

A WIRELESS HEARTBEAT AND TEMPERATURE MONITORING SYSTEM FOR REMOTE PATIENTS

Submitted in partial fulfillment of the requirements for the award
of Bachelor of Engineering degree in
Electronics and Communication Engineering

By

G. MOULI SUJITH (Reg No: 37130127)



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS
SATHYABAMA**

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

**JEPPIAAR NAGAR, RAJIV GANDHI
SALAI**

CHENNAI-600119

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of G. M. SUJITH (RegNo:37130127) who carried out the project entitled “A WIRELESS HEARTBEAT AND TEMPERATURE MONITORING SYSTEM FOR REMOTE PATIENTS” Under my supervision from December 2020 to March 2021.

Internal Guide

DR.M.SUMATHI

Head of the Department

Dr. T. RAVI, M.E., Ph.D.,

Submitted for Viva voce Examination held on _____

**Internal Examiner
Examiner**

External

DECLARATION

I, **G. MOULI SUJITH** (Register No: 37130127) hereby declare that the Project Report entitled “A WIRELESS HEARTBEAT AND TEMPERATURE MONITORING SYSTEM FOR REMOTE PATIENTS” done by us under the guidance of **DR. M. SUMATHI** (ECE) is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in **ELECTRONICS AND COMMUNICATION ENGINEERING.**

SIGNATURE OF CANDIDATES

G. MOULI SUJITH (37130127)

DATE:

PLACE: CHENNAI

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ABSTRACT

The invention of a low-cost, high-impact thermal measurement and no connection heartbeat device referred by microcontroller. The majority of monitoring systems in operation today operate without internet, but it is critical to be built that allows

patients to be tracked without connection and live. The paper is made up of sensors that monitor a patient's pulse and body temperature and are powered by a microcontroller. On the LCD monitor, all readings are reflected. The calculated data is sent to a remote location using a wireless device. The temperature sensor monitors the temperature while the pulse sensor measures heartbeat for a given period of time and averages BPM. Both measurements are received by microcontroller for delivery and display.

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CHAPTER 1

INTRODUCTION

The invention of a low-cost, high-impact thermal measurement and no connection heartbeat device referred by microcontroller. The majority of monitoring systems in operation today operate without internet, but it is critical to be built that allows patients to be tracked without connection and live. The paper is made up of sensors that monitor a patient's pulse and body temperature and are powered by a microcontroller. On the LCD monitor, all readings are reflected. The calculated data is sent to a remote location using a wireless device. The temperature sensor monitors the temperature while the pulse sensor measures heartbeat for a given period of time and averages BPM. Both measurements are received by microcontroller for delivery and display.

It has the potential to improve health care access to general public and hospitals while lowering costs. Remote Care Monitoring is time efficient for both patients and doctors, resulting in improved health delivery quality and safety. The main symptoms that are regularly measured by doctors when a patient arrives are heartbeat and body temperature.

Different age ranges have different heart rates. A typical resting heart rate for a human being aged 18 years or older is about 72 BPM. When a patient is at rest, the heart can be seen to be running efficiently if it has a lower heart rate.

While exercising, heart rate steadily increases before returning to its normal level. The pace at which a person's heartbeat returns to normal is a measure of his or her health. If the heart rate is lower than average, you have bradycardia; if it is higher, you have tachycardia. Natural body temperature, like heart rate, ranges from person to person and differs throughout the day. In today's society, the most efficient usage of time is often different per person in the day.

The early morning and early evening have the lowest and peak body temperatures, respectively. Different types of sensors may be used to calculate

temperature. The analogue voltage output of the temperature sensor is related to the temperature. The analogue voltage output of the temperature sensor must be converted to digital form, which necessitates the use of an analogue to digital (A/D) converter. The temperature sensor's output is attached to the PIC16F72 microcontroller's Port A. This data is processed by the microcontroller, which then displays it on the LCD and transfers it to the receiving end for display at a remote location.

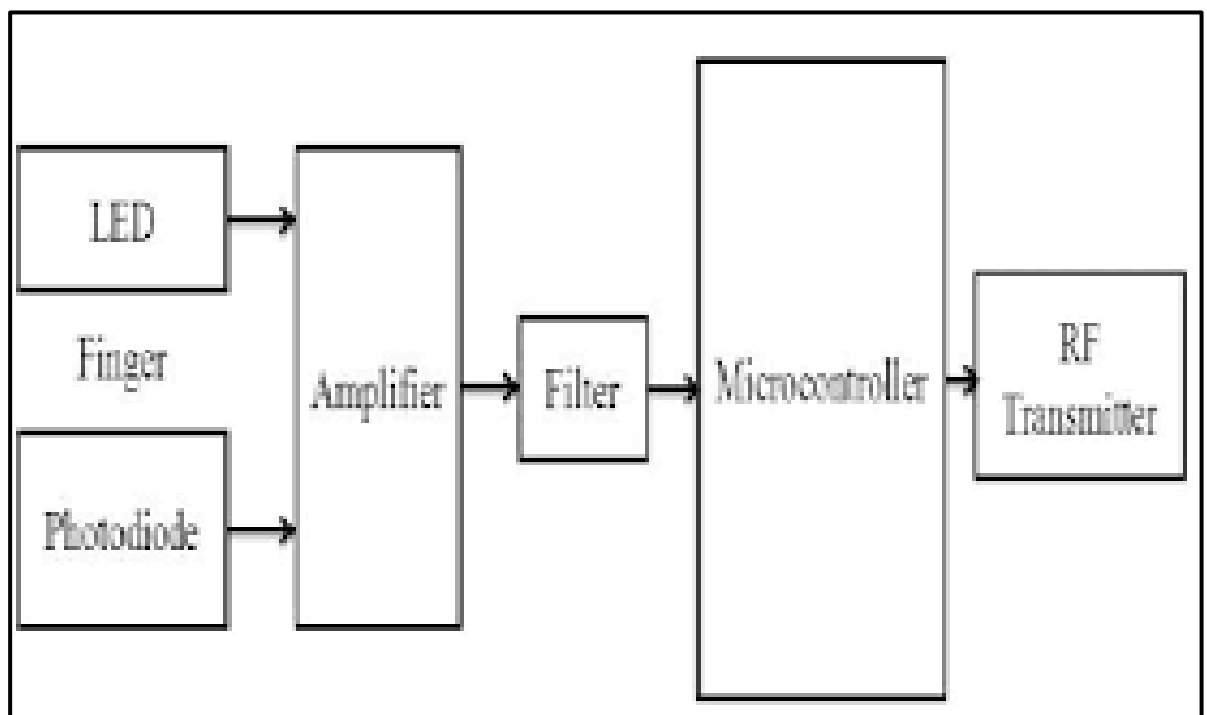
The development of a low-cost remote patient tracking device that monitors a patient's body temperature and pulse rate and transfers the information to a remote location where it can be viewed and examined by a physician or specialist. This system would come in handy during times of emergencies or to save time for both the patient and the doctor.

The data sensing module, the data analysis module, and the data connectivity module are the three main components of a Remote Health Monitoring System. A temperature sensor and a heartbeat sensor make up the data sensing module, which detects changes in the physiological parameters. The details is then sent to the data processing module's PIC microcontroller. The input signals are analysed by the data processing module.

The noise signals are filtered, and if the processed value is greater than the usual value, medication to be administered as first aid to patients is shown on the personal computer using a graphical user interface. The contact module is used to send data from one user to another. The fax, the source, the recipient, the medium, and the protocol are the basic components of this, and the letter is transmitted to the doctor via cell phones via a communication gateway for the care to be taken. The majority of monitoring systems in operation today operate offline, but it is critical to be built that allows patients to be tracked remotely in real time.

Sensors that monitor a patient's pulse and body temperature, which are regulated by a microcontroller. On the LCD monitor, all readings are reflected. The calculated data is sent to a remote location using a wireless device. The temperature sensor monitors the temperature while the pulse sensor pulse for a time period averages BPM. Both measurements are received by microcontroller for delivery and display

The most efficient use of energy is still praised in today's world. As a result, the use of wireless technologies has been increased in order to satisfy the need for remote control and tracking. RPM is a tool that allows us to keep track of patients even though they aren't in the clinic or hospital. It has the potential to improve access to health care and hospitals while lowering costs. Remote Care Monitoring is time efficient, resulting in improved health delivery quality and safety.



LITERATURE SURVEY

Because of the system's advantages such as mobility and low power usage, Zigbee technology provides wearable sensors that helps to track patients. The benefits include the ability to monitor the patient with a priority condition as compared to most patients, and the ability to hospitalise them in emergency circumstances.

These modes of networking can only function with shorter distances and durations with new wireless strategies like Bluetooth. A research was conducted to assess the kinds of vital signs that a doctor measures on a regular basis with a patient. Peripheral tissue temperature calculation is more difficult than heart temperature measurement. Biomedical devices that use Zigbee will detect vital signs of a patient's health.

The system is being used to provide high-quality health care at a low cost by preventing needless hospitalizations and ensuring immediate care. Preventative care using a low-cost telemedicine network. To cope with tracking and interpretation of patient wellbeing, the network is addressed for physiological parameter assessment.

The network collects data from sensors and sends it to the server. The machine will process and automate physiological parameters, which are then reflected on the monitor.

When opposed to most cases, care should be extended to the patient with priority to the condition they have, and in serious circumstances, they should be hospitalised at a shorter time and length.

A research was conducted to assess the kinds of vital signs that a doctor measures on a regular basis with a patient. Body temperature, heart rate, and fall recognition are the vital signs. The average temperature of body tissues is mass-weighted, and the temperature of the skin is determined. Peripheral tissue temperature

calculation is more difficult than heart temperature measurement. Biomedical devices that use Zigbee will detect vital signs of a patient's health.

This communication works two stepped and used for collecting and process signals, with new wireless methods like Bluetooth. Smart wearable remote health management devices are becoming more common as a means of ensuring high-quality health care at a low cost by preventing costly hospitalizations and ensuring prompt care.

Preventative care using a low-cost telemedicine network. To cope with tracking and interpretation of patient wellbeing, the network is addressed for physiological parameter assessment. The network collects data from sensors and sends it to the server. The machine will process and automate physiological parameters, which are then reflected on the monitor.

CHAPTER 3

AIM AND SCOPE OF THE PRESENT INVESTIGATION

AIM: To measure the temperature and heartbeat of the patient.

SCOPE OF THE PRESENT INVESTIGATION:

The aim of this proposed solution is to provide a wireless health tracking device that is automated. The aim is to use RF to track the patient's body temperature and pulse, which should be shown to the doctor.

The analysis of a patient's wellbeing is performed by medical staff members in clinics. The temp and cardiovascular rate of the person's blood are continuously monitored and recorded.

A power supply, an ATmega328 microcontroller, a temperature sensor, an RF TX, an RX module, and an LCD monitor are all necessary components for this device. The ATmega328 microcontroller is used as a CPU in this block diagram-based description.

The temperature of the patient's body is being monitored. This block diagram depicts the operation of the planned health monitoring device, which involves a power supply block that provides power to the whole circuit and a temperature sensor that detects the temperature and pulse of a patient's body.

As seen in Fig. 1, the Health Monitoring System is made up of data sensing, data analysis, and data exchange units. Data sensing systems have three sensors, including a temperature sensor and a heart rate sensor. The temperature of the body is measured using a temperature sensor. The heartbeat sensor measures the function of the heart by measuring blood flow through the finger.

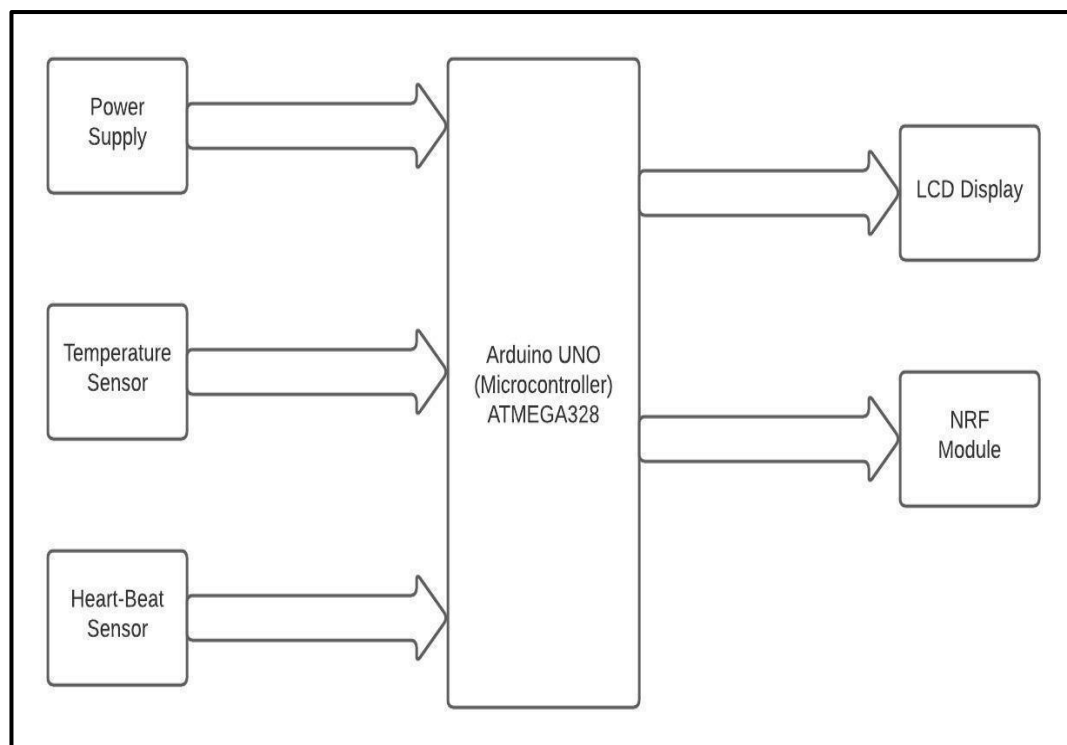
Proposed system:

The three main modules of the tele-health management system are the information sensor module, data analysis unit, and data communication unit. The data sensor package, which measures fluctuations in the physicochemical measures involved, is made up of a thermometer and a pulse sensor. The information is then sent to the processing system PIC controller. Input signals are analysed by the data processing unit.

The communication unit is used to communicate information from one person to another. The post, which involves basic elements such as fax, writer, receiver, mediator, and process, will be sent to the doctor through the knowledge portal for treatment.

The data sensor package, which measures fluctuations in the physicochemical measures involved, is made up of a temperature sensor and a heartbeat sensor. The data is then transferred to the PIC controller of the processing unit. The data analysis unit examines the data input.

Block diagram:



Hardware required:

1. Arduino
2. Body Temperature Sensor
3. Heart Beat Sensor
4. RF Module
5. LCD Display
6. Voltage Step Down
7. Power Supply

Software required:

1. Arduino ide
2. Embedded C

Working:

The goal of this proposed system would be to use NRF technology to monitor the patient's body temp and heartbeat, that should be shown to the individual being handled. In hospitals, hospital personnel have an eye on patients' honesty.

The heat and pulse rate of the patient's body are continuously monitored and recorded. The proposed system is made up of two components, one for transmission and the other for reception, all of which have been well explained. The controller, which serves as a CPU in both schemas, connects the other components. The controller is shown in the transmitter diagram.

The temperature sensor is attached to this controller, which comes with a capacity. The controller is in charge of the patient's temperature and heart rate monitor. The LCD too is connected to the heat and pulse rate of the patient, as well as an RF transmitter that transfers data to the operator's output port (the receiving circuit). The receiver's schematic diagram shows a microcontroller attached to the controller and driven by a power supply. A rack circuit to absorb

the signal from the transmitter, process it by the controller, and display it on a screen for the doctor to tap into.

TRANSMITTER SECTION:

The Sender contain of:

Heart Beat Sensor:

The Heart Beat Sensor is attached to the Arduino via three pins: (GND) to (GND) in Arduino, (VCC) to (5V) in Arduino, and (S) to pin(A0) in Arduino.

Body Temperature Sensor:

This sensor has four pins: GND, VCC, SCL, and SDL, which are attached to (GND) in Arduino, (VCC) in Arduino, (SDL) in Arduino, and (SCL) in Arduino. That contains (eight pins) attached Pin (MISO) to Pin (12) in Arduino, Pin (MOSI) to Pin (11) in Arduino, Pin (CSK) to Pin (13) in Arduino, Pin (CSN) to Pin (8) in Arduino, and Pin (CE) to Pin (7) in Arduino Pin (VCC) to (Vout) in Voltage Step Down, and Pin (GND) to Pin (GND) in Voltage Step Down, as well as the Arduino Pin (GND) to the (GND) in Voltage Step Down (For synchronisation purpose). Finally, we wired the Arduino to the Stepdown voltage and connected the battery (9V).

PROPOSED SYSTEM:

The data sensor unit, processing unit, and communication unit are the three primary modules that make up the tele-health monitoring system. A heat sensor and a pulse sensor are included in the data sensor module, which detects variations in the physical parameters.

The data is then moved to processing unit's PIC controller. Input signals are analysed by the data processing unit. The contact unit is used to send data from

one human to another. The letter is sent to a doctor by mobile via the data portal for care, and it includes basic parameters such as message, sender, recipient, mediator, and protocol.

EXISTING SYSTEM:

Microcontroller-based wireless temperature and heart rate readings that can be used in a small office or at home. With a Visual LCD, this device is simple to use. Many persons and organisations may wish to use electronic monitoring methods at some point in the future for a variety of purposes. The plan is to use commercially available RF Tx/Rx units.

The weather makes us busy all the time. Some people have even turned it into a career. We want to test all sorts of aspects relevant to our environment at home as well. As a result, weather stations come in a variety of shapes and sizes. Indoor and outside thermometers are available if we want to know the temperature inside and outside.

Previously, the outside sensor of these weather stations was attached by a wire; however, RF communication of this data is now reasonably common. The 315-MHz band is usually used for these wireless transmission systems. These units, which were once scarce, are now readily and inexpensively affordable. We'll be using an ASK (Amplitude Shift Keying) based TX/RX pair running at 315 MHz for this debate.

Serial data at a maximum rate of 2400bps is accepted by the transmitter module. They connect directly to a microcontroller. The receiver microcontroller receives the signal from the RF receiver module at the RX end, decodes the serial data, and recreates the original data in temperature and Heart Beat format. Its circuit is complex and it cannot transmit data over long distances.

DESIGN FEATURES:

As seen in Fig. 1, the Health Monitoring System is made up of data sensing, analysis and exchange. Data sensing systems have three sensors, including a heat sensor and a heart rate sensor. The body temperature is measured using a temperature sensor. The activity of the heart is measured by blood flow through the finger using a heartbeat sensor.

Each sensor's output is connected to the microcontroller's Analog to Digital circuit (ADC) pins. The ATmega328, a 28-pin 8-bit Harvard architecture microcontroller, is an elevated nRF circuit for translating RS232 signal voltage to TTL voltage that produces results, which is needed to communicate with the receiver and send SMS via information. In various cases, a gateway, LCD is used as a display device in conjunction with a microcontroller for viewing the latest specifics of physiological parameters patient monitoring.

CHAPTER 4

EMBEDDED SYSTEMS

4.1 Overview of embedded systems

A special-purpose computer machine An integrated machine is a computer that is programmed to perform one or a few specific operations, often with real-time computing constraints. It's usually part of a bigger device with both hardware and mechanical parts. A personal computer, for example, is a general-purpose computer. On the other hand, can perform a wide range of tasks depending on the programming. Embedded systems have become increasingly relevant in today's world, as they power all of the gadgets we use on a daily basis.

Since the embedded device is committed to a particular purpose, design engineers may customise it to reduce the product's size and expense while also improving its reliability and efficiency. Embedded devices are often mass-produced to take advantage of economies of scale.

Embedded systems can vary in size from small handheld devices like Huge stationary structures such as traffic lights, factory controls, and nuclear power plant control systems range from automated clocks and MP3 players to massive stationary structures such as traffic lights, factory controls, and nuclear plant control systems. Complexity is low with a simple microcontroller chip; with many components, peripherals, and channels mounted within a large chassis or enclosure, complexity is high. Complexity is very high.

In general, the term "embedded machine" isn't well known, since many devices are programmable in any way. Handheld computers, for example, share certain features with embedded systems, such as the operating systems and microprocessors that run them, but they are not fully embedded systems since they enable users to instal various programmes and attach peripherals.

Embedded devices perform a variety of tasks, including monitoring the atmosphere and reading data from input sensors. The data is then stored, and the results are shown to a user or users in some format. Embedded devices produce and relay commands for actuators, allowing you to control the environment. Change the information; embedded systems change the data captured in some manner, such as compression and decompression.

While embedded systems provide contact with the outside world via sensors and actuators, they also provide functionality unique to their applications. Control rules, finite state machines, and signal processing algorithms are popular examples of embedded applications. Faults in both the internal processing environment and the surrounding electromechanical networks must be detected and responded to by these systems.

Embedded applications fall into a variety of groups, ranging from networking instruments to home electronics to control systems. Here are some examples:

Apps for communication

For example, modems and mobile phones.

CD player, VCR, microwave oven, and other household appliances

Automobile anti-lock brake systems, automation, and satellite control are examples of control systems.

4.2 Characteristics of embedded systems

Embedded devices have a distinct range of features that make them stand out. Embedded machine designers were subjected to a unique range of design limitations as a result of both of these characteristics. The difficulty in constructing embedded systems is adhering to the application's particular set of restrictions.

Application Specific Systems:

Embedded devices aren't the same as regular machines. The architectures of embedded systems are tailored to a particular application. Before the hardware is built, much of the work characteristics are understood. This encourages the designer to concentrate on the application's precise design constraints. As a result, the user's ability to reprogram is minimal. Any embedded devices, on the other hand, necessitate the opportunity to reprogram. For such applications, programmable DSPs are popular.

Reactive Systems:

A standard embedded systems model, as previously said, responds to the environment via sensors and controls the environment via actuators. This necessitates embedded systems running at the same rate as their surroundings. The term "reactive" refers to this feature of the embedded framework. The machine (primarily the software component) operates in response to external events, which is known as reactive computation. External occurrences may be either regular or irregular. Periodic incidents make it possible to plan processing so that it runs smoothly. Aperiodic phenomena are more difficult to plan. In order to account for worst-case scenarios, the maximum incident arrival rate must be calculated. The majority of embedded systems have a reactive component. Performing an effective worst-case design study on applications with predictive performance characteristics is one of the most difficult tasks for embedded device designers (e.g., cache memory on a DSP or other embedded processor). The correctness of a calculation depends in part on the time at which it is delivered in a real-time environment. When dealing with this necessity, it's common to design for the worst-case scenario. On complex architectures, though, correctly estimating the worst case can be difficult. This sometimes results in unnecessarily cautious forecasts that fall on the side of caution. In order to satisfy external I/O and control stability criteria, many embedded devices have a substantial necessity for real-time service. Many real-time and reactive structures are the same thing.

Distributed Systems

An embedded device that consists of interacting processes running on multiple CPUs or ASICs linked by communication links is a typical feature. The explanation for this is due to the state of the economy. 4 8-bit microcontrollers are potentially less expensive than 32-bit processors. And when the cost of contact connections is factored in, this solution could be preferable. Multiple processors are typically expected in this approach to manage multiple time-critical tasks. Physical distribution of devices regulated by embedded systems is also possible.

4.3 POWER SUPPLY

We need to have a voltage regulator to have the necessary voltage since all electronic circuits need a low DC voltage to function properly. This machine is made up of a converter, rectifier, filter, and regulator. An AC voltage of usually 230 volts rms is connected to a transformer voltage that is reduced to the desired ac voltage. A diode rectifier produces a full-wave rectified voltage, which will then be processed by a basic filter capacitor to generate dc voltage. The resulting dc voltage usually has a ripple or ac voltage difference. This dc supply could be used by a circuit model to produce dc voltage which has less ripple and retains a same dc value even if the dc voltage differs marginally or the dependence power to the outlet dc voltages varies.

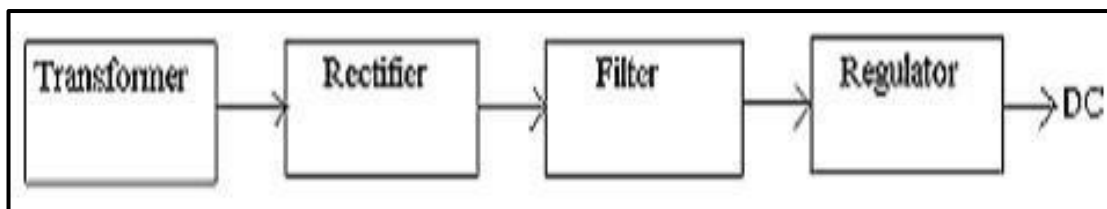


Fig 4.3. The Power Distribution Unit's General Block

4.4 TRANSFORMER:

A transformer is a static component that converts electric power from one circuit to electric power from another circuit at the same frequency. It has the ability to

increase or decrease the voltage in the circuit, but it does so at the expense of a change in current. It operates on the reciprocal induction principle. A stepdown transformer is used in our project to provide the required supply for the electronic circuits. We're converting 230 volts ac to 12 volts ac here.

4.5 RECTIFIER:

A process known as full wave rectification will increase a dc degree obtained by multiplying a sinusoidal source over 100%. In our project, full wave correction is achieved using bridge rectifiers. As seen in the simple bridge setup, two diodes (say D2 & D3) perform while the other two diodes (D1 & D4) are in the off condition from $t = 0$ to $T/2$. D1 and D4 are the transmitting diodes for the input's negative circle. As a consequence, the polarity has been reversed consistent in the load.

The diodes used in the bridge rectifier can be of various forms, such as 1N4001, 1N4003, 1N4004, 1N4005, 1N4007, and so on. However, we'll use 1N4007 because it can handle 1000 volts.

4.6 FILTERS:

To have a dc voltage of 0 Hz, we'll need to use a low pass filter. As a consequence, to obtain adc via it, a capacitive filter circuit with a capacitor connected at the rectifier outlet is required. The processed waveform is essentially a dc voltage with limited swirls, which is then fed to a load.

4.7 REGISTERS:

Two 8-bit registers, an instruction register (IR), and a data register make up the controller IC (DR). For show data RAM (DD RAM) and character generator RAM,

the IR stores the instruction codes and address information (CG RAM). The MPU will write to the IR but not read it.

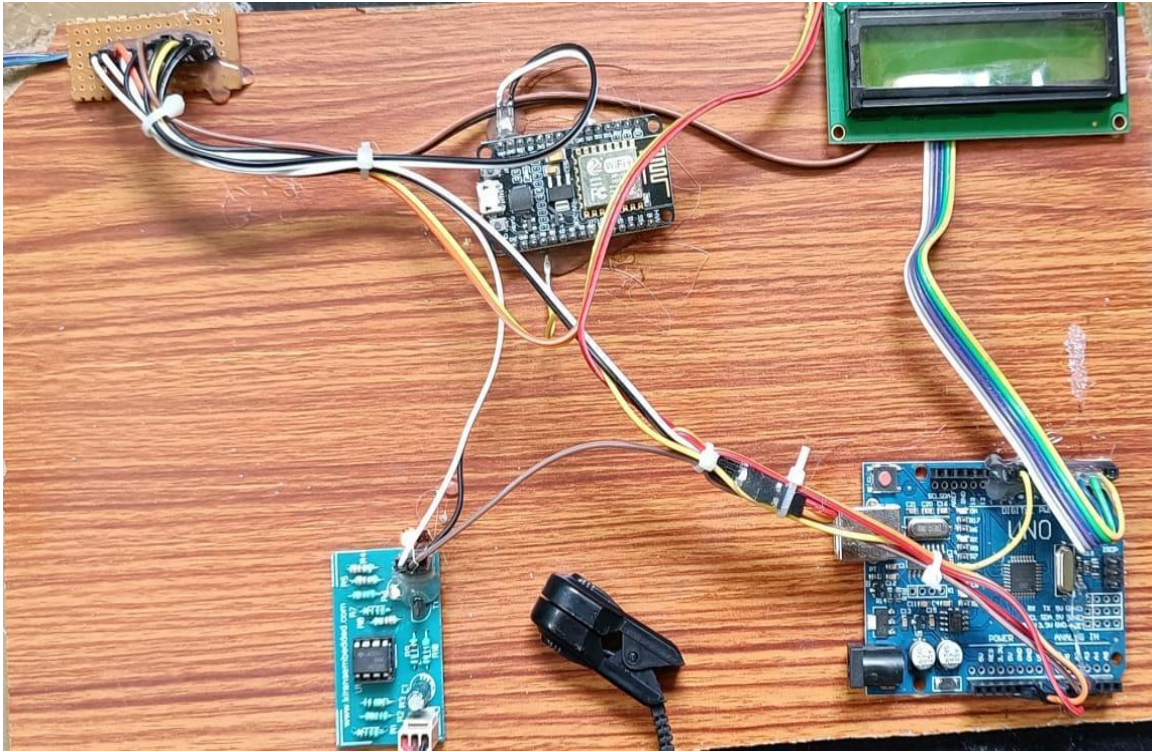
Information that will either be written to or read from the DD RAM or CG RAM is saved in the DR. The value written to DR by the MPU is automatically written to the DD RAM or CG RAM as an internal function.

Info from the DD RAM or CG RAM is automatically forwarded to the DR when an address program is compiled to IR. The data transfer between the MPUs is full when the MPU reads the DR. Similarly, data in DD RAM either CG RAM at the address is automatically sent off to the DR in preparation for the DR's next MPU read. Similarly, for the DR's MPU write process, the next DD RAM or CG RAM address is selected.

The LSI dot-matrix liquid crystal monitor controller and pilot monitor alphanumeric, Japanese kana characters, and icons. It can be configured to drive a dot-matrix liquid crystal panel and control a 4- or 8-bit microcontroller. Since all of the functions required for driving a dot-matrix LCD, such as display RAM, pattern generator, and liquid crystal controller, are locally provided on one chip, a minimal unit can be configured with this controller/driver.

4.8 REGULATORS:

The voltage output of the capacitor is processed and gradually controlled. The voltage regulator is a device that maintains a steady voltage output independent of supply, load, or temperature fluctuations. The LM7805, which is a constant voltage regulator, will be used. The IC LM7805, a +5v regulator, is used in microprocessors.



The schematic configurations for the Arduino-based IoT interface are as follows:

The Arduino UNO is an ATmega328-based microcontroller module. One of the most common development and testing boards on the market. The board has an Arduino boot disk. There are 14 GPIO pins, 6 PWM pins, 6 Analog inputs, SPI and TWI controllers, an on-board resonator, a reset switch, and pin head mount gaps on the board. The panel could be configured and operated on USB power by linking it to a Computer via a USB socket. There are 32 kb in size of flash storage, 1 kilobyte of EEPROM, and 2 kbps of SRAM on the Arduino UNO. The boards can be attached to various Arduino Shields for communicating with ETHERNET, BLUETOOTH, WI-FI, Zibee, or Cellular networks, and it can be wired to most Iot systems. The pinout of the ATmega328 controller is as follows:

Pin Number	Pin Name	Function
1	PC6	Reset
2	PD0	Digital Pin (RX)
3	PD1	Digital Pin (TX)
4	PD2	Digital Pin
5	PD3	Digital Pin (PWM)
6	PD4	Digital Pin
7	V _{CC}	Positive Voltage (Power)
8	GND	Ground
9	XTAL 1	Crystal Oscillator
10	XTAL 2	Crystal Oscillator
11	PD5	Digital Pin (PWM)
12	PD6	Digital Pin (PWM)
13	PD7	Digital Pin
14	PB0	Digital Pin
15	PB1	Digital Pin (PWM)
16	PB2	Digital Pin (PWM)
17	PB3	Digital Pin (PWM)
18	PB4	Digital Pin
19	PB5	Digital Pin
20	AVCC	Positive voltage for ADC (power)
21	AREF	Reference Voltage
22	GND	Ground
23	PC0	Analog Input
24	PC1	Analog Input
25	PC2	Analog Input
26	PC3	Analog Input
27	PC4	Analog Input
28	PC5	Analog Input

Two Analog Input pins on the panel are used to connect the Pulse sensor and LM-35 temperature probe in this project, two GPIO pins are used to connect the ESP8266 module, where connectors are coded as UART receiver and transmitter

pins using software serial, and six GPIO pins are used to connect the 16X2 pattern LCD.

Heartbeat Monitoring Unit:

Using an optical sensor as well as an infrared light - emitting diodes (IR LED), this instrument tracks heartbeat in bpm. The optical sensor senses spike in blood density and produces a signal, which would then be enhanced and processed with the aid of the IR LED. The information is then sent to the output port by an RF transmitter and retrieved by an RF receiver after the encoded data has been analyzed in the microcontroller. At the receive side, the data is sent to a secondary microcontroller, which shows it on the LCD.

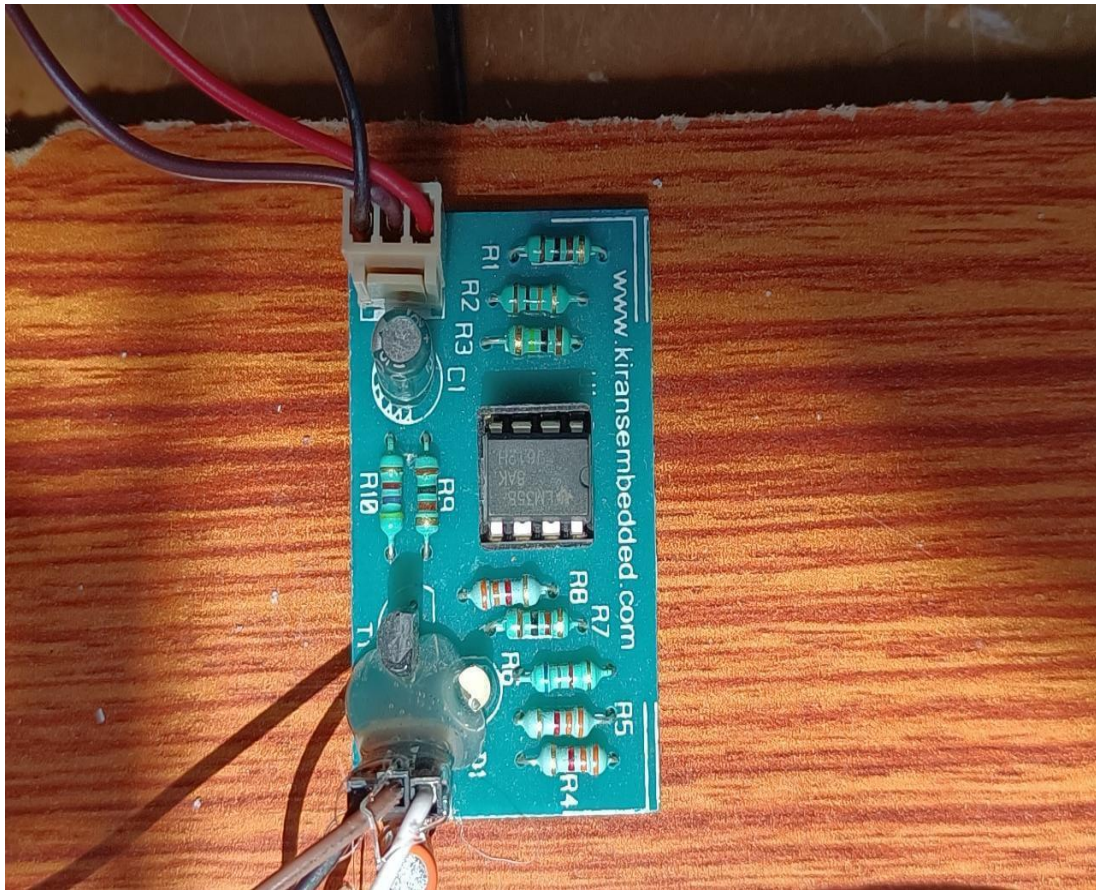
Fingertip Sensor:

The fingertip sensor is made up of a photodiode and a bright LED. A steel frame holds both the LED as well as the photodiode. On the circuit board, the photodiode and LED are on opposite directions. The intensity of daylight falling on the photodiode depends given the volume of blood, and the light from LEDs is illuminated on the tissues of the finger that is placed into the tube. The photodiode and LED are positioned on opposite sides to detect a gap in reflected light. The photodiode and LED are installed in a concrete conduit that is circular in form. Drilling in the tube secures the LED and photodiode, allowing them to be held against each other in the perfect position to detect a change in transmit power. For secure grasping, both instruments are welded to the piping. The infrared mask on the phototransistor prevents interference from fluorescents, that have a large AC component in their output [6]. For proper attachment, the LED and photodiode are soldered together.



Temperature Sensor:

The LM35 series of temperature sensors are accurate integrated-circuit temperature sensors. The LM35's output voltage is dependent upon temperature expressed in degrees Celsius or centigrade. On the other hand, the temperature controls are tuned in Kelvin. Without the need for external calibration, the LM35 has more sensitivity of 14°C at room temperature and 34°C over a complete -55°C to $+150^{\circ}\text{C}$ temperature spectrum than most temperature sensors. As a result, the LM35 has a competitive edge over other sensors. Since it draws very little current (60A) from the source, the in still air, the LM35 has a very low levels of self-heat of less than 0.1°C . The control circuit for this thermometer is easy to implement because it has a static output, low output impedance, and accurate internal calibration. This temperature sensor only needs a single power supply to run. It can withstand temperatures ranging from -55°C to $+150^{\circ}\text{C}$ [8]. The temperature sensor LM35 is reliable, does not require calibration, operates in a variety of environments, and is consistent between readings since it has no moving parts. It is inexpensive and easy to use.



RF Module:

There are two components to the RF module: an RF transmitter and an RF receiver. The RF module operates on radio frequency. The digital result is represented as amplitude variations in the carrier wave, indicating that it uses a digitally modulated process in which the carrier's intensity is modified to relay data. Amplitude Shift Keying is the name for this form of modulation (ASK). For a variety of purposes, the study looked at RF transmission over IR (infrared). One of the most cost-effective methods of wireless networking is RF transmission. The serial communication system is used by the RF module. Long-range systems benefit from RF transmission because the signals can travel longer distances. RF communication is unaffected by a barrier between the transmitter and receiver, but IR communication is. In comparison to infrared transmission, RF communication is more efficient and reliable. Other emitting sources have little effect on RF communication because it uses a certain frequency, but emitting

sources have an impact on IR communication. The PIC16F72 microcontroller's Pin 11 or Port Cof transfers data to the RF transmitter. The data is then sent to the receiving end via frequency range, in which it is retrieved by the RF receiver then sent to the microcontroller, which further presents the results on the local end's LCD.



LIMITATIONS:

The following are the disadvantages of the method:

1. The RF module used in this project is only capable of one-way data transmission and cannot send and receive data.
2. The RF module is unable to filter out junk data.
3. According to the specifications, the system has a transmission range of 100 metres in open space, but we considered it to be just 15 metres, which can be overcome by using the XBee-PRO 868, and can be used for RF transmission over long distances.

Pulse Sensor:

The Amped Pulse Sensor is a heart-rate sensor that works with PLCs, AVR, Arduinos, and other microcontrollers. It can be used to rapidly and easily

incorporate live heart-rate data into a project. It combines a simple optical heart rate sensor with enhancement and noise suppression circuitry to rapidly and efficiently provide precise pulse readings. It is simply attached to the ears or fingers and connected to the Arduino's or battery's 3.3 V or 5 V supply. The pulse sensor module has three terminals: VCC, Ground, and Out. The output pin of the trigger sensor module is wired to the Arduino's analogue pin A0. Ground is connected to common ground, while VCC is connected to the Arduino's 5V DC supply.

ESP8266 Wi-Fi Modem:

The ESP8266 Wi-Fi Module attaches an Arduino board to a Wi-Fi router, allowing it to link to the corresponding web cloud services. It's a self-contained SOC with an optimised TCP/IP network architecture that can connect to a Wi-Fi network. Either the ESP8266 will host a software or a different application processor will handle all Wi-Fi networking functions. Every ESP8266 module comes with pre-programmed AT command set firmware. The module is twice as fast: ESP-01 and ESP-12. The ESP-12 has 16 interfacing connectors, while the ESP-01 only has 8 cores.

Pin Number	Pin Name	Pin Function
1	RESET	Active Low External Reset Signal
2	ADC(TOUT)	ADC Pin Analog Input
3	CH_PD	Active High Chip Enable
4	GPIO16	General purpose IO
5	GPIO14	General purpose IO
6	GPIO12	General purpose IO
7	GPIO13	General purpose IO
8	VCC	Power Supply
9	Ground	Ground
10	GPIO15	General purpose IO, should be connected to ground for booting from internal flash
11	GPIO1	General purpose IO, Serial Tx1
12	GPIO0	General purpose IO, Launch Serial Programming Mode if Low while Reset or Power ON
13	GPIO4	General purpose IO
14	GPIO5	General purpose IO
15	GPIO3	General purpose IO, Serial Rx
16	GPIO1	General purpose IO, Serial Tx

16X2 LCD:

On a character LCD, the heart rate and ambient temperature are shown. The data pins on the 16X2 LCD display are wired to pins 3 to 6 on the Arduino board, which are used to connect it to the Arduino board. The RS and E pins on the LCD are connected to pins 13 and 12 on the Arduino board, respectively. The RW pin on the LCD is grounded. The VCC pin on the LCD module is connected to the Arduino's 5V DC supply. To adjust the brightness of the LCD frame, a variable resistor is attached to the VEE pin, and the variable resistor's other two terminals are connected between VCC and ground.

LCD	Arduino UNO
RS	13
RW	GRND
E	12
D7, D6, D5, D4	3, 4, 5, 6 respectively

How the circuit function is as follows:

This is a model for a prototype IoT-based cardiac output sensor. It may be turned into a watch or earplug. In a portable design, the component LCD could be removed, and the whole circuit could be replaced with a small control box or SOC.

When the circuit is powered by the batteries, the Arduino starts reading the heart rates from the gsm module and the temperature change from the LM-35 temperature controller. The pulse sensor measures the pulse at the fingertip or earlobe using an infrared LED and a phototransistor. If it detects a pulse, its LED will pulse.

The phototransistor detects the IR LED's flash and varies its resistance in response to the pulse. The heart rhythm of an adult person is 60 to 100 beats per minute. To track bpm, an interval is first set that triggers every 2 milliseconds (BPM). As a consequence, the Arduino's pulse detection sampling rate is 500 Hz. With this sampling frequency, every heart beat can be detected.

As a consequence, the Arduino reads the pulse sensor's analogue voltage reading every 2 milliseconds. The pulse sensor's analogue signal is converted to a digital value by an in-built ADC channel. The digitised value can be between about 0 and 1024 since the Arduino has a 10-bit ADC channel. This set's middle value is 512. The very first beat is set to true and the second beat is counted when the analogue value from the pulse sensor is higher than the middle point, which is 512.

The next beat is counted until the pulse sensor's analogue output is greater than 512 and 3/5 of the time between beats observed in the previous loop has passed. Any time the beat is detected, a vector representing BPM is modified. The value of this vector is saved in an array per minute and used to represent the actual Beats Per Minute or Heart Rate. The Arduino code uses a feature to create an LED fading effect on each beat.

You may also use the pulse sensor to determine how hot or cold you are. The LM-35 is used to detect the air temperature in this situation. The relative humidity of the LM-35 is -55 to 150 degrees Celsius. With a scale factor of 0.01 V/oC, the power output varies by 10 mV for any oC rise in ambient temperature. To obtain specified temperature accuracies of 0.25°C at ambient temperature and 0.75°C over a temperature range of 55°C to 150°C, the LM-35 IC involves no external calibration or trimming.

The temperature determined by the sensor will not surpass or recede outside the sensor's operational range under normal conditions. In the temperature range of 55 °C to 150 °C, the sensor's output signal usually rises by 10 mV per degree Celsius. The following formulae calculate the sensor's voltage output.

$$V_{out} = 10 \text{ mV/}^{\circ}\text{C} \cdot T$$

where,

V_{out} = Voltage output of the sensor

T = Temperature in degree Celsius

So, $T \text{ (in } ^{\circ}\text{C)} = V_{out}/10 \text{ mV}$

$$T \text{ (in } ^\circ\text{C)} = V_{\text{out}}(\text{in V}) * 100$$

The analogue reading is compared to the perceived voltage over a 10-bit spectrum by the following formulae if VCC is believed to be 5 V –

$$V_{\text{out}} = (5/1024) * \text{Analog-Reading}$$

As a result, the valve timing can be used to calculate the heat in degrees Celsius:

$$T \text{ (in } ^\circ\text{C)} = V_{\text{out}}(\text{in V}) * 100$$

$$T \text{ (in } ^\circ\text{C)} = (5/1024) * \text{Analog-Reading} * 100$$

As a result, by detecting the analogue voltage output from the electrode, the temperature can be directly determined. To read analogue voltage at a controller pin, use the `analogRead()` feature.

The Arduino receives information from both sensors and transforms it to strings. The heartbeat, as well as the measured pulse rate and time between pulses, are graphically displayed on the character LCD. On the LCD module, the temperature is also shown.

When another Arduino's ESP8266 Wi-Fi module senses a Wi-Fi Access Point, it sends the same information to ThingSpeak Server. To display and monitor data sent to the ThingSpeak server, you'll need a digital portal or a data broker. In this project, a software dashboard called Freeboard.io is being used to visually monitor visual data digitally.

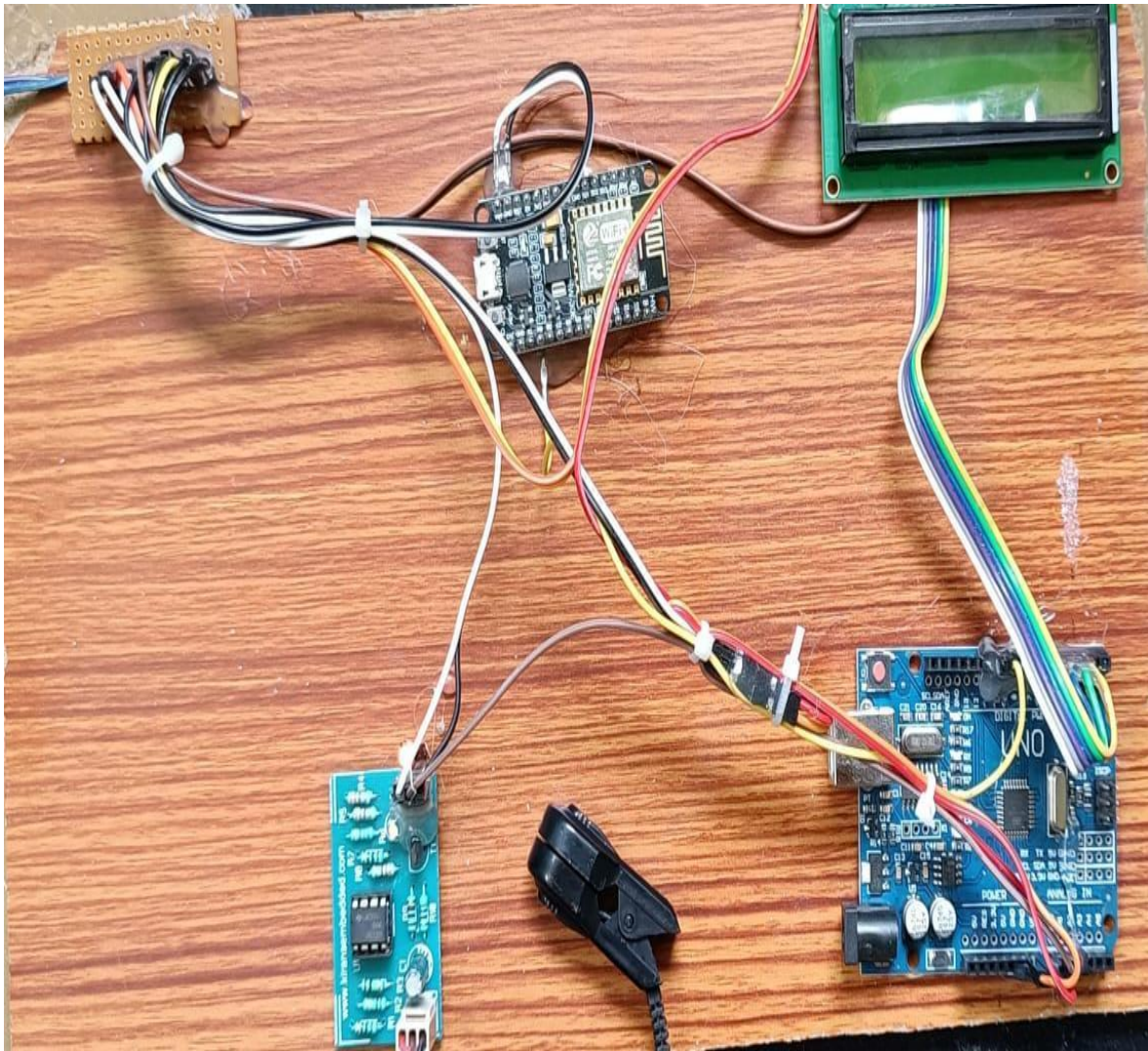
The JASON file is used by Freeboard.io to visualise ThingSpeak results. It provides three components for creating a dashboard –

1) Data Sources – Data is obtained from external sources by data sources. Data broker facilities, JavaScript programmes, and JSON files accepting content from an HTTP server are examples of external sources. The data source in this project is a JSON file that collects information from the ThingSpeak api.

2) Widgets – Widgets are small pieces of software that let you view data in a textual or graphical format. Text, table, gauge, and other widgets are available in Freeboard.io.

3) Panes – These are used to group widgets together.

Freeboard.io requires registration before creating widgets.



GSM MODEM:

A GSM modem links to a GSM network and is a form of wireless modem. A wireless modem works in the same way as a dial-up machine. The only difference is that a plug modem sends and receives data over a fixed land line, while a wireless modem delivers data over radio waves. A GSM modem, like such a GSM phone, requires a wireless service's SIM card to be used.

The Matrix Simado GDT11 is a data-oriented Fixed Cellular Terminal (FCT). It's a tiny, lightweight terminal that can handle a variety of GSM data transmission needs. A typical RS232C serial port can be used to link it to a device. Simado GDT11 supports Short Message Services (SMS), Communication Services (exchanging data files), Directory Facilities, and Internet Browsing.

Logging in from a distance and transferring data files are also possible. It's ideal for manufacturing plants, resorts, lakes, and building sites where wired internet access isn't accessible or practical. The Simado GDT11 is easy to operate. It is used by IT firms, financial institutions, logistics providers, service suppliers, remote worksites, experts, and other businesses.

AT commands are used by computers to monitor modems. A universal series of basic AT commands is supported for both GSM and dial-up modems. The GSM modem should be used in the same way as a dial-up modem. GSM modems accept an expanded range of AT commands in addition to the regular AT commands. The GSM standards describe these applied AT commands. Various stuff can be achieved with the expanded AT commands: -

- Sending SMS texts, reading, publishing, and deleting SMS messages, and monitoring signal strength
- Monitoring the battery's charging state and charge speed.
- Reading, recording, and searching phone book entries are all tasks that must be completed.

UNIQUE FEATURES:

The incoming common-mode voltage range includes ground, or the power output can also swing to ground, even though the static mode is powered by a single power supply. Temperature compensation is used for the incoming bias voltage and the input signal converge frequency.

The circuitry links for the Arduino-based IoT interface would be as follows:

An Arduino UNO is an ATmega328-based microcontroller module. One of the most common development and testing boards on the market. The panel has an Arduino boot disk. It has 14 GPIO pins, 6 PWM pins, 6 Analog inputs, as well as on-board uart, SPI, and TWI interfaces, an on-board circuit, a reset switch, and pin header holes. The panel can be configured and run on USB power by connecting it to a PC via a USB socket. There are 32 kilobytes of memory chips, 1 kilobyte of EEPROM, and 2 kilobytes of SRAM on the Arduino UNO. ETHERNET, BLUETOOTH, WI-FI, Zibee, and Network nodes are all supported, The panel can be attached to many other IoT platforms and could be associated with different Arduino Shields. The ATmega328 controller's pinout is as described.

5.RESULTS AND DISCUSSION

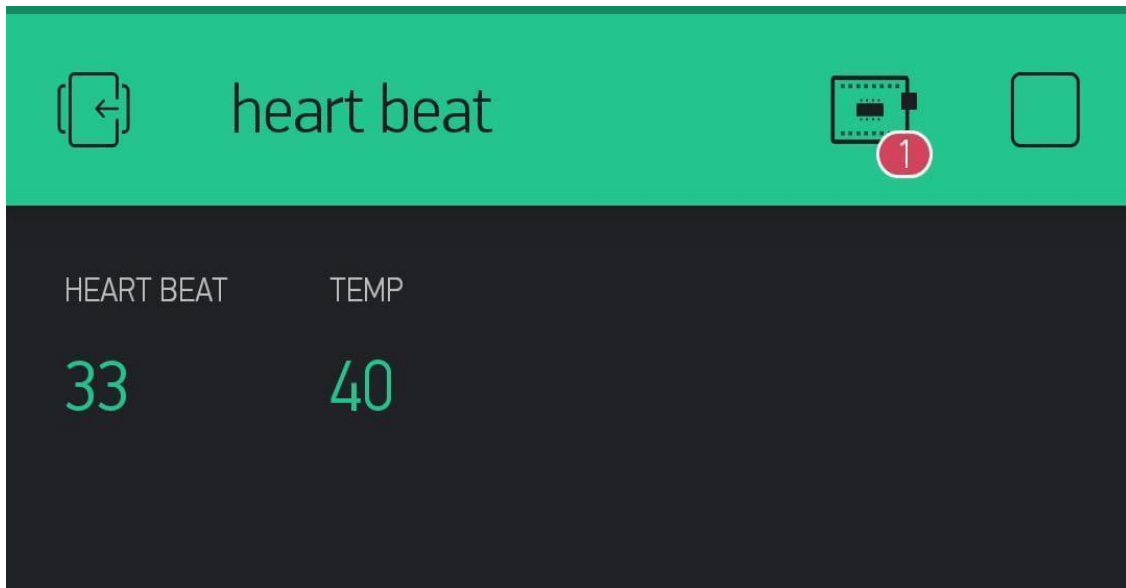
TEMPERATURE MEASUREMENT:

Whenever the power is turned on, all of the LEDs on the PCBs begin to illuminate, signalling that the circuit is functioning properly. The industrial temperature monitor MLX90614 is used here, which brings us the room temperature in °C as well as the body temperature. The outcome is shown on the LCD.

HEART BEAT MEASUREMENT:

To monitor We place the patient's finger in a cavity comprising an LED and LDR arrangement, with the finger in the space between them, to detect the pulse. We use an LM358 active adapter with two integrated modules OPAMPs, to accommodate analogue voltages once more. On the LCD panel, the final outcome is shown. The customer receives these accumulated results in the Recipient section.





OUTPUT FROM BLYNK APP

DISCUSSIONS:

In this experiment, an optical sensor was used to provide electrical insulation to the consumer. The pulse from the sensor was amplified and filtered using a simple operating amplifier with inverting and non-inverting configuration, narrowing the detection range of heartbeats. For better signal conditioning, Other filters, like Butterworth and Chebyshev filters with higher order, and improved setup of instrumentation amplifier could be used without losing the efficiency of the amplifier and filter circuit.

An Analog to Digital Converter is integrated into the PIC16F72 microcontroller (ADC). As a result, additional Analog to Digital Converter devices are not needed. RF transmitters and receivers were chosen over infrared transmitters and receivers because RF transmitters and receivers are superior in many respects to infrared systems. The temperature was calculated using a precision integrated temperature sensor LM35, while the heartbeat was measured using a photodiode and bright LED.

Both sets of data were stored in the microcontroller before being transmitted wirelessly. An RF transmitter transmits data to the remote end, and is then recovered by an RF receiver. The data was saved in the microcontroller, as well as the calculations were effectively displayed on the distant end's LCD. Since wireless networking allows for more mobility, it was chosen. This contributes to the sensor equipment and reduces the expense once there are multiple-transmitting components.

LIMITATIONS:

The method has the following drawbacks:

1. The RF module used here experiment is only capable of one-way data transmission and cannot send and receive data.
2. The RF module is unable to filter out unwanted results.
3. According to the specifications, the system has a transmission range of 100 metres in open space, but we estimated it to be just 15 metres, that can be resolved while using the XBee-PRO 868, a deep RF communication device.

FUTURE WORKS:

1. The program's serial output may be connected to a PC, allowing for the transfer of recorded pulse and heat to a PC for more wired or wireless research.
2. Health-related anomalies may be shown as a warning.
3. Sound should be applied to the system such that it sounds every time a signal is received and an alert is triggered in the event of adverse health problems.
4. For more study, the performance may be transmitted to cell phones via GS Module or Bluetooth module.
5. The system may be expanded to provide additional criteria (such as blood pressure).

FUTURE APPLICATIONS AND DEVELOPMENTS:

The pulse and temperature readings can be sent to a computer for further analysis, either online or offline.

It is possible to show an alert about anomalies in health conditions. Sound may be applied to the system such that it produces a sound every time a signal is received and a warning is triggered in the event of adverse health conditions. GSM or Bluetooth modules may be used to send the output to cell phones for further study. The unit may be expanded to include more criteria (such as blood pressure). In addition, the app can have multiple phone numbers, allowing multiple users to receive an emergency call.

6.CONCLUSION

In this experiment, an optical sensor was used to provide electrical insulation to the consumer. The pulse from the sensor was amplified and filtered using a simple operating amplifier with inverting and non-inverting settings, narrowing the detection range of heartbeats.

For better signal conditioning, Other filtering, such as Butterworth and Chebyshev filters of higher order, can be used instead of the instrumentation amplifier without sacrificing the performance of the transformer and filtering connection. An Alog to Digital Converter is integrated into the PIC16F72 microcontroller (ADC). As a result, there is no requirement for additional Analog to Digital Converter units. RF transmitters and receivers were chosen over infrared transmitters and receivers because RF transmitters and receivers are superior in many respects to infrared systems. The temperature was calculated using a precision integrated temperature sensor LM35, while the heartbeat was measured using a photodiode and bright LED.

Both sets of data were stored in the microcontroller before being transmitted wirelessly to the remote end via RF transmitter sends information to an external point, which is received by an RF receiver. The data was saved in the microcontroller, and the measurements were correctly shown on the remote end using the LCD. Since wireless networking is so convenient, it was chosen allows the sensor instruments to move around more easily and eliminates the expense of multi-transmitting parts.

Using the nRF24L01, we investigated a portable patient health tracking device for Humans have a heat and a pulse. A photodetector and a bright LED were used to determine the temperature, and a photodiode and a bright LED were used to test the heartbeat. The precision integrated temperature sensorLM35 was used to calculate the temperature. Both sets of the information was analysed on the Arduino Uno before being transmitted wirelessly to the remote end via nRF transmitter and retrieved by nRF receiver.

Using the nRF24L01, we investigated a portable patient health tracking device for temperature and heartbeat in humans. A sensitivity integrated thermometer was used to calculate the temperature LM35, while the heartbeat was measured using a photodiode and bright LED. Both datasets were stored on the Arduino Uno before being wirelessly transmitted to the receiver side by a nRF transmitter and collected by a nRF receiver. The information captured was stored in the Arduino Uno, and the information calculated was effectively displayed on the LCD at the output port. Wireless connectivity was chosen because it allows the detector instruments to move around more easily and eliminates the expense of multi-transmitting parts.

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