A Project Report

On

IoT Module for Infant Incubators & Warmers

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Chapter 1
Introduction

An infant incubator is a medical device that provides a controlled environment for premature or ill newborns. It is required to regulate temperature, humidity, and oxygen levels, mimicking the conditions of the mother's womb. This controlled setting supports the development of underdeveloped organs and reduces the risks associated with premature birth, improving the chances of survival and healthy growth for vulnerable newborns.

1.1 Background of the project topic

A warmer is a device in which the incubation process is done which conditions an enclosure to a predetermined temperature because it provides and maintains all artificial optimal conditions for growth of infants to live while their vital organs develop.

1.2 Motivation and scope of the report

Mostly all existing warmers/incubators are manually operated, i.e., all readings have to be manually collected and stored for numerous infants. Our project aims to eliminate such tedious tasks as all readings will be collected automatically and sent to the respective parents/guardians on their mobile phones. Similarly, any sudden drop or rise in any parameters will automatically alert the respective contact.

Chapter 2
Literature survey

Exhaustive literature survey

[1] Fog Assisted-IoT Enabled Patient Health Monitoring in Smart Homes

Abstract:
Internet of Things (IoT) technology provides a competent and structured approach to handle service deliverance aspects of healthcare in terms of mobile health and remote patient monitoring. IoT generates an unprecedented amount of data that can be processed using cloud computing. But for real-time remote health monitoring applications, the delay caused by transferring data to the cloud and back to the application is unacceptable. Relative to this context, we proposed the remote patient health monitoring in smart homes by using the concept of fog computing at the smart gateway. The proposed model uses advanced techniques and services, such as embedded data mining, distributed storage, and notification services at the edge of the network. Event triggering-based data transmission methodology is adopted to process the patient's real-time data at fog layer. Temporal mining concept is used to analyze the events adversity by calculating the temporal health index of the patient. In order to determine the validity of the system, health data of 67 patients in IoT-based smart home environment was systematically generated for 30 days. Results depict that the proposed Bayesian belief network classifier-based model has high accuracy and response time in determining the state of an event when compared with other classification algorithms. Moreover, decision making based on real-time healthcare data further enhances the utility of the proposed system.

[2] Temperature monitored IoT based smart incubator

Abstract:

Baby neonatal Incubator is a closed apparatus for providing a controlled environment in all the possible ways for the immense care of premature babies. Majority of premature babies are born between 32 to 37 weeks of gestation period and die due to lack of simple essential care such as warmth. Until recently, most of the developing countries turned a blind eye to premature babies leading to their demise. This research work provides a cost-worthy design of an embedded device for real time monitoring of newborn babies in the incubator. It permits early detection of potential life-threatening events and maintains a safe environment for the infant. Many of the existing medical technological companies (such as small and medium) may not adopt the best existing technologies as its maintenance might not be cost effective. On the other hand, the bigger medical firms which have adopted them are cost effective and common man cannot afford the same. So, the main objective of this research is to overcome the drawbacks and provide eco-friendly service to all the common people.

[3] Design of Indoor Air Quality Monitoring Systems

Abstract:

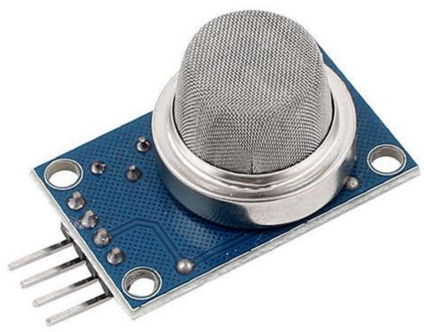
Indoor air quality is a problem that needs attention because it will affect human health. To maintain indoor air quality, it is necessary to regularly monitor several parameters that can affect air quality. Along with the development of sensor and monitoring technology based on IoT (Internet of Things) which helps a lot in designing monitoring devices automatically and periodically. This supports us to conduct research in designing a device that can periodically monitor indoor air quality conditions. In this study we designed an air quality monitoring system using the ESP32 as a controller and several sensors to measure air quality. The result is a system that can monitor temperature and humidity, dust particles and polluting gases (H_2S, NH_3, CO, NO_2, and SO_2).

Chapter 3
Methodology and Implementation

3.1 Hardware description

- MQ2 Air quality sensor:

Easy-to-use sensor to measure the concentration of LPG, I-butane, propane, methane, alcohol, hydrogen and smoke in the air. The MQ-2 measures a gas concentration of 100 to 10000ppm and is ideal for detecting a gas leak, as a gas alarm or for other robotics and microcontroller projects.

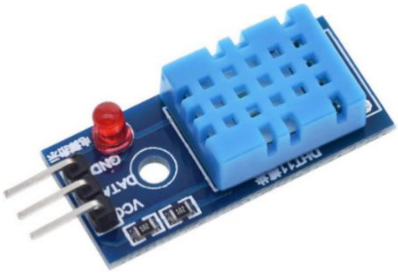


- DS18 Probe Temperature sensor:

The digital temperature sensor like DS18B20 follows single wire protocol and it can be used to measure temperature in the range of -67F to +257F or -55C to +125C with +-5% accuracy. The range of received data from the 1-wire can range from 9-bit to 12-bit. Because this sensor follows the single wire protocol, and the controlling of this can be done through only a pin of the Microcontroller.

- DHT11 digital temperature and humidity sensor:

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin. It is fairly simple to use, but requires careful timing to grab data. You can get new data from it once every 2 seconds, so when using the library from Adafruit, sensor readings can be up to 2 seconds old. It also comes with a 4.7K or 10K resistor, which you will want to use as a pullup from the data pin to VCC.



- Max 30100 Pulse Oximeter sensor:

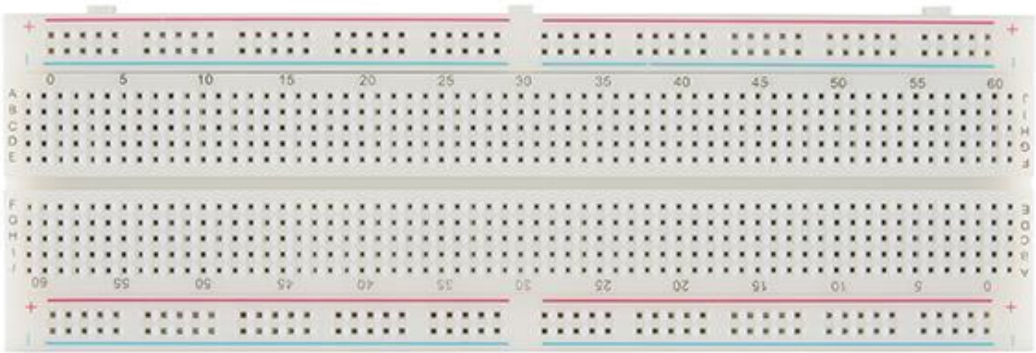
The MAX30100 is a Pulse Oximetry and heart rate monitor sensor solution. It combines two LEDs, a photodetector, optimized optics, and low-noise analog signal processing to detect pulse oximetry and heart-rate signals.

- Node MCU:

Is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Support for the ESP32 32-bit MCU was added.

- Breadboard:

The purpose of the breadboard is to make quick electrical connections between components- like resistors, LEDs, capacitors, etc. so that you can test your circuit before permanently soldering it together. Breadboards have many small sockets on them, and some groups of sockets are electrically connected to each other.

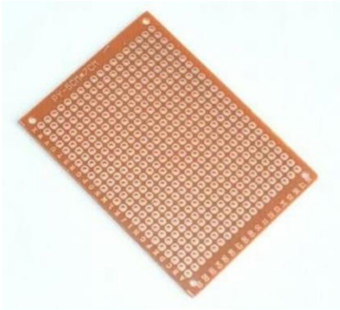


- Jumper wires:

Jumper wires are used for making connections between items on your breadboard and your Arduino's header pins.

- Perforated/Vero Board:

Used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate.

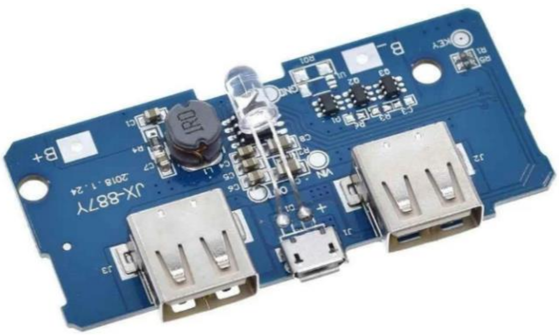


- Liquid Crystal Display (Lcd) with I2C module:

It is a type of flat panel display which uses liquid crystals in its primary form of operation.LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it.

- Power bank module:

Power Bank Module is a super mini power bank mainboard compatible with 3.7V-4.2V li-ion battery. On-board micro USB port for battery charging and USB type A female output port supporting DC 5V 1A input and 5V 1A output. Just connect it with a 18650 battery then you can get a portable power bank.

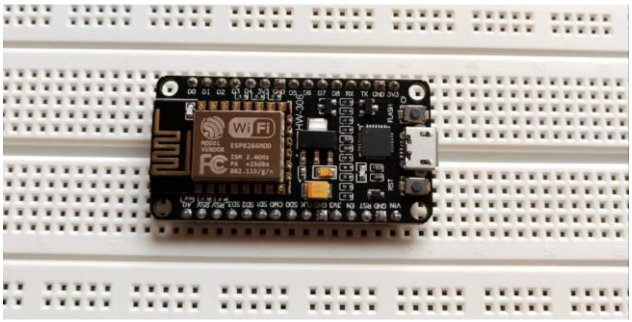


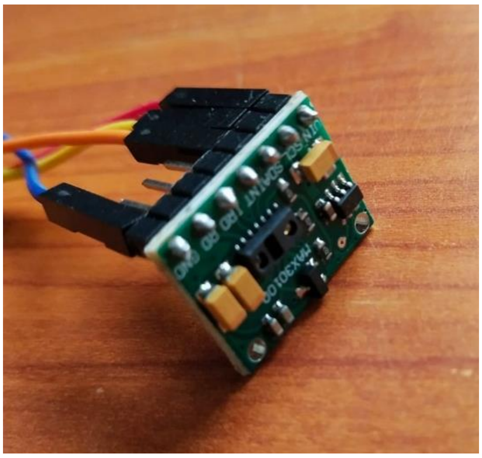
- Li-ion batteries:

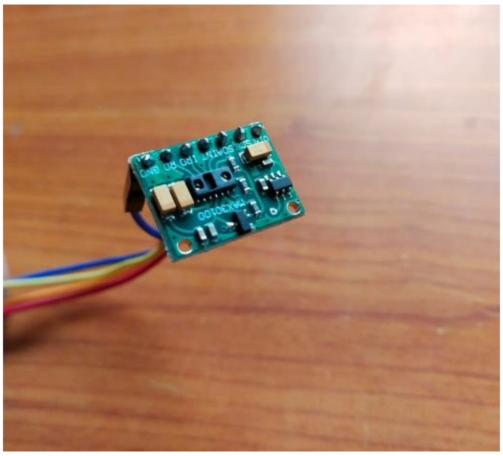
Li-ion battery is a type of rechargeable battery in which lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge, and back when charging.

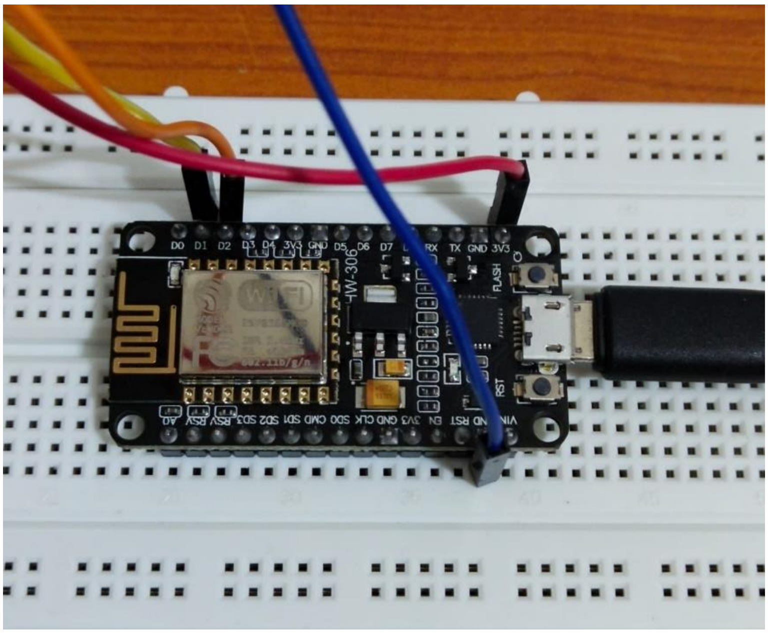
- Resistors used 4.7kΩ and 100 Ω.

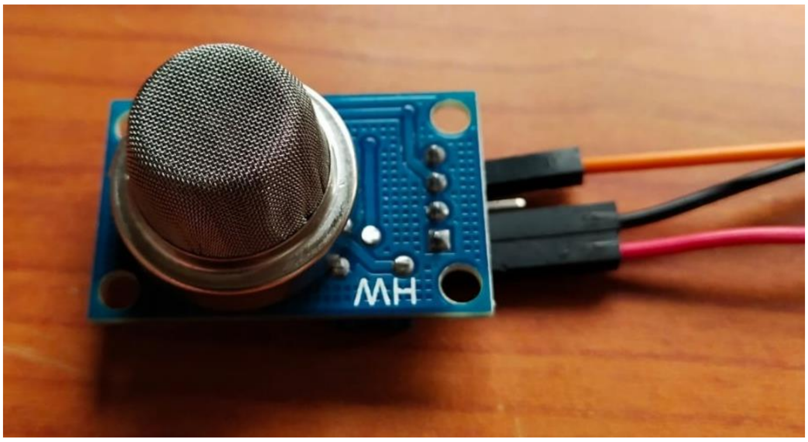
3.1 Hardware Implementation

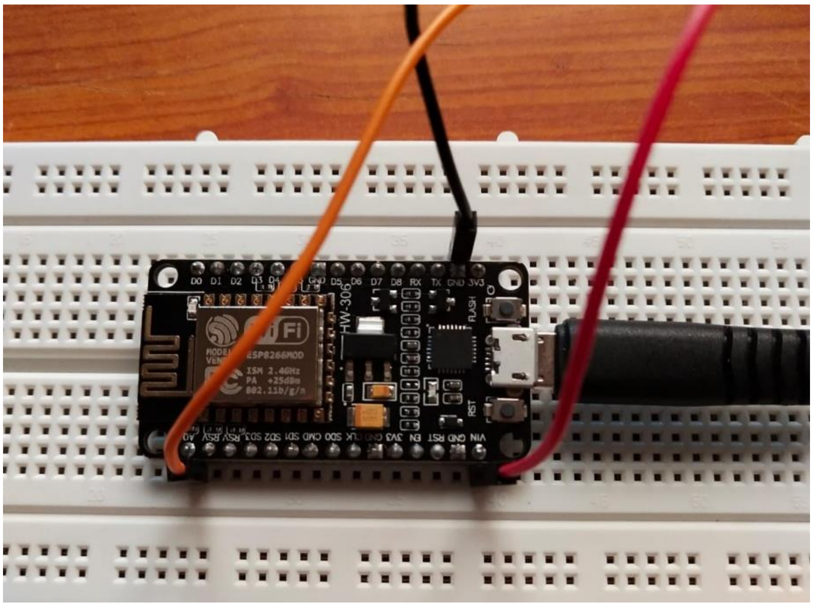


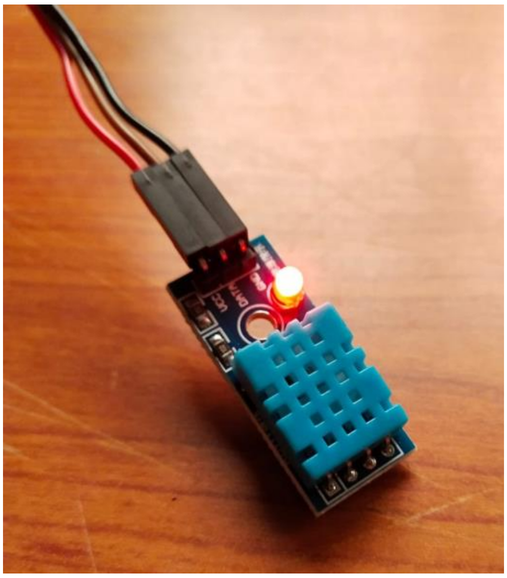


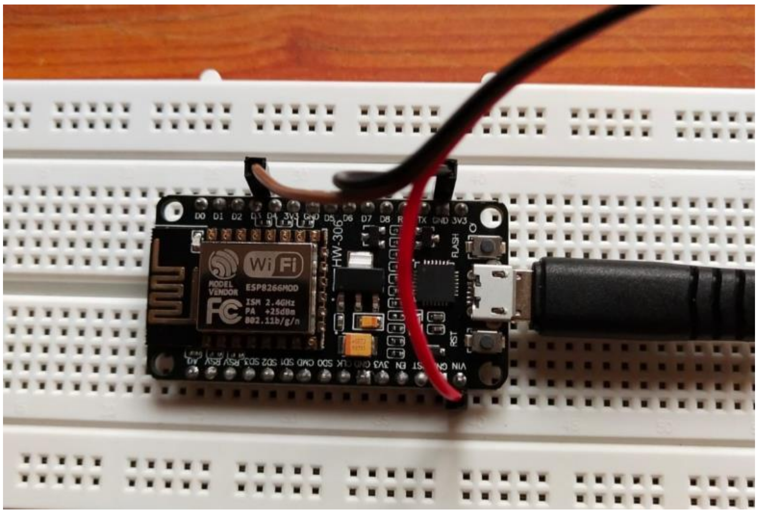




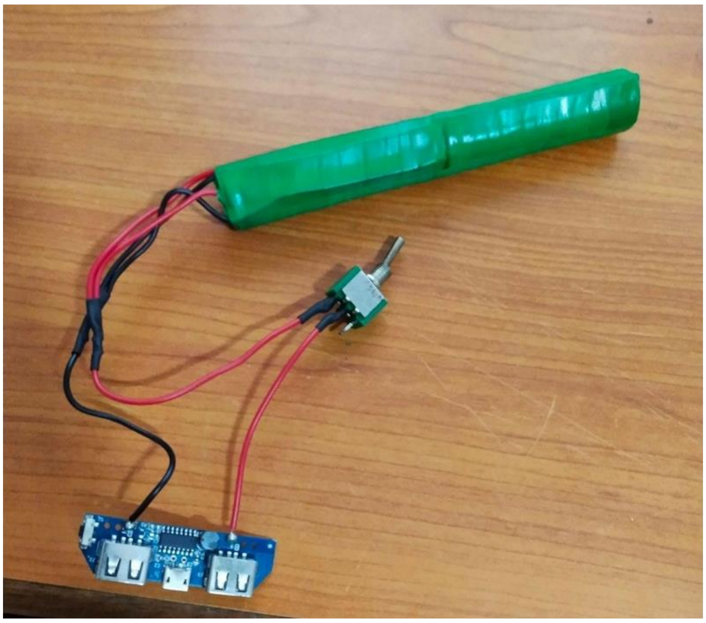


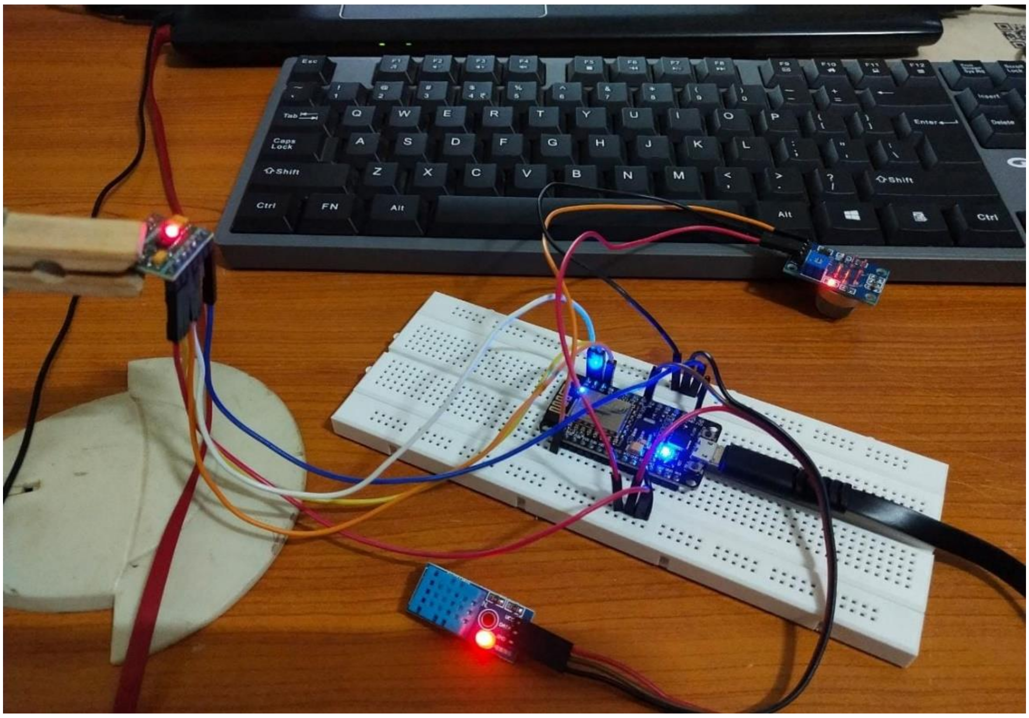

ESP8266MOD
HW-306

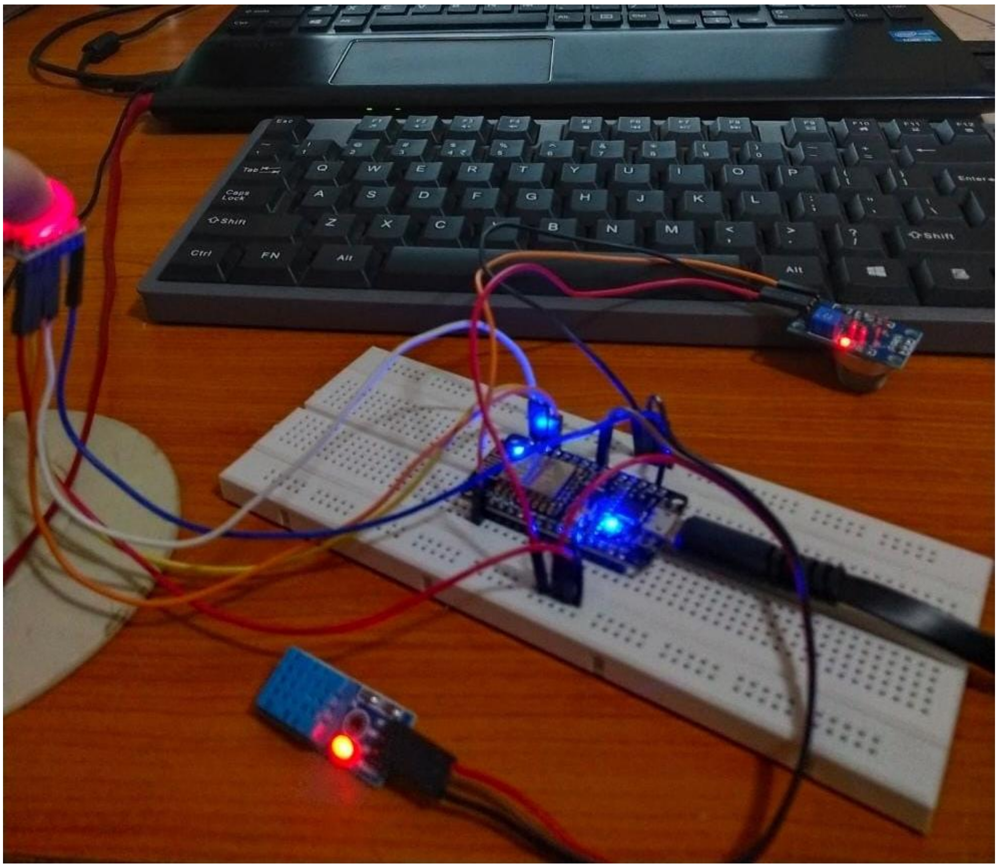


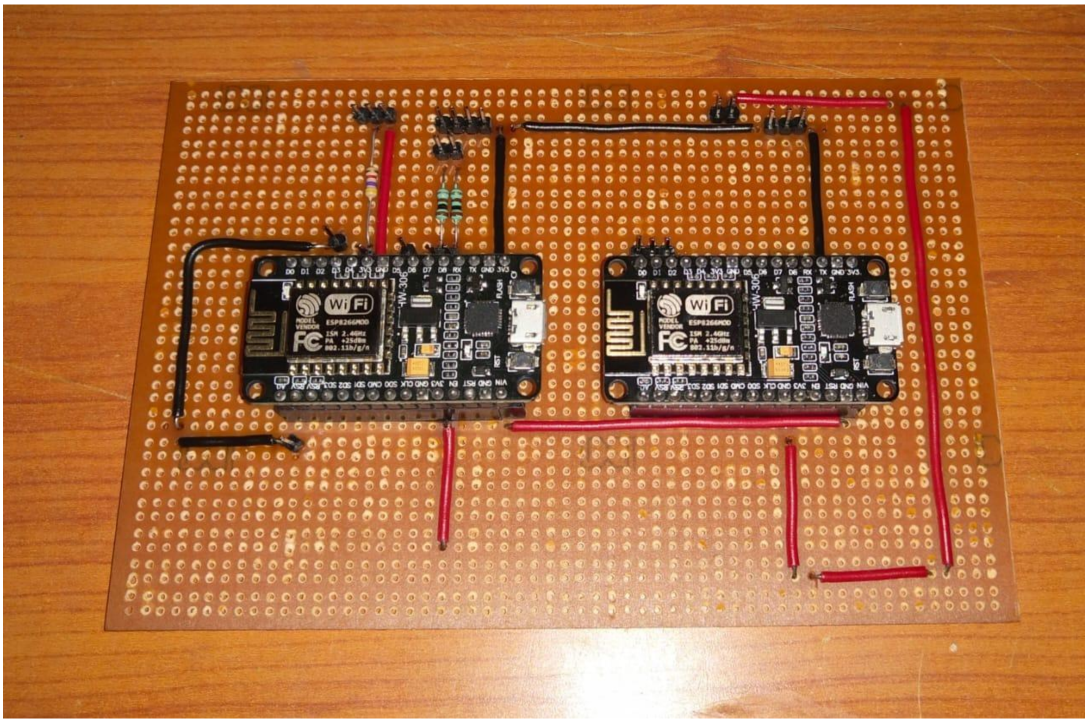

HW-306
ESP8266MOD

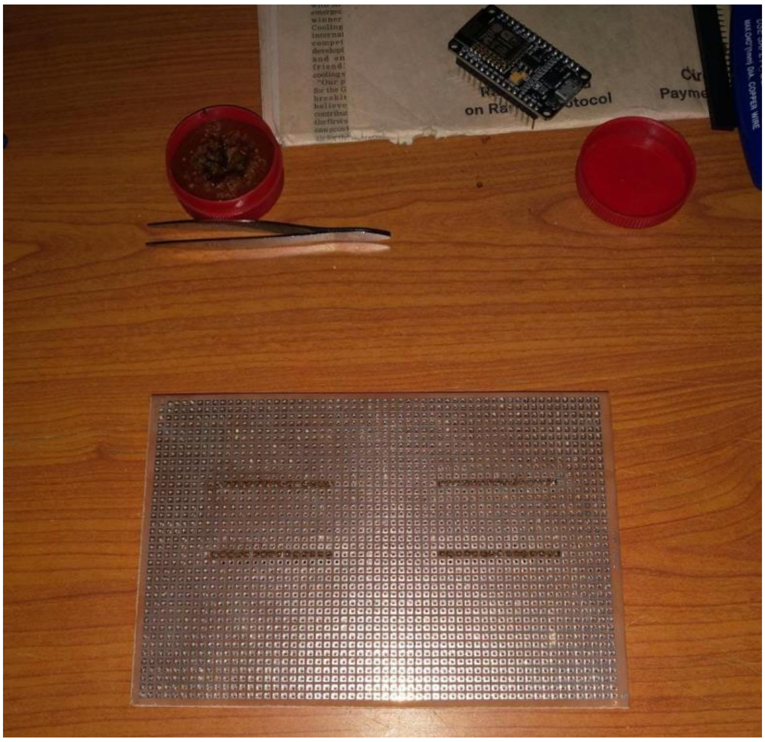

HONGLI 18650 1500mAh 3.7v
R-41120022

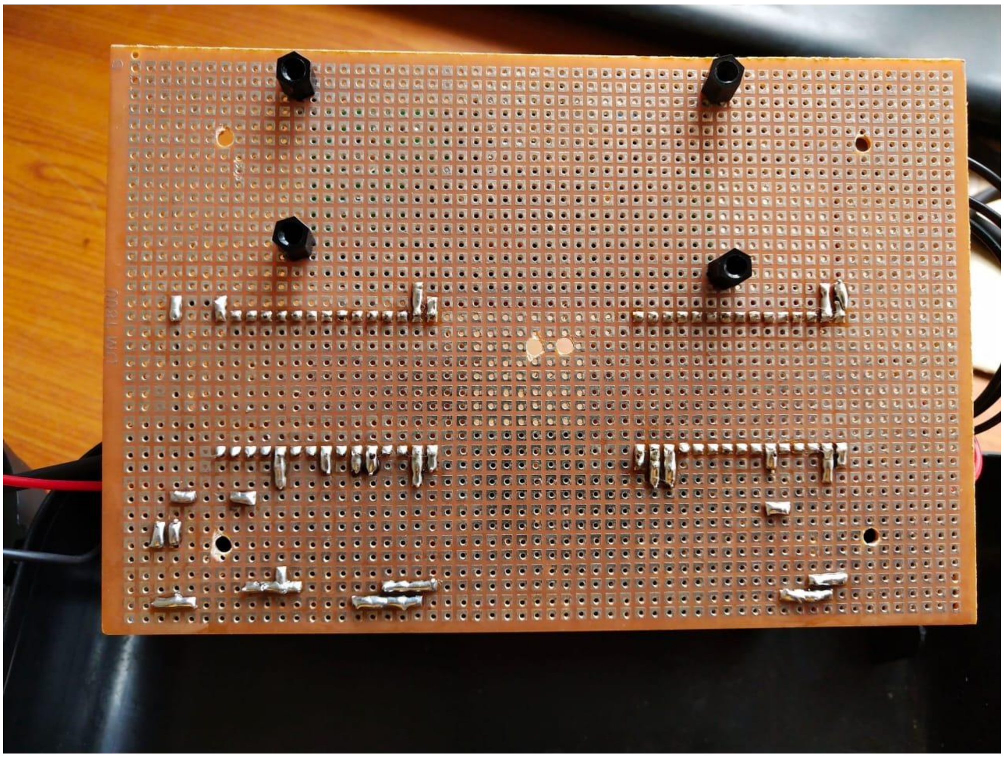


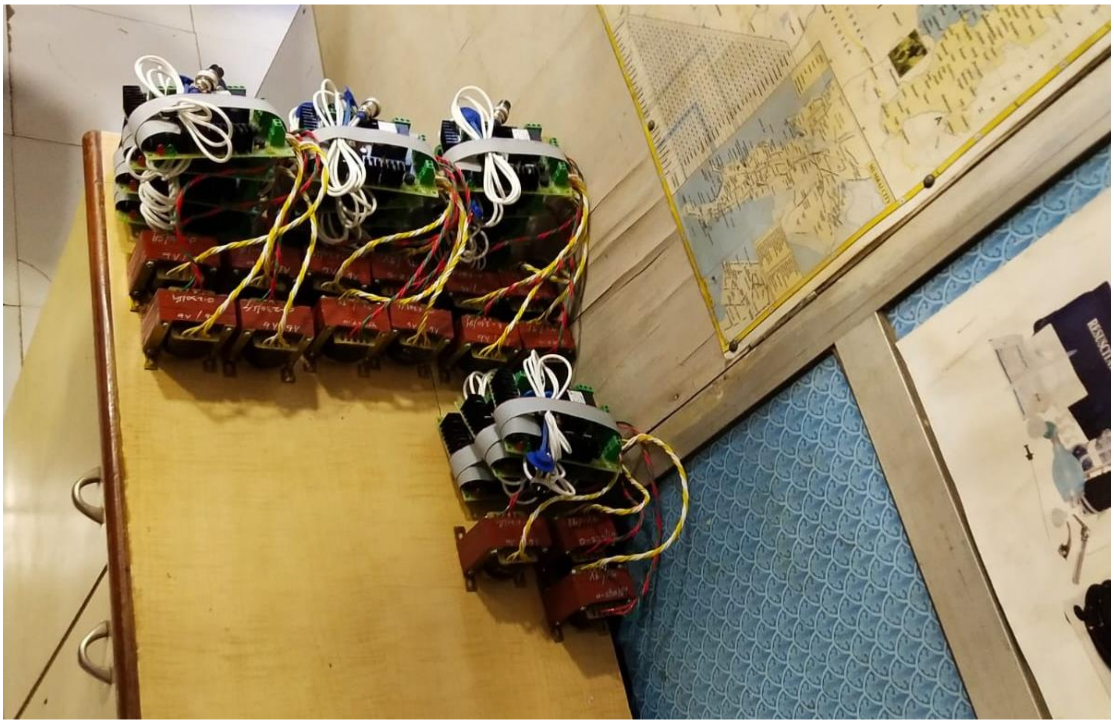


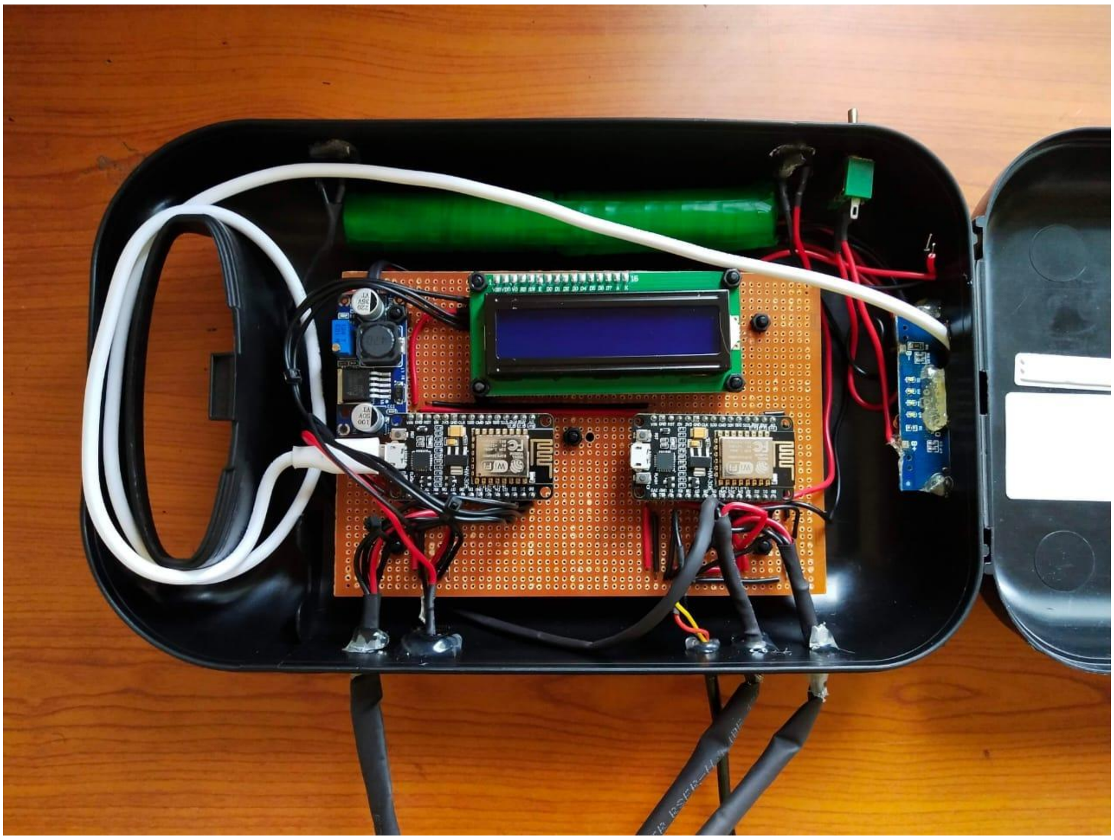


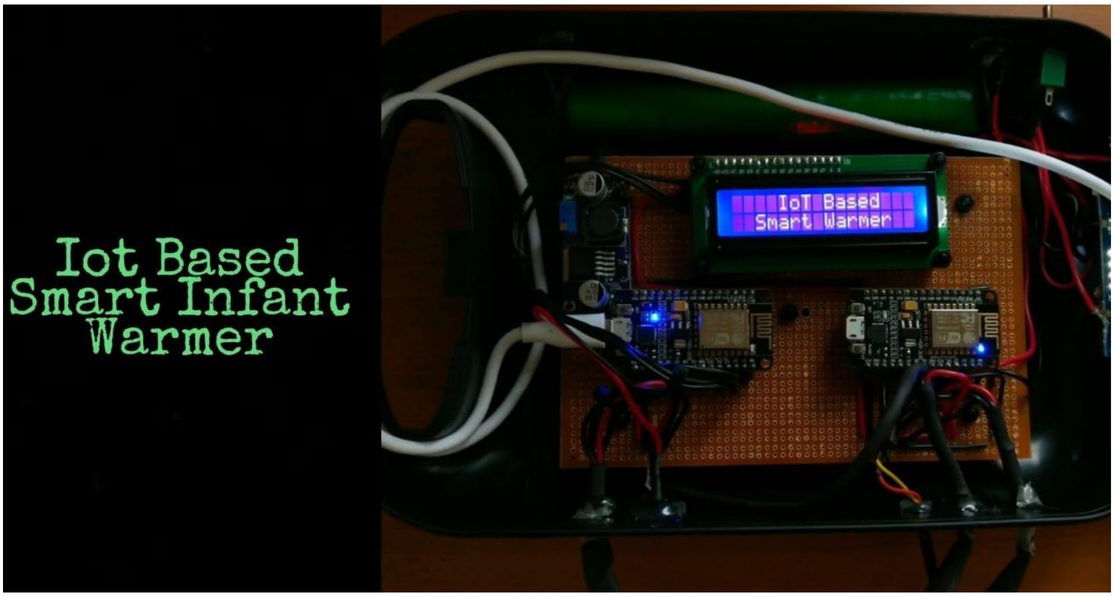


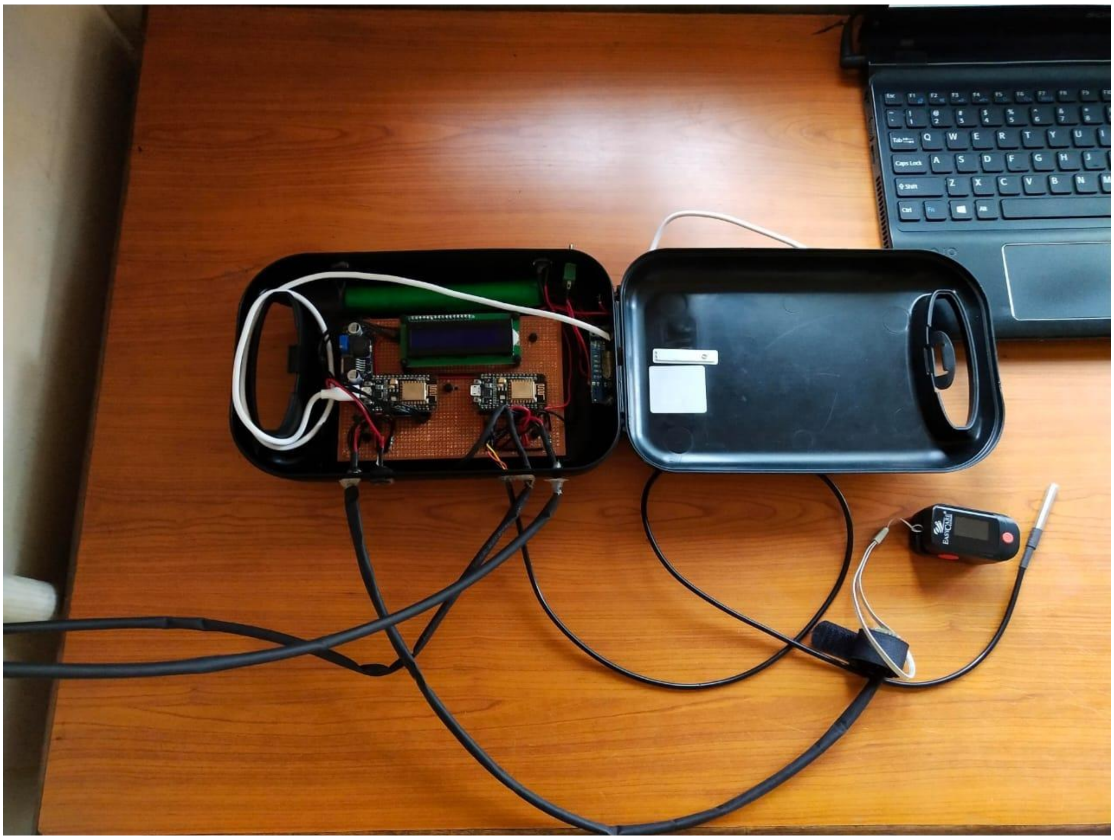








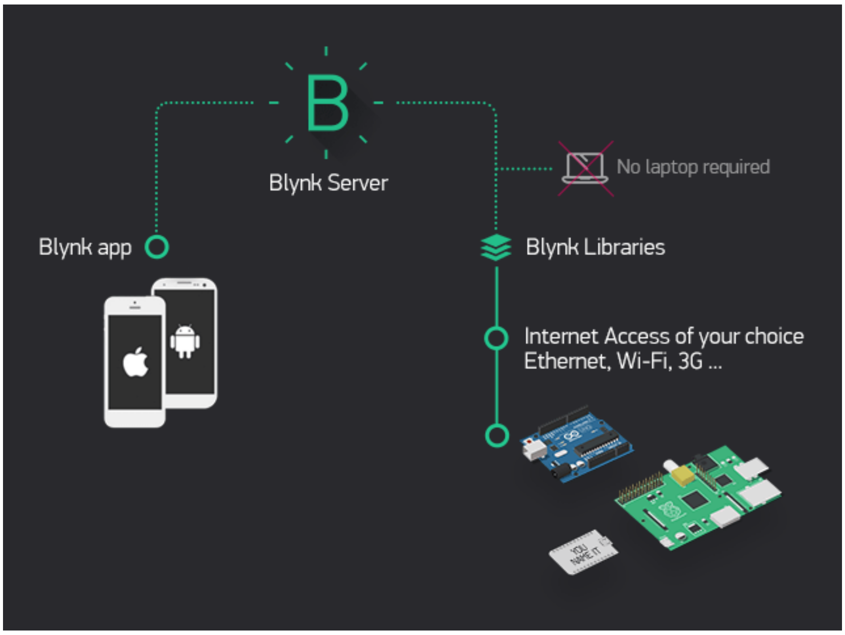

Iot Based
Smart Infant
Warmer
IoT Based
Smart Warmer



3.3 Software description

- Blynk:

Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. You can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. It is used to control Arduino, Raspberry Pi and Node MCU via the Internet. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.



- Arduino: IDE:

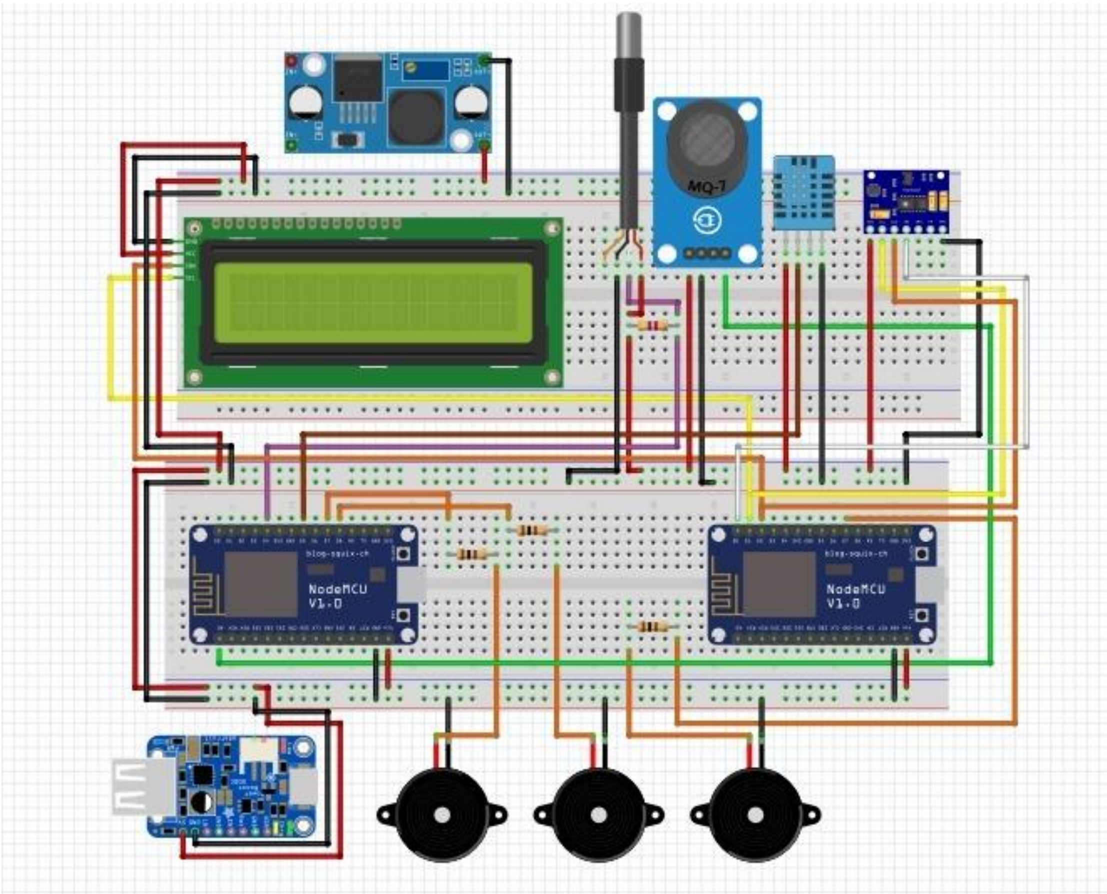
The Arduino Integrated Development Environment (IDE) is a cross-platform application that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards. The source code for the IDE is released under the GNU General Public License, version 2.

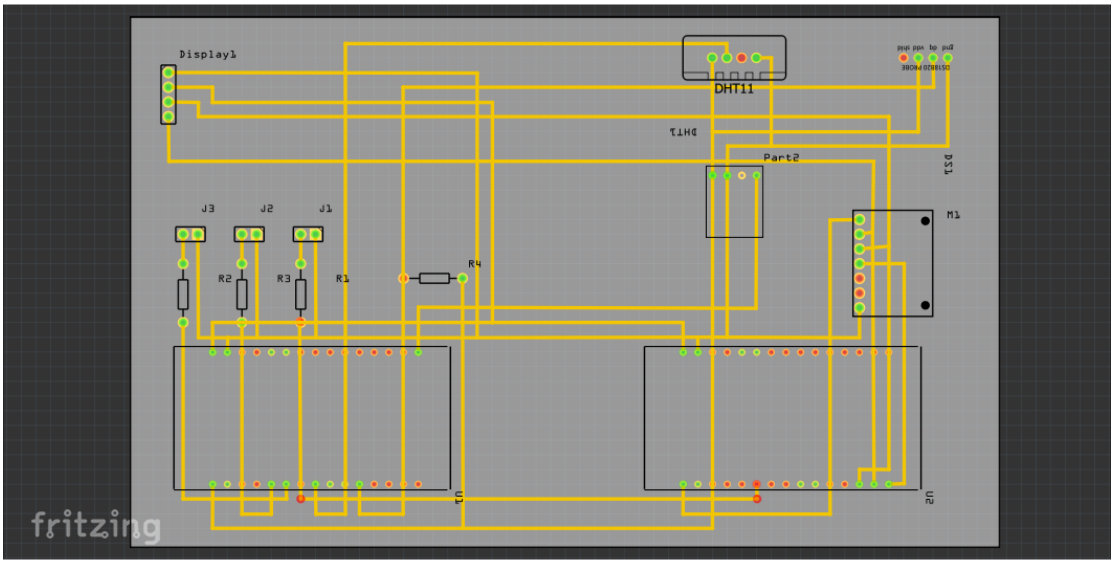
The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards.

- Fritzing:

Fritzing is an open-source hardware initiative that makes electronics accessible as a creative material for anyone. We offer a software tool, a community website and services in the spirit of Processing and Arduino, fostering a creative ecosystem that allows users to document their prototypes, share them with others, teach electronics in a classroom, and layout and manufacture professional PCBs.

- Circuit diagram:





Chapter 4
Results and Analysis

Please refer to the following drive links for the Results and Analysis of this project:

1. Working and Testing:

https://drive.google.com/file/d/12B4273YZ4-CsNsEFtaJrWCIYTIXgrwdq/view?usp=sharing

2. Schematic and Code Explanation:

https://drive.google.com/file/d/17UnPDuIFWVKHglB0P2mUoRFUN81uWxrO/view?usp=sharing

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