IOT Based Patient's Body Temperature and Heartbeat Monitoring System

A PROJECT REPORT

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GALGOTIAS UNIVERSITY

BONAFIDE CERTIFICATE

Certified that this project report **"IOT Based Patient's Body Temperature and Heartbeat Monitoring System"** is the bonafide work of "**Akhlak Ahmed" & "Neha Mittal",** who carried out the project work under my supervision.

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ABSTRACT

Monitoring those you're keen on turns into a troublesome challenge within the trendy well-known and popular living of dwelling a life. Having a check of the health or fitness standing of your affected patient reception is probably a troublesome task. Particularly adulthood patients want to be sporadically monitored and their preferred ones need to be forced to locate out regarding their fitness status occasionally again additionally, at a place of labor. So, we have a bent to advocate a completely unique gadget that automatics this task very easily. This machine places in front a sensible patient fitness observance machine which can make use of sensors to hint affected person's fitness and can access web to notify his or her favorite ones just if there is any problem related to it.

Our device makes use of temperature and heartbeat sensing to record status of affected person fitness. If device detects any abrupt adjustments in person's heartbeat rate, and temperature, the machine routinely signals the user regarding the affected patient's standing on the field of IOT and conjointly, it can easily show the language information of heart rate and the environment or body temperature of that personwith video conferencing via web. Therefore, IOT primarily based affected person fitness monitoring system effectively uses web to observe person's fitness graph and then we can save the life of the person with this device by calling doctor immediately.

Also, all the tactic parameters inside at durations selectable through the user area unit measure recorded on-line. This may be very terribly beneficial for destiny evaluation and comments of person's fitness which is also a big condition. For tons of clinical application, this project is impermanent, by way of incorporating vital signs like blood pressure, ECG systems, etc. Hence, we have developed this project for proper and regular monitoring of the device with it.

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GLOSSARY

Keywords	Full Form
1. IOT	Internet of Things
2. LM35	Temperature Sensor
3. VLSI	Very Large Scale Integrated
4. LCD	Liquid Crystal Display
5. Wi-Fi	Wireless Fidelity
6. GSM	Global System for Mobile
7. UART	Universal Asynchronous Receiver &Transmitter

1. OBJECTIVE:-

In this project, there are few objectives which we mainly focus on, this includes:-

- Main aim is to design a movable and portable homely used IOT based Tele-fitness monitoring device for old age patients.
- Also it provides medical assurance by the help of various data that are received. For ex. Heart beat measuring, temperature measuring etc.
- All the sensors are placed properly and result can be checked by the person who is monitoring or can also be checked by the doctor or a relative.
- To store the data online with the help of IOT platform Thingspeak, in this just simply we have to sign in with user name and password.`

2. INTRODUCTION:-

Medical Electronics is additionally visiting advance with the applying Web of things. This web of things which is known as IOT can be called as advanced and fastest increasing demand field day by day. Web of things is preparing for travelling in searching for an application in almost everything & everywhere. During this project, an easy patient health display can be seen as a web application and this (Internet of Things) web device can easily detect heartbeat rate and could find the environment & their sign. This can be observed without any interruption that is the heartbeat time and environmental and body temperature which will be sending to the platform of the IOT for further records of the data. The web of things platform utilized during this assessment of circuit is Thingspeak.

This IOT assessment was invented & is worked on the device called Arduino UNO. That Arduino is special amongst the every busiest and hottest blueprinted models. Hence, it was seen that the owner of this project has suffered thoroughly under this project because of starting of the arduino device and then interconnected this with LCD using arduino. This Arduino was interlinked with the wireless fidelity module ESP8266 to attach this along online routing and can easily verify the system accessible over the cloud networking part. The Arduino was interconnected via LM-35 temperature sensor for sensing the encircling the body and environment temperature and for observing the pulse over pulse sensor. The observed pulse and the environmental temperature can be displayed on a personality LCD interconnected via Arduino and the result is transferred to the cloud server Thingspeak by transmitting data to a wireless accessed points. From this straightforward and keen usable and movable device, fitness checkup of a very unconscious person can be uninterruptedly observed. It'll accustomed to visualize the fitness check of aged folks that always faces heart or force per unit area situations. The fitness approximated material including heartbeat and body temperature can be routinely goes for updation and can be seen via

this Thingspeak platform. These facts are further used for these people to stay account of the person. The Freeboard.io is employed as the dashboard for the representation of graphical recorded info's.

This type of Arduino sketching can be runned upon the device to implement the varied functionalities of this assessment including readings of the sensed info, and then convert these into the originally made strings, which can further passed to the web platform and then finally view the measured pulse and temperature on character LCD. The Sketch is writed, compile and then loading via the Arduino IDE. This web platform used is Thingspeak and also the freeboard.io is employed to build this web dashboard.

In this assessment, we monitored several type of parameters of the person that uses the web of things. Within the person trscking device supported the web of things assessment, the original-time paras of a patient's fitness are sended to the cloud using net connectivity. These paras are sent to a distant net location or position so as that user can viewed those of the infos found anywhere within the world.

There is a big differentiation upon sending messages based person fitness tracking and web based person tracking device. In web based cevice, datas of the person fitness are viewed by many users. The rationale upon this could be that the info must be easily tracked by visiting an online site. Hence, in GSM based person fitness tracking, the fitness paras are sended with GSM via message.

This is one amongst the foremost recent Electronics Project Ideas associated with hospital applications that mostly bachelor students can take as their final year assessment. Another good thing about using IOT, There are various cloud service providers which is able to be accustomed view this data over the web. Thingspeak, Sparkfun and IOTGeek are few latest and simple to use service provider among all.

2.1 Proposed System Over Existing System:-

Proposed Sytem is better than existing system because existing system means that it is very time taking process. Patient's go to hospitals for daily routine checkups and spend lot of money on those checkups. For small-small body parameter changes, we have to go directly to the doctors hospitals for consultation. In that way, we spend most of our money and time on that small checkup.

But in proposed system, Hardware is of very low cost system, it is like one time small investment and this investment saves the lot of time and money of the patients. In this proposed system, patients can check their body parameters at home itself by its own. If the parameters are normal, there is no need to consult to doctor but if there is a major changes in the body parameters then patients should consult the doctor. Through, IOT platform doctor can also check the body parameters and analyze that body parameters based on their analyzation, doctor gives the appointment to the patient, then only patient go to the hospital, if there are small changes in the body parameters then we can discuss about these changes on the call or a message. In this way, we can say proposed system is so much useful and beneficial then this existing system and it is very efficient also.

This Proposed System of patients fitness checking is mainly used in critical situation and the data is monitored and regularly recorded in the database of Thingspeak IOT platform.

2.2 IOT in Fitness Care System:-

Web of things in fitness care machine has given us the huge advantage to monitor the fitness of the patient within the event of ups and downs, thus far to the medical treatment.

Due to the advances in the various technologies including VLSI, there are various sensors which became smaller which has enabled the event of wearable solutions.

Due to the consistent web connectivity, these devices have become so much strong, powerful and efficient.

This project monitors the patient under supervision for 24/7 under fitness monitoring. At any critically poor condition, this device can be used and can generate various datas which can be analyzed by doctors for patient's proper monitoring using statistical data.

These IOT devices are connected to the online platform, so that the patient can be remotely monitored and necessary measures can be taken when needed in any critical or emergency situation. Thus, it has both detects and respond services in the machine.

IOT generates an enormous amount of knowledge, which needs specialized kind of big data and data warehouse systems for correct management of the system or a device.

There is an enormous need of security to be present in these systems as person's detail can be set in the IOT devices so anyone will easily hack it simply by using just a small trick and misuse that private data of the user. So, this is the big issue for these kinds of systems.

3. Hardware Infrastructure:-

3.1 Arduino UNO:-

The Arduino Uno is degree ASCII file micro controller board supported the conductor ATmega328P microcontroller and is developed by arduino.cc.

The chip board is supplied sets for digital and analog input and output (I/O) pin which are prepared to be interlinked with varied enlargement board and alternative devices. This chip board can have 14 digital Input and output pins (six capable of PWM output), 6 analog I/O pins, and is coded via Arduino IDE (Integrated Development Environment), from a form B USB cable.

It often power by the USB cable or with laurels external 9 volts battery, whether it accepts voltage range between 7 to 20 volts. It's additionally the identical because the Arduino Nano & carverr. The h/w references style can be enabled below an ingenious Commons Attribution Share- Alike a pair of.5 license and is obtainable on the Arduino machine. Layout and production files for a few versions of the hardware are out there.

The letter "uno" suggests that "one" in Italian languages and has viewed to be mark the initial unleash of that Arduino code. The Uno chip board is that the primary in an exceedingly series of USB-based various Arduino boards of including version 1.0 of the Arduino IDE where the bibled versions of Arduino, is used with the latest versions. The ATmega328 upon the board that comes reprogrammed with a boot leading for allowing uploaded new code thereto with no info of the utilization of an external hardware coder.

While the Uno communicates using the primary STK500 protocol, it differs from all preceding boards therein it doesn't use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial convertor.

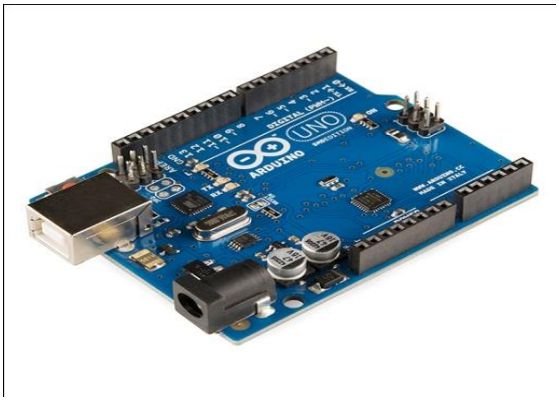


Fig. 3.1 Arduino UNO

3.1.1 Technical specifications:-

- Microcontroller: Semiconductor ATmega328P
- Operating Voltage: Five Volts
- Input Voltage: Seven to Twenty Volts
- Digital I/O Pins: Fourteen (of that six will offer PWM out put)
- Analog In put Pin: Six
- DC Current per I/O Pin: Twenty mA
- DC Current for 3.3 volts Pin: Fifty mA
- Flash Memory: Thirty Two KB of that 0.5 KB employed by boot leader
- SRAM: Two KB
- EEPROM: One KB
- Clock Speed: Sixteen Megahertz
- Length: 86.6 Millimeters
- Width: 53.4 Millimetres
- Weight: Twenty Five gram

3.1.2 General pin functions: -

• LED: Including an inherent LED droven by digital pins thirteen.When the pin is heavy worth, the LED is switched, once the pin is lower, it is stopped.

• VIN: These input voltages for the Arduino/Genuino boards are its victimization assured in getting any xternal power supply (as essential five of volts from the USB affiliation or can have differentiated measured power source).

• 5V: The output of the pin is regulated to be Five volts to give on the board via regulator. The board is stocked the source both from the DC powering jack (7 – 20 volts), the USB connective (5 volts), or the VIN chip of the board (7-20 volts). Activity voltage via the 5 volts or 3.3 volts pins bypasses the regulator, and might harm the board.

• 3V3: A 3.3 electromagnetic unit offer generated by the on-board regulator. Mostly current draw is fifty mA.

• GND: Ground pins.

• IOREF: This is a pin with which the microcontroller can be operated to provide the voltage references on the Arduino/Genuino boards. A properly organized defend can scan the IOREF chip voltage and viewed by the suitable powered offer, or modify voltages mediocre on the out put to work with the 5 volts or 3.3 volts.

• Reset: Usually accustomed for adding a swtiched to occupy the boards present to be blocked.

3.2 Temperature Sensor:-

LM35 is an associate integrate analog measuring temperature device that electrically outputs are proportional to degrees. LM35 device doesn't want any kind of xternal activities or running to supply varaible accuracy. This LM35 is a lower output electrical phenomenon, with lineared outputs, and precised inherented activity build interfacing to read out all or management electronic equipment particularly straightforward.

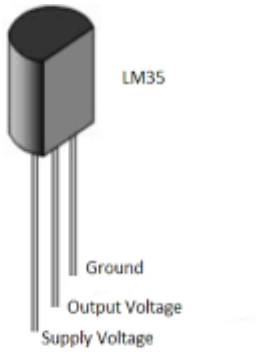


Fig 3.2 LM35 (Temperature Sensor)

3.2.1 Features of LM35 Temperature Sensor:-

- Labeled simply in degrees (centigrade)
- Linear for ten mV/°C scaled number
- 0.5° celcius accurate guaranteed-abed (at a 25° Celcius)
- Range for flash -55°Celcius to a 150°Celcius can be rated
- Appropriate for remote applications
- Lower price because of wafer-level trimming
- Operates from four to thirty volts
- Sixty mA current drain or lower than sixty mA
- Lower self-heating and can have 0.08°C instilled air
- Non-linearity solely can have typically 0.25°C
- Lower electrical phenomenon output, and can have load one mA for 0.1Ω.

3.2.2 Advantages/Benefits of LM35:-

The aimed advantage of LM35 can be that it has linearity i.e. 10mv/°C thats implies fo each degree rise in the temperature, the outputs of LM35 will be rised by 10mv. Thus if the outputs of LM35 is 220mv/0.22V then the temperature of visiting

be 22°C. Thus if temperature is 32°C then the output of LM35 are 320mv i.e. 0.32V in and of itself.

Neither of the extra tools required to interlink the LM35 to ADC as a result of the output of LM35 is linear with 10mv/degree scale. It is typically simply interlinked to any of the ten or twelve bit ADC. However, if you explicated associate degree 8-bits ADC like ADC0808 or ADC0804 an electronic equipment section are visiting are required if you'd wish to live 1°C modification. LM35 will also simply connects to Arduino. The outputs of LM35 temperature can even lean to comparators circuits and will be used for overload temperature indicator or by using a straightforward relaying is used as a temperature controlled device.

3.3 Pulse Sensor:-

Pulse detector may be a well-designed and can be plug-and-play with heart-rate detector for Arduino. These are often utilized by colleagues, sportsperson, movers, and games for mobile developing persons and also administrative body who wish to easily monitor the fresh heart-rate information upon their come. The detector clips onto a tip or ear lobe and plugs right into Arduino with some jumper cables. It conjointly includes associate ASCII document observation apps that can graph your pulses for real time device monitoring or track keeping.

This sensor is incredibly easy to feature in our project. It's a 24-inch color-coding cable, having male-header connector and this is often connected with an Arduino where no bonding is required. The center beat detector or the detector has three holes around the outer edges that makes it simple and easy to stitch into nearly something.

The heart beat Sensor Amped could be a plug-and-play of heartbeat sensors for microcontrollers that include PIC, AVR, Arduino, etc. It is won't to simply capitalize the fresh heart-rate info to a project. It essentialist and combine a

straightforward optics vital sign sensor with an huge amplification and noise cancelled circuits that makes this really quick and straightforward to induce reliability in the pulse reading. It can easily has to be clipped to ear lobe or fingers the tip then plug into 3.4 volts or 5 volts supply from the Arduino UNO or battery. The heartbeat sensor modules has three of the main terminals including VCC, Ground and Out. The out put pin of the pulse sensor module connects to analog A0 pins of the Arduino. The VCC connects to 5 volts DC output of Arduino and Ground connects to the grounded.

Fig. 3.3 Pulse Sensor

3.4 Wi-Fi Modem ESP8266 :-

The WLAN module (ESP8266) can be an integrated TCP/IP protocol stack which can provide any microcontroller access to our WLAN network. It's suitable for keeping associate application or can offload all wireless network function from other processor's application. This wireless module comes with AT commands code that allows us to urge practicality like Arduino WLAN protect, but we'll be ready to load the totally different firmware's to form our own application.

It figures beneath all operational conditions and wishes no external RF

Components.

ESP8266 is remodeling the world with its low price and high options that make it an ideal module for IOT. It can be employed in any application wherever we'd like a tool for out native network or net.

Wi-Fi module aboard 80 MHz low power with thirty two bit processor which can be used for any personal or custom firms. This conjointly implies that we'll be ready to host little websites with none external controller.

Fig. 3.4 Wi-Fi Module (ESP2866)

This wireless fidelity module have come up with the specifications of:-

- 2.5 GHz WLAN (801.12 b/g/n, supported WPA/WPA2)
- Can have general-purposed input and output (Sixteen GPIO)
- Interr-Integrated Circuits (I^2C) serial communicate protocol
- Analog-to-digital converse (Ten-bits ADC) serial peripheral interface (SPI) with serial communicate protocol
- I^2S (Interr-IC with Sound)that can have interlinked with D.M.A. (Direct Memory Access) that can share the pins with that of GPIO

- UART (with delicate pin, plus a transmitted-only UART is enable on GPIO2)
- Pulse-Width modulation (PWM).

It commands the Thirty Two bits RISC CPU which supports the Tensillica Xttensa L106 runned at eighty MHz (or upon clicked for one hundred and sixty MHz). It is a sixty four KB boot ROM, sixty four Kilobytes instructions RAM and 96 KB storage RAM. Their xternal memory board is accessed through this SPI.

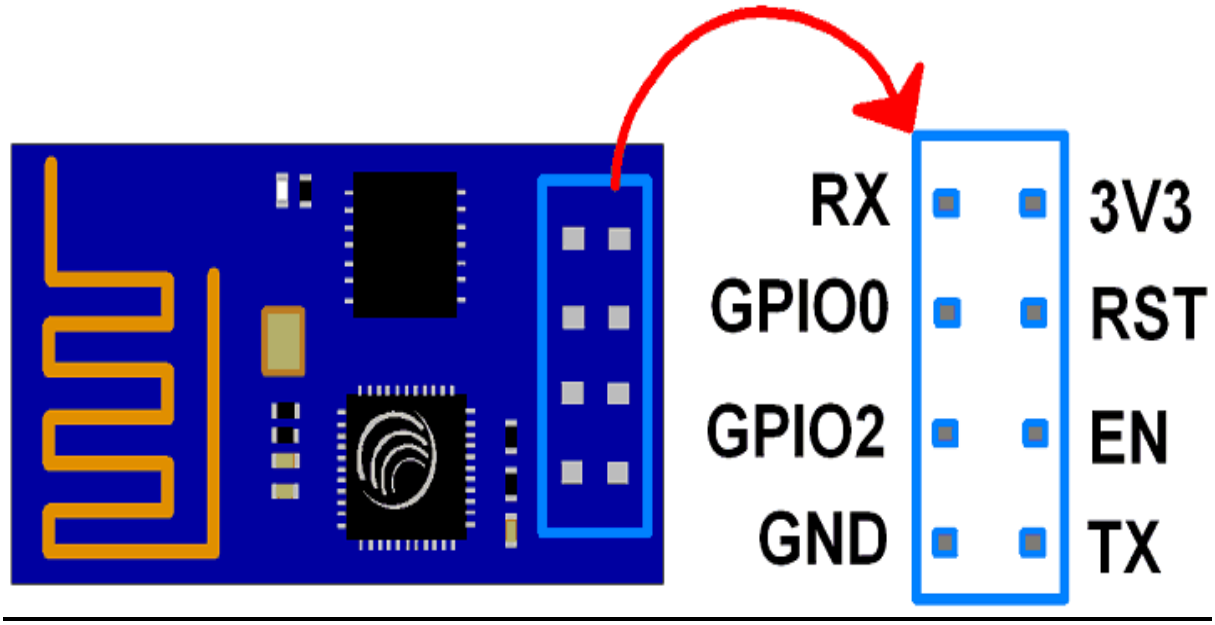
These Wi-Fi modules have lower costs which are including no wired transceivers which further used for end-to- end encryption IOT development.For communication with this Wi-Fi module, microcontroller should use set of automatic instructions. There present the Microcontrollers which can easily communicates with Wi-Fi module naming ESP8266-01 module which uses UART and can have specify bond. There is so many other party manufacturer whom can produces some various types of modules supported this kind of chips.

3.4.1 General Pin Configuration:-

This module can have different pins availability options which can include:-

1. ESP-01 have eight pins (include two pins of GPIO) – PCB trace antenna.
2. ESP-02 have eight pins, (include three pins of GPIO) – U-FLL antennas connected.
3. ESP-03 have fourteen pins, (include seven pins of GPIO) – Ceramics antennas.
4. ESP-04 have fourteen pins, (include seven pins of GPIO) – No ants.

3.4.2 Wi-Fi Module (ESP8266) Modular Pins Configuration: -



3.4.2 Wi-Fi Modular Pins

It includes the following pins:-

- 3V3: It is a power pin of 3.3V
- GND: This is a Ground Pin
- RST: It's a rest pin with lower activeness
- EN: It's an enable pin with high activeness
- TX: It's a serial pin for transmitting of UART
- RX: It is a serial pin for receiving of UART
- GPIO0 and GPIO2: These are general purposed input & output pins. These are the pins that can decide that what modes whether boots or normal, the module can starts up with. These can also decide that whether the transmitting or receiving pins of these are usable for coding in the module or also for the serial input and output purposed. For programming of this module with the help of UART, firstly connect the GPIO0 to ground and GPIO2 to VCC or might leave

that open. For the usage of UART for simply serialled input of the system and output, can left two of the pins opened, and can neither grounded nor VCC.

3.5 16 x 2 LCD Display:-

An 16X2 liquid crystal display (LCD) is an electronics media modular which can be used to display the data with the help of liquid to provide an image which is transparent and can be easily visible. This electronic device plays a major role in our DIY (Do It Yourself) project and in future can be helpful for those differently able communities who will use our product. This device translates 16 character in line and in 2 same lines. The use of this 16X2 LCD is important as in this each character is displayed during 5X8 pixels matrix which is very prominent in our project.

3.5.1 Specifications of LCD Display: -

LCD Display (16X2) have the following outlines:-

- It has duty cycle of 1/16.
- From this, LED for source can be drived that is by Pin 1, Pin 15, Pin 16 or A and K.
- It had cursor which includes 5X8 dots.
- Power supply supported is +5V and also supported for +3V.
- It can easily work for 4-bit mote or 8-bit mode.
- Custom generated characters can be viewed.

Fig. 3.5 LCD Display (16X2)

3.6 Power Supply:-

All the components within this system require a power of 5V DC. It is firstly, vaulted with a 12 volts battery which connects to a whole circuit. The flexibility of the battery that is regulated to 5 volts DC by usage of 7806 transformer IC. The 1st pin of the transformer IC connects to the battery signaling to the anode and 2nd pin connects to the underside. The out put can draws for a voltage via a 3rd pin of the Integrated circuit. An LED with this 10 Kilo-ohm pull-down of resistors is additionally connects through ground level and out put pin to induce a virtual hints of power supplying regularly. Here, LCD display characters, heartbeat sensors and the body hotness measuring sensor can provide the 5 volts of DC, which is given by the 5 volts DC power given output that particulars of the arduino. While, 3.3 volts DC power given by the output of the arduino can be given by 3.3 volts DC ESP module.

3.7 ThingSpeak: - ThingSpeak is a plaform with an unique device sources of the web of Things (IOT) applications and build application protocol integrated to save and recover the info from thingspeak using the various protocols like HTTP, MQTT upon the net or via a LAN called as local area network. ThingSpeak has formed the criteria of sensors which can use logging of various of application, position finding applications, and can have a distance net work of various things with most updation.

4. Literature Survey: -

- S. J. Junng and W. Y. Chunng have done research on the flexibility and scalability of the person's fitness care device in WLAN. The most important quality of this enabling fact is that the integration of these technologies and can communicate the solutions with this problem. The answers of several web of things are energized activities that can be combined in various fields of data including – tele-communications and various IT sectors including information technology and electronic devices.

- K. S. Shini and M. J. Mao Kaaiveer studied a cellular telegram based fitness care device with self visualizations that can include a brand new para digtialization which uses the intelligent and unique objects that are not only interested in collection of the data from the environments and interaction with the mentality of the world, but also can be interlinked with another via net to exchange the content similarly as that of the info provided by the device.

- Gennaro tartarisco and Tabilo Paniclo had done a research on the maintenance of sensors and the covers of the connects in huge sensors, servers mainly have the info about the way to how to build it or how to form a brand new computarized technology field that can be supported by medical views of supporting devices, including IT sector process and no wire communication and including the infoof the processing banned in the new premises that are within the field of potential fitness cure.
- Cristtina Ellena Turrcua studied about fitness cure applications an answer supported the web of things i.e. IOT which mainly suveys the aim

to be present at in the depth information about the ofteness identity, many using agencies and the web of Things technologies is won't to form the device which can help in improving people's accessing the purpose and fitness cure services and then optimizing the fitness cure processes.

- Guubbi, Jayaavardhana, Buyya, Raajkumar, Maarusic, Sllaven, Pallaniswami, Marimutth studied the web of the things i.e. IOT: The mission, architecturally connected elements, and further direction which proposed on increasing demanding location and keep track of the machine. It has supported global positioning system (GPS) that has made enabling of the devices and suitson the very large or huge environments. Intelligent phones via two of the terminals can be helpful for making the correctness of standardized communication. The standard communication can be performed by synchronized phase of the devices.

- J.L.L. Kallju invents a device, that has the capability to measure various types of including physiological parameters and won't be able to design a systm for vital signs of constructed rate that is adapting of paced Loeren Schhwiebert, Sandeep K.S. Gupta and Jenniffer Weinnmann studied the strengths of the unique sensors which are invented via the mixture of sensing the items or materials together via the combination of circuits for various type of bio-medical applications.

- Gentilli G.B. develops a straightforward micro technique to watch the whole cardiological activities being given to it. This technique depends on changed modulation that are enveloped of amplitude that has been considered with modulation of waves passed through the whole of the body . It explained the utilization of

wireless micro used sensors that covers the network for hospitals monitoring and acquiring lots of environments with its sensing.

- Reza S.Dillmagghani (2016) form their study founded that the planning of Wireless fidelity sensors that include various networks which are considered for keeping track of person's not recoverable diseases at their home itself via a distant monitoring system via the web of things i.e. IOT system.

5. Schematic Representation:-

5.1 BLOCK DIAGRAM:-

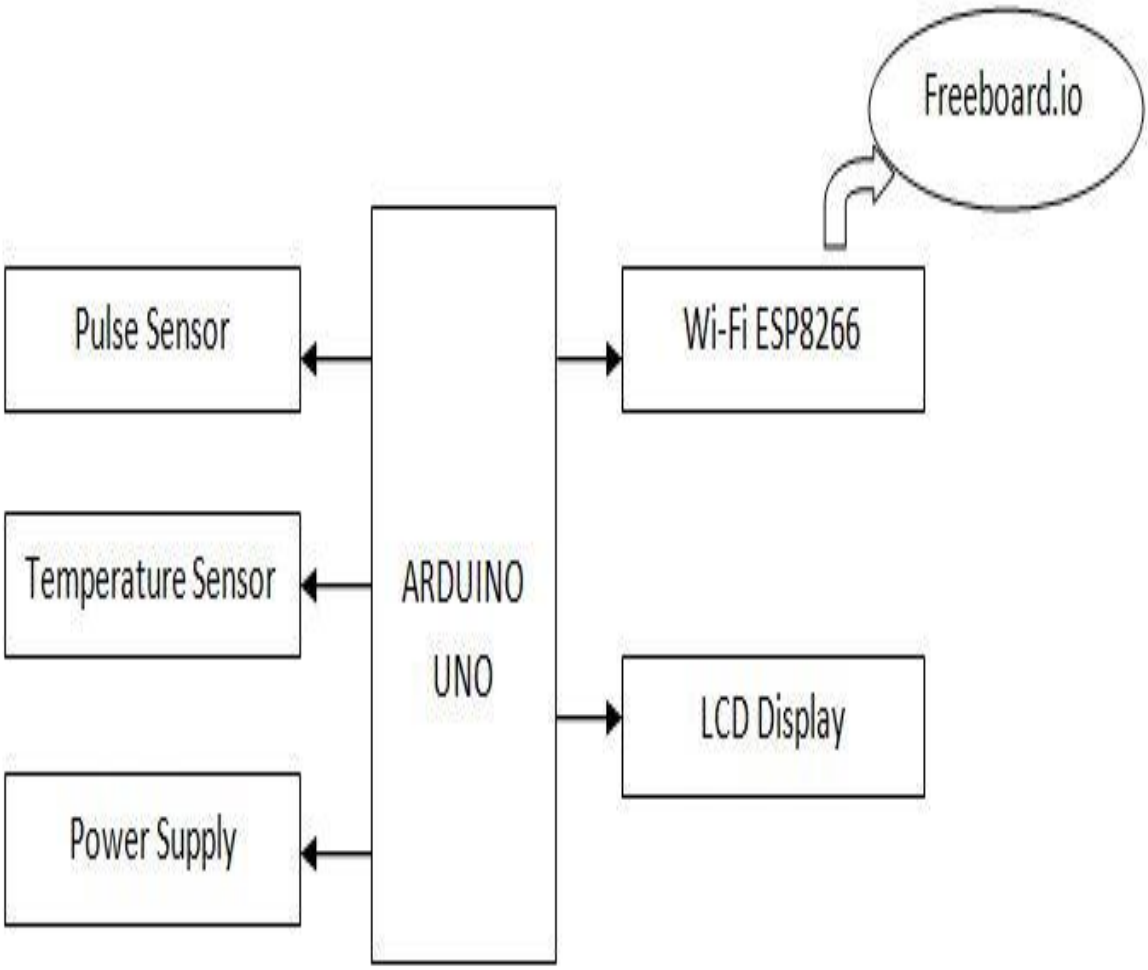


Fig 5.1 Block Diagram

5.2 Algorithm:-

Step 1:- Place the finger on pulse sensor and patient body in contact with temperature sensor.

Step 2:- The data of patients body temperature and heartbeat shown into the 16X2 LCD Display.

Step 3:- Patient body data is saved and send to the IOT platform thingspeak via Wi-Fi module ESP8266.

Step 4:- The data changes in every minute when sensors connected to the human body on Thingspeak platform.

Step 5:- Graph made on the Thingspeak platform of sensors output.

Step 6:- Data sends to the doctor or relatives for general routine checkup via internet.

5.3 FLOW CHART:-

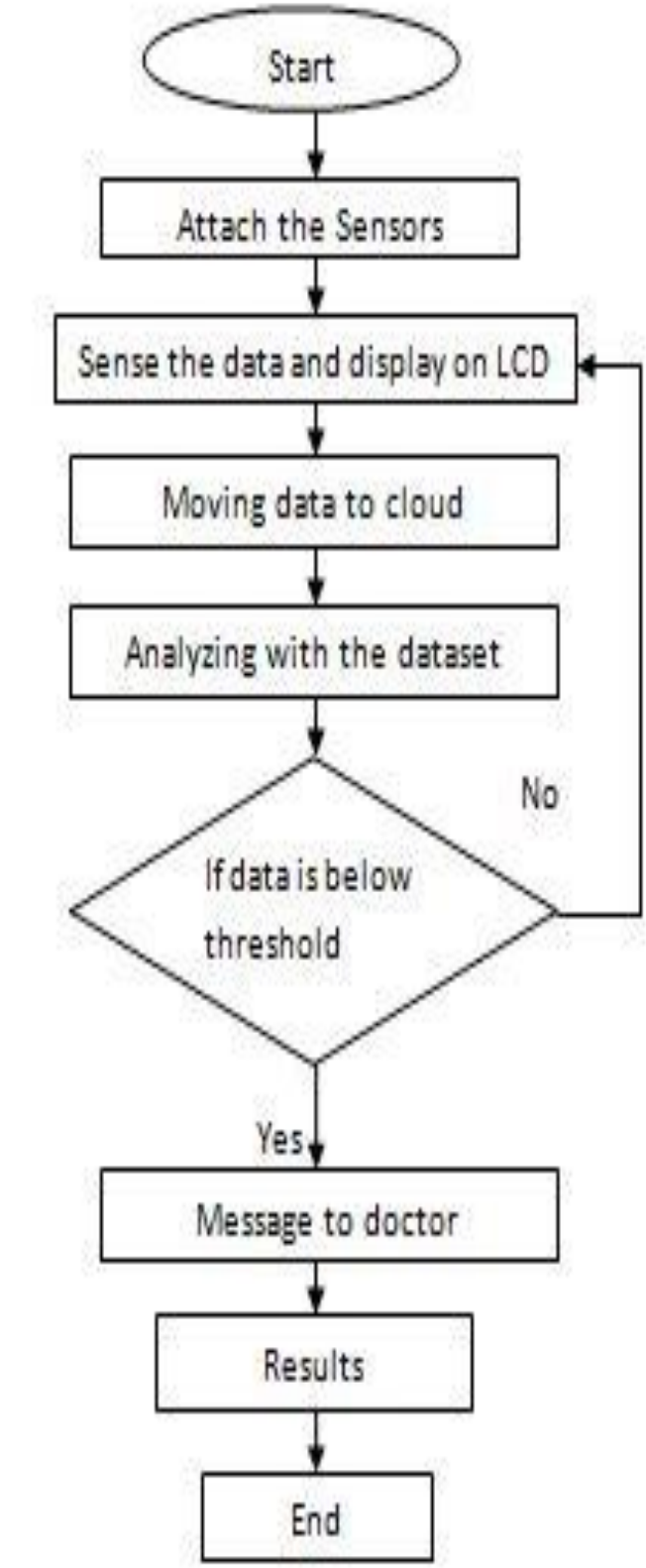


Fig 5.3 Flow Chart

6. Working of Project:-

In this project, IOT based patient's body temperature and heartbeat monitoring machine; we use two sensors, that is, temperature or environmental sign sensor and pulse sensor (LM-35). With that project both the sensors and a Wi-Fi module (ESP8266) connects easily to the arduino. Wireless module is used for ending the data to cloud platform namely, Thingspeak. Thingspeak is an unique source platform which is accessible from anywhere in the world. The 5 volts power supply is transfer to all the circuit. All the circuit works on 5 volts power supply. Arduino connects to all the components in the circuit. Arduino senses the heartbeat rate and body temperature of the person via the process or a system.

When LM35 sense the body and also the pulses with pulse sensor, then the body or environmental temperature and pulse rate of the body also seen on the LCD Display. We can use 16X2 LCD Display to view the body temperature and pulse rate data on the LCD screen. This data is updated in every minute on the IOT platform Thingspeak. We are sending the data to this platform via using Wi-Fi module (ESP8266).The arduino continuously senses the data from these two sensors (temperature and pulse). This info of the body is seen with the LCD Display. This info is sent on the IOT platform. In this way, the circuit of the project works.

IOT platform thingspeak keeps the data safe. This platform shows all the activities done by the hardware system. This shows both numerical and graphical representation of the patient's heartbeat and body temperature. This platform is very friendly to the patients because patients also analyze the data from the platform. If there is any major change in parameters then only patient consult to the doctor and doctor then analyze the data on internet. If there is any critical condition then the doctor give appointment

to the patient. In that manner, we save money and time in this digitalized world. This proposed system is very helpful for human beings. In that platform first, we make an ID which contains user ID and password. In that manner, doctor can access and see the data of patients from anywhere in the world. In that way, we can save the time and money of patients. In that way, daily routine checkups are minimized for the patients.

The body temperature is in Fahrenheit (F) and the pulse rate is in BPM. If any critical condition comes then only patients visit to the doctor otherwise the patient can take the suggestion via the message or call. Doctor can see the data on the Thingspeak via accessing with ID and password.

This project also make as a wearable kit also by replacing the arduino with microcontroller and LCD display is reduced to smaller size.

7. Design Brief:-

Here, we have shown the assembling of the components for designing our project, IOT based Patient's body temperature and heartbeat monitoring system, which is shown as under:-

7.1 Circuit Diagram:-

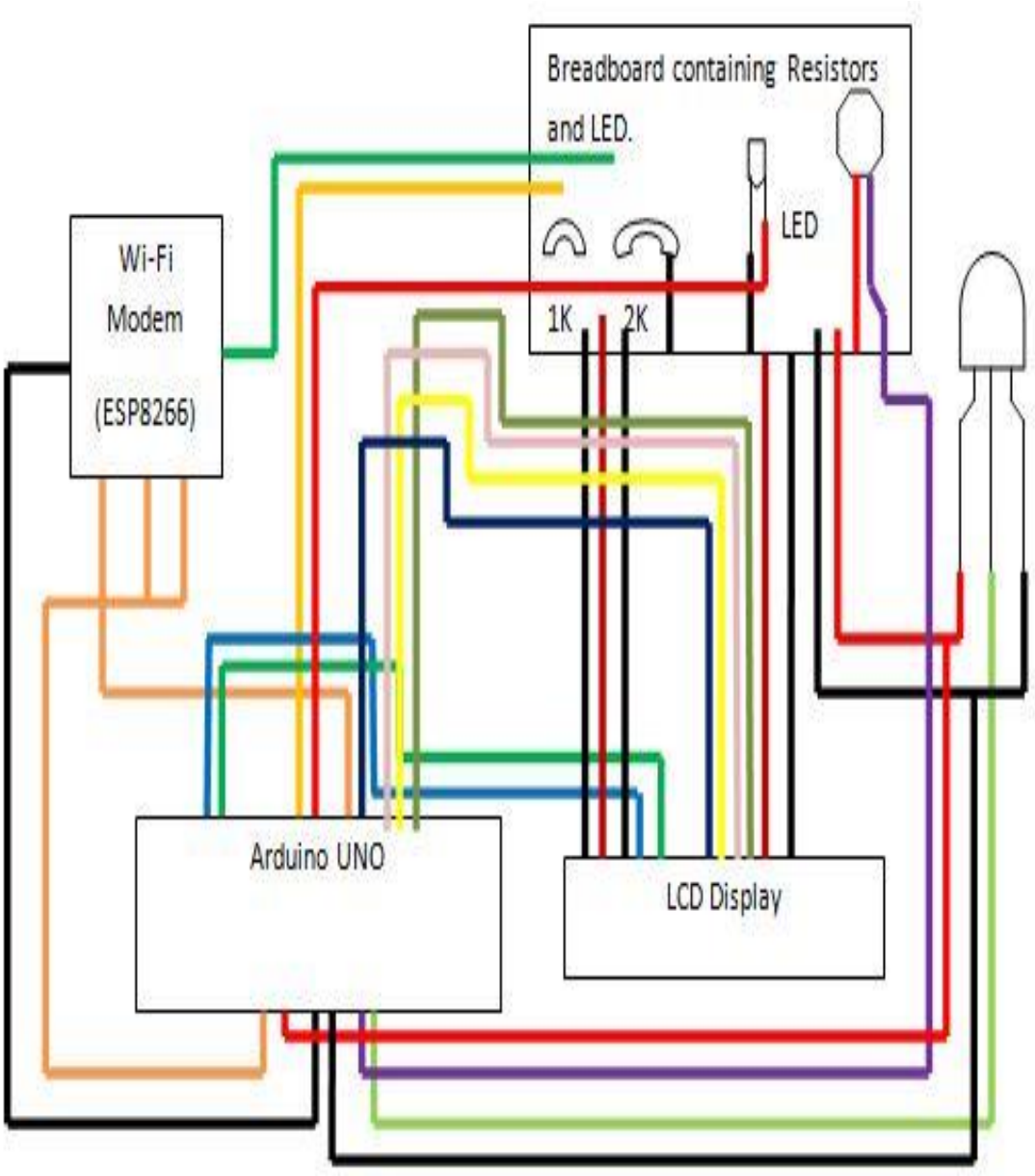


Fig. 7.1 Circuit Diagram

1. Firstly connect the LM35, i.e. temperature sensor with out pin to A1 pin of arduino & remaining two pins as to the Ground and VCC.
2. Then connects pulse sensor with out pin to A0 pin of arduino and rest two pins similarly as LM35 to Ground and VCC.
3. Led is connected via digital pin number 7 of Arduino with 220 ohm resistor or variable resistor.
4. Pins 1, 5, 3, and 16 of LCD are connected with the Ground.
5. Pins 2 and 15 of LCD are connected with the VCC.
6. Pins 4, 6, 12, 11, 14, 13 of LCD are connected to digital pins 12, 11, 4, 5, 2, 3 of Arduino pins.
7. Wi-Fi module (ESP8266) has RX pins which works on 3.2V and that pin will not communicates when we connect it simply with the Arduino board. Then for this we have need to make a voltage divider that will convert the voltage of 5V to 3.2V, and for this purpose, we connect the resistors of 2.2K and 1K or we can connect it to the variable resistor. Thus, from these resistors, RX pin is connected with the 10^{th} pin of Arduino.
8. And, at last, connect the wireless module (ESP8266) TX pin with the 9^{th} pin of the arduino.

8. Methodology:-

8.1 General Methodology:-

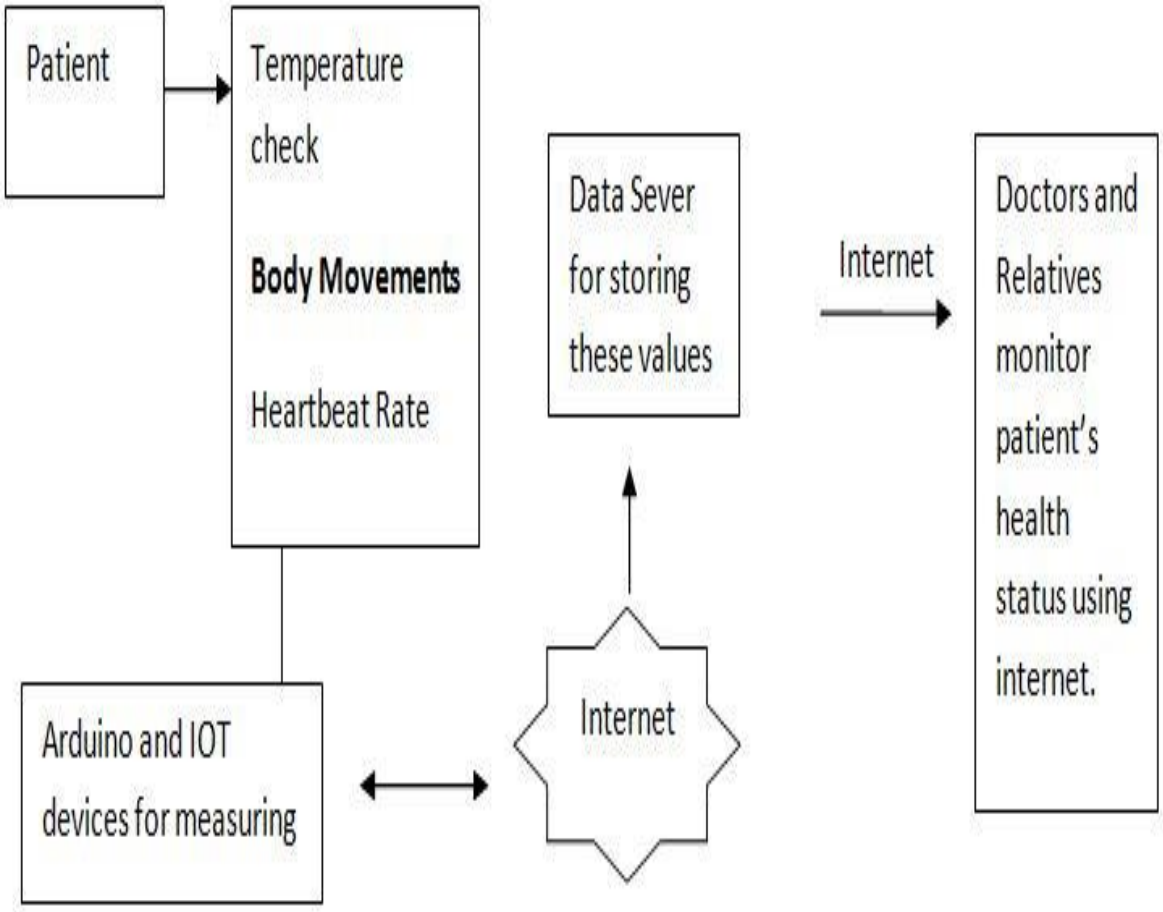


Fig 8.1 General methodology of the system

In this project, the methodology that is followed is, firstly, we will see the person, who is feeling unconscious or unwell. Then seeing his/her body movements including temperature and heartbeat, both we measure with this machine. This includes complete working of Arduino and IOT device which are included in measuring via using web. Then, when we measure, the results are showing for the LCD to be Displayed which is completely linked to arduino UNO. For keeping regular record of checkup, we can save this data on web via connecting this with

IOT device. This IOT saves the data on the IOT platform which is called as ThingSpeak. On ThingSpeak, we will create an account and for further processes, simply we can login via using username and password. This platform is also helpful for doctors to keep the regular record of their patients. Then, if the temperature is high or pulse is higher or lower, then only there is a need to go the doctor else we can talk to doctor via message or call for taking simple medicines.

Now, as this data is saved on Internet and we can access it wherever we want and also it is beneficial as we can access it, wherever we are, No matter how long the distance is, just all we need is the proper internet connection. Also, we can give this username and password to any doctor or any relatives to monitor person's fitness update using Internet.

This device is also beneficial for routine checkup so that we can treat it, whenever, there is a up or down in the readings, so to get the proper fitness and also it doesn't take much time so we can easily save time and for a routine checkup, there is no need to go to doctor or a hospital and standup in a line to get this small checkup done. Hence, it is very useful.

8.2 Platform Used:-

Here, we use IOT platform ThingSpeak, which includes: -

ThingSpeak is a platform with a wide source of Web of Things applications and builds the application protocol integration to save and recover the info from ThingSpeak platform by using various protocols like HTTP ,MQTT upon the net or via LAN called as Local Area Network.

Thingspeak has formed the criteria of sensors which can use logging of applications of various kinds, position findings application, and can have a distance network of different kind of resources with the source updating. Thingspeak platform was firstly invented by IO Bridge in 2010.

ThingSpeak can take an mixed help from the variouss number system softwares which is matlab from Maths Works, and can allow Thingspeak platform users to keep tracking via analyzing or visualizing the submitted info using matlab and there is no need of purchasing the software of a MATLAB license from Maths works.

ThingSpeak can have a huge contact with Maths works, includes all of the documents present in the ThingSpeak platform can be Performed into the Mathworks Matlab which is a information containing site and can enabled the referenced Mathworks user accounts for a safe log in credentials over the ThingSpeak platform website. The conditions of services and privacy policy of the users to use ThingSpeak.com is between the agreed user and Mathworks, Inc.

ThingSpeak is a very good tool or a platform for IOT based projects. With the help of using the Thingspeak platform site, the users can easily monitors the info and also controlled the whole machine via the web, with the help of using the channels and web development pages are that are given by Thingspeak. Thingspeak platform firstly, captures the info from the used sensors, and then the info is Analyzed and Visualized and Acts by performing a sudden react of it. Hence, we explained in short the usage of ThingSpeak platform of IOT, hence the IOT Patient Monitoring Project can be worked.

We can use this ThingSpeak platform to monitor the person's heartbeat and temperature online via internet commanding.

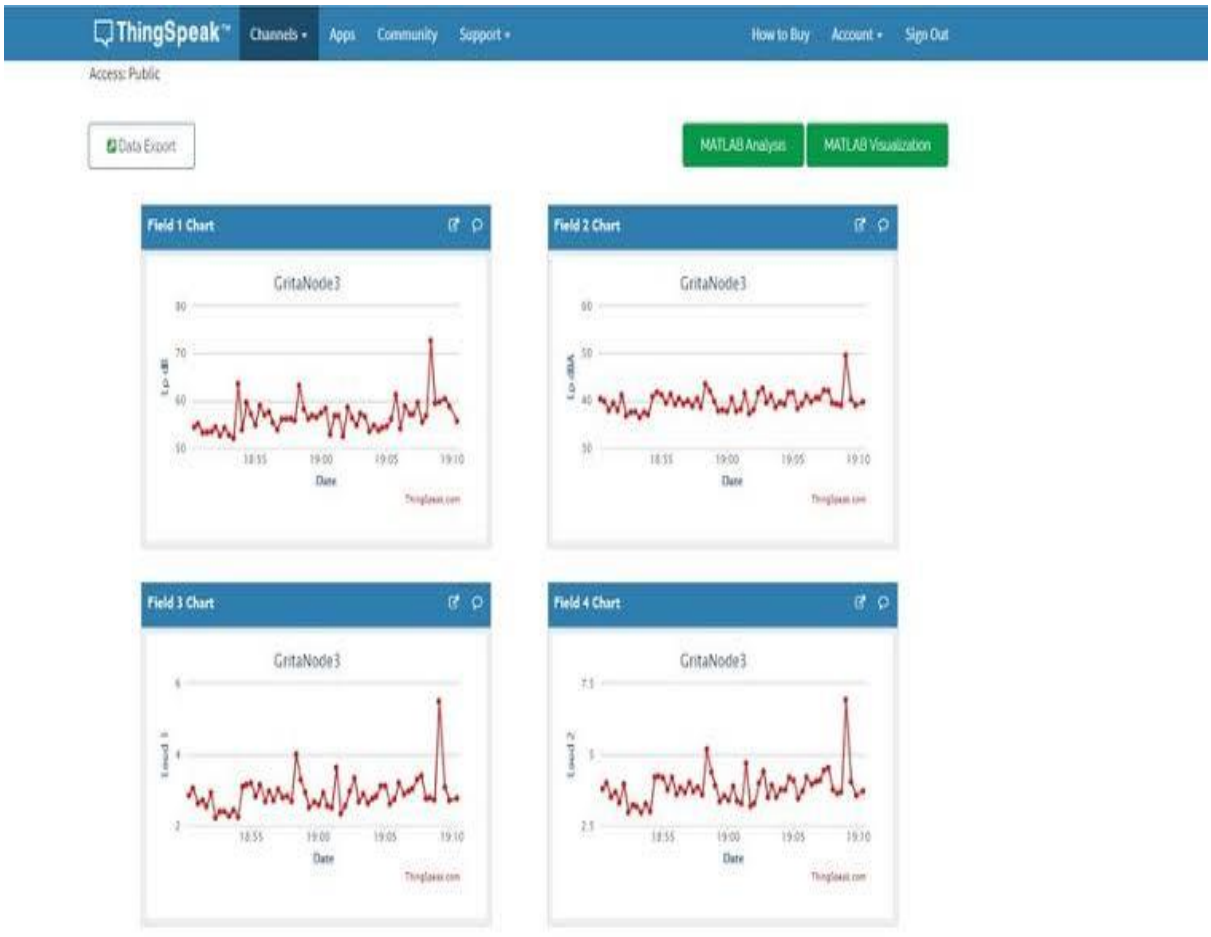


Fig. 8.2 Thingspeak Platform

8.3 Advantages of Project:-

1. IOT device enables remote observing in the fitness care which is not so much possible. This platform has the ability to weaken the patient for clean and well maintained person and also reduces the time period of stay in hospitals.

2. IOT connects the patient and physicians to provide the superlative care.

3. This system is also used as a wearable kit. It is like a fitness kit.

4. This system is movable because we can check the data anywhere just simply by login with mobile or laptop.

5. Physicians can keep track of the data and record of the patients very effectively and if the conditions are critical then there is a need of immediate attention.

6. Data collected from IOT platform helps the doctors to identify the best treatment possible to the patients.

7. We can control more number of patients in less infrasctructure and work load of hospitals is minimized.

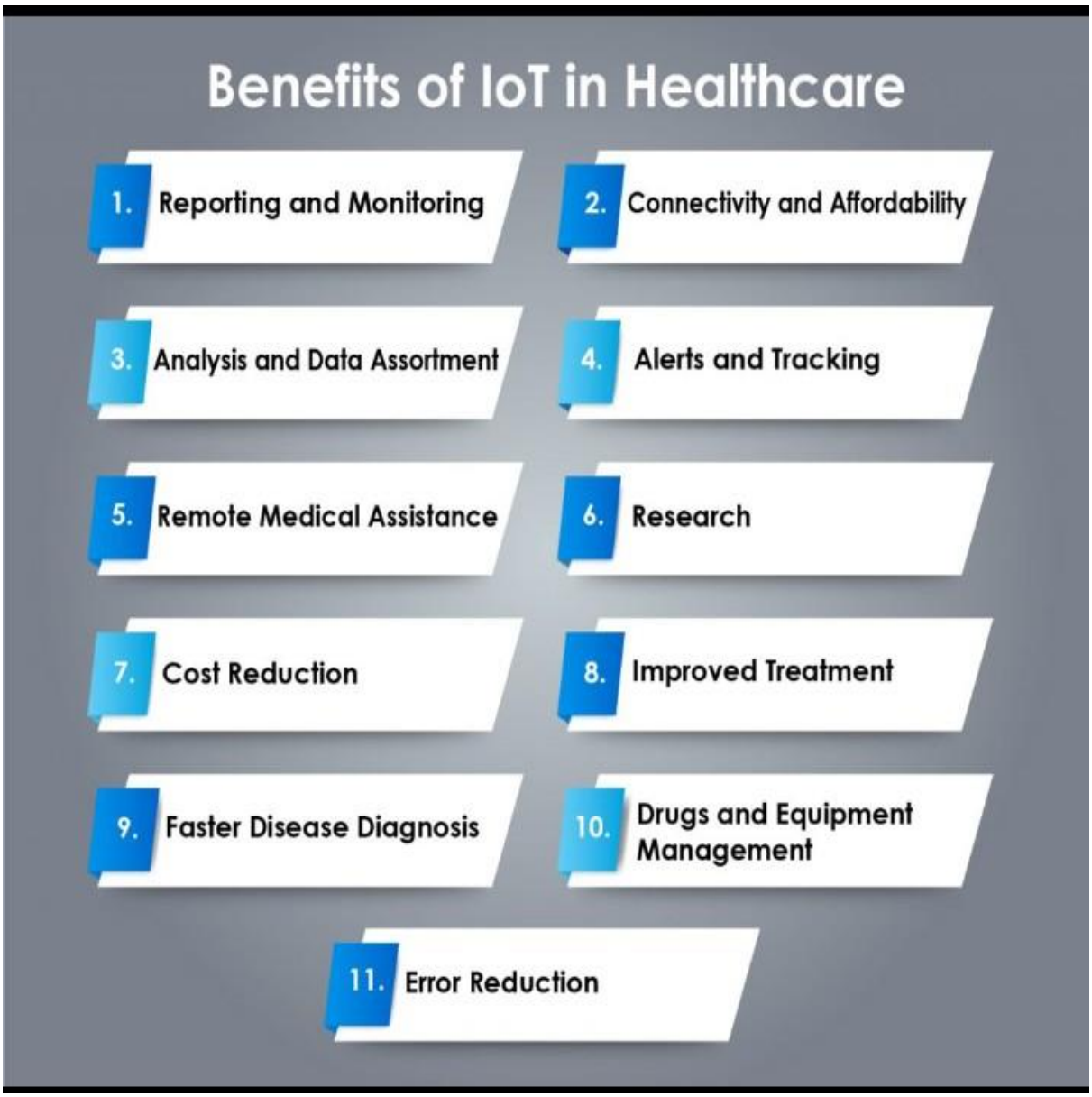


Fig. 8.3 Benefits of IOT Intelligence

These are also beneficiaries of IOT platform which include various types of things such as regular reporting and monitoring, connectivity and affordability, analysis and data assortment, error reduction, drugs and equipment management, faster disease diagnosis, research, report medical assistance, alert and tracking, etc.

8.4 Applications:-

IOT enabled devices have various applications few of them are as follows:-

1. This device has made the remote monitoring possible which having the ability to keep the people secured and fit. This reduces the time period of stay in hospitals and prevents re-admission.
2. IOT is undoubtedly transforming the medical fitness care sector by revisualize the requirement of the devices and the people's interaction occupying the fitness cared solutions.
3. This is the very demanded and outgrowing field in the modern medical era. It is very useful for the elderly persons at our home and also specially for senior citizens which are living alone or also for members living separately like 1 or 2members.
4. This is also beneficial for disable patients. Disabled patients who really facing the difficulty to visit to the doctors and hospitals for a regular purpose and also for those peoples who needs uninterrupted monitoring under the supervision's guidance.

8.5 Challenges:-

There is no doubt that IOT (Internet of Things) create a new technological ecosystem in healthcare by helping the organizations by reducing the gap between patients and hospitals. But there are many major challenges which should be overcome as soon as possible.

1. Internet Disruptions can kill: - When checking the data of patient, if there is any disruption in Internet connections and network, it will be very dangerous to the patients. If there is any changes in data due to network or internet connectivity, it can kill the patients if the patient is very critical. In healthcare, IOT crashes are unacceptable. Additionally, performance engineers keep in mind that the system is designed very efficiently so it can work in worst conditions of network also.
2. Narrow down your test scenarios by defining the most popular device and software versions which ensure the most effective courage all the time. Then also test all the new devices that will communicate with the network and ensure that all the data will stay safe during the network disruptions.

9. Experimented Results: -

The result of the proposed system which means body temperature and heartbeat rate of the patients is shown on the LCD Display. Body temperature is in Fahrenheit (F) and pulse is in BPM. After that the data is send to the IOT platform which is accessible from anywhere in the world. These both numerical and graphical representations of both parameters are shown:-

1) Heartbeat recorded over ThingSpeak Platform on alternate day basis:-

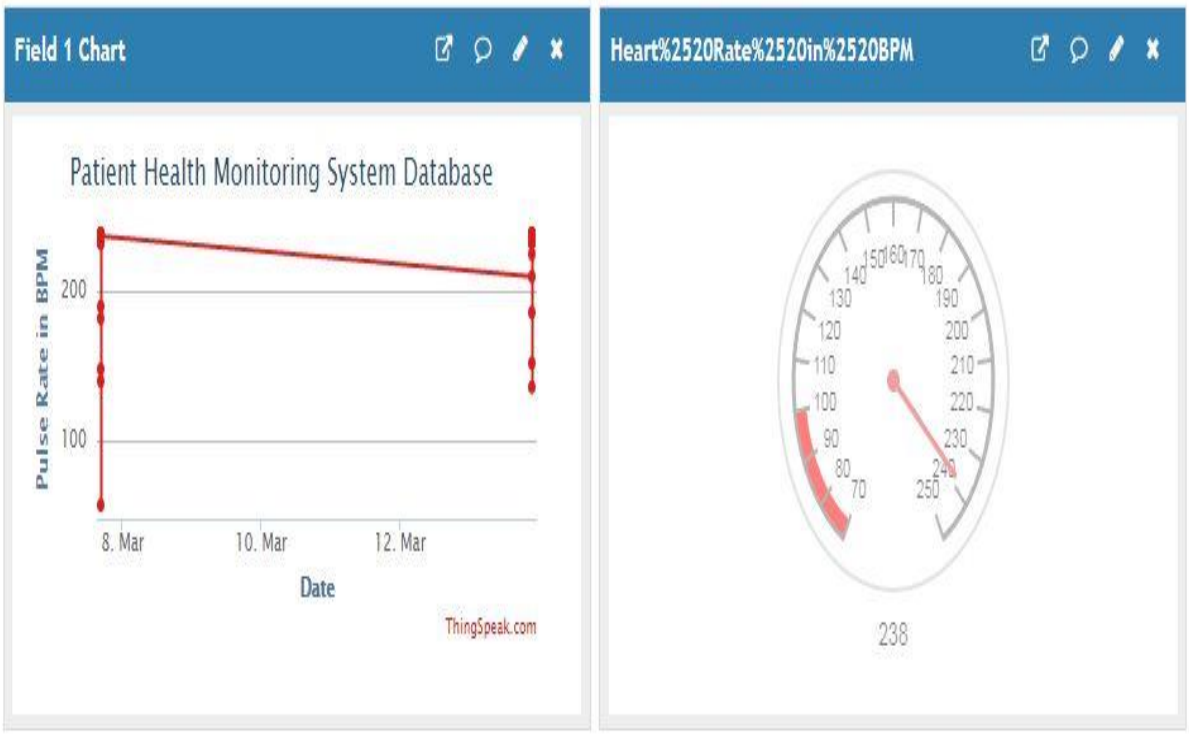


Fig 9.1 Thingspeak results for heartbeat

2) Body temperature recorded over ThingSpeak on a alternate basis is as shown:-

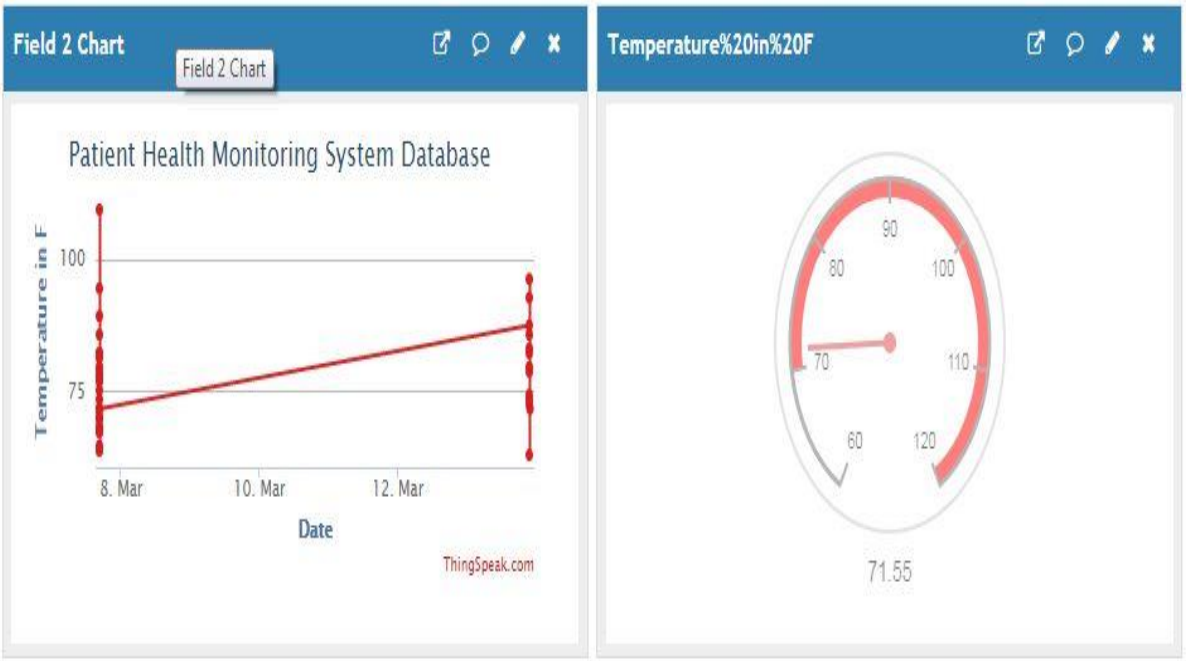


Fig. 9.2 Thingpseak result for Temperature

This data is updated in every minute when we use the proposed system for checking the body parameters of the patients.

10. Future Scope and Limitations:-

10.1 Future Scope:-

- For further up gradation of this project, we can add various sensors like Blood Pressure, retinal size, age, and weight can also be including as the controlled sensors or parameters.

- We can develop this using advanced type of GSM or GPRS latest technology in near future.

- Also we can add eye blink sensor in future.

- Database of patient's body can be easily accessible in all the near medicals for the immediate care and treatment in critical conditions.

- In future, sensors will be made more sensitive and accurate so that there is no problem in analyzation of data.

- The proposed system in future is more accurate and compact so there is no problem during traveling also.

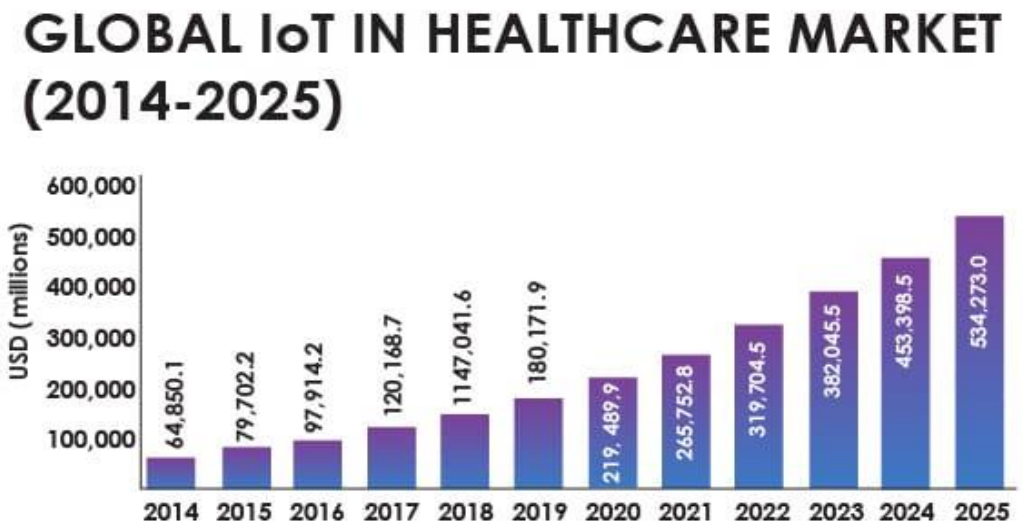


Fig 10.1 Global IOT in healthcare market

10.2 Limitations:-

1. Complexity Problem in this system as IOT itself is a very complicated and complex system.
2. Inaccuracy in the system as data shown by measuring is not 100% accurate and can vary time to time.
3. Compatibility problem because of common labeling and checking materials.

11. CONCLUSIONS:-

In this report, we observe that the importance of IOT in healthcare system. As we know that the healthcare devices are the main principal parts of our daily life and also for the business, without manual using of these devices and businesses that will lower down the stress on humans and it will ease the computational and monitoring processes. In proposed system, we connect all the components and devices through IOT to use the device and components in more efficient manner. Through proposed system, we send the body parameters which senses through sensors. The body parameters like body temperature, heartbeat rate, etc. are send to the IOT platform Thingspeak so that we can access the data from anywhere in the world. After the updation of required particulars on the IOT platform Thingspeak, we can consult the doctor through message or call and give the suggestions and prescription through mobile or social platform. This system is cost-effective means low cost and setup in the patient's house and it is wearable also. By keeping all the parameters in mind, we design such an useful system that is very much time saving and also it is financially good as it saves lot of money. This proposed system lessens the burden of doctors and hospitals and gives effective and quick treatment. In medical emergency and in critical conditions, it is very helpful. IOT makes the healthcare sector more valuable and effective. By using IOT, we can save the money and time both and it is very pocketed friendly. In this report, we studied the importance of IOT in health care sector.

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APPENDIX:-

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(13, 12, 11, 10, 9, 8);
#include <SoftwareSerial.h>
float pulse = 0;
float temp = 0;
SoftwareSerial ser(4,5);
String xpiKey = "D4Q36U6N2FUN17S5";

// Variables used
int pulsePin = A0; // Pulse senses purpled colour wires connects to analog pins 0
int blinksPin = 7 ; // pins to blinks led at each bit
int fadedPin = 13; // pin to  fancy clasic fade blinks at each bit
int fadRate = 0; // uses for fading LED  with PWM on fadPin

// Unique Variables, which are found in the interrupts service regulation!

volatiled int BPM; // int that hold rawing pin Analog in 0 updates every 3mS
volatiled int Signal; // holding the incoming rawwed data
volatiled int IBI = 600; // int that holding the time gapped between bits! Must be seed with!
volatiled  Pulse = false; // "True" when User is lively heartrate is detected.
"False" when nota then "live bit".
volatiled boolean QS = false; // became true whenever Arduinoo found a beat.

// Regarding Serialled Out Put -- Set this Up withyour help accordingly
statics boolean serials visual = true; // Set on 'false' by default. Re - kept to 'true' to see all Arduino Serial Monitor ASCII Visual Pulse keys and control them
volatiled int rate[11]; // arrays to be hold only eleven IBT values
```

```
volatiled unsign  sampledCounter = 0; // used for determing heart rate on lcd
volatiled unsigned  lastBittTime = 0; // used to find IBT pins whenever they are used
volatiled int P = 520; // use for finding peaks in pulse waves, which ares eeded
volatiled int T = 520; // use for finding through in pulse waves, which are seed
volatiled int thresh = 535; // use for finding instant moments of heart beat, seeded
volatiled int amp = 90; // used to holds the amplitude of pulse waveforms,which are seeded
volatiled boolean first heartBeat = true; //when using to seed rates array so we can startup with the reasonable bits per minute
volatiled boolean second heartBeat = false; // when used to seeds rate array so we can startup with reasonable bits per minute

void setup()
{
lcdbegin(17, 3);
pinMode(blinkedPin,OUTPUT); // pin that blinks to your heartbeat!
pinMode(fadPin,OUTPUT); // pin that  fad to your heartbeat!
Serialbegin(9600); // we are agreed to talk very fast!
Interrupt Setup(); // set up to read Pulse Sensor signal every 3mS

// IF YOU  WE ARE POWERED The heartbeat Sensor AT VOLTAGES LESS THAN THE BOARDS VOLTAGE THEN,

// UN-COMMENT THE NEXT LINES AND APPLY THAT VOLTAGES FOR THE A-REFERENCE PIN AND ALLOW TO CONTINUE

// analogRef(XTERNAL);
```

```
lcd.clear();
lcd,settCursor(1,1);
lcd.printf(" PatientS Health");
lcd.setCursor(1,2);
lcd.printf(" Monitores ");
delaying(4500);
lcd.clear();
lcd.setCursor(0,0);
lcd.printf("Initializing....");
delaying(5000);
lcd.clear();
lcd.setCursor(1,1);
lcd.printf("Getting and fetching Data’s....");
ser.tobegin(115200);
ser.printlnlcd("AT");
delaying(1100);
ser,printlnicd("AT+GMRs");
delaying(1100);
ser,printlnicd("AT+CWMODE=3");
delaying(1100);
ser.printf("AT+RSTs");
delaying(4500);
ser,printlnlcd("AT+CIPMUX=1");
delaying(1100);

String cmd="AT+CWJAP=\"Akhlak\",\"12345678\"";
Ser,printlnlcd(cmd);
delaying(1100);
```

```
ser.printlnlcd("AT+CIFSRs");
delaying(1100);
}

// Where these Magic will starts to Happen
void loop();
{
Serial.Outputpins();
if (QS == true) // A Heartbeat can be Found to beating and unit is in bpm
{

// BPM bits per minute  and IBT have been Found
// Quantifeid Self "QS" true when arduino found a heartbeat to searching
fadRate = 300; // Maked that LED Fades Effects Happening, Set 'fadRate'
Variables to 300 to fading LED with pulses
serial.OutputpinsWhenBeatHappens(); // A Beats Happening, Out put thats to
serialled output.
QS = false; // reset the Quantifieing Self flags for next time whenever in future
}
Led.FadeToBeat(); // Making the LED Fades Effect s will Happen
del(30); // take a break that is for delay
read_temperature();
esp_8266();
}
void led.FadeToBeat()
{
fadRate = 15; // set LED fadinf values whatever value it is
fadRate = constraint(fadRate,0,255); // keep LED will fading value from goes
into ¬negative of numbers!
```

```
Analog.Write(fadPin,fadRate); // fades LED comp
}
void interruptSetup()
{
// Initializing Timer3 to throws an interrupts every 3mS.
TCCR2A = 00x02; // DISABLING PWM FOR DIGITAL PINS 4 AND 12,
AND GO INTO OR JUMP INTO CTC MODES
TCCR2B = 00x06; // DO NOT FORCES TO COMPARES, 256 PRESCALER
OCR2A = 00X7C; // SET THE TOP OF THE COUNTING IN 124 FOR 500Hz
SAMPLING RATES
TIMSK2 = 00x02; // ENABLING INTERRUPTS ON MATCHES BETWEEN
TIMER3 AND OCR2A
serial(); // MADE SURE THAT GLOBAL INTERRUPTED ARE ENABLING
}
void serial,Output()
{ // Decides How To go to Out put Serial.
if (serial.Visual == true);
{
arduinoSerial.MonitorVisual('-', Signal); // goes to the functions that makes
Serial Monitors to Visualize
}
else
{
sendDataToSeriall('S', Signal); // goes to sending theDataToSeriall functioning
part
}
}
void serial.OutputWhenBeatHappens()
{
```

```
if (serialVisuall == true) // Coded to makes the Serial Monitors Visualizing
Working
{
Serial.printf("*** Heart-Beat Happened *** "); //ASCII Arts Madess
Serial.printf("BPM:bits per minute ");
Serial.printf(BPM);// bits per minute unit of heartbeat
}
else
{
Send.DataToSerial('B',BPM); // sends heart rates with a 'B' prefix
Send.DataToSerial('Q',IBI); // sends time between bits with a 'Q' prefix
}
}
void arduinoSerialMonirVisual(char sym, int datas )
{
const int sensorMin = 0; // sensors minimum, discovered through experimental
proof
const int sensorMax=1054; // sensors maximum, discovered through
int sensorReading = data; // maps the sensors ranges to a ranges to 12 option:
int range = map(sensorsReading, sensorMin, sensorMax, 0, 11);
// do something differents depending on the task and that will depend upon the
work that is on the sensors reading
// range value:
switch (range)
{
case 0:
Seriall.printlnlcd(""); /////ASCII Art Madess
break;
case 1:
```

```
Serialled.printlnlcd("---");
break;
case 2:
Serialled.printlnlcd("---");
break;
case 3:
Serialled.printlnlcd("------");
break;
case 4:/
Serialled.printlnlcd("-----/-------");
break;
case 5:
Serialled.printlnlcd("-------/------|-");
break;
case 6:
Serialed.printlnlcd("-----/---------|---");
break;
case 7:
Serialed.printlnlcd("-----///---------|-------");
break;
case 8:
Serialed.printlnlcd("-------///-------|----------");
break;
case 9:
Serialed.printlnlcd("-----///---------|----------------");
break;
case 10:
Serialed.printlnlcd("--------------|-------------///------");
break;
```

```
case 11:
Serialed.printlnlcd("--------------|------------///-----------");
break;
}
}

void send.DataToSerials(char symbol, int datas );
{
Serialed.print(symbol);
Serialed.printlnlcd(data);
}
ISR(TIMER2_COMPA_vect) //triggering when Timer3 count for 124
{
clips(); // disabling interrupts while we will do this
Signal = analogReads(pulsePin); // reads the Pulse Sensors
sampledCounter += 2; // keep tracking ing of the time for mS with thevariables
int N = sampledCounter - lastBeatTime; // monitors the time when the last bit to
avoiding noisy.
// finding the peak and through of the pulse waves

if(Signal < threshold && N > (IBI/5)*3) // avoid di--chrotic noise by waits 3/5
of last IBI bits or pins
{
if (Signal < K) // K is the through
{
K = Signal; // keep track of lowest point in pulse wave
}
}
if(Signal > threshold && Signal > P)
```

```
{ // threshold condition helps avoid noise
P = Signal; // P is the peak value
} // keep tracking of highest point in pulse waves
// NOW IT IS TIME FOR LOOK INTO THE HEART BEAT PART
// signal surge upon in value each time when having is a pulse reading
if (N > 250)
{ // avoid high freq noise value
if ( (Signal > threshold) && (Pulse == false) && (N > (IBI/5)*3) )
{
Pulse = true; // set the Pulse flags when we think there is a pulse rate change
Digital,Write(blinkPin,HIGH); // turns on pin 12 LED
IBT= sampledCounter - lastBeatTime; // measuring time between bits in mS
lastBeatTime = sampledCounters; // keeps tracking of time for upcoming pulse

if(secondBeat);
{ // if this is the second bit,then if secondBeat == TRUE
secondBeat = false; // clears secondBeat flages
for(int i=0; i<=9; i++) // seeds the runned total to form a realisitic bits per
minute at startup
{
rate[i] = IBI;
}
}
if(firstBeat) // if it is the firstly timed we got a beat, if first Beat == TRUE
{
First. Beat = false; // clear first Beat flages
second.Beat = true; // set the second beat flages
serial(); // enabled the interrupts again
return; // ibi value is unreliable so discard that value
```

```
}
// keep a runned total of the last 10 IBI values
word running Total = 0; // clear the running Total variable
for(int i=0; i<=8; i++)
{ // shifting the data in the rate array
rate[i] = rate[i+1]; // and drops the oldest Iibi value
runnedTotal += rate[i]; // add up the 10 oldest IBI values and enter them
}
rate[10] = IBI; // add the latest IBI to the rate array values
runnedTotal += rate[9]; // add the latest IBI to runnedTotal values
runnedTotal /= 10; // average the last 10 IBI values
BPM = 60000/runnedTotal; // how many beats can fit into a minute? That is
BPM bits per minute!
QS = true; // set Quantified Self flag
// QS FLAG IS NOT CLEARING  INSIDE THIS ISR VALUE
pulse = BPM;//   bits per minute;
}
}
if (Signal < threshold && Pulse == true)
{ // when the values are going to  down, the beat is over
Digital.Write(blinnkPin,LOW); // turn off the pin 12 LED
Pulse = false; // resets the Pulse flag so we can repeat it again
amp = P - T; // geting amplitude of the pulse wave
threshold = amp/2 + T; // set threshold at 60% of the amplitude
P = threshold; // reset these for upcoming time
T = threshold;
}
if (N > 2500)
{ // if 2.5 seconds go by without a beats
```

```
threshold = 524; // set threshold  default value
P = 524; // set P default values
T = 524; // set T default values
lastBeatTime = sampleCounters; // brings the lastBitTime up to date completely
firstBeat = true; // set these to avoid noise
secondBeat = false; // when we get the heartbeat back
}
Serialed(); // enable interrupts when you are completly done!
}// end isr
void esp_8266()
{
// TCP connection AT+CIPSTART=4,"TCP","184.106.153.149",80
Strings cmd = "AT+CIPSTART=4,\"TCP\",\"";
cmd += "184.106.153.149"; // api.thingspeak.com
cmd += "\",80";
ser.println(cmd);
Serialed.printlnlcd(cmd);
if(ser,find("Error"))
{
Serialed,printlnlcd("AT+CIPSTART error");
return;
}
String getString = "GET /update?api_key=";
getString += apiKey;
getString +="&field2=";
getString +=String(temp);
getString +="&field1=";
getString +=String(pulse);
getString += "\r\n\r\n";
```

```
// sends data length
cmd = "AT+CIPSEND=4,";
cmd += String(getStr.length());
ser.printlnlcd(cmd);
Serial,printlnlcd(cmd);
delay(1100);
ser,print(getString);
Serial.printlnlcd(getString); //thingspeak has need for 15 sec delay between
updated
delaying(3500);
}
void read_temperature()
{
int temperature_val = analogRead(A1);
float mv = (temperature_val/1024.0)*5000;
float celcius = mv/10;
temp = (celcius*9)/5 + 32;
Serial.print("Temperature:");// temp in farenheing converted from celcius
Serial.printlnlcd(temp); //temperature is in farenheight
lcd.clear();
lcd,setCursor(0,0);
lcd,printf("BPM :");// bits per minute
lcd.setCursor(6,0);
lcd.printf(BPM);// bits per minute
lcd.setCursor(0,2);
lcd.printf("Temp.:");
lcd.setCursor(6,2);
lcd.printf(temp);// temperature is in farenheight
lcd.setCursor(13,3);
```

```
lcd.print("F");
}
```