SECURITY SYSTEM

MINOR-PROJECT REPORT

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CERTIFICATE

This is to certify that the work titled "SECURITY SYSTEM" submitted by "**RISHIKA BAHL (20102169) and AAKASH MEHTA (20102004)**" in partial fulfillment for the award of degree of **Bachelor of technology** of Jaypee Institute of Information Technology, Noida has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

Signature of Supervisor …….

Name of Supervisor ……..

Designation ……..

Date ……..

ACKNOWLEDGEMENT

It gives us immense pleasure to express our deepest sense of gratitude and sincere thanks to our highly esteemed guide, **Mr. Mandeep Narula**, Dept. Of Electronics and Communication, Jaypee Institute of Information Technology for providing us an opportunity to present our project on "**SECURITY SYSTEM**" and also for his valuable guidance, encouragement and wholehearted cooperation and constructive criticism throughout the project. We with full pleasure converge our heartiest thanks to our external guide **Mrs. Shraddha Saxena**, Dept. Of Electronics and Communication, for their invaluable advice and wholehearted cooperation without which the project would not have seen the light of the day. We attribute heartiest thanks to all the faculties of the Department Of Electronics and Communication, our friends and seniors for their valuable advice and encouragement.

Signature of the student ……..

Name of Student ……..

Date ……..

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ABSTRACT

Our project consists of a gate, which can be integrated in the prior metal detecting gates present in areas like malls, shopping complexes, airports, bus and railway stations etc. The temperature sensor present in the gate would measure the temperature without a person to operate it while simultaneously detecting metal components when the person is passing through the gate.

If the person's temperature is higher than the permissible range, they would be asked to give their contact details such as email id and address. With the use of IOT technology, we intend to ease their job and help to make a difference.

We can integrate this in the prior detectors which would prove to be more convenient than buying new temperature and metal detector gates. Also, it has been made cost effectively so as to ensure that people do not have to pay extra for such sophisticated equipment. By ensuring that the whole process does not require people to operate them, we intend to make it safe for everyone and more cost effective.

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Signature of Student	Signature of Supervisor
Name	Name
Date	Date

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CHAPTER - 1

INTRODUCTION

1.1 THE IDEA

The most basic definition of any security system is found in its name. It is literally a means or method by which something is secured through a system of interworking components and devices. In this instance, our security system, which are networks of integrated electronic devices working together with a central control panel. This can be implemented in various in important sites like airport, railways, hotels, military facility, and various other government buildings for providing security whilst being cost effective. As they can filter out the category of people sick from a large crowd and sense those carrying metal simultaneously.

1.2 CONCEPT

The temperature sensor present in the gate would measure the temperature without a person to operate it while simultaneously detecting metal components when the person is passing through the gate. If the person's temperature is higher than the permissible range, they would be asked to give their contact details such as email id and address

1.3 MOTIVATION FOR PROJECT

The whole idea is to ensure that people do not endanger their lives for a work that could be done using machines and equipment. The existing technology and equipment in the market are costly and not Smart or IOT based devices, which means that our equipment is far more technologically advanced, while being cost effective. Not just cost effective, our project has very low running cost as it does not require additional people to be hired in order to operate it.

CHAPTER - 2

HARDWARE AND SOFTWARE COMPONENTS

2.1 HARDWARE COMPONENTS

2.1.1 NodeMCU ESP8266 BOARD

NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

The NodeMCU ESP8266 development board comes with the ESP-12E module containing ESP8266 chip having Tensilica Xtensa 32-bit LX106 microprocessor. This microprocessor operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

NodeMCU can be powered using Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface

NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB

- SRAM: 64 KB
- Clock Speed: 80 MHz

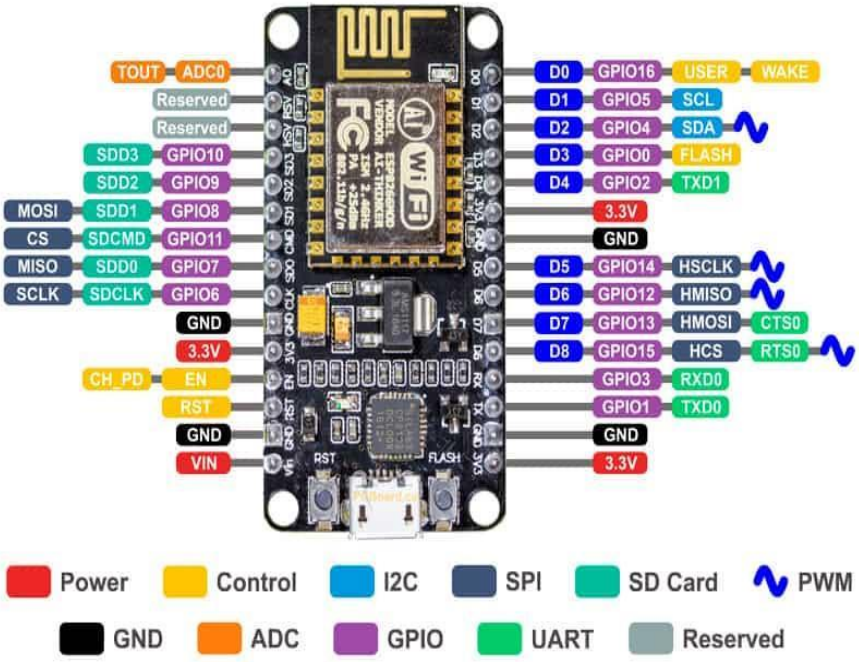

Fig 1 - NodeMCU ESP8266 PinOut

The above figure shows the Pin diagram of NodeMCU / ESP8266 Wifi Development Board. It depicts various GPIO, GND, VCC pins. It also shows the pins reserved for specific functions, and pins that are used for I2C, SPI, UART protocols. In a way, it shows all 30 pins of the Board and gives a brief description of them.

NodeMCU Development Board Pinout Configuration

Pin Category	Name	Description
Power	Micro-USB, 3.3V, GND, Vin	**Micro-USB:** NodeMCU can be powered through the USB port **3.3V:** Regulated 3.3V can be supplied to this pin to power the board **GND:** Ground pins **Vin:** External Power Supply
Control Pins	**EN, RST**	The pin and the button reset the microcontroller
Analog Pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 - GPIO16	NodeMCU has 16 general purpose input-output pins on its board

SPI Pins	SD1, CMD, SD0, CLK	NodeMCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2, RXD2	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins		NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C

Table 1 - NodeMCU Development Board PinOut Configuration

2.1.2 MLX90614 INFRARED TEMPERATURE SENSOR

The MLX90614 is a Contactless Infrared (IR) Digital Temperature Sensor that can be used to measure the temperature of a particular object ranging from -70° C to 382.2°C. The sensor uses IR rays to measure the temperature of the object without any physical contact and communicates to the microcontroller using the I2C protocol.

Working Principle of MLX90614

As mentioned earlier, the MLX90614 sensor can measure the temperature of an object without any physical contact with it. This is made possible with a law called **Stefan-Boltzmann Law**, which states that all objects and living beings emit IR Energy and the intensity of this emitted IR energy will be directly proportional to the temperature of that object or living being. So the

MLX90614 sensor calculates the temperature of an object by measuring the amount of IR energy emitted from it.

MLX90614 Temperature Sensor Specifications

- Operating Voltage: 3.6V to 5V (available in 3V and 5V version)
- Supply Current: 1.5mA
- Object Temperature Range: -70° C to 382.2°C
- Ambient Temperature Range: -40° C to 125°C
- Accuracy: 0.02°C
- Field of View: 80°
- Distance between object and sensor: 2cm-5cm (approx.)

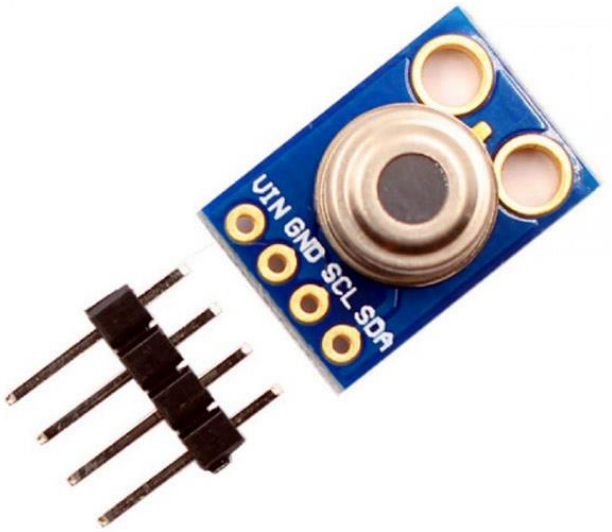

Fig 2 - MLX90614 IR Temperature Sensor

Above figure shows the Contactless IR Temperature Sensor used in our project - MLX90614. It shows the PinOut of the senor. It has 4 pins; namely- Vin, GND, SCL, SDA and uses I2C Serial Communication Protocol to communicate with NodeMCU.

MLX90614 Pinout Configuration

Pin No.	Pin Name	Description
1	Vdd (Power supply)	Vdd can be used to power the sensor, typically using 5V
2	Ground	The metal can also act as ground
3	SDA – Serial Data	Serial data pin used for I2C Communication
4	SCL – Serial Clock	Serial Clock Pin used for I2C Communication

Table 2 - MLX90614 PinOut Configuration

ADVANTAGE OF USING MLX90614

The key feature of MLX90614 is that it is a contactless IR temperature sensor with high accuracy. Due to its high accuracy and precision, it is used in a wide range of **commercial, health care, and household applications** like room temperature monitoring, body temperature measurement, etc.

2.1.3 PIEZO SOUND BUZZER

Piezo sounders contain a piezoelectric vibration plate (also known as a piezo element) within a moulded case. Sound is emitted when a voltage is applied and the piezo element inside the case

vibrates. Piezo buzzers generally use less current, have a higher sound output and wider operating voltage.

Fig 3 - Piezo Sound Buzzer

The above figure shows another component used in our project - Sound Buzzer. Here, we are using a Piezo Sound Buzzer which consists of a piezoelectric vibration plate within a moulded case. And the buzzer produces a sound when voltage is applied and the piezo element vibrates inside the moulded case.

2.1.4 ARDUINO NANO

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor.

The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery

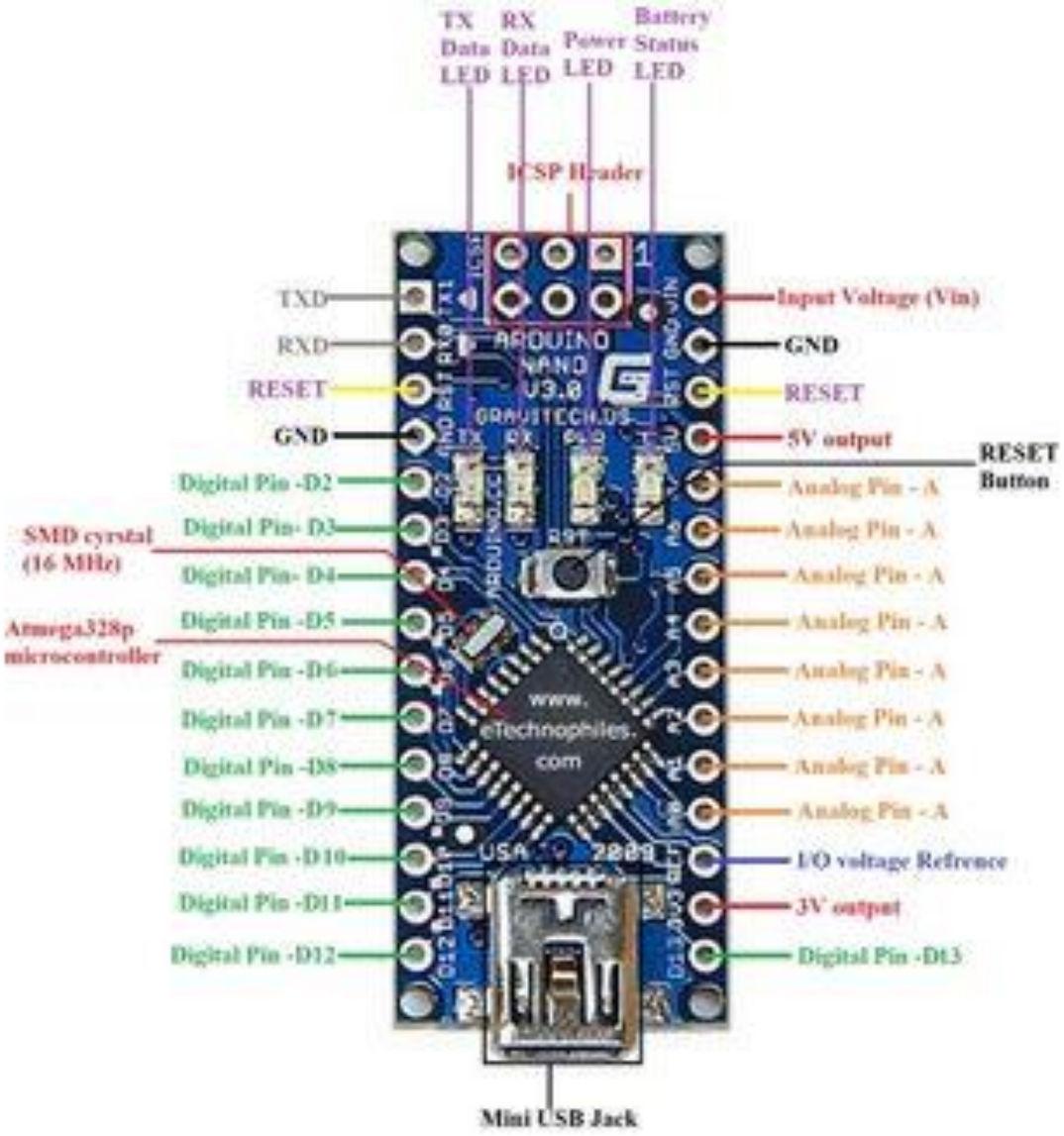

Fig 4 – Arduino Nano

The above figure shows another component used in our project – Arduino Nano. Here, we are using this to give alert when a metal is detected through the coil.

Technical Specifications:

- Microcontroller: Microchip ATmega328P
- Operating voltage: 5 volts
- Input voltage: 5 to 20 volts

- Digital I/O pins: 14 (6 optional PWM outputs)
- Analog input pins: 8
- DC per I/O pin: 40 mA
- DC for 3.3 V pin: 50 mA
- Flash memory: 32 KB, of which 2 KB is used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock speed: 16 MHz

2.1.5 Coil

When any metal comes near to the coil then coil changes its inductance. This change in inductance depends upon the metal type. It's decreases for non-magnetic metal and increases for ferromagnetic materials like iron. Depending on the core of the coil, inductance value changes drastically. In the figure below you can see the air-cored inductors, in **these inductors, there will be no solid core**. They are basically coils left in the air. The medium of flow of magnetic field generated by the inductor is nothing or air. These inductors have inductances of very less value.
Remember the coil wound here is a air-cored one, so when a metal piece is brought near the coil, the metal piece acts as a core for the air cored inductor. By this metal acting as a core, the inductance of the coil changes or increases considerably. With this sudden increase in inductance of coil the overall reactance or impedance of the LC circuit changes by a considerable amount when compared without the metal piece.
So here in this **Arduino Metal Detector Project**, we have to find the inductance of the coil to detect metals. So, to do this we have used LR circuit (Resistor-Inductor Circuit) that we already mentioned. Here in this circuit, we have used a coil having around 20 turns or winding with a 10cm diameter. We have used an empty tape roll and wind the wire around it to make the coil.

2.2 SOFTWARE USED

- Arduino IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino.

- Google Spreadsheets

Google Sheets is a free, web-based spreadsheet application that is provided by Google within the Google Drive service. The application is also available as a desktop application on ChromeOS, and as a mobile app on Android, Windows, iOS, and BlackBerry. The Google Drive service also hosts other Google products such as Google Docs, Slides, and Forms.

- JavaScript

JavaScript often abbreviated as JS, is a programming language that is one of the core technologies of the World Wide Web, alongside HTML and CSS. As of 2022, 98% of websites use JavaScript on the client side for webpage behavior, often incorporating third-party libraries. All major web browsers have a dedicated JavaScript engine to execute the code on users' devices.

CHAPTER - 3

FLOW OF PROJECT

3.1 FLOWCHART

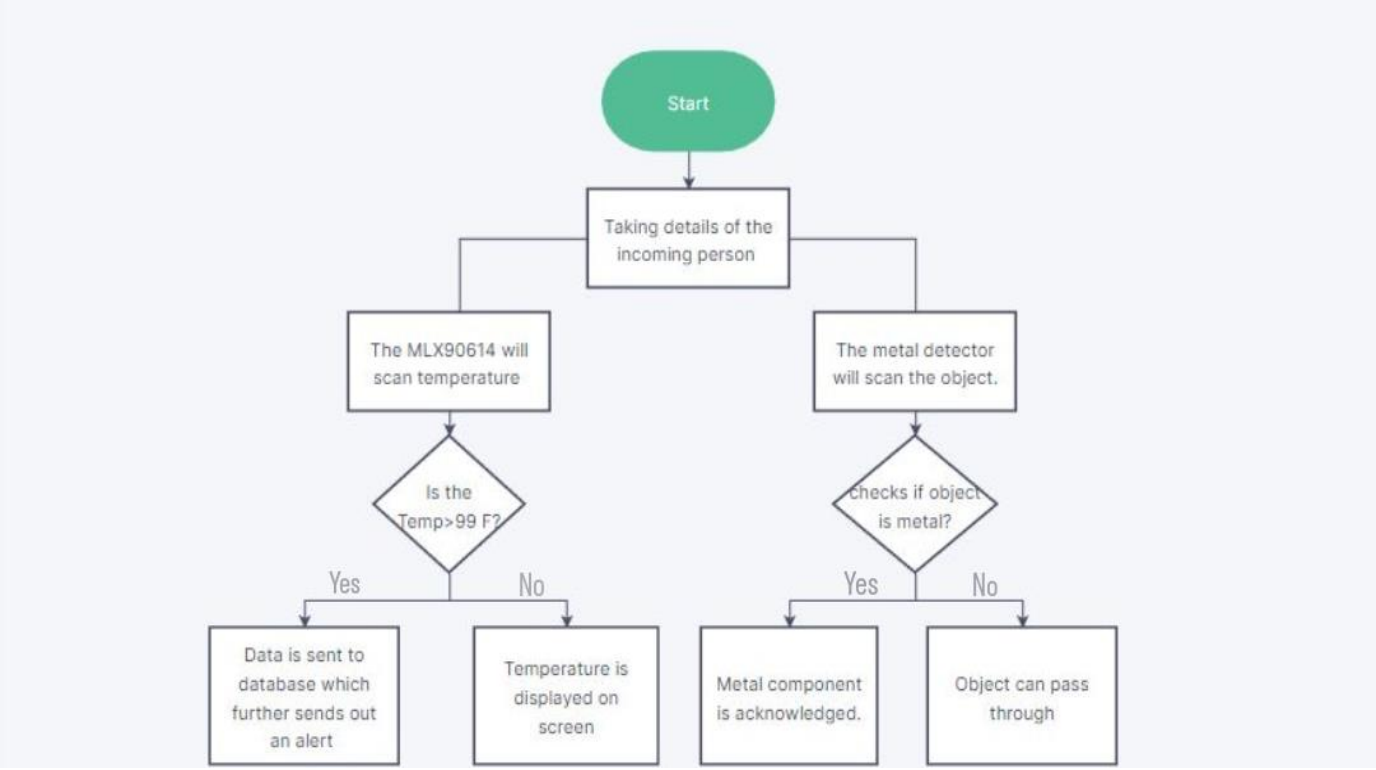

Fig 5 - Flowchart of the project

The above flowchart shows the core working of the project. Firstly, the details of the incoming person is taken and is fed to the microcontroller. Then, the temperature sensor measures the temperature of the person which is again fed to the microcontroller whilst simultaneously scanning for metal components. And finally, if the temperature is greater than the limit (85F) or metal component is detected, a sound buzzer is activated indicating the denial of entry to the person

3.2 WORKING OF PROJECT

The temperature sensor uses IR rays to measure the temperature of the object without any physical contact and communicates to the microcontroller using the I2C protocol. Then the sensor calculates the temperature of an object by measuring the amount of IR energy emitted from it according to Stefan-Boltzmann Law.

In case of the metal detector, we provide the block wave or pulse, generated by Arduino, to the LR high pass filter. Due to this, short spikes will be generated by the coil in every transition. The pulse length of the generated spikes is proportional to the inductance of the coil those spikes are of very short duration (approx. 0.5 microseconds) and that is very difficult to be measured by Arduino.

So instead, we use a capacitor that is charged by the rising pulse or spike. After a few pulses to charge the capacitor to the point where its voltage can be read by the analog pin A5. The Arduino reads the voltage of this capacitor by using ADC.

After which, the capacitor quickly discharges as capPin pin is set as output and set to low. This whole process takes around 200 microseconds to complete. After getting the result we transfer the results to the LED and buzzer to detect the presence of metal.

3.3 CIRCUIT DIAGRAM AND CONNECTIONS

- The below table shows the circuit pin connections between the MLX90614 IR Temperature sensor, piezo buzzer and the NODE-MCU ESP8266 board.

MLX90614 IR Temperature Sensor	**NodeMCU ESP8266 Pins**
SDA	D2
SCL	D1
Vcc	3.3V
GND	GND
Piezo Sound Buzzer	**NodeMCU ESP8266 Pins**
+ve Wire	D7
-ve Wire	GND

Table 3 - Circuit Pin Connections between MLX90614, Piezo Sound Buzzer and NodeMCU Wifi Board

The above table shows how circuit connections are made. It tells which pins of NodeMCU are used to connect and communicate with MLX90614 and to which pin our Piezo Buzzer is connected to. It gives onpoint details of which pin is connected to which pin in the entire circuit.

As, MLX90614 uses I2C Communication Protocol, so its SCL (Serial Clock) pin is connected to D1, SDA (Serial Data) to D2, VCC to 3.3V and GND pin to the GND pin on our NodeMCU Board.

And for Piezo Buzzer, the +ve wire is connected to D7 pin and -ve wire to GND on our NodeMCU Board.

- The below diagram the circuit pin connections between the MLX90614 IR Temperature

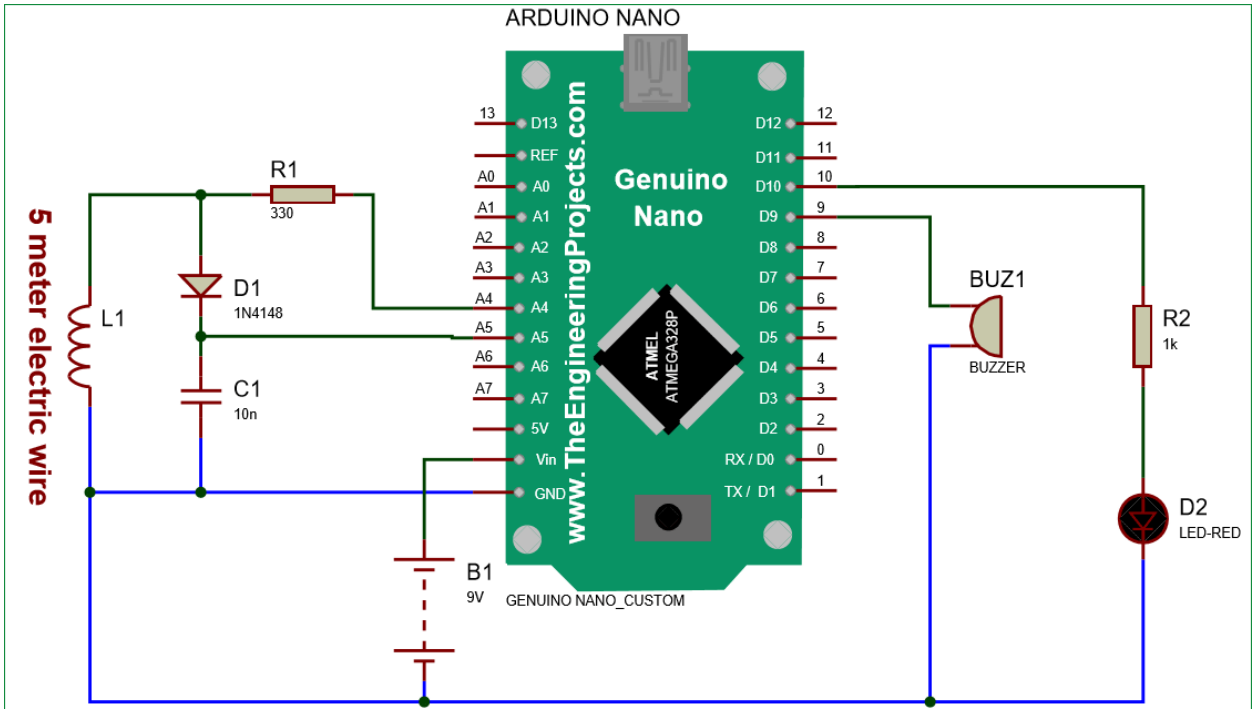

Fig 6 - Circuit Pin Connections between Coil, Arduino Nano and the Buzzers Led

CHAPTER - 4

RESULTS AND CONCLUSION

4.1 RESULTS

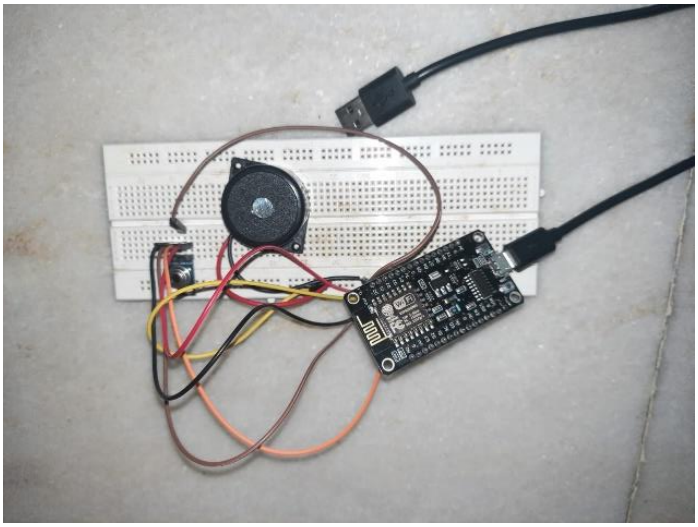

Fig.7- Temperature Sensor

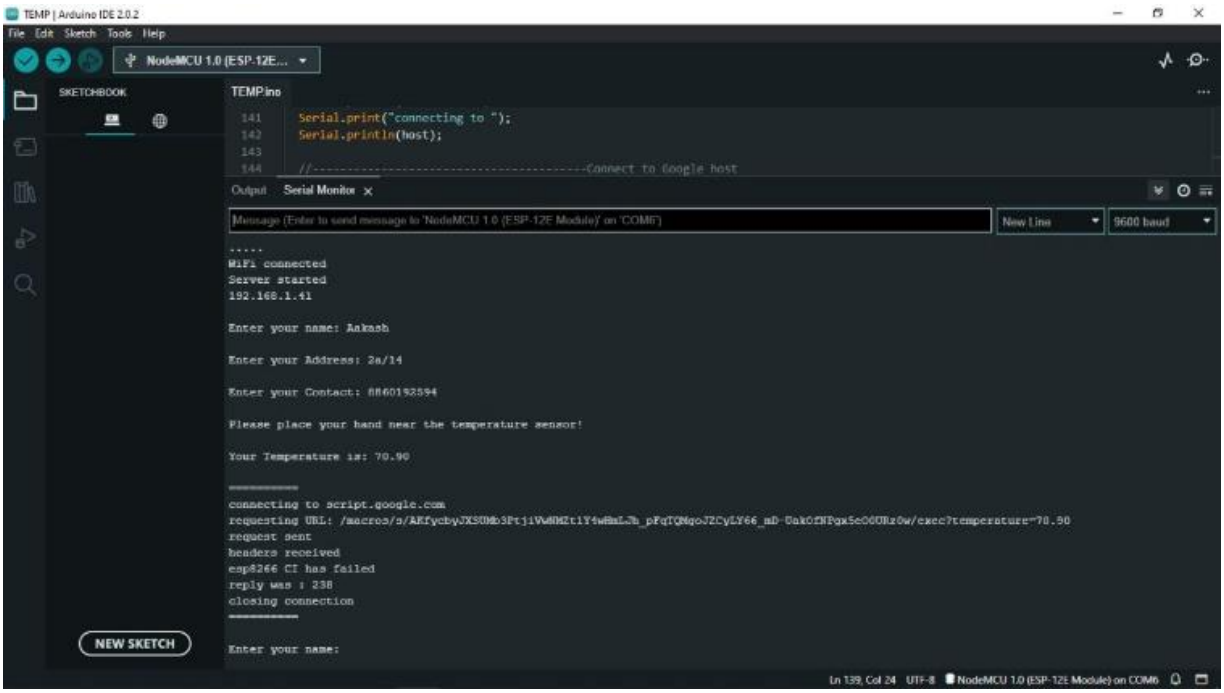

Fig.8- O/P of Temperature Sensor and sending data to DB

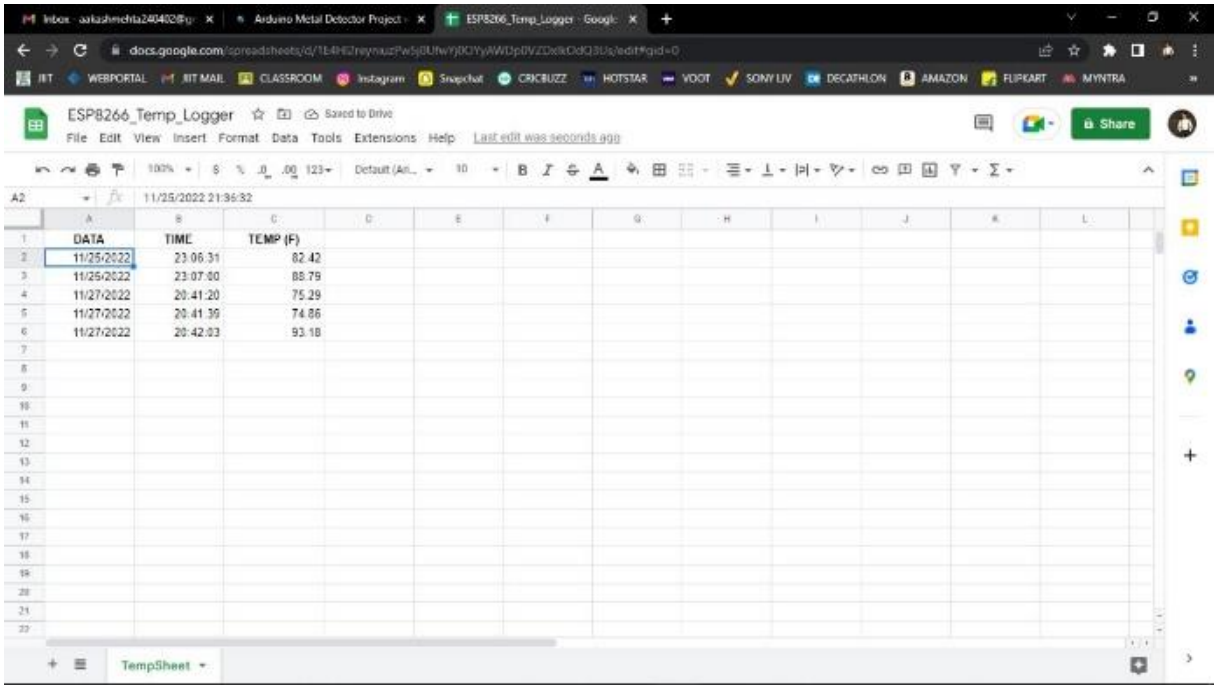

Fig.9- Database (before)

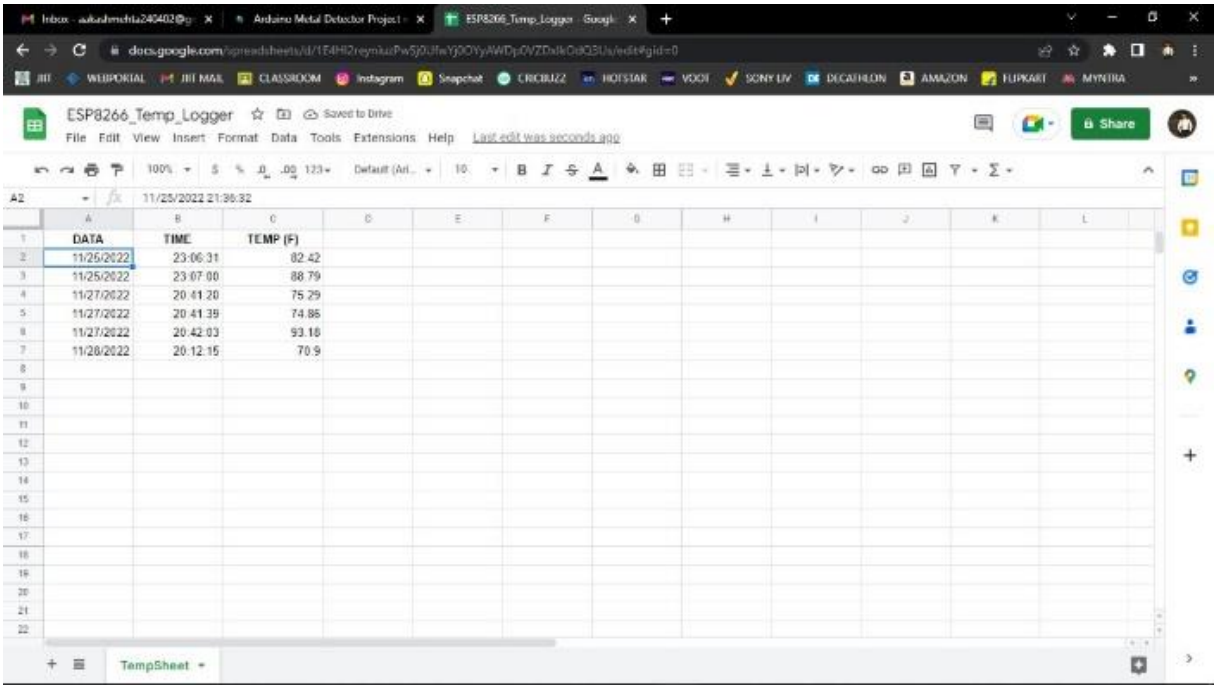

Fig.10- Database (after)

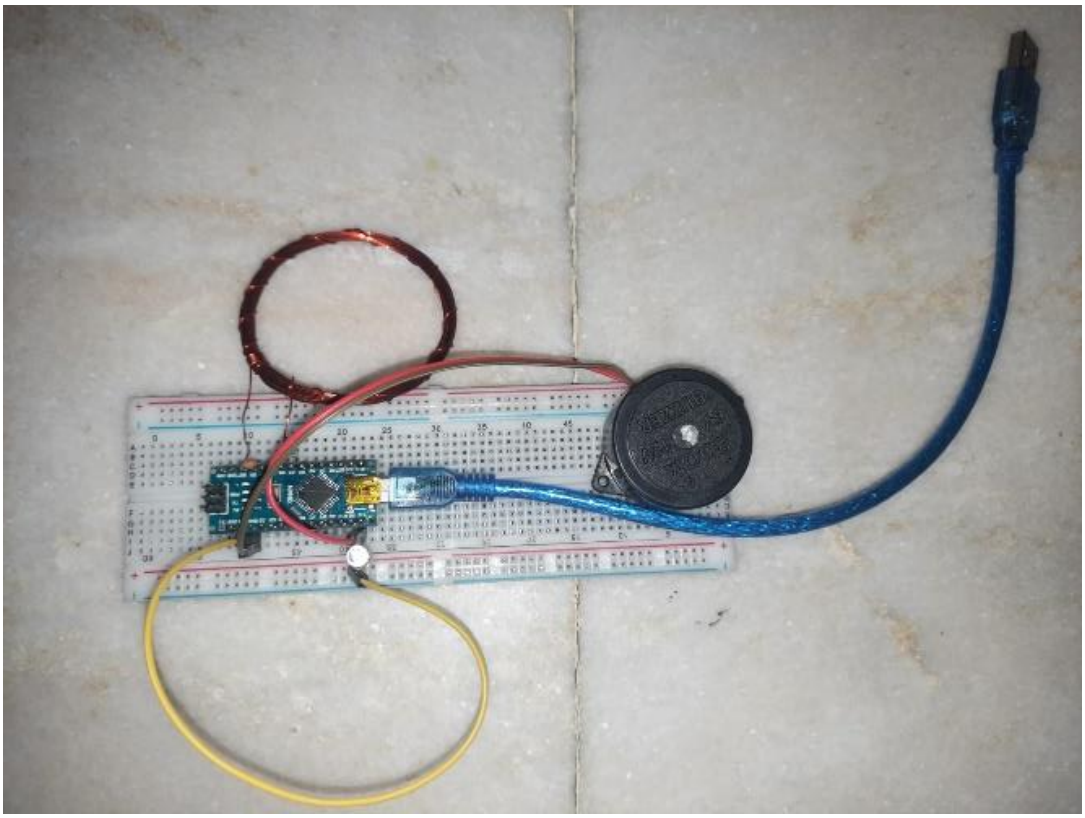

Fig11.- Metal Detector (Before)

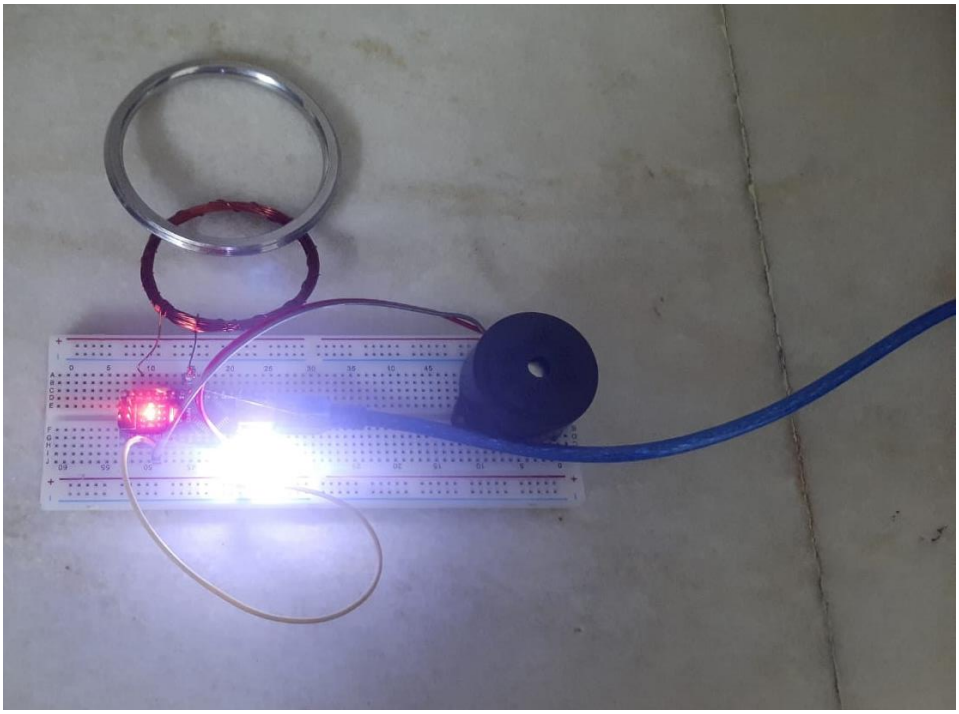

Fig12.- Metal Detector (After)

4.2 FEATURES

- The key feature of this project is that it makes the detection contactless and has high accuracy.
- Our project has very low running cost as it does not require additional workforce to be hired. Due to its high accuracy and precision, it can also be used in a wide range of commercial, health care, and household applications like room temperature monitoring, body temperature measurement, etc.
- Remote Monitoring: The detector can take be monitored using voice controls or via remote control.

4.3 FUTURE SCOPE

- This security system can really be a technological boon and advancement in the market as it is very precise while screening.
- These prototypes of these gates can be implemented wherever possible making the screenings of the individuals hassle free while also protecting the lives of the employees hired by various institutions to regulate social distancing norms.
- Our Concept of Proximity sensing can be made more efficient by using a big database and making it into a real time firmware application connected to the national database. So, if by chance, we find a person suspicious, we can search the database making it possible to reach out and alert people nearby.

4.4. REFERENCES

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