time.Its Intolerable for emergency.So this paper proposed that The concept of fog computing can be applied at the smart gateway for checking patient health from remote locations.In this model event triggering information transmission procedure is received to process real-time patient information at the fog layer by including advanced techniques like data mining,distributed storage,edge computing. Temporal mining idea is utilized to examine the events difficulty by calculating the temporal b- health index of the patient. in request to decide the validity of the system.health information of 67 patients in iot based brilliant home condition was efficiently created for 30 days. Results show that in deciding the condition of an event.when compared to other classification algorithms, the proposed bbn classifier based model has high accuracy and response time[4][5][6].

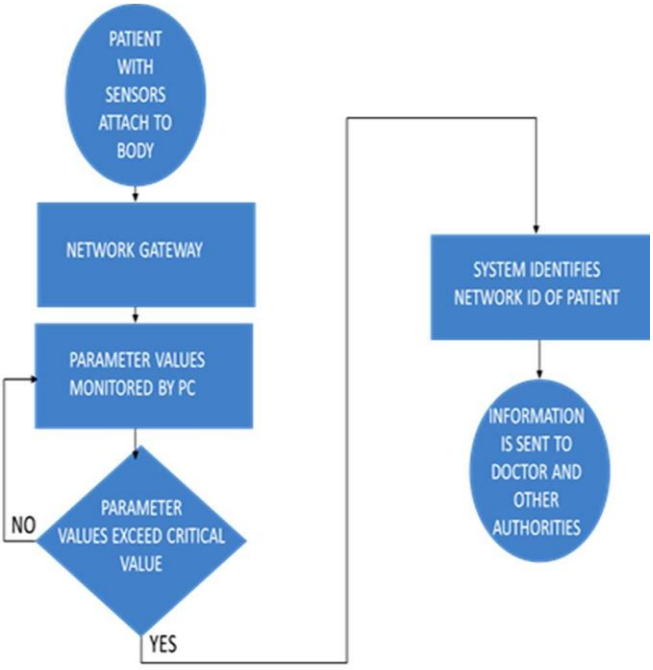
In 2017 "Internet of Thing Based HealthCare Monitoring System", this paper proposes that this paper recommends that observing a patient on a consistent basis,aggregating and adequately examining such data can realize an enormous positive change in the field of healthcare .our matter of worry in this task is to concentrate on the advancement and usage of a successful healthcare checking system dependent on iot.this system screens the significant health parameters and transmits the information through a wireless communication,which is additionally moved to a network by means of a WI-FI module. the information can be gotten to whenever advancing the reception of the present status of the patient.in case any abrupt change or any siginificant signs are perceived. the caretaker,as well as the specialists are told quickly through a message service or buzzer.in request to structure an effective remote observing system,security plays a significant part.cloud computing and password secured wifi module handles confirmation ,protection and security of patient details by permitting restricted access to the database .subsequently the system gives quality medicinal services to all[1][2][3].

III. SYSTEM ARCHITECTURE

This paper presents the framework of Smart Healthcare System which is useful in monitoring the patients' health remotely, which involves number of sensors which are connected together to monitor the health condition of the patient. The heartbeat, and the body temperature information of patient will be acquired in the form of set of biomedical signals ,will be Stored in Cloud servers to avoid eliminate smartphone acceptance as processing unit because of low memory and little computing capability of sensors. To fully automatically record people's health requirements, we need to follow some measures. There is a systematic way to do all of these tasks to run the Wi-Fi module detectors an d handle the ThingSpeak data. Following are the linear stage s of this thesis,

1. Individually collect data from the sensors through Arduino.
2. Send the data's to ThingSpeak with the ESP-8266.
3. Use ThingSpeak to sort the different data's into different channels.
4. Analyze the already stored data.
5. Display the data to Doctors and concerning people for relative host.
6. Alarm the necessary person for abnormal health situation.

After successful execution of these steps we can be able to achieve our goal of monitoring the health conditions of people even when we are away from them. So, for us to achieve this we need some connected hardware components. Let us discuss them in detail.



The components required for monitoring the patients' health remotely are:

- Temperature Sensor
- Pulse Sensor
- Arduino Uno
- Jumper Wires
- Bread Board

- Wi-Fi Module
- GSM Module

The suggested health monitoring system is intelligent to a utomatically identify the patient using the Internet of Things (IoT), which collects the status data through the provisions b elow that would include the heart rate and temperature of the patient and uploads the data to the cloud from where the ph ysicians can access the recent data.This would assist the phy sician to keep his patient's ongoing record from anywhere an d to ship his health situation solely to the patient..

A remote sensor system (WIRELESS-SN) may be a remote organization consisting of structurally dispersed self-sufficient gadgets to screen physical or ecological conditions using sensors. These self-sufficient devices, alternate nodes, consolidate a passage made of WIRELESS-SN framework for routers in addition. Sensor networks are the way to collect most of the data needed for advanced mobile environments, whether in construction, manufacturing, home-based, crafts, mechanization of conveyance frameworks, or elsewhere.

IV. CIRCUIT CONNECTION

a. Wi-Fi Module

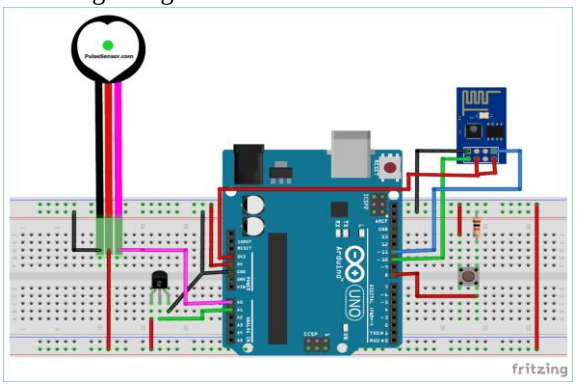
The ESP-8266 has eight ports, one of them is the power port which is used to supply power to the module and this was connected with the Arduino's 3.3v. ESP-8266 is very sensitive to high power so it was not connected to the 5v power besides it works better at 3.3v. Another port of the ESP-8266 is the ground port which is connected with the Arduino's ground. ESP-8266 sends and receives data with 2 different ports these ports are called TX and RX ports. ESP-8266's TX port was connected with Arduino's digital port number 2 and ESP-8266's Rx port was connected with Arduino's digital port 3. There is a reset port on the ESP-8266 which was not used as we did not need it, there is a port called ch-pd on ESP-8266 which is connected to the Arduino's 3.3v port. There are 2 GPIO ports on the ESP-8266, the GPIO1 is connected with the Arduino's 3.3v and the other port, GPIO0 is left unused.

b. Temperature Sensor

The DS18B20 has 3 pins to operate. One pin, VDD is for power and another pin is for ground. The DS18B20 can operate with power from 3.0v to 5.0v. The VDD port is connected with the Arduino's 3.3v through a 4.7ohm register. The ground port is connected with Arduino ground. The other port of the DS18B20 is the data port. This port is used to send temperature data to the Arduino, this port can also take power from the Arduino if it needs any extra. The data port of the DS18B20 is connected to the Arduino digital pin 5 through the same 4.7-ohm register. So, basically one end of the 4.7ohm register is connected with the VDD port and the other end of the register is connected with the data port. This register is put with both these ports so that overpower cannot harm the DS18B20 as the data port also may take power from the Arduino.

c. Pulse Sensor

The pulse sensor has three pins; one of them is the VCC pin to power the pulse sensor as usual. This pin is connected with Arduino's 5v power supply. . The other pin of the pulse sensor is the data pin. This pin sends analog data to the Arduino so we had to attach this pin with the Arduino's analog pin 0. This way the Arduino will be converting the analog data to digital and we can avoid using an extra analog to digital converter.



V. IMPLEMENTATION

After all the detail discussion about the hardware connections and introduction to ThingSpeak, in this segment we are going to follow the above methodology to complete the implementation of this thesis.

i. *Individual data collection*

As we are implementing a project based on IoT there are few things we have to ensure before the implementation. One of them is to ensure that it is fully automated i.e. without any human interaction. Secondly, it is better to form a nodal based architecture rather than wearable architecture. So, in our implementation each sensor performs as a node and data are collected from these individual nodes rather than collectively.

Simple Arduino codes are used to obtain data from each node. The sensor of temperature can measure the surrounding temperature. At first, only the room temperature is given by the temperature sensor. When the host directly touches the sensor, it will gradually adjust with the host's body temperature and that data is taken to the Arduino. For temperature sensor the data obtained is in Celsius scale. We have connected the pin 5 with Arduino which shows the data. So, in the void loop section retrieve that data into a variable "temperature" and then we print that variable in order to see the temperature in the serial monitor.

In case of pulse sensor, there are 4 different tabs; the main tab we named is Pulse Sensor Amped Arduino_1.5.0, All serial handling, Interrupt and Timer Interrupt notes. In the main tab we collect the data from the analog zero or A0 pin. Whenever a heartbeat is discovered in the loop of the first tab, then in the Serial handling tab, beats per minute (BPM) and inter beat interval (IBI) is calculated. Then the print in the serial monitor is done for all the three different values. The visual serial planning is then performed on the second tab and in the serial plotter we can see three distinct graphs [18].

The interrupt handles all the interrupt related issues which differs in different Arduino board. We selected the calculation necessary for Arduino Uno. Timer notes give the detail idea of how interrupt works in Arduino.

ii. *Sending data to ThingSpeak*

We need the assistance of esp-8266 to transmit information to ThingSpeak storage.The data available to us. The only thing you need is to combine the esp-8266 code with each Arduino device code to assist you send the information to ThingSpeak.. ThingSpeak has some popular characteristics that we need to guarantee when the software is merged. First of all, esp-8266 has its own language set. So we need to follow the language correctly to send those information ; Second, to link to the network, each file will need the SSID and password. The ThingSpeak server will need the IP. Third, the channel ID and the field number of that ID will be needed. And last but not least, each channel has its own unique data reading and writing number whenever we read or write information. these are the compulsory things to integrate into each Arduino code sensor.

iii. *Data Retrieval*

We may obtain original data from ThingSpeak using the Export / Import Data option provided in it. The updated field data can be downloaded from the corresponding channel. The data we can obtain is provided in the format of. CSV.

After the data gets uploaded into ThingSpeak, if the value of temperature or heartbeat exceeds the critical value.the concerned doctor and relatives will get alert message which describe patients' health is critical.

VI. RESULTS AND DISCUSSION

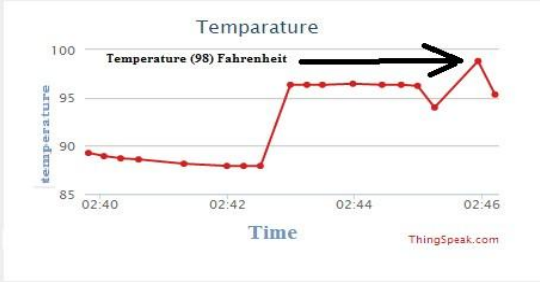
In this segment after implementing the code we will discuss how it is displayed in the ThingSpeak account of a user and how reaction or feedback is sent on the email and twitter. The data's we obtained after transmitting is saved in the cloud of ThingSpeak server and from there with the help the features provided from ThingSpeak we are able to display data and send alarming message.

I. Result Display

For each data entry, 15 seconds delays are required in the ThingSpeak server. In the display, the data entered in the storage is then portrayed graphically. The data entered in the storage is specific to the channel and field. That means it will go the specific field of that channel that is given by the user. For, convenience of the doctor of the elderly we opened a separate channel for them. The patient who is under observation of that doctor is then placed on different fields of that doctor's channel.

II. Temperature Graph

As we can show below the normal heat.here is the peak value reached at about 2.40-2.50 PMGMT +6.The Quantity shown here is progressively becoming saturated with temperature of the skin and displaying the peak value at around 98 degrees Fahrenheit.

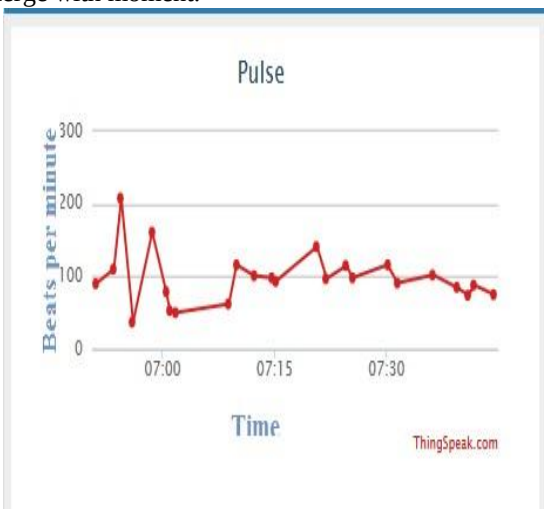


The temperature data which is in the Celsius scale will have been converted into the Fahrenheit scale using MATLAB. So, our retrieved data for temperature remains in Celsius scale. The following figure shows the temperature rise with a human touch and goes back to room temperature once contact is removed along with the time of entry.

III. Pulse Graph

The pulse graph which is taken at first gives three different values of parameters, which are already discussed above. The first figure shows the three different columns, the first column being the pulse rate, the second being the IBI and the third being the pulse signal. The following graph is acquired in Arduino's serial plotter. The blue color indicates the pulse rate, the red color indicates the inter beat Interval(IBI) and the green graph indicates the pulse signal.

We only chosen the pulse rate data as a monitoring criterion from this data set for the convenience of this project. The following graph of a host is created in the ThingSpeak after applying the ESP-8266 code with this pulse sensor data. Initially, some results for the noise factor are a little big. But as we can see in the following graph, ordinary pulse begins to emerge with moment.



We can see the corresponding raw data value that we retrieved from the ThingSpeak server in a .CSV format. Initially, for high noise margin, the pulse rate is high, but the noise margin stabilizes over moment.

After the data gets loaded into the cloud, now if some value exceeds the critical value then an vigilant message will be sent to the corresponding relatives and the concerned physician using the GSM module.

The only cost that was needed for our project was the hardware cost, on the other had any other project that was conducted was needed more costly hardware with more limited features, like the **Masimo Radical-7** and **Free Scale Home Health Hub reference platform.** So, it is safe to say that our project is more cost effective, with more features.

VII. CONCLUSION

Our main objective in this paper was to successfully monitor the basic four criteria's namely temperature, pulse, using of toilet and sleep and react during emergency without any human interaction. We wanted to create a mark with the health industry in the field of IoT.the Technology age is shifting towards a far superior dimension with increase of IoT technology. This project can certainly create way for the progress in this industry to maintain pace with latest technologies. Although our model is examined and applied it will be hard to continue the project with lot of fresh inclusion without high quality hardware assisstane.onlt when it could be applied in complete scale then only the true advantage of this Project fully realized.

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