Health monitoring System using IoT

Major Project (Phase - II)

Submitted to

IKG Punjab Technical University

Kapurthala (PUNJAB)

IN THE FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

ELECTRONICS AND COMMUNICATION ENGINEERING

BY

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UNDER THE SUPERVISION OF

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Department of Electronics & Communication Engineering

DAV Institute of Engineering & Technology, jalandhar

April 2023

DECLARATION

We, hereby declare that, this project entitled as "Smart Health Monitoring System" is an authentic record of our study carried out as requirement for the award of B. Tech in Electronics and Communication Engineering, DAV Institute of Engineering and Technology, Jalandhar PUNJAB under the supervision of Mr. Navleen S Rekhi (Assistant Professor, Deptt. of ECE).

The matter embodied in this report is true to the best of our knowledge and have the full authenticity.

Date: _____ Place: DAVIET, Jalandhar

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CONTENT

ABSTRACT

This report presents the design and implementation of a health monitoring system using the Internet of Things (IoT). In present days, with the expansion of innovations, specialists are always looking for innovative electronic devices for easier identification of irregularities within the body. IoTenabled technologies enable the implementation of novel and non-invasive clinical support systems. This report presents a health care monitoring system. Buying individual instruments or making frequent visits to hospitals is also expensive for the general population. The system we developed will measure a patient's body temperature, heartbeat and blood pressure. The physical, information, and application layers are the three layers that make up the system. The logical layer processes the data collected by the sensors in the physical layer. Media access management and intersensory communications are handled by the logical layer. Depending on the logical layer's processed data, the application layer makes decisions. The main objective is to increase affordability for regular people. Besides sustainability in the context of finance, patients will have easy access to personal healthcare. This report presents an IoT-based system that will simplify the use of an otherwise complicated medical device at a minimum cost while sitting at home.

ACKNOWLEDGEMENT:-

I would like to express my gratitude and appreciation to all who gave me the possibility complete this project.

Also, I take this opportunity to express my deep sense of gratitude to my teacher, Mr. Rajesh Wadhwa (Assistant Professor (ECE)) and our HOD Dr. Neeru Malhotra under whose valuable guidance; this project work has been carried out.

I would like to extend my special thanks to my group partners, without their support and coordination we would not have been able to complete this project.

Last but not least, I hereby express our deep gratitude to our instructor Mr. Navleen Singh Rekhi (Assistant Professor (ECE)) and special thanks to all the faculty of the college who is responsible for the project.

LITERATURE SURVEY :-

The study of "IoT" was comprehensive and montages relations and constrains. The main goal of "IoT" is to ensure that, in conjunction with "Electronic Sensor" devices, Internet-based The study of "IoT" was comprehensive and montages relations and constraints. The main goal of "IoT" is to ensure that, in conjunction with "electronic sensor" devices, Internet-based communications and the sending and reception of information are conventionally accessible.

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In a report "28.4 billion IoT users in 2017 and by 2020 they are going up to 50.1 billion" remained the result of one report. "IoT", according to scientific charity, provides a range of services. "Wi-Fi, mobile phone, NFC, GPS etc." is continuity of contact. The IoT main aim, though, is to incorporate organizations, mechanization so that messages can be transmitted without interruptions, compared to software creation; the start of the programmed is the most frequently recycled sensors with accelerometers, compression-embedding camps such as the "MCUS, MPUs". The services have improved "intelligent fitness, transportation, grids, parking and intelligent homes." Therefore, the core goal of IoT is to combine organizations and mechanization in order to provide messages continuously. The initial opinion for the "IoT phase is divided into criteria, specifications and implementation" is comparable to software development overall. An essential method is the final section containing the company process. "H." In order to understand the specifications of any IoT project Eskelinen submitted two questions and included them in the design phase. These moments of design-based science lead to adequate exploration of the following concepts, before the construction is funded, a strategy needs to be created that blends realistic goals with theory, and one has to bear in mind at the same time that real life is a research centre. Systematic and professional testing methods should be carried out. The designs should always be taken into account for any failure, and the designs chosen should be demonstrated to be durable over time. While Saini et.al developed its healthcare system, the consumer was the subject of the study: the programmed specifications

used a basic design methodology similar to typical software development courses. The WSN is a significant part of IoT, and it also plays an important role in its healthcare applications. They are known for their high-end and miscellany wireless control systems over other regular devices. Working on the WSN for pulse rates and oxygen

saturation was emphasized by Rotariu and Manta in 2012. Yuehong etc., on th other hand, and ECG and blood pressure sensors mounted on the mobile telephone in 2016. With the IoT approach in the health analogy, the wireless network improves, he said. Tan et.al used Wi-Fi technology for its 2012 work in the control area to relay messages on different body functionality, such as blood pressure, pulse rate, body temperature and oxygen saturation. J.J.R. and Wannenburg.

INTRODUCTION

Internet of Things (IOT):

The term Internet of Things (IoT) was invented by Kevin Ashton in 1999 and refers to data on the Internet that are connected to evolving global service architecture. IoT is the product of advanced research on information and communications technology. It can potentially enhance urban residents' quality of life. Since the global population is increasing at an astonishing rate, and the prevalence of chronic diseases is also on the rise, there is growing demand for designing cost-effective healthcare systems that can efficiently manage and provide a wide range of medical services while reducing overall expenses. The IoT has become a key development area recently, enabling healthcaremonitoring system advancement. The IoT healthcare-monitoring system aims to accurately track people and connect various services and things in the world through the Internet to collect, share, monitor, store, and analyse the data generated by these things. However, the IoT is a new paradigm where all connected physical objects in any intelligent application, such as smart city, smart home, and smart healthcare, are addressed and controlled remotely. Diagnosing disorders and monitoring patients is essential to providing medical care and applying sensor networks to the human body will significantly assist in this endeavour. In addition, the information is readily accessible from any location in the world at any given time.

In this project, we will learn how to build an IoT-based patient health monitoring system using ESP8266NodeMCU. We can measure Heart Rate/Pulse (BPM) as well as Temperature using the pulse sensor. We use the LM35 temperature sensor to measure body temperature. Similarly, the patient needs to be kept in a room having a certain temperature and humidity level. Hence, the patient does not feel uncomfortable in the room. IoT' it has been possible to distinguish between 'health data' in the analyzing and diagnostic of a physician after systems of physical sensors. The biggest benefit of the 'IoT in healthcare' is to reduce maintenance burden, followed by an increase in the chance of healthcare. The addition individual and online health care network was great learning experience and anticipated that mobile information and general technology killing applications would lead to the development of cloud health services. IoT is already offered as a primary platform for neurological awareness monitoring. Because effective surveillance devices are not available, it is possible to take many higher risks.Technologies such

as IoT are played here. The best interest of the patient is such caution. Multiple sensors are used to analyze patient details. The caregiver can provide adequate guidance on health care. Increased monitoring is required for IoT devices commonly used for disabled patients. Monitoring strategies, through the assistance of the sensors, have been collected to maintain a constant material movement by the patients referred to there for

caregivers. In turn, this enhances care quality. In the end, this leads to care costs. The figure below shows how IoT plays a major role in healthcare.

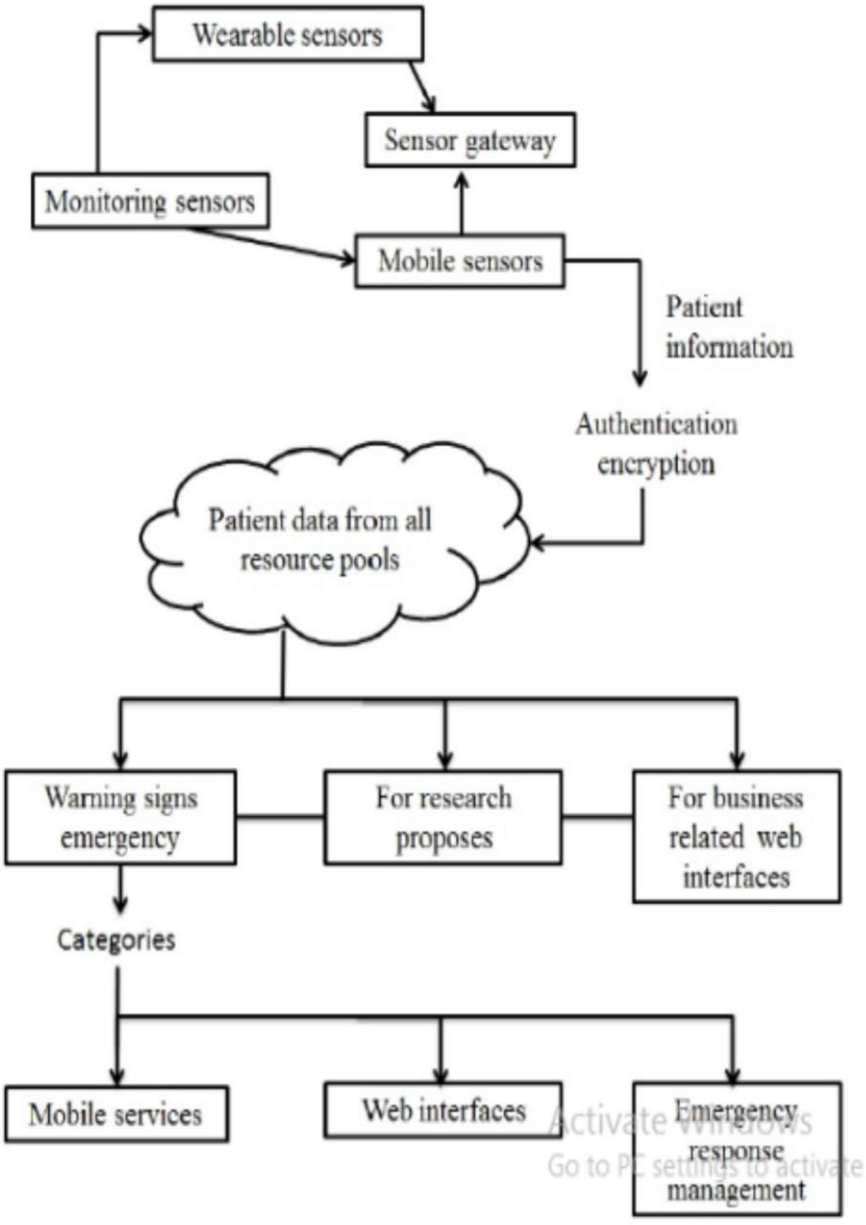


Figure. 1. IoT in Healthcare Monitoring Systems

The Architecture of IoT in HealthCare

IoT is a network of physical object-linked devices that allow remote devices to hear,analyze, and monitor. The computational mechanism for linking computer hardware to allow communication between sensors and smart sewing equipment. IoT implementations in IoT data processing rely heavily on the middleware layer. Smart grid, clever city, clever home, clever agriculture,clever communications... are all other IoT systems. The three-layer IoT architecture is based on the layers of understanding and networking. It is further expanded to include middleware and business applications.

1. Perception layer: The sensory and physical instruments are identified in the cognitive layer. The perceptual layer sensor system points to and then detects an object and collects object information. Information on temperature, mobility, position, moisture, vibrations, distance, speed, chemical changes etc can be collected according to the kind of sensor.The information is then passed to the next processing layer. When a lady wears fixed earrings which are clean to her ears and help diagnose various organ conditions and win a woman's position? The viewing layer transmits the collected data to the processing network layer through the node.

2. Perception Layer:The “Broadcast Layer” is often named, with its key purpose being to connect various waiters, intelligent objects and network devices. Collect sensor data on sensor devices transmits. The system of communication can be infrared, Bluetooth,ZigBee, Wi-Fi, UMTS and 3 G technologies. After network layer coating, the information European Journal of Molecular & Clinical Medicine from the core is then moved to the middleware layer, which transfers the information from the core to the front of the working layer.

3. Middle wave Layer: Experiencing the enormous amount of data obtained from the network layer is the big processing layer that stores it. The data base communication and resource management are responsible, because it is in the middle layer and provides the lower layers with a service layer. To process vast quantities of data links it with Big Data and Cloud computing. Body temperature analysis and checked is performed on data obtained by earrings.

In a sector which is reliable and similar to the customer, if there is a difference in the average temperature.

4. Application Layer: An essential aspect of this layer is to provide end-users with applicationoriented services. That is because the layer explicitly interacts with the end

user by having application layers. When the information has been obtained on the earrings of a lady, tell you that you have fever and you can contact the lady in question on the application form. This is a layer that communicates with the user by sending a smart phone message about the flu.

4. Business Layer: The corporate layer controls the whole eco-business model of IoT. It helps end users decide more efficiently. For example, a person with fever would suggest details in your closest clinic or hospital.Wearable Devices For things such as bracelets, ornamentation, patches, caps, t-shirts (t-shirts), bands, glasses Wearable processes can be tailored to the "real body." This equipment has been used to contact the person who monitors the disease, personal health and the information gathered which has been sent to the central and internal research centre. Three elements are wearable devices such as cameras, machine buildings and exhibits. Wearable devices may provide natural statistics, including calories, steps, heart rate, blood pressure; time spent exercising, and so on. The effect on these devices is enormous and of course very strong, which has a good focus on monitoring the physical health of our users.

Various wearable devices as given below:

- Pulse Oximetry: The unit tests the oxygen saturation level of the human body and monitors the difference in the skin blood flow associated with the cardiac cycle. The pump oximeter, containing an image detector and light-emitting diodes (LEDs), is connected to the finger or ear. The red light sent or carried back into the human body tests infrastructure. The distinction between the level of the installation and the amount of deoxygenated hemoglobin helped to measure oxygen saturation. It is used to calculate the heart rate as Photo Plethysmo Graph (PPG).
- Electrocardiography (ECG): A waveform that monitors the heart continues to function and provides time information. There is also restricted readiness for automation for ECG calculation based on wireless sensor devices.

 Blood Pressure: The energy used by blood pumping into the blood vessels helps to quantify it. The oscillometric approach is used to calculate these types of sensors for the hand frame and systolic readings.

 Electromyography (EMG): The muscle research works by looking at the muscle's electrical signals. For all electric signals EMG is the spatio-temporal DRM. The EMG signal therefore provides an efficient way to monitor human muscles' activities.

 Electroencephalography (EEG): EEG is a representation of human brain functions. Wireless Intelligent Sensor (WISE) is a low-frequency control device equipped for EEG data acquisition, wireless communication and analogue signal synchronization applications, and low-level real-time signal processing. European Journal of Molecular & Clinical Medicine Implantable Devices Under the jar of the human body and the help overhaul part or structure are inserted Artificial Implants. Implants are more widely used for multiple applications including neural prosthesis, orthopedics, heart stent, artificial pacemakers, etc. Any organic material such as apatite, silicone, titanium can be extracted from the outside layer of the implanted equipment, and the contents must be chosen according to the human body's specifications. Ceramics, metals and polymers may be manufactured from materials used for artificial devices.

The following are other equipment listed:

 Glucose Monitoring: A mixed membrane in the tumor tissue is the competent procedure for the implantation of the sensor. During the 30s, body sugar levels can be tracked and data transmission occurs every 5 minutes. When the sensors are in place and the level of glucose can be regulated, an alternative to the insulin level is given.

 Implantable Neural Stimulators: These types of electrical stimulation trigger electric impulses to relieve chronic pain in the human spinal cord or brain.

Applications of IoT in Healthcare

Applications to healthcare allow patients and adults to live independently. IoT sensors are used during this period for diagnosing and re-evaluation of their wellbeing and sending alerts in unlawful circumstances. The IoT device itself will advise the patient appropriately when other minor problems are detected". "The sections below cover the different IoT uses in healthcare.

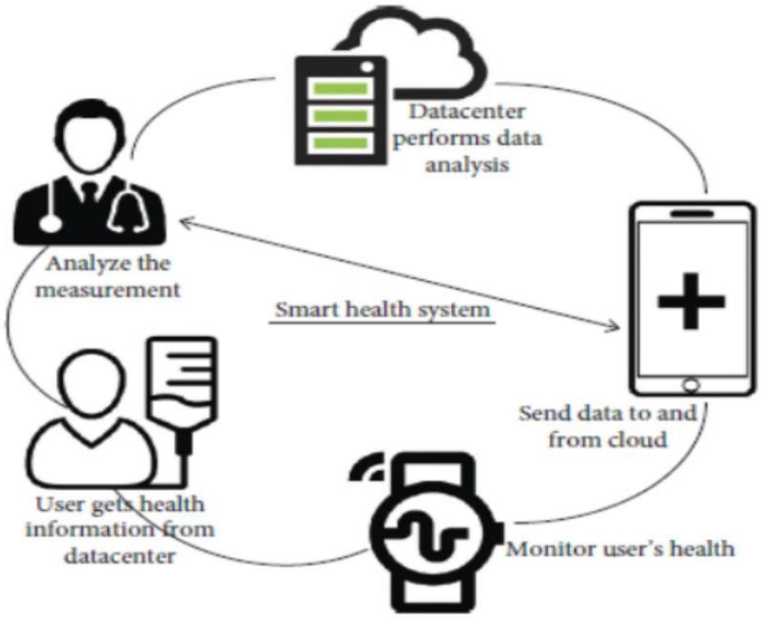


Fig.2 Applications of IoT in Healthcare

They are split into two general types of health applications made for IoT: single step and mixed mode, as seen in Figure 3.

i. Single status applications: such applications designed for a specific disease. European Journal of Molecular & Clinical Medicine

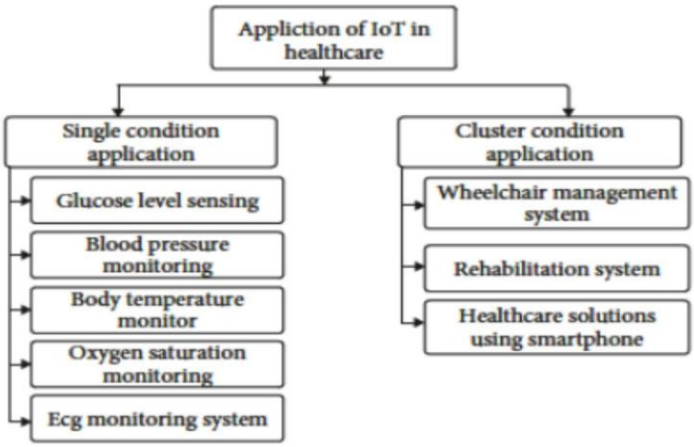


Fig.3 Classification of applications in IoT based Healthcare

• Glucose Sensitivity: Diabetes is a metabolic condition if the sugar level at a long-term period is above average. The blood sugar control system generates blood glucose of some kind and helps to prescribe a healthy diet, appropriate tests and medications. It is currently proposed an m-IoT configuration process that is not permitted based on glucose. To this end, different sensors are linked in patients through the correct provider of IPv6 connectivity. In the operating system, it creates an IoT-based communication unit that transmits the information gathered to the level of blood sugar. A collector of glucose, a computer or a smart phone and the processor is included in this package. A standard IoT based detector for glucose levels is also proposed.

• Blood Pressure Monitoring System: High blood pressure shows the heart pumping through the body powerfully. The method of IoT promotes the diagnosis and treatment of health problems, including blood pressure (BP), hemoglobin (HB), levels of blood sugar and abnormal cell growth. An IoT system for blood pressure, diabetes and obesity treatment.

• Body Temperature Monitoring: Body temperature control and tracking is an essential component in health applications. The homeostasis change depends on the temperature of the body, based on the m-IoT principle. Telos Bmote software body-sensor sensors have clear and efficient internal performance. On the top of an IoT unit, the body temperature control device is centered on the home port. It supports the control and calculation of the temperature infrared detection and RFID module.

• Oxygen Saturation Monitoring System: The Pulse oximeter is used to measure oxygen in the blood continuously. The use of IoT with pulse oximetry is useful for technical applications. The benefit of IoT-based pulse oximetry is addressed by coAP-based health care system studies. Ninin shows the function of the Wrist OX2 oximeter machine. This system is wired to Bluetooth and links the sensor directly to Monere. To track remote patients, an IoT-based norm and low-pulse oximeter is used. The IoT network allows this system to continuously monitor the health of patients.

• ECG (Electrocardiogram) Monitoring System: The ECG monitoring unit has the option of displaying the user / patient ECG waves. A patient's medical report is published by gathering ECG signals and uploading data to the cloud network. Provides user input on the basis of the collected information. With a traditional analogue to digital transformer, the IIo-OTG microcontroller transforms ECG signals and downloads a binary file output from the cloud network for analysis and identification of irregular European Journal of Molecular & Clinical Medicine conditions for human health. The full advantage of these machines decreases waiting times and decreases facilities in hospitals and emergency departments. ii. Consolidated status requests: These applications can treat certain diseases together.

• Wheelchair Management System: Comfortable wheelchairs are suggested by experts to save the lives of the elderly and individuals with disabilities. IoT plays a significant role in speeding up this process in this region. Smart wheelchairs are fitted with different sensors to track seat movement and also to display the status of patient / user.

• Rehabilitation System: The process of regenerating population growth issues and a lack of life skills can be improved by IoT. The capabilities of physically disabled people can be strengthened. In order to strengthen the recovery mechanism, the Body Sensor Network was introduced. Ontologybased automation architecture reveals that IoT can be a great way to manage information in real time. The Early Childhood Education programmed, the intelligent city medical recovery programmed and the integrated goal technology programmed are many of the services that IoT has created.

• Healthcare Solutions Using Smartphone: The electronic device control system with sensors has so far been seen on the Smartphone. Specific mobile applications are offered in the healthcare sector to support patients, provide medical training and provide initial training. A range of software and hardware products that portray the Smartphone as a useful tool in healthcare are being dev

PROBLEM STATEMENT :-

In the absence of the doctors, the patient cannot consult the doctors due to which emergency may also be created. The personal health monitoring of everyone is considered very important because of the rise in health problems in today's world. The increasing stressful lifestyle is taking a maximum toll on public health. With the ever-increasing queues at hospitals and an increasing number of patients, the doctor fees have sky-rocketed which is affecting especially those patients who cannot afford the fee or who are not suffering from major ailments but get to know so only after paying a hefty fee to the doctor.

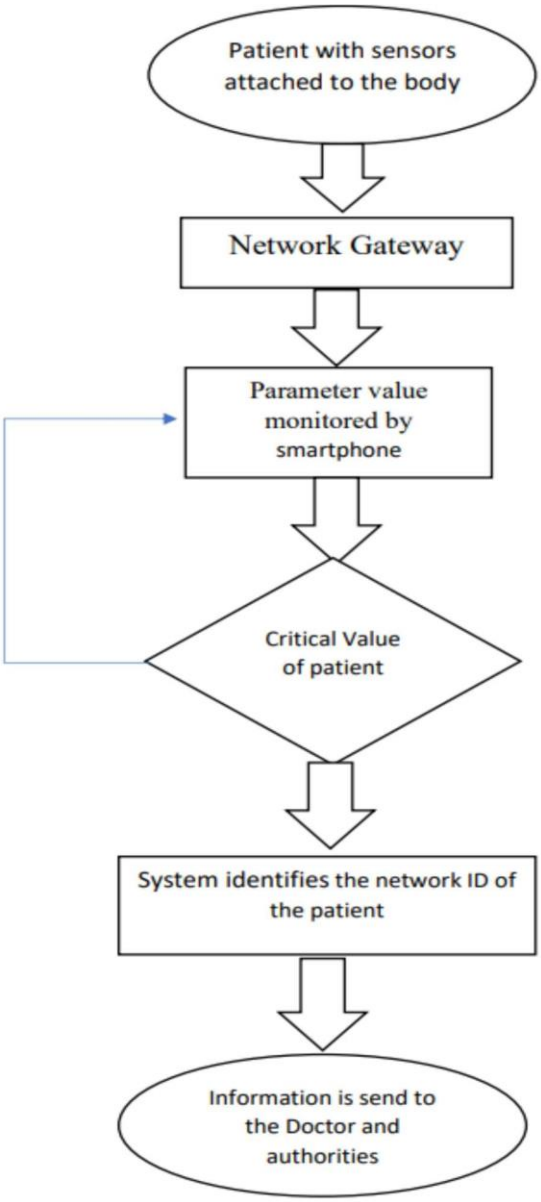
OBJECTIVE

- To make an automated system that will help to monitor host remotely is our primary objective.
- To provide a way to remotely control the temperature, pulse in a day of the patient via Node MCU.
- To analyze the collected data using the built-in MATLAB of the Node MCU sever to detect future hazards.
- To contribute to the field of IoT to pave the way for a future project in technological development.

EXISTING SYSTEM

In a hospital, either the doctor or nurse must move physically from one person to another for checking health condition, which may not be possible to monitor their health conditions continuously. Thus, any critical situations are not found easily unless the doctor or nurse checks the person's health at that moment. This may be a strain for the doctors who must take care of many numbers of people in the hospital. Also, when medical emergencies happen to the patient, they are often unconscious and unable to indicate or press an Emergency Alert Button.

More than 50% of hospital deaths occur in patients who are not continuously monitored.



Flow chart of Existing system

METHODOLOGY

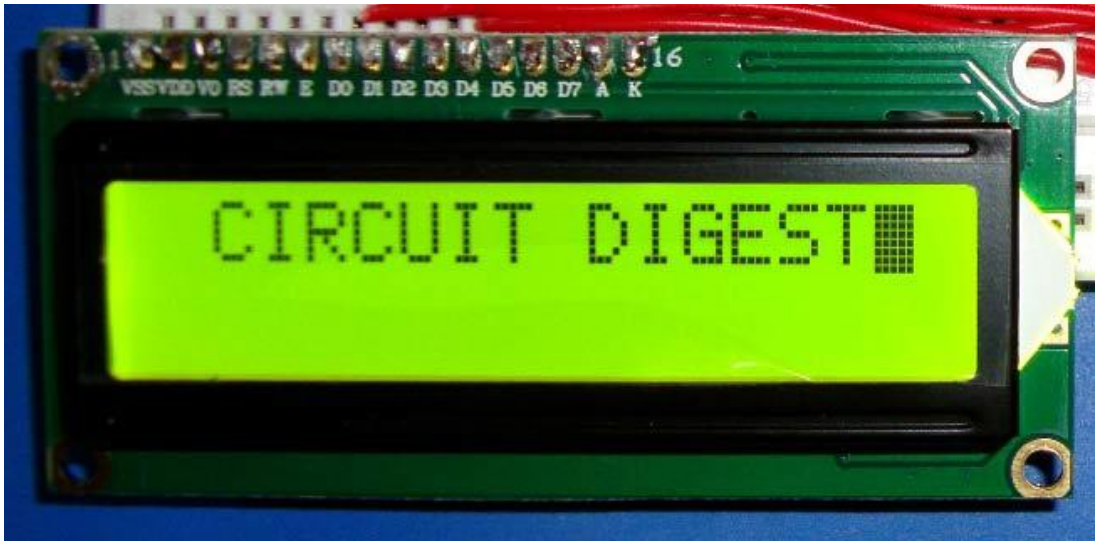
IOT Based Health Monitoring System can measure two types of health data, one is heartrate (Heartbeats Per Minute) or BPM and the other one is body temperature in Celsius. The most important and sophisticated part of this system is the measurement of heartrate. For the calculation and determination of heartrate, detection of heartbeats is crucial.

SYSTEM REQUIREMENTS SPECIFICATION

Hardware Specifications

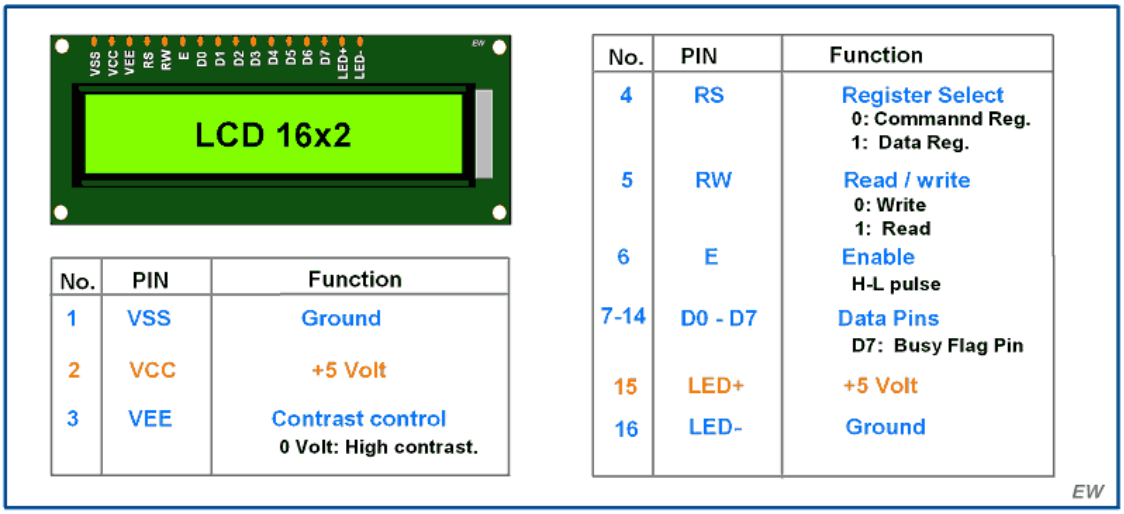
- 16*2 LED Display
- I2C Module
- Jumper Wire
- Heart Rate Senssor
- Bread Board
- LED And Buzzer

16*2 LED DISPLAY



16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. But the most used one is the 16*2 LCD, hence we are using it here.

All the above mentioned LCD display will have 16 Pins and the programming approach is also the same and hence the choice is left to you. Below is the **Pinout and Pin Description of 16x2 LCD Module**:



First two pins of LCD16x2 are used for ground and supply (+5 V).

Pin 3 - VEE pin

This pin is used for adjusting the contrast of the display. Voltage on this pin defines contrast on display, lower the voltage, higher the contrast. We can connect 4.7 k pot for contrast adjustment or simply connect this pin to ground to get maximum contrast.

Pin 4 –RS: Register Select pin

RS = 0: Data on the D0 to D7 pins is considered as a command**.**

RS = 1: Data on the D0 to D7 pins is considered as data to display on LCD16x2.

Pin 5 – RW: Read / Write pin

RW = 0: Write data to the LCD

RW = 1: Read data from the LCD

Pin 6 –E: Enable

This pin is used to latch the data present on the data pins D0 to D7. High to low pulse with a minimum width of 450 ns is required to latch the data to the display.

Pins 7:14 - DATA pins D0 to D7

Data pins are used to send data/command to the LCD16x2 as parallel 8 data bits.

Pin 15:16 - LED + and LED -

Liquid Crystal Displays don't have their own light like seven segment displays. Therefore, the module has a backlight LED. Supply to this LED is provided through these pins.

Specification of LCD16x2

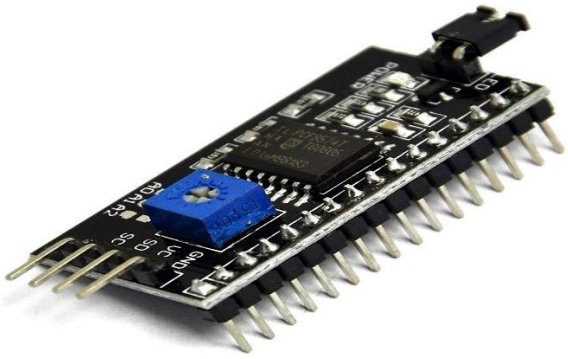
1. Display Type: Alphanumeric character display
2. Character Format: 5x8 dots matrix format
3. Display Size: 16 characters x 2 lines
4. Display Color: Blue or Green
5. Backlight: LED backlight
6. Voltage Supply: 5V DC
7. Operating Temperature: -20°C to +70°C
8. Interface: 4-bit or 8-bit mode
9. Dimension: 84.0 x 44.0 x 13.0 mm

I2C MODULE

I2C Module has a inbuilt PCF8574 I2C chip that converts I2C serial data to parallel data for the LCD display.

These modules are currently supplied with a default I2C address of either 0x27 or 0x3F. To determine which version you have check the black I2C adaptor board on the underside of the module. If there a 3 sets of pads labelled A0, A1, & A2 then the default address will be 0x3F. If there are no pads the default address will be 0x27.

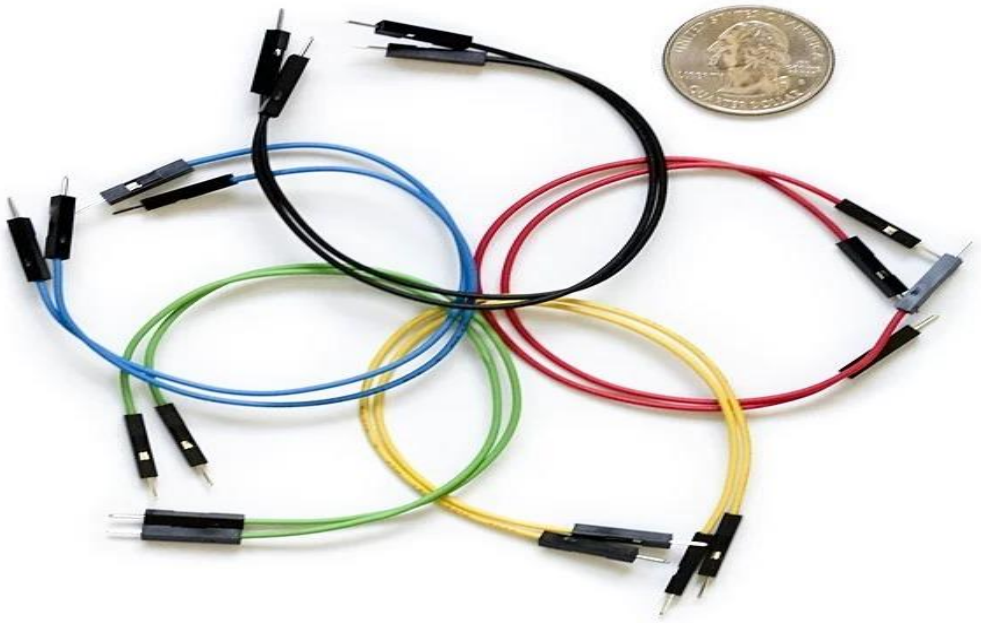
The module has a contrast adjustment pot on the underside of the display. This may require adjusting for the screen to display text correctly.



Features :- Operating Voltage: 5V Backlight and Contrast is adjusted by potentiometer Serial I2C control of LCD display using PCF8574 Come with 2 IIC interface, which can be connected by Dupont Line or IIC dedicated cableCompatible for 16x2 LCD This is another great IIC/I2C/TWI/SPI Serial Interface With this I2C interface module, you will be able to realize data display via only 2 wires.

JUMPER WIRES

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed. Fairly simple. In fact, it doesn't get much more basic than jumper wires.

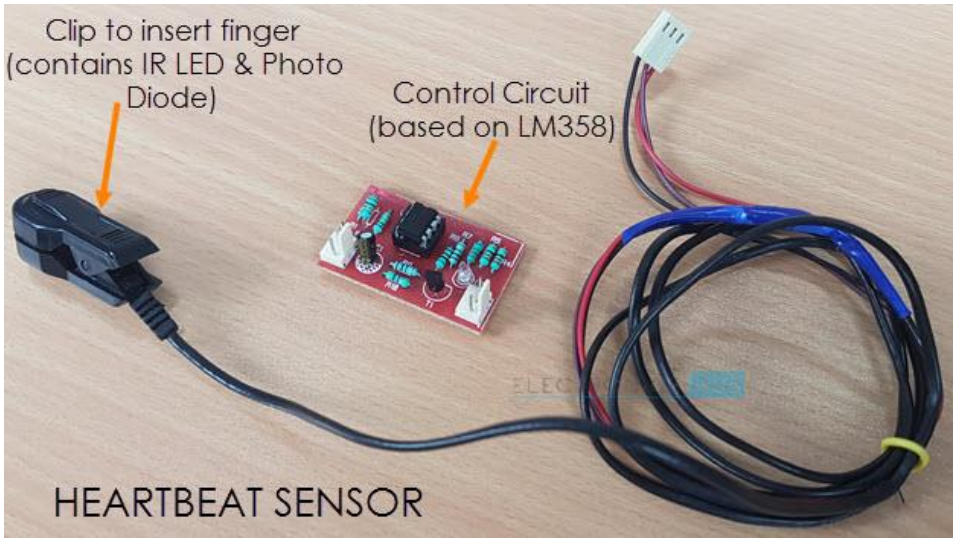


HEART SENSOR

Monitoring heart rate is very important for athletes, patients as it determines the condition of the heart (just heart rate). There are many ways to measure heart rate and the most precise one is using an Electrocardiography

But the more easy way to monitor the heart rate is to use a Heartbeat Sensor. It comes in different shapes and sizes and allows an instant way to measure the heartbeat.

Heartbeat Sensors are available in Wrist Watches (Smart Watches), Smart Phones, chest straps, etc. The heartbeat is measured in beats per minute or bpm, which indicates the number of times the heart is contracting or expanding in a minute.



PRINCIPLE OF HEART-BEAT SENSOR

The principle behind the working of the Heartbeat Sensor is Photoplethysmograph. According to this principle, the changes in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ.

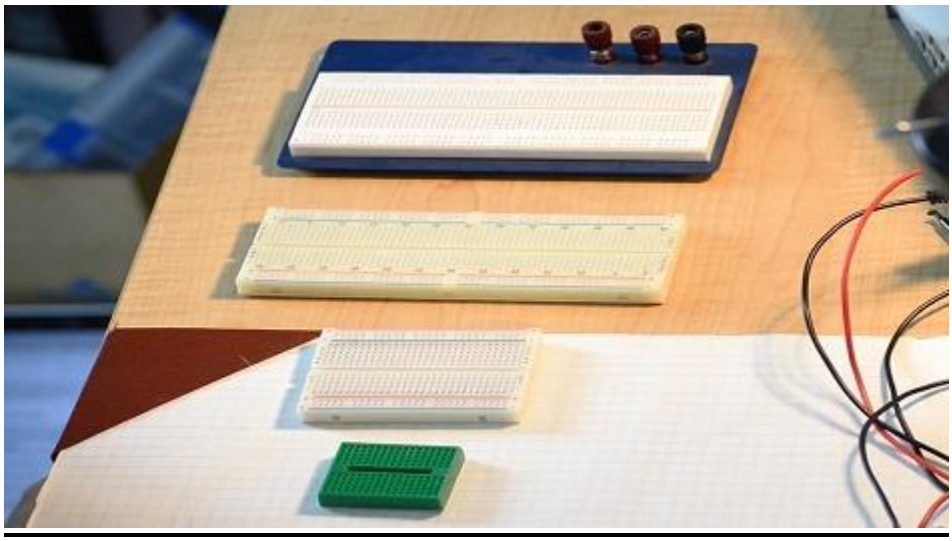
Usually, the source of light in a heartbeat sensor would be an IR LED and the detector would be any Photo Detector like a Photo Diode, an LDR (Light Dependent Resistor) or a Photo Transistor.

With these two i.e. a light source and a detector, we can arrange them in two ways: A Transmissive Sensor and a Reflective Sensor.

In a Transmissive Sensor, the light source and the detector are place facing each other and the finger of the person must be placed in between the transmitter and receiver.

Reflective Sensor, on the other hand, has the light source and the detector adjacent to each other and the finger of the person must be placed in front of the sensor.

BREAD-BOARD

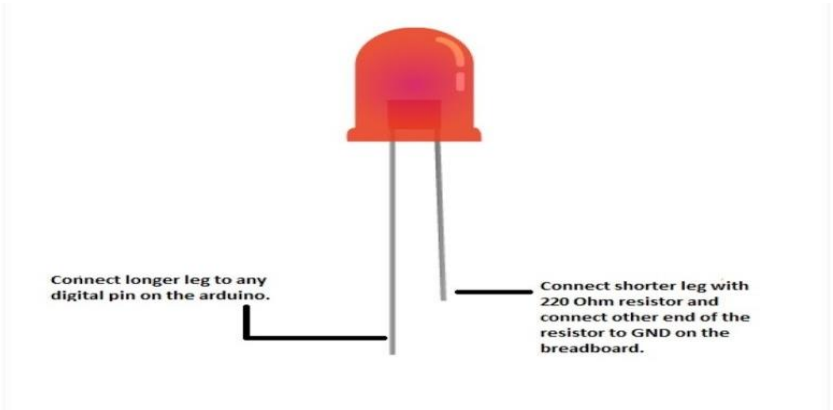


A Breadboard is simply a board for prototyping or building circuits on. It allows you to place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board. The ease of use and speed are great for learning and quick prototyping of simple circuits. More complex circuits and high frequency circuits are less suited to breadboarding. Breadboard circuits are also not ideal for long term use like circuits built on perfboard (protoboard) or PCB (printed circuit board), but they also don't have the soldering (protoboard), or design and manufacturing costs (PCBs).

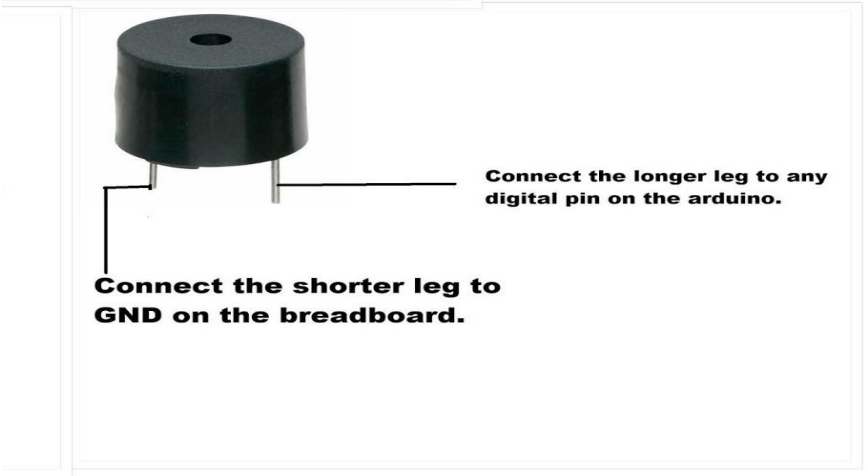
LED AND BUZZER

Buzzers and LEDs are connected in the same way. They must be connected to one of the rings (P0, P1 or P2) and the GND ring. To connect a buzzer – connect the red wire to the output ring (either P0, P1 or P2) and the black wire to GND.

LED :-



BUZZER:-



SOFTWARE SPECIFICATIONS

ARDUINO IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.' The Arduino IDE will appear as:

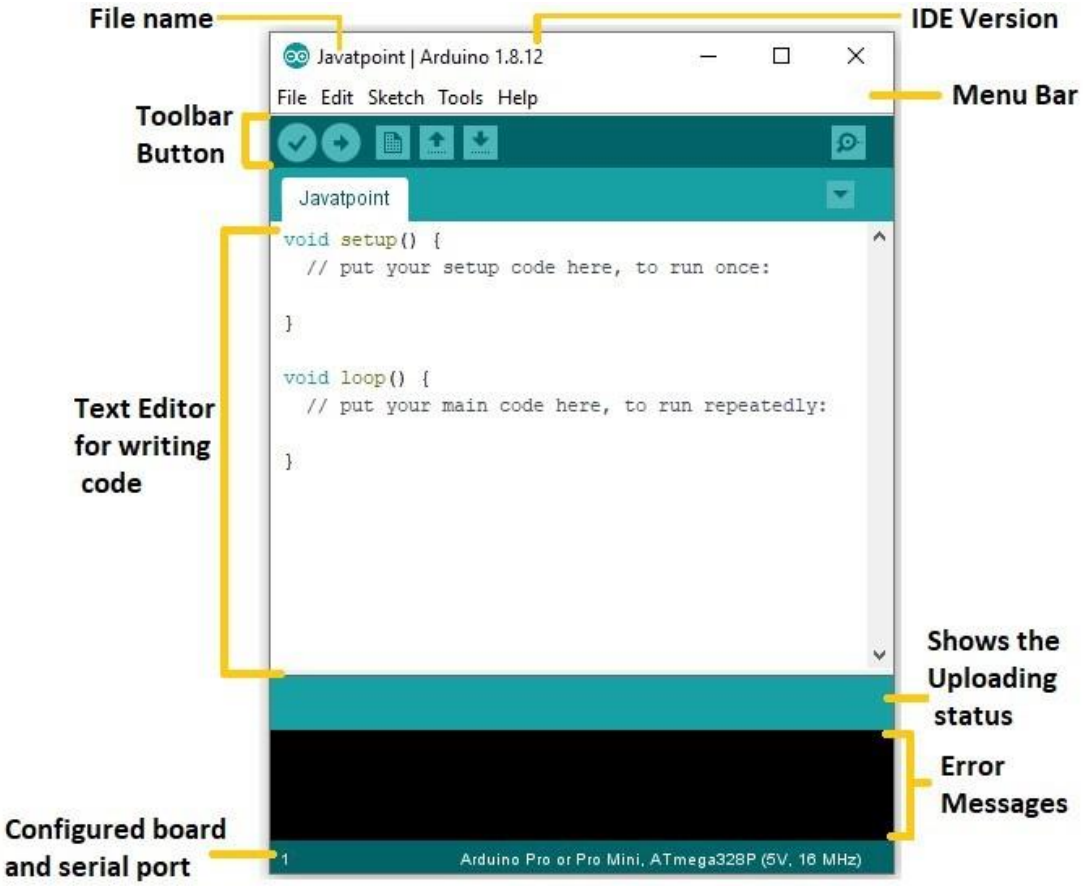


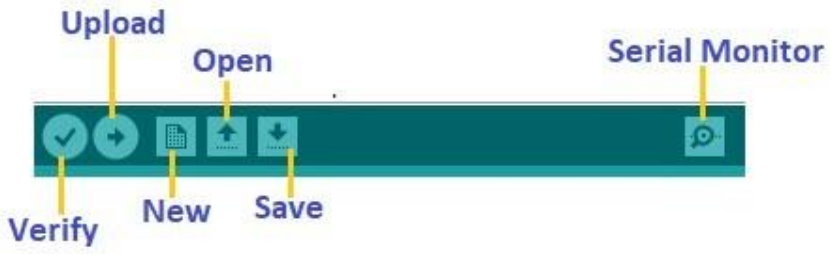
Figure 8. Arduino interface

Let's discuss each section of the Arduino IDE display in detail.

Toolbar Button

The icons displayed on the toolbar are New, Open, Save, Upload, and Verify.

It is shown below:



Upload

The Upload button compiles and runs our code written on the screen. It further uploads the code to the connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected.

We also need a USB connection to connect the board and the computer. Once all the above measures are done, click on the Upload button present on the toolbar.

The latest Arduino boards can be reset automatically before beginning with Upload. In the older boards, we need to press the Reset button present on it. As soon as the uploading is done successfully, we can notice the blink of the Tx and Rx LED.

If the uploading is failed, it will display the message in the error window.We do not require any additional hardware to upload our sketch using the Arduino Bootloader. A Bootloader is defined as a small program, which is loaded in the microcontroller present on the board. The LED will blink on PIN 13.

Open

The Open button is used to open the already created file. The selected file will be opened in the current window.

Save

The save button is used to save the current sketch or code.

New

It is used to create a new sketch or opens a new window.

Verify

The Verify button is used to check the compilation error of the sketch or the written code.

Serial Monitor

The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor.

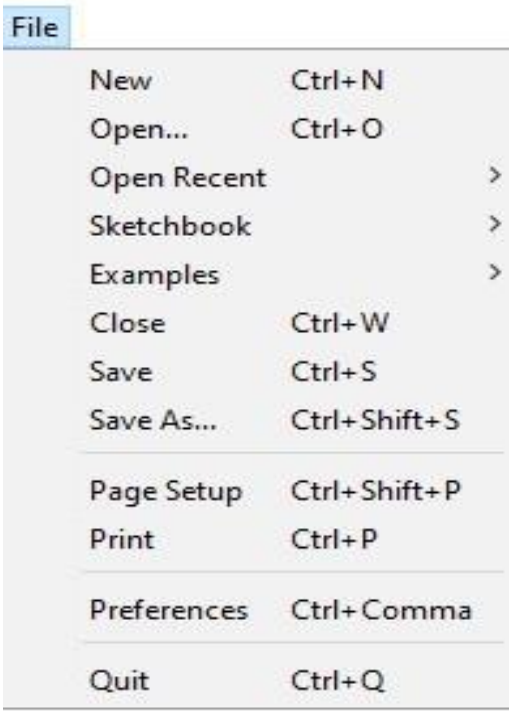
It is shown below:

When we connect the serial monitor, the board will reset on the operating system Windows, Linux, and Mac OS X. If we want to process the control characters in our sketch, we need to use an external terminal program. The terminal program should be connected to the COM port, which will be assigned when we connect the board to the computer.

Menu Bar

File

When we click on the File button on the Menu bar, a drop-down list will appear. It is shown below:



Let's discuss each option in detail.

New

The New button opens the new window. It does not remove the sketch which is already present.

Open

It allows opening the sketch, which can be browsed from the folders and computer drivers.

Open Recent

The Open Recent button contains the list of the recent sketches.

Sketchbook

It stores the current sketches created in the Arduino IDE software. It opens the selected sketch or code in a new editor at an instance.

Examples

It shows the different examples of small projects for a better understanding of the IDE and the board.

The IDE provides examples of self-practice.

Close

The Close button closes the window from which the button is clicked.

Save

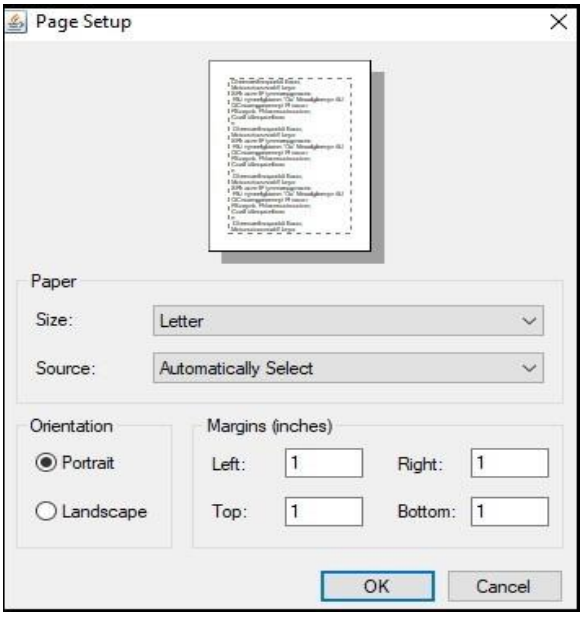
The save button is used to save the current sketch. It also saves the changes made to the current sketch. If we have not specified the name of the file, it will open the 'Save As...' window.

Save As...

We can save the sketch with a different name using the 'Save As...' button. We can also change the name accordingly.

Page Setup

It allows setting the page margins, orientation, and size for printing. The 'Page Setup' window will appear as:



Print

According to the settings specified in the 'Page Setup', it prepares the current sketch for printing.

Preferences

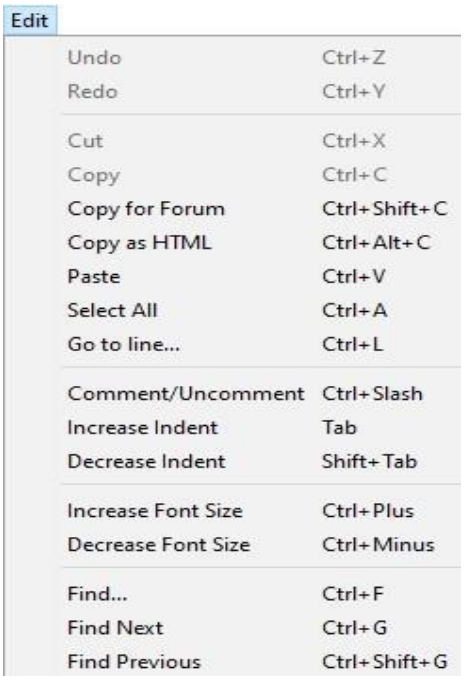
It allows the customization settings of the Arduino IDE.

Quit

The Quit button is used to close all the IDE windows. The same closed sketch will be reopened when we will open the Arduino IDE.

Edit

When we click on the Edit button on the Menu bar, a drop-down list appears. It is shown below:



Let's discuss each option in detail.

Undo

The Undo button is used to reverse the last modification done to the sketch while editing.

Redo

The Redo button is used to repeat the last modification done to the sketch while editing.

Cut

It allows us to remove the selected text from the written code. The text is further placed to the clipboard. We can also paste that text anywhere in our sketch.

Copy

It creates a duplicate copy of the selected text. The text is further placed on the clipboard.

Copy for Forum

The 'Copy for Forum' button is used to copy the selected text to the clipboard, which is also suitable for posting to the forum.

Copy as HTML

The 'Copy for Forum' button is used to copy the selected text as HTML to the clipboard. It is desirable for embedding in web pages.

Paste

The Paste button is used to paste the selected text of the clipboard to the specified position of the cursor.

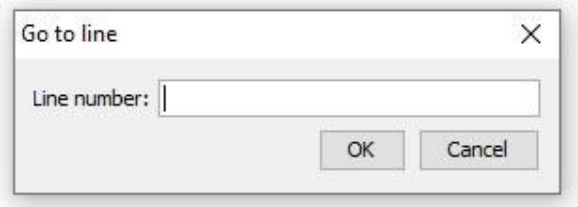
Select All

It selects all the text of the sketch.

Go to line...

It moves the cursor to the specified line number.

The window will appear as:



Comment/Decomment

The Comment/ Decomment button is used to put or remove the comment mark (//) at the beginning of the specified line.

Increase Indent

It is used to add the space at the starting of the specified line. The spacing moves the text towards the right.

Decrease Indent

It is used to subtract or remove the space at the starting of the specified line. The spacing moves the text towards the left.

Increase Font Size

It increases the font size of the written text.

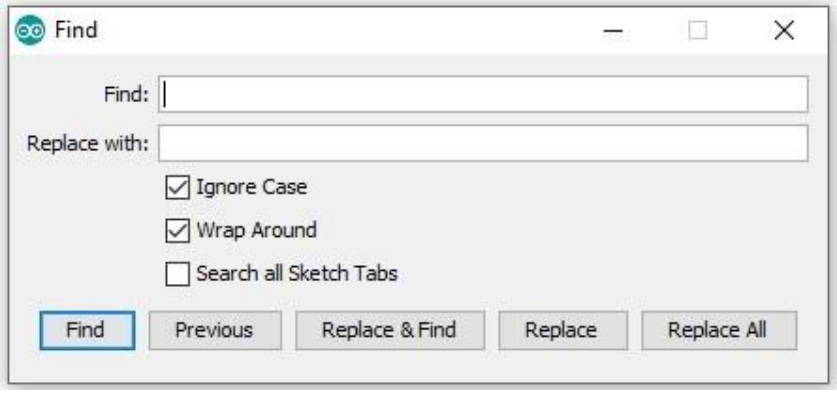
Decrease Font Size

It decreases the font size of the written text.

Find...

It is used to find the specified text. We can also replace the text. It highlights the text in the sketch.

The window will appear as:



Find Next

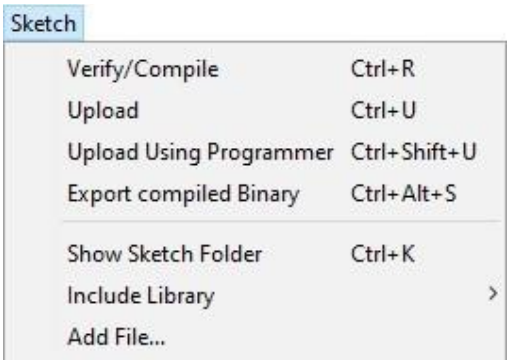
It highlights the next word, which has specified in the 'Find...' window. If there is no such word, it will not show any highlighted text.

Find Previous

It highlights the previous word, which has specified in the 'Find...' window. If there is no such word, it will not show any highlighted text.

Sketch

When we click on the Sketch button on the Menu bar, a drop-down list appears. It is shown below:



Let's discuss each option in detail.

Verify/Compile

It will check for the errors in the code while compiling. The memory in the console area is also reported by the IDE.

Upload

The Upload button is used to configure the code to the specified board through the port.

Upload Using Programmer

It is used to override the Bootloader that is present on the board. We can utilize the full capacity of the Flash memory using the 'Upload Using Programmer' option. To implement this, we need to restore the Bootloader using the Tools-> Burn Bootloader option to upload it to the USB serial port.

Export compiled Binary

It allows saving a .hex file and can be kept archived. Using other tools, .hex file can also be sent to the board.

Show Sketch Folder

It opens the folder of the current code written or sketch.

Include Library

Include Library includes various Arduino libraries. The libraries are inserted into our code at the beginning of the code starting with the #. We can also import the libraries from .zip file.

Add File...

The Add File... button is used to add the created file in a new tab on the existing file.

For example, let's add 'Blink' file to the 'Javatpoint' file. The tab will now appear as:

We can also delete the corresponding file from the tab by clicking on the small triangle > Delete option. Tools

When we click on the Tools button on the Menu bar, a drop-down list appears. It is shown below:

Let's discuss each option in detail.

Auto Format

The Auto Format button is used to format the written code. For example, lining the open and closed curly brackets in the code.

Archive Sketch

The copy of the current sketch or code is archived in the .zip format. The directory of the archived is same as the sketch.

Fix Encoding and Reload

This button is used to fix the inconsistency between the operating system char maps and editor char map encoding.

Manage Libraries...

It shows the updated list of all the installed libraries. We can also use this option to install a new library into the Arduino IDE.

Serial Monitor

It allows the exchange of data with the connected board on the port.

Serial Plotter

The Serial Plotter button is used to display the serial data in a plot. It comes preinstalled in the Arduino IDE.

WiFi101/WiFiNINA Firmware Updater

It is used to check and update the Wi-Fi Firmware of the connected board.

Board

We are required to select the board from the list of boards. The selected board must be similar to the board connected to the computer.

Processor

It displays the processor according to the selected board. It refreshes every time during the selection of the board.

Port

It consists of the virtual and real serial devices present on our machine.

Get Board Info

It gives the information about the selected board. We need to select the appropriate port before getting information about the board.

Programmer

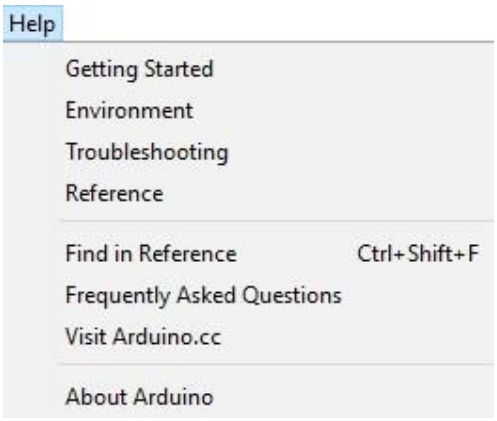
We need to select the hardware programmer while programming the board. It is required when we are not using the onboard USB serial connection. It is also required during the burning of the Bootloader.

Burn Bootloader

The Bootloader is present on the board onto the microcontroller. The option is useful when we have purchased the microcontroller without the bootloader. Before burning the bootloader, we need to make sure about the correct selected board and port.

Help

When we click on the Help button on the Menu bar, a drop-down list will appear. It is shown below:



The Help section includes several documents that are easy to access, which comes along with the Arduino IDE. It consists of the number of options such as Getting Started, Environment, Troubleshooting, Reference, etc. We can also consider the image shown above, which includes all the options under the Help section.

CODE: -

```
#define USE_ARDUINO_INTERRUPTS true // Set-up low-level interrupts for most acurate BPM math.
#include <PulseSensorPlayground.h> // Includes the PulseSensorPlayground Library.
#include<LiquidCrystal.h>
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);

// Variables
const int buzzer = 6;
const int led = 8;
const int PulseWire = 0; // PulseSensor PURPLE WIRE connected to ANALOG PIN 0
const int LED13 = 13; // The on-board Arduino LED, close to PIN 13.
int Threshold = 550; // Determine which Signal to "count as a beat" and which to ignore.
// Use the "Gettting Started Project" to fine-tune Threshold Value beyond default setting.
```

```
// Otherwise leave the default "550" value.

PulseSensorPlayground pulseSensor; // Creates an instance of the PulseSensorPlayground object called "pulseSensor"
void setup() {

Serial.begin(9600); // For Serial Monitor
lcd.begin(20,4);

// Configure the PulseSensor object, by assigning our variables to it.
pulseSensor.analogInput(PulseWire);
pulseSensor.blinkOnPulse(LED13); //auto-magically blink Arduino's LED with heartbeat.
pulseSensor.setThreshold(Threshold);

// Double-check the "pulseSensor" object was created and "began" seeing a signal.
if (pulseSensor.begin()) {
Serial.println("We created a pulseSensor Object !"); //This prints one time at Arduino power-up, or on Arduino reset.
lcd.setCursor(0,0);
pinMode(buzzer,OUTPUT);
digitalWrite(buzzer, HIGH);
delay(500);
digitalWrite(buzzer, LOW);
delay(500);
pinMode(led, OUTPUT);
digitalWrite(led, HIGH);
delay(500);
digitalWrite(led, LOW);
delay(500);
lcd.print(" Heart Rate Monitor");

}
```

```
}

void loop() {

int myBPM = pulseSensor.getBeatsPerMinute(); // Calls function on our pulseSensor object that returns BPM as an "int".
// "myBPM" hold this BPM value now.
if (pulseSensor.sawStartOfBeat()) { // Constantly test to see if "a beat happened".
Serial.println("♥ A HeartBeat Happened ! "); // If test is "true", print a message "a heartbeat happened".
Serial.print("BPM: "); // Print phrase "BPM: "
Serial.println(myBPM); // Print the value inside of myBPM.
digitalWrite(buzzer, HIGH);
delay(500);
digitalWrite(buzzer, LOW);
delay(500);
digitalWrite(led, HIGH);
delay(500);
digitalWrite(led, LOW);
delay(500);
lcd.setCursor(0,2);
lcd.print("HeartBeat Happened !"); // If test is "true", print a message "a heartbeat happened".
lcd.setCursor(5,3);
lcd.print("BPM: "); // Print phrase "BPM: "
lcd.print(myBPM);
}
delay(20); // considered best practice in a simple sketch.
}
```

IMPLEMENTATION

Figure 11

FUTURE SCOPE

Reasons for IoT being beneficial in the healthcare industry are as follows:

1. Error reduction in treatments

With the help of IoT devices, there is a decrease in manual errors in diagnosing patients. Thus, patients can get proper treatment on time. Also, the 24/7 diagnosis through gadgets gives a clearer idea about patients' health when compared to manual diagnosis.

2. Decrease in the cost of treatments

Manual diagnosis requires time and the use of various types of costly equipment, along with other hospital charges. Due to this, the overall cost of the treatment increases. We can reduce these costs by using IoT gadgets. Also, the hospital charges and congestion in hospitals can be reduced as patients can be diagnosed from their respective locations.

3. Availability of specialists in remote locations

Internet of Things solves one of the major problems of the healthcare industry that is the availability of doctors, especially specialists, in remote locations. With the help of IoT devices, the treatment of patients in the physical absence of doctors has become possible. The patients just need to wear the device. Then, the device will send all the real-time data of patients' health to the respective doctors for analysing the condition. In this way, the scope of Internet of Things is helping the healthcare sector give proper treatment to the needy.

4. the market for healthcare IoT increases, so do the challenges it needs to combat. To begin with, there is the humongous amount of data collected by the large number of connected devices, which can pose quite a bit of a challenge to the healthcare institution personnel to manage. Since data is exchanged with other devices, the question of security cannot be ignored either. Unauthorized access to devices can also lead to possible harm of the patients' health and safety. Authentication and encryption are the stepping stones to achieving success in the battle against these challenges.

CONCLUSION :-

In this modern era, IoT has become one of the brightest fields by which human life has become easier, safe and efficient through variety of its applications. In every sector of our daily life, we realize the impact of this particular field. However, our effort was to develop a life saver. Heartrate (BPM) and temperature of a person was determined on device and rendered over the internet through a Wi-Fi network. Uploaded data was stored in a remote webserver and displayed through the MIT App inventor APK. Comparison with another device was conducted in order to ensure precision and accuracy. Finally, advantages and areas of further development were discussed. Remote health diagnosis systems, particularly those equipped with IoT technology, offer access to increased frequency of patients' health data, help to reduce hospital stays and enable patient monitoring even after release. They can save lives through real-time interventions and support while reducing cost and diagnosis time. These systems have the potential of radically improving healthcare facilities around the globe. However, challenges in sensing, analytics, and visualization of health data requires further research and discussion. They need to be addressed before these systems can be designed for seamless integration into clinical practice.

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   Electrical Engineering, Bucharest, pp. 1–4 (2014)
3. Alexandros Pantelopoulos, Nikolaos G. Bourbakis," A Survey on Wearable Sensor-Based Systems for Health Monitoring and Prognosis", Publisher: IEEE DOI: 10.1109/TSMCC.2009.2032660