IOT Based Health Care Service Robot

A BS Final Year Project by

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Certificate of Approval

It is certified that we have checked the project presented and demonstrated by **Arooj Waheed Mirza 558-FET/BSEE/F19, Suhilah Batool 557-FET/BSEE/F19, Faiza Mir 571-FET/BSEE/F19** and approved it.

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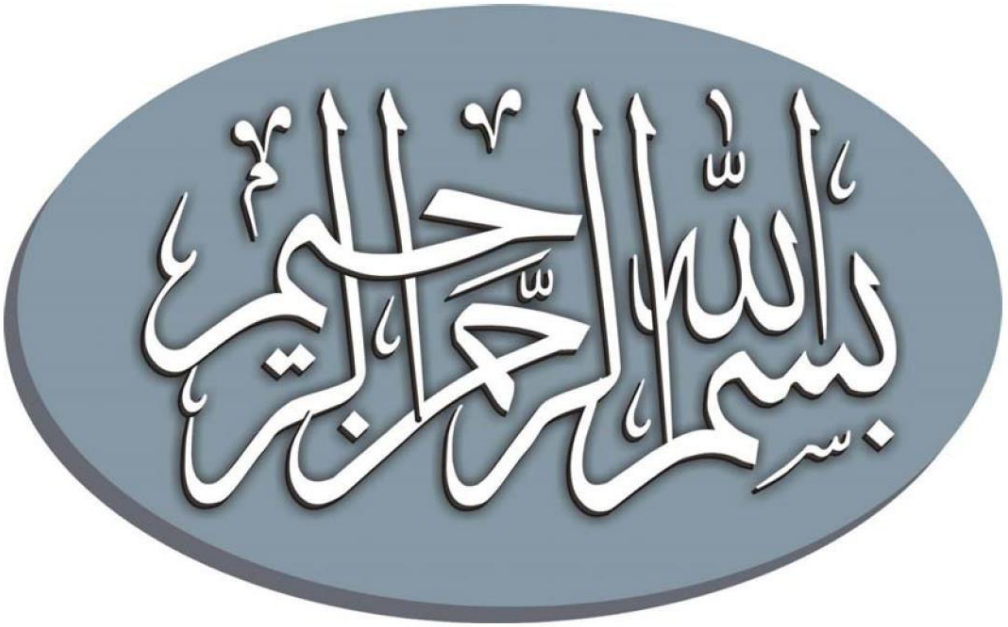

In the name of Allah (SWT), the most beneficent and the most merciful

A BS Final Year Project submitted to the

Department of Electrical and Computer Engineering

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For the award of the degree of

Bachelor of Science in Electrical Engineering

Declaration

We hereby declare that this work, neither as a whole nor as a part thereof has been copied out from any source. No portion of the work presented in this report has beensubmitted in support of any application for any other degree or qualification of this or any other university or institute of learning. We further declare that the referred text is properly cited in the references.

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Date Started: september, 2022

Date Completed:

Tools Used:

- Arduino
- Thing Speak
- Proteus

Abstract

The main task of the hospital logistic system is to maintain the material flow with in the hospitals because the quality of services that hospital provide is mostly depends on this system. And ith increasing population and major outbreaks that happen recent times will need this system to be more fast and safe as that system involves in transporting test samples that is directly connected to patients life.

So our project gives solution by providing fast and safest method for transporting blood samples and reportwith in the hospitals. This method combines the cooling compartment with an intelligent robot which is also made with an peltier plate that does not produce hamful gases which ozone depletion. Both the cooling compartment and intelligent robot are equipped with sensors and different electrical devices which is coonected to IOT platform so that they monitors and controls the temperature of cooling compartment so it provides optimum temperature for blood samples and robot movement.

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List of Abbreviations

IOT	Internet of Things
USB	Universal Serial Bus
FYDP	Final Year Project Design
EEPROM	Electrically Erasable Programmable Read-Only Memory
PWM	Pulse Width Modulation
LCD	Liquid Crystal Display
DC	Direct Current
MQQT	Message Queuing Telemetry Transport

Chapter 1
Introduction

1.1 Motivation

The hospital environment brings many constraints that the system needs to fulfill. The main task of the hospital logistic system is to maintain the material flow in the hospital but most of the existing transportation is carried out manually with the help of nursing staff which also responsible for taking care of patients so this system takes more time and has less capacity to carry materials. So the existing transportation routines of a hospital are analyzed in order to verify the need for automation and identify possible areas of improvement.

In this project, we are going to design a system that controls blood sample delivery and other transportation tasks within hospitals and laboratories by maintaining the specific temperature for various test samples. so this setup will help the medical staff deal with a maximum number of patients in less time. Thus, this system is capable to provide efficient and effective services to patients.

1.2 Project Overview

In times of covid-19, the hollow space of controlling the spreading of the virus especially among the doctors and the medical staff, wanted to unbound them from the unwanted stuff so that they facilitate maximum patients in lesser time. And as we know Hospital is an environment that is composed of laboratories, different wards, scan centers, etc. So the main aim of a hospital is to offer maximum health care services. If we analyze the number of Pakistan hospitals by division they are very less in number which is one of the major issues in Pakistan. So if the hospitals are already in lesser number and in that situation if medical staff involve in doing transportation tasks then the quality of life of the patients really suffer.

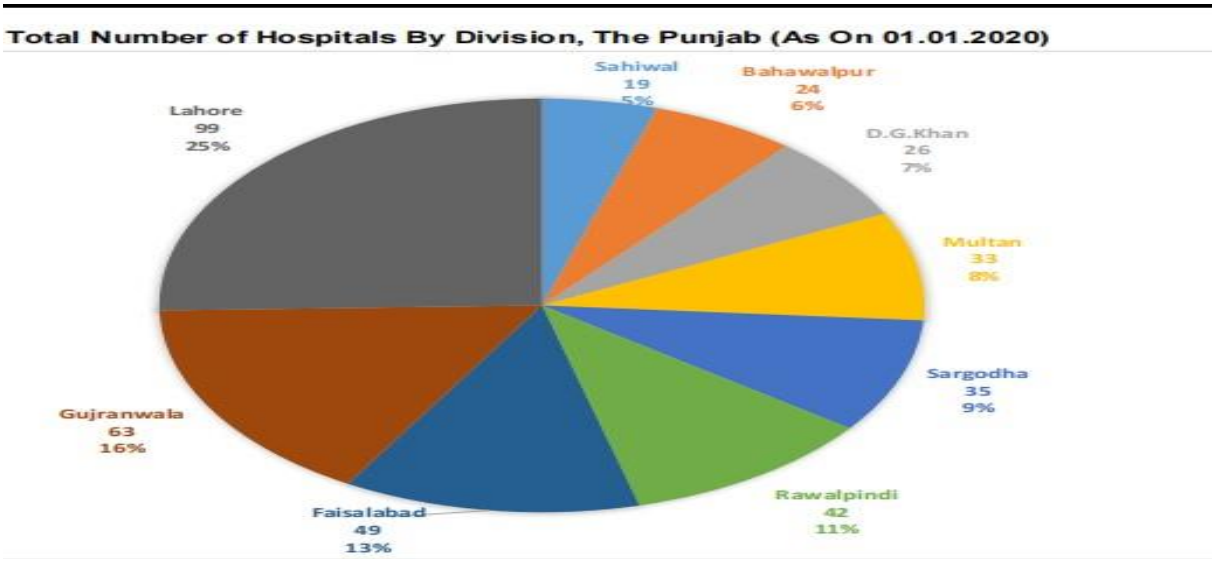

Figure 1.1: Total Number of Hospitals By Division

So in that case robots play a vital role by doing tasks that are important for patients' health but at the same time, patients suffer because of these tasks when nurses or other medical staff involving these tasks and not giving them proper time and care. A robot is a human-like machine that does not look like a human but is capable of doing some tasks humans can do with more accuracy. In the past few years, robots providing different services in various industries, malls, and homes to facilitate humans by mostly doing repetitive tasks. So Our research goal is to provide a safe and quicker method of delivering goods in hospitals.

1.3 Problem Statement

The hospital environment brings many constraints that the system needs to fulfill. During the times of Covid-19, even the best hospitals were under tremendous pressure. According to the WHO report, we have less than one physician per one thousand people [1]. In such situations, the robot plays an important role in assisting medical staff which can really help to lessen the patient’s hassle

In this project, we are going to design a system that controls blood sample delivery and other transportation tasks within hospitals and laboratories by maintaining the specific temperature for various test samples. so this setup will help the medical staff deal with a maximum number of patients in less time.

1.4 Project Objectives

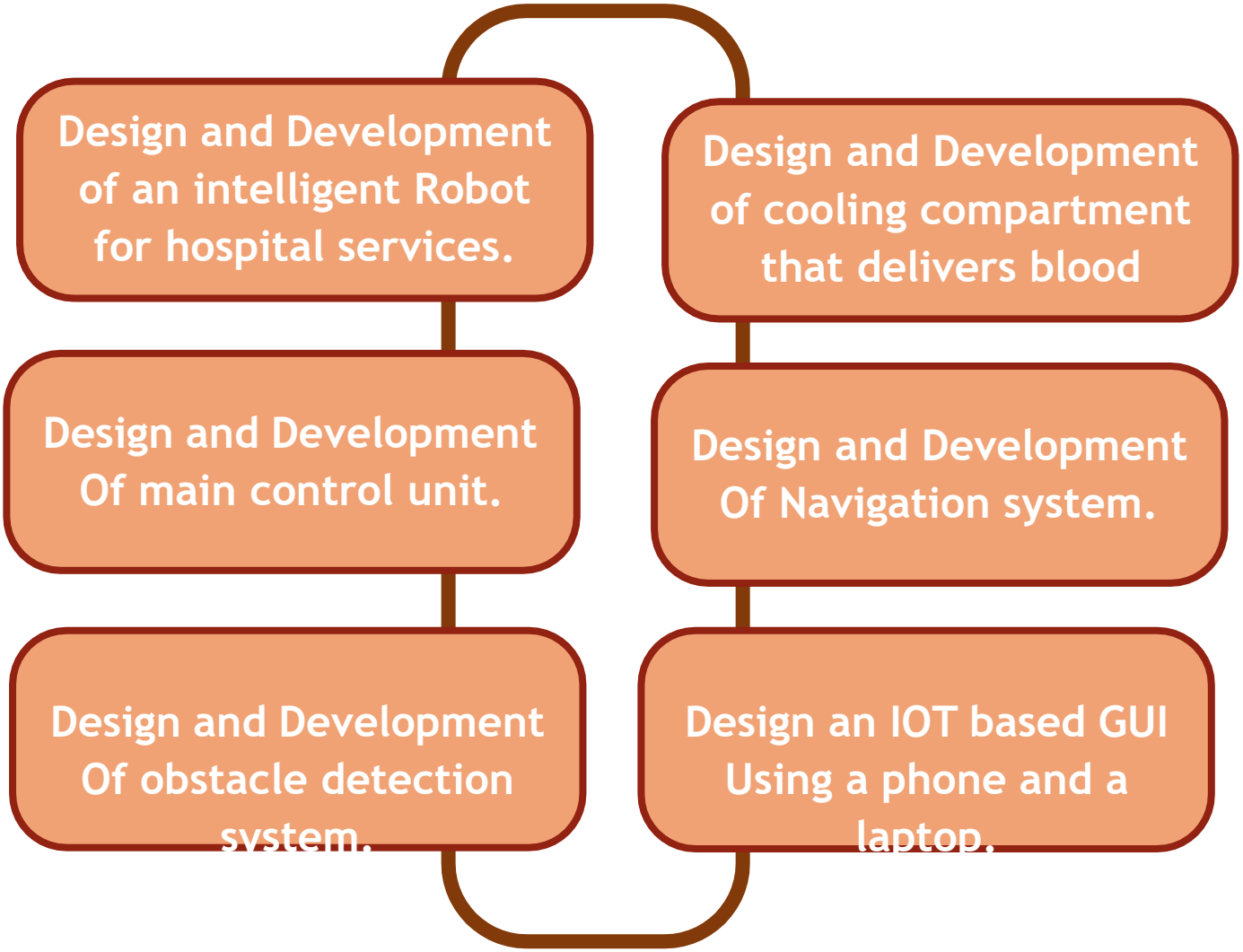

Figure 1.2: Project Objectives

1.5 Brief Project Methodology

In this project we want to achieve a good transportation system for transporting medicines in hospitals with the following phases.

- Phase: 1

Design a prototype of our project.

- Phase: 2

Design intelligent line mapping robot.

- Phase: 3

Design an obstacle detection system.

Phase:4

Integrate a cooling compartment with an intelligent robot.

- Phase: 5

Design main control unit.

- Phase: 6

Testing this system.

1.6 Report Outline

This report is organized into seven chapters.

Chapter 1: Provides background, introduction, motivation and insight into IOT Based HealthCare Service Robot.

Chapter 2: Explain previous implementations, current and future trends of delivering goods within the hospitals.

Chapter 3: Provides the names and uses of specific components and modules used in the project.

Chapter 4: Give insights into the electrical design, simulation results and hardware testing pictures of the modules used in this project.

Chapter 5: Discuss about the IOT.

Chapter 6: Explains the integration of project.

Chapter 7: Provides the conclusion and future recommendations.

Chapter 2
Literature Review

In this chapter, we see the work that is already done by using robots and how these robots provide great benefits in all areas of life and especially the healthcare sector we also look at the benefits of the cooling compartment that is made by using Peltier plate as compared to the compressor and what are the specification of the different blood sample with respect to temperature.

2.1 Design and implementation of an IOT Based medical assistantrobot(Aido-Bot)

This robot is used to assist disabled persons and patients by reminding them and providing Medicines also provide a safe environment by reducing person-to-person contact. Also, it measures patients' Pulse rate, and Oxygen saturation level,and body temperature by using Physiological parameters observing system which is IOT based.

2.2 Development of IOT based robot for hospital floor cleaning

In times of covid 19 proper cleaning and social distancing are the main requirements but it is difficult to achieve by doing cleaning tasks with labor so as to safe from viruses and at the same time ensure cleaning from time to time will be achieved by having cleaning robot which Used to clean floor that worked by a web of things and Arduino programming.

2.3 Koolio: An Autonomous Refrigerator Robot

This technology is a combination of R2D2 and vending machines. This technology works in a Machine Intelligence Laboratory at the University of Florida. Where it Use to transport snacks and drinks by using a single-board computer. It uses cameras to avoid any obstacles and find the correct office number where he has to deliver.

2.4 Peltier-Based Eco-Friendly Smart Refrigerator for Rural Areas

It is an eco-friendly project which shows the implementation of the solar-powered thermoelectric refrigeration system. As rural areas have run out of electricity most of the time so this project is definitely the solution to that problem because in that project Peltier plates are used to cool the refrigerator which does not emit any harmful refrigerants like compressors so it causing ozone depletion.

2.5 On the improvement of blood sample collection at clinicallaboratories

Blood samples are collected from different wards of hospitals and transported to a laboratory for testing so this reason in two of the largest clinical laboratories in Spain collection routes of blood samples get improved by using two constraints, vehicle capacity, and two-hour time windows between collection and delivery capacity.

2.6 Design of a Low-Cost Indoor Navigation System for FoodDelivery Robot Based on Multi-Sensor Information Fusion

The meal delivery robot is the technology that allows customers to experience robot technology and along with that, it helps the restaurant business financially by reducing labor costs and serving more customers in lesser time. most of the meal delivery robots need magnetic strip installation for moving

paths but in this technology, we use sensors to o achieve the positioning of a non-rail of robot for navigation.

2.7 Obstacle detection using the ultrasonic sensor for a mobilerobot

There are many techniques that we apply to design an obstacle avoidance robot by using a camera or different sensors. But that paper uses an ultrasonic sensor for obstacle avoidance robots because it is cheap and gets the same results that we get by using cameras or other sensors. We use it with an Arduino Uno, an Arduino motor shield driver which controls the robot through the geared dc motors.

2.8 Design and Implementation of Line Follower Robot

This is the technique used for the navigation of a robot in which a line may be drawn on the floor which the robot follows for moving. The line may be visible like black on a white surface or invisible by using magnetic strips. and in this, we use TABAR for the design and implementation of a robot designed for the line follower robots competition.

2.9 A Comparative Analysis of a Solar-Powered Dc Refrigerator anda Conventional Ac-Powered Refrigerator

In this paper comparison OF a Solar Powered Dc Refrigerator and a Conventional Ac Powered Refrigerator was made on the basis of Current Consumption And Corresponding Cooling Effect Of Each Refrigerator which we measure using an Lm35 Temperature Sensor and along with that we use a liquid crystal display LCD to display the temperature and also with a multimeter. r, The Dc Refrigerator Was Operating On 12v While The Ac Refrigerator Was operated With A Stabilizer. Given the same circumstances In Both Refrigerators, The Dc Unit Shows More efficiency than AC powered refrigerator.

2.10 *Computational analysis of blood clot dissolution using avibrating catheter* tip

Thrombolysis experiments was performed to predict the efficacy using the developed vibrating actuator. Computational results showed that plasminogen

activator perfusion into a clot was enhanced by actuator vibration at frequencies of 1 and 5 Hz.

2.11 New cost-effective design of PCR heating cycler system usingPeltier plate without the conventional heating block

DNA amplification needs proper control of temperature in PCR for efficient results. The speed of PCR depends on the reduction of the thermal mass of the heating part of PCR. So this paper proposed an efficient Heating/cooling system by using Peltier for PCR.

2.12 Design and implementation of explorer mobile robotcontrolled remotely using IoT technology

The mobile robot uses hardware and software which is also intended to work with different sensors peripherals and cameras uses to inspect the robot environment and is controlled remotely by using a technology called the Internet of Things.

2.13 Design and development of digital PID controller for DC motordrive system using the embedded platform for mobile robot

For agriculture purposes, we need a mobile robot to continuously investigate plant environment because plants get affected and have diseases caused by pathogens and environmental conditions. So robotic system has been proposed that monitors the plant condition such as temperature, humidity soil moisture content by using a suitable data acquisition system.

2.14 IOT and big data-based cooperative logistical deliveryscheduling method and cloud robot system

IoT and cloud are the monitoring system of mobile robots , By using the information from logistics delivery resources from logistics delivery companies through the IOT and/or Internet, creating the map of logistics delivery routes, by using the shortest route algorithm enhances customer experience and delivery cost.

2.15 Robot navigation using human cues: A robot navigationsystem for symbolic goal-directed exploration

This robot was designed such that it was provided with a floor plan and a destination which the robot autonomously navigated using an abstract map,text recognition, and path planning systems. In this paper, the robot used a symbolic navigation system to find the efficient way to the destination.

Chapter 3

Modules

3.1 Sensors:

The sensors are interfaced with a microcontroller that interacts with theNode-MCU wifi module to send data from sensors to the IoT platform for real-time monitoring and controlling.

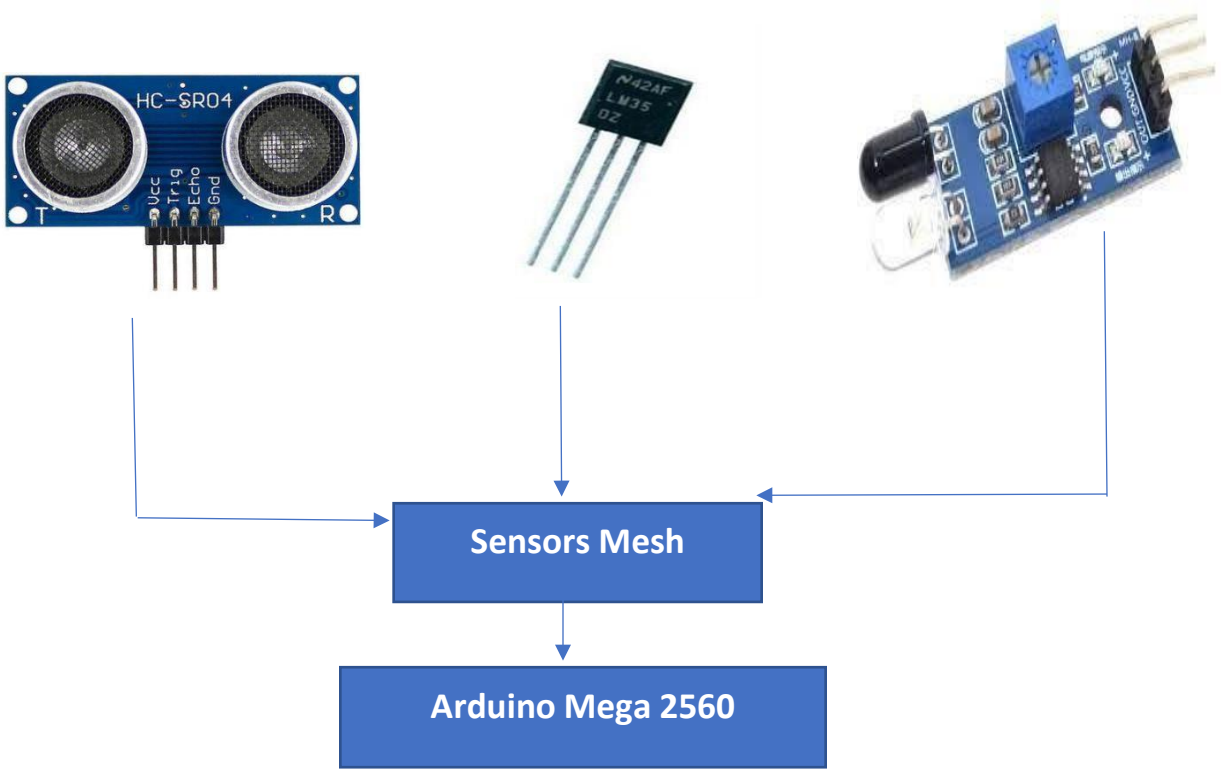

Figure 3.1: Block Diagram of Sensors

3.1.1 Ultrasonic sensor

It is a device that generates electronic sound waves to calculate thedistance of the targeted object.

This sensor is used for obstacle avoidance purposes in our project.

Figure 3.2: Ultrasonic Sensor

3.1.2 IR sensor

It is a device that works by emitting and receiving infrared radiation anddetects the motion of an object.

This sensor is used in our project to detect black lines for the purpose ofline following.

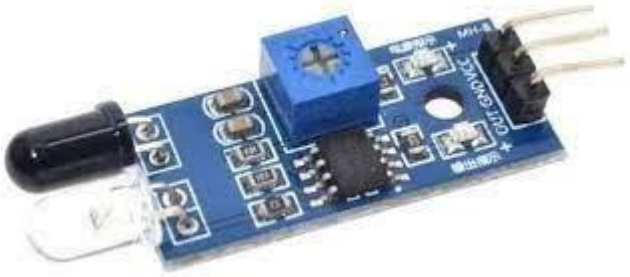

Figure 3.3: IR Sensor

3.1.3 LM35 Temperature sensor

It is a device that uses to determine the temperature by taking anoutput of analog which is directly proportional to temperature.

This device is used to measure the temperature of the coolingcompartment of our project.

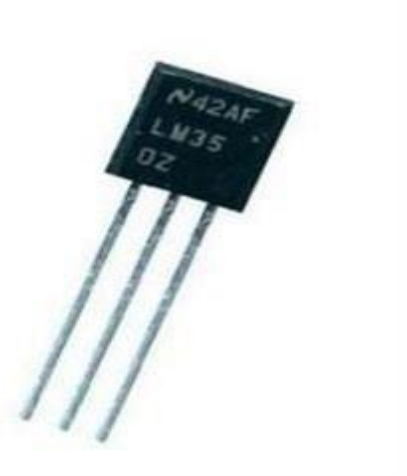

Figure 3.4: LM35 Temperature Sensor

3.2 **Components used**:

3.2.2 Arduino

Microcontroller that has ATmega 2560 processor is called an Arduino mega 2560. It consists of 54 digital pins and fifteen of them are PWMand have sixteen input pins.

3.2.2.1 Software

Arduino mega 2560 works with Arduino integrated development software(IDE) in which we first compile the program and upload it intothe Arduino board.

This microcontroller serves as the main control unit of our project and itis working as the bridge between sensors and the IOT platform.

3.2.2.2 **Components in Arduino Mega**

The parts of the Arduino Mega are

- Power jack indicator
- 16 MHz oscillator
- USB Cable port
- Reset button
- ICSP header
- Voltage regulator

3.2.2.3 Memory

The memory of 256KB has an Arduino mega 2560 and the EEPROM hasa memory space of 4KB. The SRAM has the size of 8KB.

3.2.2.4 Power

We can power this board by using its various ports.

5v: Arduino is mostly powered by a DC source via a USB connection orother methods. In the board, a voltage of 5v is provided.

3v: in the board, the voltage supply is approximately 3v which isgenerated by the regulator installed on the board.

Vin: In this port of board the input power is given by using a jack orcables.

Ground: in the board, the ground is given to make the circuit completewhen power is given.

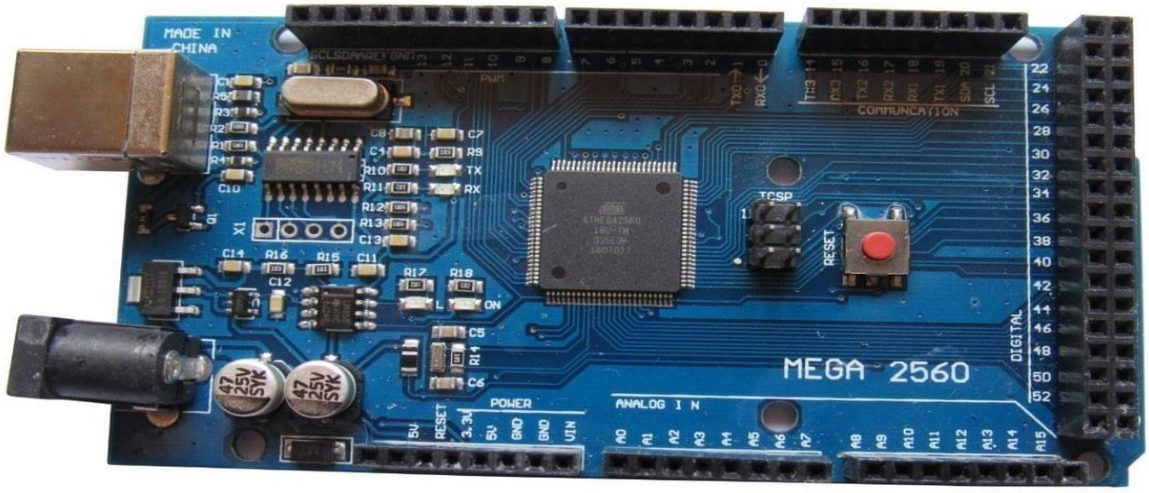

Figure 3.5: Arduino Mega 2560 Board

3.2.3 Peltier plate

This is a plate in which one side gets cold and when the side gets hotwhen power is given to that this phenomenon is called the Peltier effect and it has a specific rating.For our cooling compartment, weuse that plate in our refrigerator which is more environmentally friendly than a compress

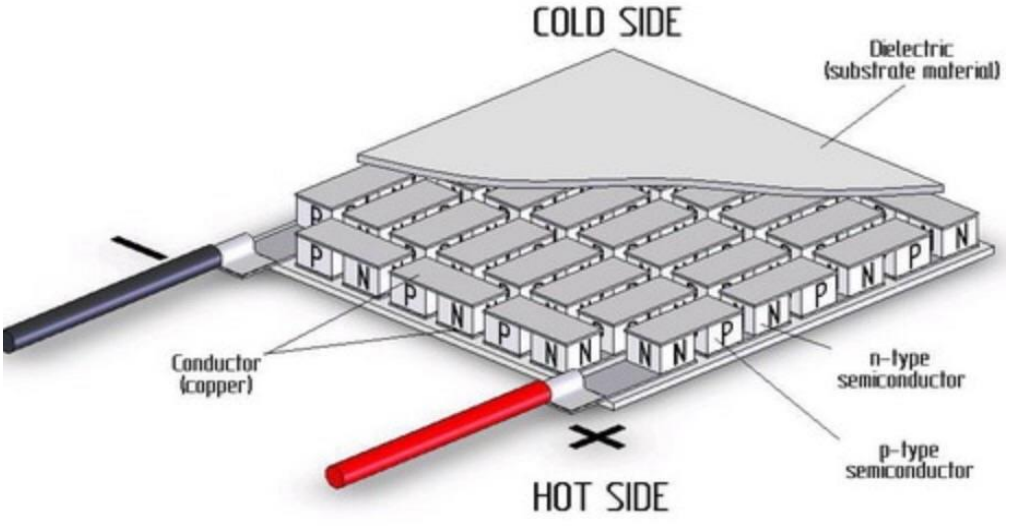

Figure 3.6: Peltier Plate

3.2.4 Heat sink

This is a metal mostly in a cube shape which works to dissipate heat.

We use this to dissipate heat along with a fan from the hot side of the Peltier plate**.**

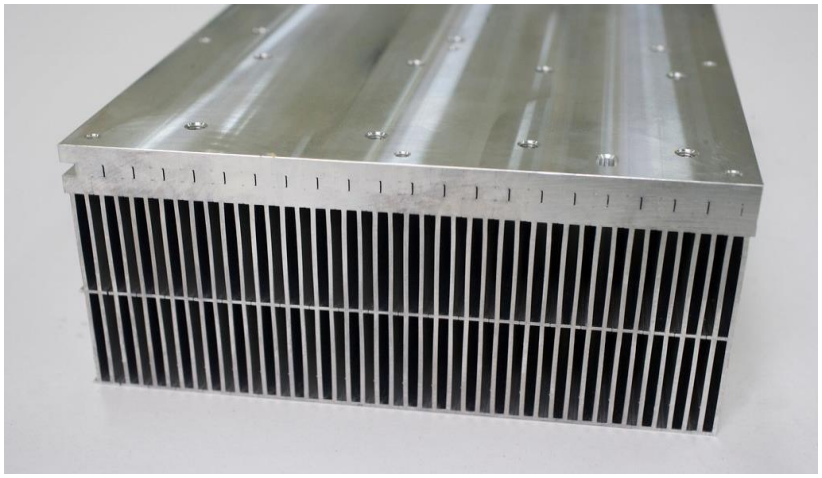

Figure 3.7: Heat Sink

3.2.5 DC Fan

Dc fan is used to dissipate heat mostly from computers, laptops e.t.cwhich is in various sizes and shapes.

We use it to remove heat from the hot side of the Peltier plate**.**

Figure 3.8: DC Fan

3.2.6 LCD

Liquid crystal display is a technology which uses to display by giving anelectric voltage to a layer of liquid crystal.

We use this along with an lm35 temperature sensor to display a temperature in centigrade and Fahrenheit of a cooling compartment**.**

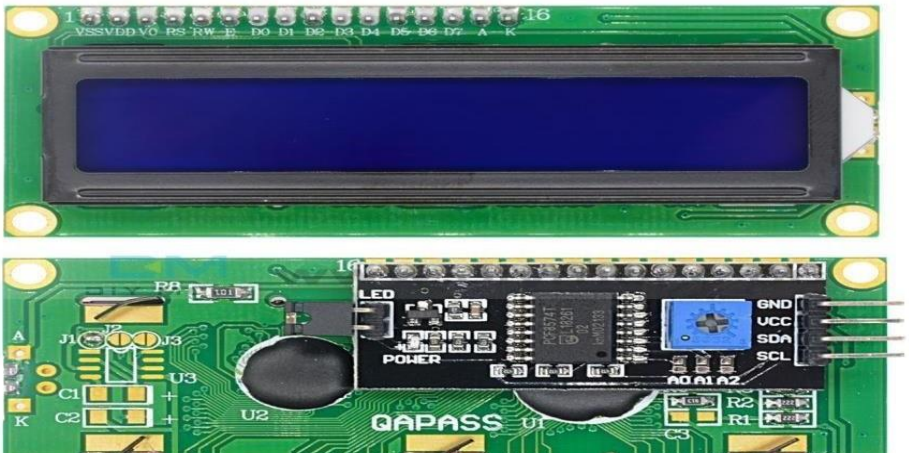

Figure 3.9: LCD

3.2.7 LM298 Motor Driver

It is a module that works as a dual H-bridge for driving dc and steppermotors. It controls the speed and direction of two dc motors at one time**.**

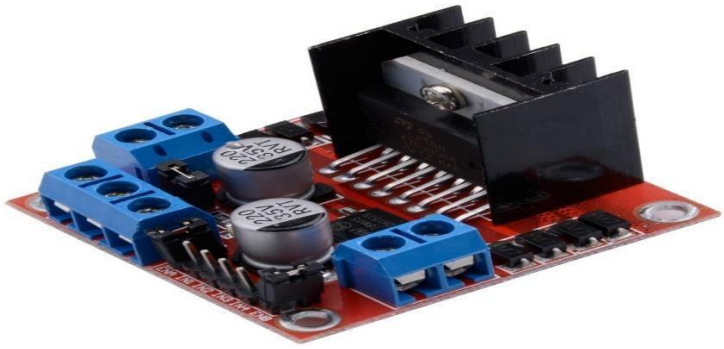

Figure 3.10: LM298 Motor Driver

3.2.8 DC motor

It is one type of motor that takes input from a direct current and givesoutput in the form of mechanical energy. it has highly controllable speed so it gives accurate results for many industrial applications

Figure 3.11: DC Motor

3.2.9 Node MCU

Node Microcontroller unit is also known as ESP-8266 wifi module because the wifi chip is connected to that board already which acts asa bridge for various devices to communicate together.

Node MCU connects to the main control unit which provides internetto transfer data of sensors to IOT so it monitors and controls the intelligent robot.

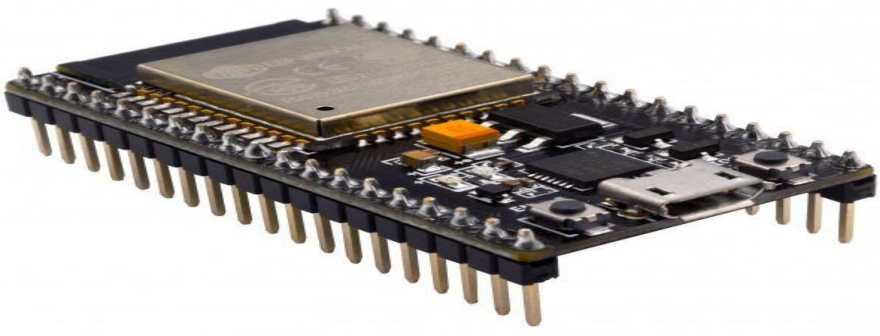

Figure 3.12: Node MCU

3.2.10 Bridge Rectifier

The bridge rectifier works as a converter that takes alternating currentas input and gives output as direct current. It mostly works in laptops computers and uninterruptible power supply**.**

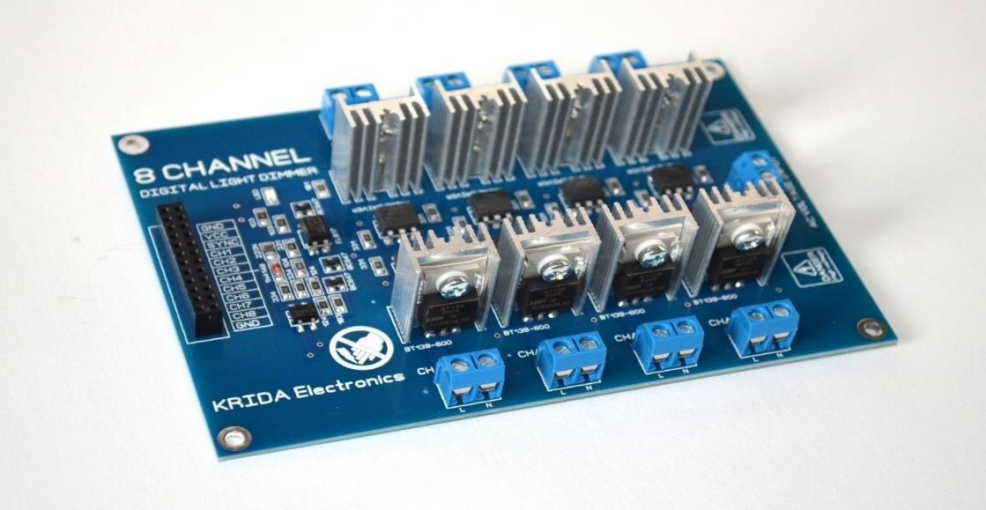

Figure 3.13: Bridge Rectifier

3.2.11 Transformer

It is a device which works on faradays law which works as a converterthat does the conversion of electrical energy from one alternating current circuit to one or more than one circuit by giving a voltage of either high or low.

Figure 3.14: Transformer

3.2.12 Tyres

Molded rubber of ultra-durable matrix which has the benefit of givinga grippy surface on the outside with a hollow inside that is filled with air for comfort ride.

Figure 3.15: Tyres

3.2.13 Jumper wires

These are the simple insulated wires that mostly use with
breadboards and other equipment of prototypes which give a path forelectrical current to flow from one circuitry to another. it has differenttypes like Male to male, male to female, female to female.

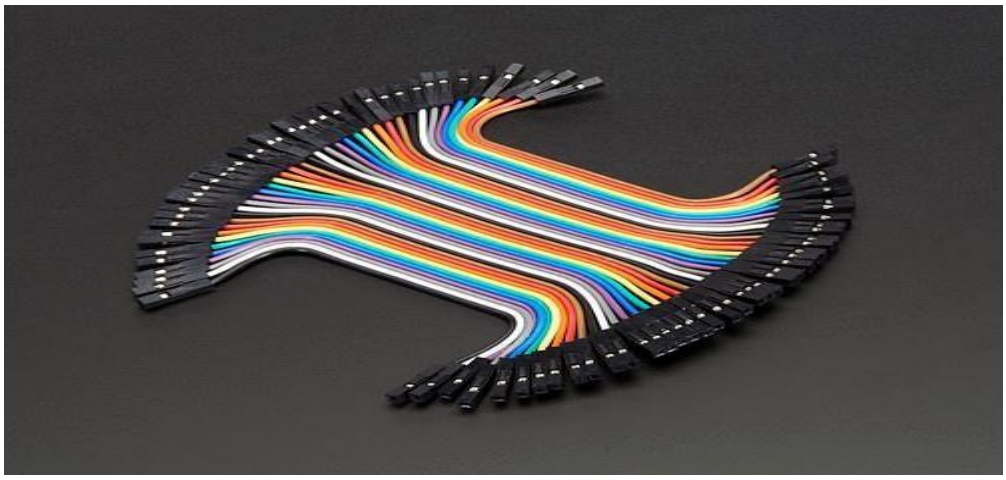

Figure 3.16: Jumper Wires

Chapter 4

Electrical Circuit Design, Testing, and Results

In this Chapter, we are showing the working of each module that wediscuss in the previous chapter and present its circuit diagram and
lastly discuss its output.

4.1 Peltier plate

As we know in our project, we have to integrate a cooling
compartment with an intelligent robot that works on the Peltier effect principle. So in this task, we use a 12V module, which is rated for up to72 watts max (up to 14V/6A). so in this task, we give power to the Peltier plate and measure the temperature of the Peltier plate with
the help of a temperature meter concerning time.

Table 4.1: Table for temperature and time for cooling of peltier plate

S.NO	Temperature (celcius)	Time (sec)
1	21.3	1s
2	21.1	2s
3	20.8	3s
4	20.6	4s
5	20.4	5s
6	20.2	6s
7	19.9	7s
8	19.6	8s

Table 4.2: Table for temperature and time for Heating of peltier plate

S.NO	Temperature (celcius)	Time (sec)
1	19.3	1s
2	19.8	2s
3	20.6	3s
4	21.6	4s
5	22.5	5s
6	23.5	6s
7	24.3	7s
8	25.1	8s

Results Both tables show the trends for the heating and cooling of aPeltier plate. The one thing that is most important about the Peltier plate is if it works without a heat sink its cold side gets cold for around6 to 8 seconds maximum and then starts getting hot. So that's how thePeltier plate works.

4.2 LM35 Temperature sensor

Lm35 is a digital sensor used to determine the temperature of the surrounding, the temperature of the cooling compartment which is made up of a Peltier plate was measured by using a lm35 temperature

sensor in this project to maintain specific temperature according tothe requirements of a specific test sample that is placed in cooling compartment at that time.

The sensor was connected to a microcontroller and also connected with a liquid crystal display to show the temperature of the cooling compartment in real time. The figure shows the simulation and outputof the LM35 temperature sensor in Proteus.

4.2.1 Simulation Results

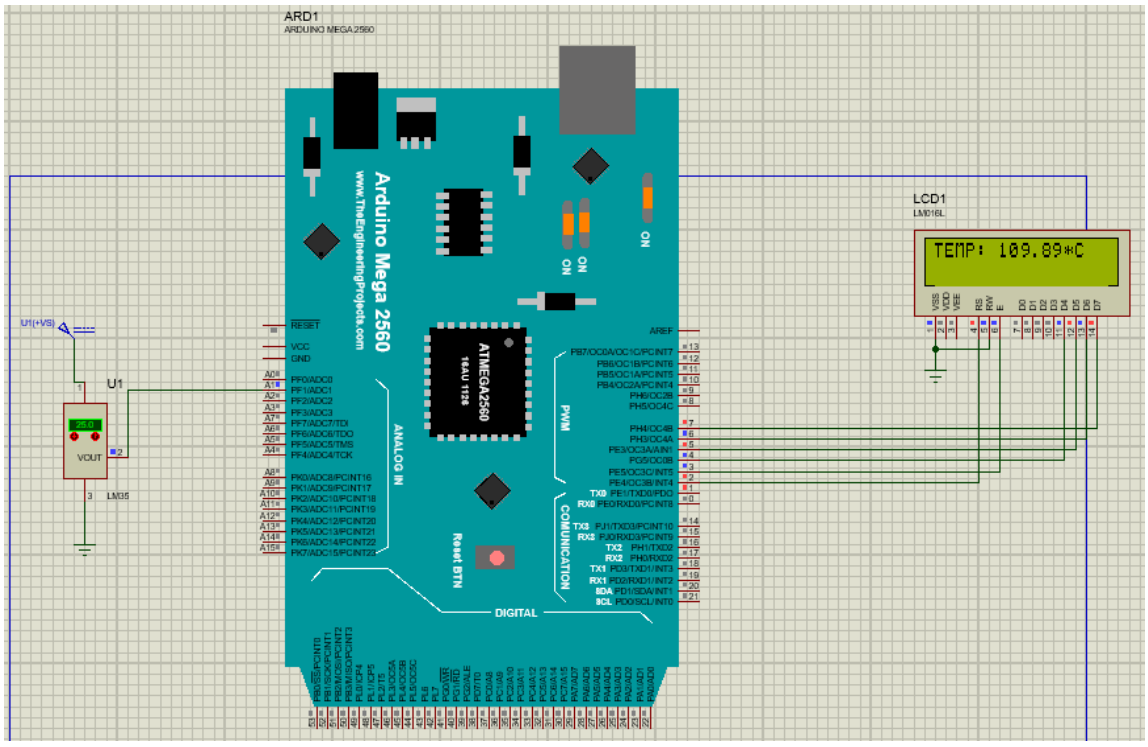

Figure 4.1: Schematic and Output of LM35 Temperature sensor

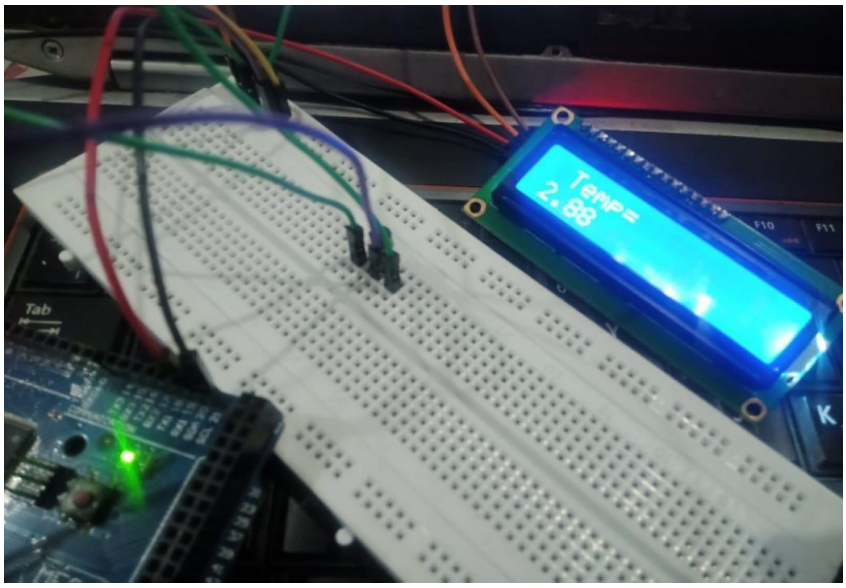

Figure 4.2: LM35 Temperature sensor testing

4.3 DC Motors

The type of motor that uses dc power to run the motor which convertselectrical energy into mechanical form. This motor is used to run the tires of the intelligent robot along with motor driver lm298 which
controls the speed and direction of that motor. The figure shows thesimulation and output of the dc motor in Proteus.

4.3.1 Simulation Results

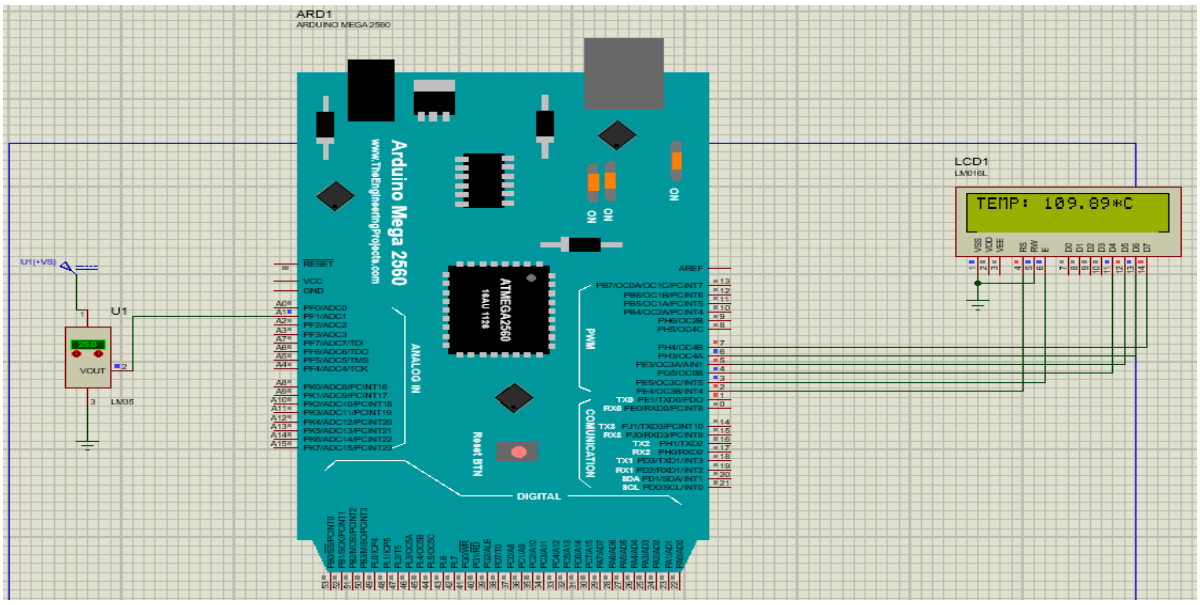

Figure 4.3 Schematic and Output of LM35 Temperature sensor

Results:

This shows the motors(gear motors) that we use to move in forward and reverse directions with the help of a motor driver(LM298) and byusing the PWM pins of Arduino to control the speed and the directionof the motor. That's how the motor works.

4.4 IR SENSORS

IR sensor which is also known as an infrared sensor which uses in various wireless applications to observe specific characteristics in theenvironment by using IR radiations. Its working concept is likewise a human sense of vision that detects hurdles in the way.

Ir sensor is used for navigation in this project by detecting black lightto follow the line which creates the path of the robot. The figure shows the simulation and output of the IR sensor in proteus and thefigure shows the sensor testing in the base of the intelligent robot.

4.4.1 Simulation Results

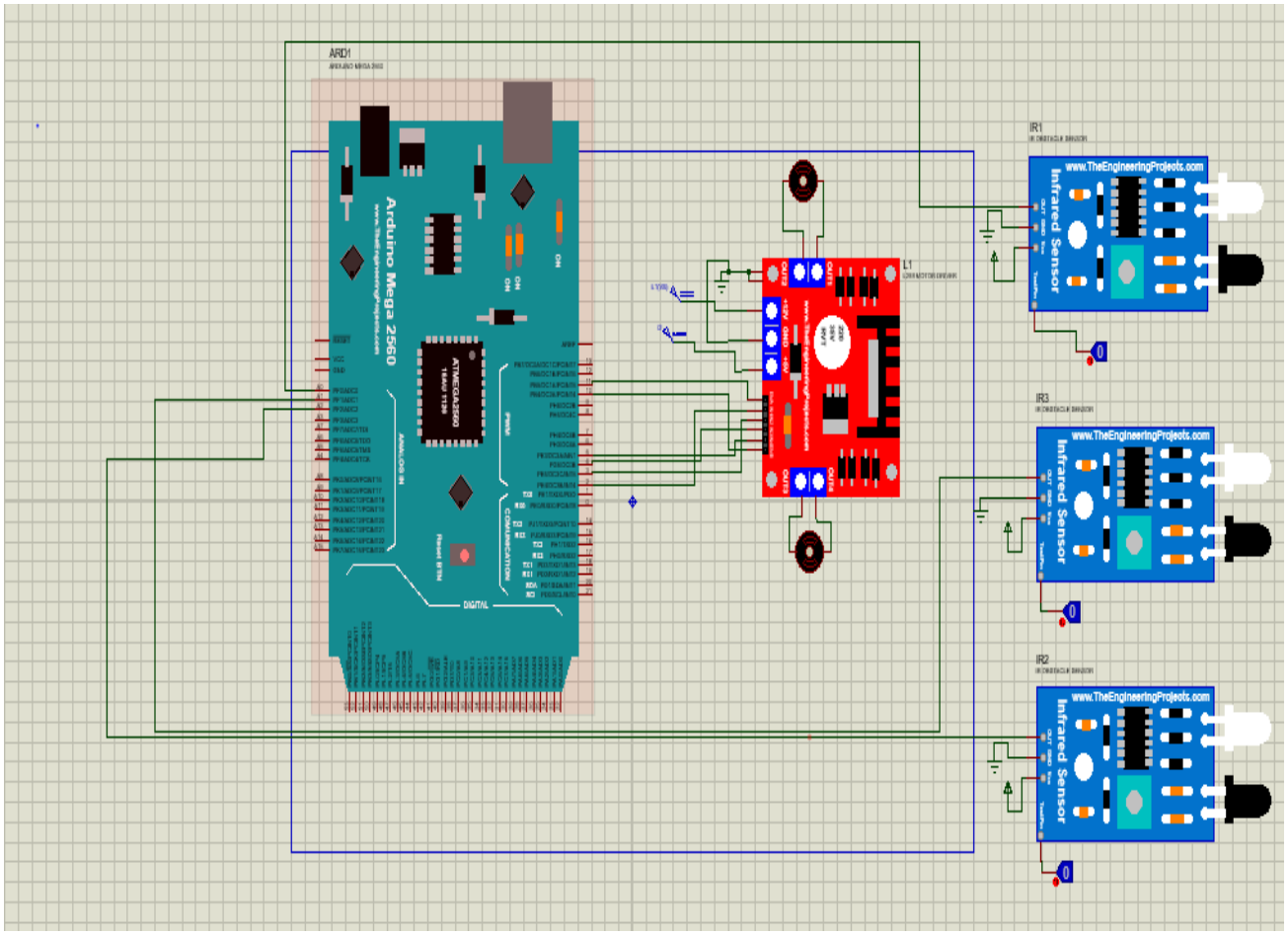

Figure 4.4: Schematic and Output of IR sensor

4.4.2 Sensor Testing

Figure 4.5: IR sensor testing

4.5 Ultrasonic Sensor

This sensor works by producing ultrasonic sound waves and changing
the reflected sound into an electrical signal to calculate the distance ofan obstacle .ultrasonic sensor is used to measure any object's distancein the path of robot movement to avoid any obstacle.

In this we connect the ultrasonic sensor to Arduino mega 2560 Nowconnect the servo motor with ARDUINO So in the end when the
ultrasonic sensor detects any object the servo motor will rotate. Thefigure shows the simulation and output of the IR sensor in proteus
and the figure shows the sensor testing in the base of the intelligentrobot.

4.5.1 Simulation Results

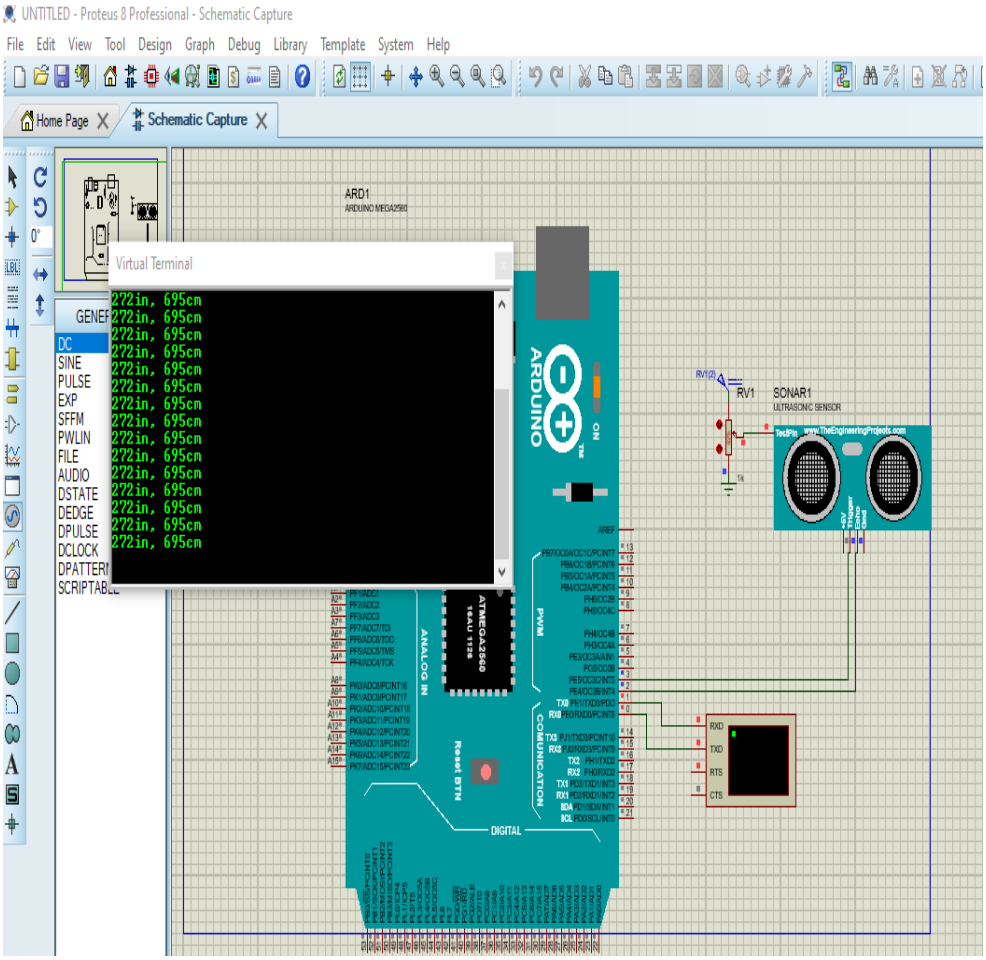

Figure 4.6 : Schematic and Output of Ultrasonic Sensor

Sensor Testing

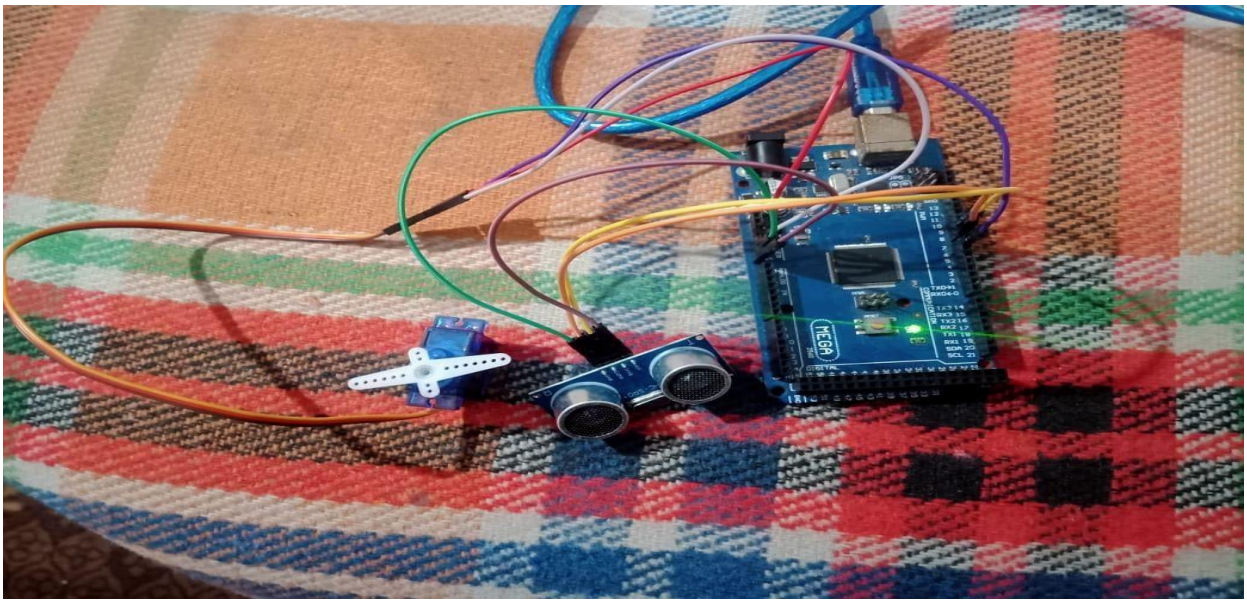

Figure 4.7 : Ultrasonic sensor testing

4.6 GPS Module

It is a wireless chip module that connects that is capable of communicating with the global positioning system and determining the latitude and longitude of the surrounding. In this project, we connect a GPS module with a microcontroller to send all information
about the surrounding. The figure shows the simulation and output ofthe IR sensor in Proteus.

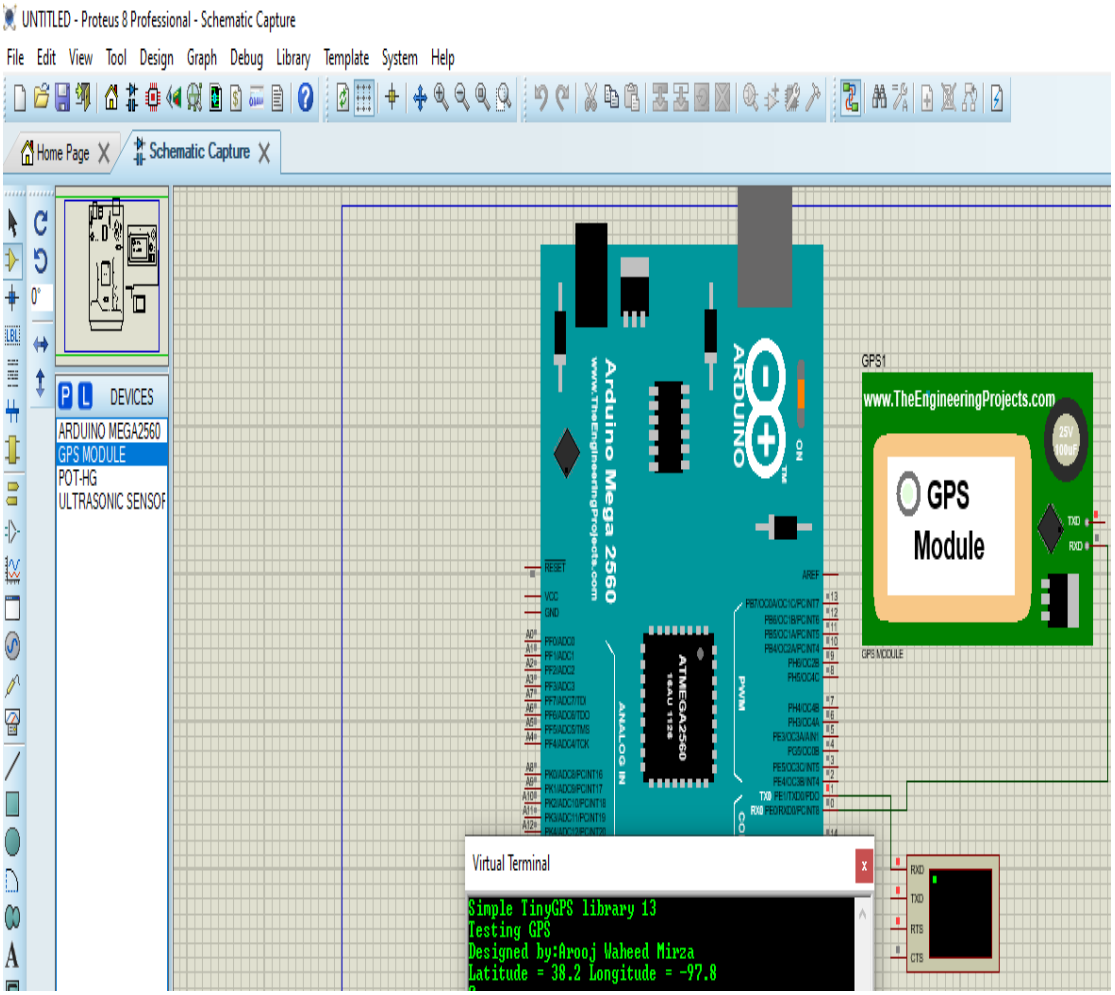

Figure 4.8: Schematic and Output of GPS Module

Chapter 5

Internet of Things

5.1Introduction

In past years the Internet was just limited to devices like smartphonesand laptops e.t.c but now because of the Internet of Things, we can

link anything to the Internet and remotely monitor any environmentor thing because everything has now the capability to communicatewith one another. for IOT sensing and general are two types of

hardware devices. IoT is a mesh of interconnected devices that usesthe internet for communication.

Figure 5.1: Internet of Things

5.1 ThingSpeak

It is a platform of the Internet of Things that is based on the cloud. Forreal-time determination, the data can be sent from devices and

sensors to Thingspeak, and controlling the data by createdvisualization and sending an alert.

5.2 Features of Thingspeak

- Data can be collected in private channels
- MQTT and Restful APIs

- **Organizing an event**
- **Data can be shared through public channels**
- Analyze and visualize through MATLAB

5.3 IOT implementation

In our project, an IOT-based health care service robot the system consists of a microcontroller Arduino mega 2560 which collects all
data from all devices and sensors connected to our prototype which isconnecting to things Speak by using the wifi module NodeMCU. The IOT-based GUI displays all sensor values in real-time to the user who controls all the systems according to his convenience.

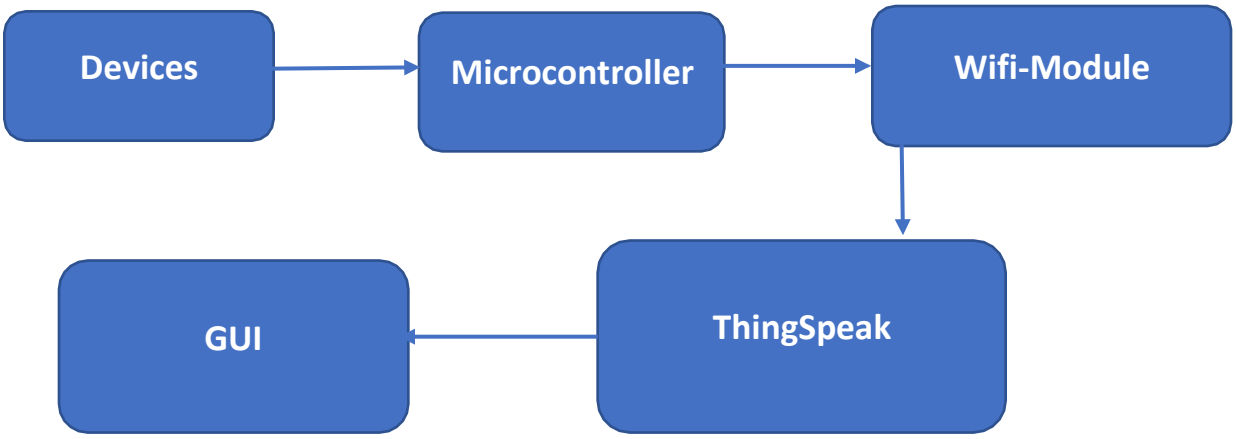

Figure 5.2: Block Diagram of IOT

Chapter 6

Prototype and Integration

6.1 Cooling Compartment

6.1.1 components

- Peltier plate
- Heat sink
- Thermal paste
- Dc Fan
- Thermopore sheet
- Digital Thermometer
- Jumping wires
- Battery
- Breadboard

6.1.2 procedure

we made a cooling chamber from a Thermopore sheet in which we connected 3 Peltier plates along with a heat sink and fan so by using alarge number of Peltier plates cooling chamber gets cool faster.

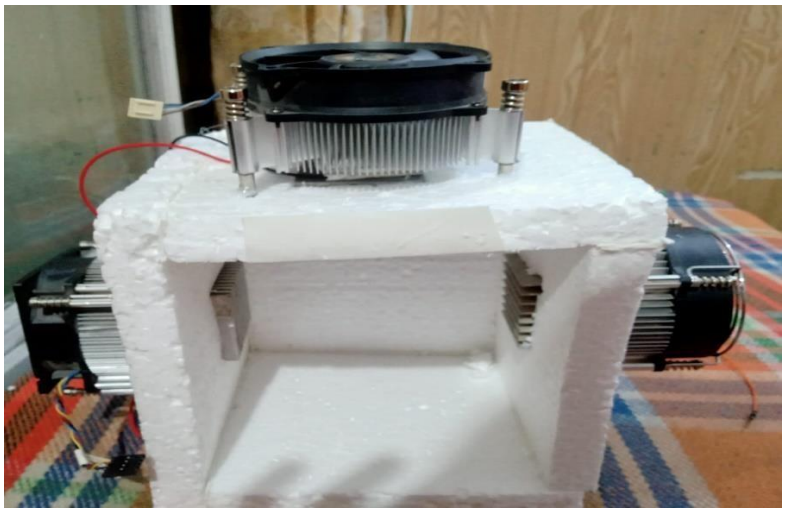

Figure 6.1: Structure of Cooling Compartment

Digital Thermometer is connected with the door of a cooling compartment which ultimately measure the temperature of a cooling compartment.

Figure 6.2: Digital Thermometer and Cooling Compartment

Table 6.1: Table for temperature and time for cooling of Cooling Compartment

S.NO	Temperature (celcius)	Time (min)
1	34	0
2	30	2
3	26	4
4	22	5
5	18	7
6	14	9
7	10	12

6.2 Robot Base

6.2.1 components

- DC Motors
- Tyres
- LM298 Motor driver
- Ultrasonic Sensor
- Infrared Sensor
- GSM

- Battery
- Breadboard
- Jumping wires
- Arduino
- Servo motor

6.2.2 procedure

In this, we integrate all sensors like Infrared sensors, Ultrasonic sensors, and GPS modules together to make a base of the robot and make a robot line follower. All these sensors are connected to Arduinomega 2560 and also the motor driver is connected to Arduino motors are connected to the motor driver from this system our project is capable of doing movement by following lines without obstacles.

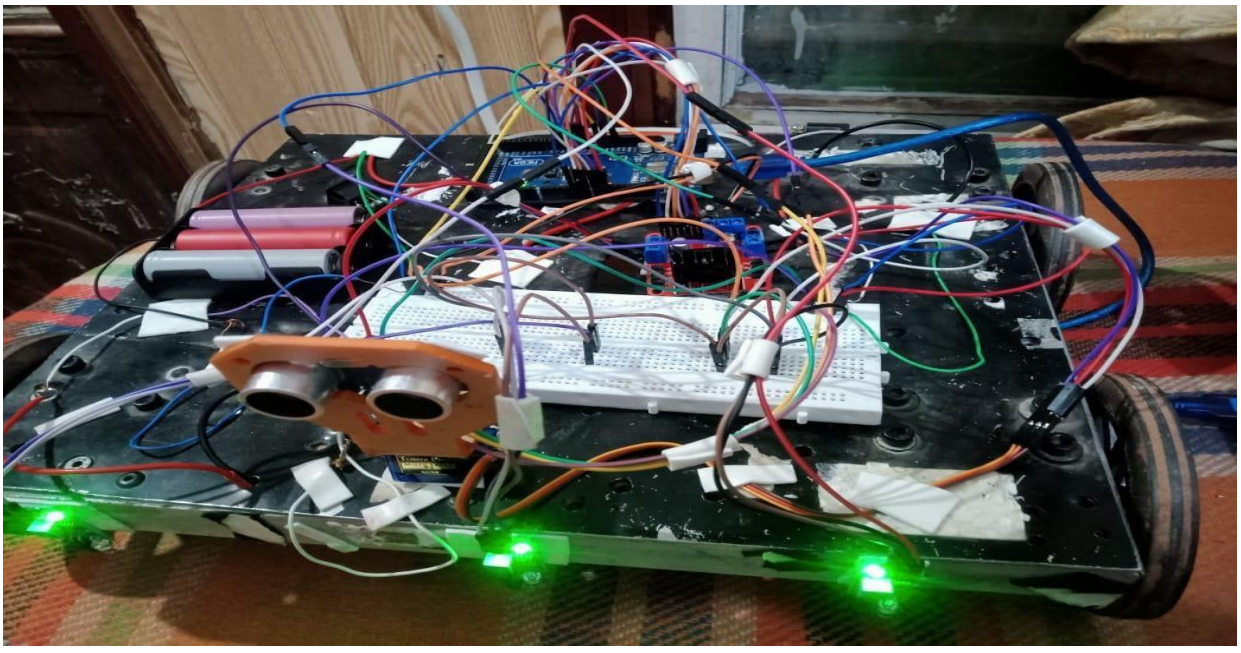

Figure 6.3: Robot Base

And then we integrate a cooling compartment with that base to makean intelligent robot to do transporting blood samples by giving optimum temperature to these samples and also connect Node MCU

with Arduino 2560 to transfer data of all devices to Thingspeak whichis IOT plat6form to monitor and control the robot according to top your requirements.

Chapter 7

Conclusion and Recommendations

7.1 Conclusion

The aim of the final year design project presented in the first chapterwas to prosper a prototype of IOT Based Health Care Service Robot. The explanation of each module and circuit related to that has been explained in previous chapters. So from all these, we come to an endthat

1. The cooling compartment has been developed successfully.

2. The cooling compartment was cooled down using Peltier plates.

3. The intelligent robot has been developed successfully.

4. All sensors and device tests that are equipped with a base of theintelligent robot were conducted successfully.

5. All the parameters were monitored and controlled remotely.

This project can open many types of delivery robots in hospitals fordifferent purposes by considering environment-friendly tech.

7.2 Recommendations

As the use of robots were increasing rapidly in all fields of life so this proposed system is not just for this application or not final as a system. If we talk about technology or if we work in that field there is

always a chance of improvement in that but as an engineer of thissystem some suggestions are there for future work of this project.

1. Robotic hands can be integrated with this prototype so that therobot itself collects blood samples from wards and take place in the laboratory.

2. The same robot will be used in restaurants and as a rider for delivering food from restaurant TO HOME as by using the other side ofPeltier, it will warm the food for a large period of time.

3. The current IOT environment can be replaced by using Artificial intelligence so robot makes their own decisions according to the environment**.**

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