# Geo-location Prohibition Device

**MINI PROJECT REPORT IN PARTIAL**

**FULLFILLMENT OF REQUIREMENT FOR THE**

**Degree of**

**BACHELOR OF TECHNOLOGY**

Electronics and Communication Engineering


**Proposed by**

Astitva Srivastava

(200013125024)

Tanu Srivastava

(200013125051)

**Guided by**

Dr. Manoj Kumar Jain




FACULTY OF ENGINEERING AND TECHNOLOGY

**UNIVERSITY OF LUCKNOW, LUCKNOW**


2022 – 23

# DECLARATION

We hereby declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person or material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher education, except where due acknowledgement has been made in the text.

**Signature**
**Astitva Srivastava**
(200013125024)

**Signature**
**Tanu Srivastava**
(200013125051)

# CERTIFICATE

Certified that **Astitva Srivastava (200013125024)** and **Tanu Srivastava (200013125051)** has carried out the project work presented in this mini project report entitled **"Geo Location prohibition device"** for the award of **Bachelor of Technology** (Electronics and Communication Engineering) from **Faculty of Engineering and Technology, University of Lucknow, Lucknow** under my our guidance. The project is prepared for study and practical hand on purpose.

**Signature**

**Dr. Manoj Kumar Jain**

(Department of Electronics and Communication Engineering)

# ABSTRACT

Geolocation Prohibition device is a small, lightweight GPS tracker that can be attached to an animal or person. The tracker sends its location to a central server, which can then be accessed by the farmer or prison authority. This allows the farmer or authority to track the movement of their livestock or prisoners, and to intervene if they see that they are trying to escape.

The device is a valuable tool for cattle farmers and prison authorities who want to keep their livestock and prisoners safe. It is also a cost-effective solution, as it is much cheaper than hiring security guards or installing fences.

Here are some of the benefits of using a geolocation prohibition device:

* It can help to prevent livestock from escaping.
* It can help to prevent prisoners from escaping.
* It can help to track the movement of livestock and prisoners.
* It can help to intervene if livestock or prisoners are trying to escape.
* It is a cost-effective solution.

If you are a cattle farmer or prison authority, then you should consider using a geolocation prohibition device. It is a valuable tool that can help to keep your livestock and prisoners safe.

# ACKNOWLEDGEMENT

In accomplishment of this project successfully, many people have best owned upon me their blessings and the heart pledged support, this time I am utilizing to thank all the people who have been concerned with this project.

Primarily, I would thank god for being able to complete this project with success. Then i would like to thank my lecturer. Dr. Manoj Kumar Jain whose valuable guidance has been the ones that helped me patch this project and make it full proof success. His suggestions and his interactions have served as the major contribution towards the completion of this project.

Then I would like to thank my lab assistants Mr. Arun and Ms. Kavita who have helped me with their valuable suggestions and guidance which have been very helpful in various phase of the completion of the project.

Last but not the least I would like to thank my batch mates who have helped me a lot.

THANK YOU

# TABLE OF CONTENTS

# Chapter 1

# Introduction

## I Introduction

In today's technologically advanced world, the need for effective location-based solutions has become increasingly crucial. Geolocation prohibition device have emerged as a powerful tool in this realm. These devices enable users to establish virtual boundaries and receive alerts whenever a person or object enters or exits a designated area. The versatility of geolocation prohibition devices allows them to be utilized in a wide range of applications, including livestock management, prisoner monitoring, and more.

The necessity for geolocation prohibition devices arises from the growing need to monitor and control movements within specific geographical areas. Traditional methods of physical surveillance are often time-consuming, expensive, and prone to human error. Geolocation prohibition devices provide a more efficient and reliable alternative by leveraging the power of geolocation technology.

While there are other alternatives available to address this problem, they often fall short in terms of effectiveness and convenience. Physical barriers, such as fences or walls, may provide a certain level of containment, but they are costly to install and maintain. Furthermore, they can be breached or damaged, potentially compromising the security of the area. Human guards or personnel can also be employed, but they are limited in their capacity to cover vast areas and may be susceptible to fatigue or distractions.

Geolocation prohibition devices offer a comprehensive and scalable solution by combining geolocation technology, real-time tracking, and instant notifications. These devices utilize GPS (Global Positioning System) or other positioning technologies to accurately determine the location of individuals or objects within the defined boundaries. When a violation occurs, such as an unauthorized exit or entry, the device immediately sends alerts to the designated recipients, enabling swift and targeted responses.

One of the notable applications of geolocation prohibition devices is in livestock management. Farmers and ranchers can utilize these devices to create virtual boundaries around grazing areas, ensuring that their livestock remains within designated areas. In the event of a breach, the devices can trigger alarms, allowing farmers to promptly locate and retrieve the animals, preventing loss or potential harm.

Similarly, geolocation prohibition devices have proven invaluable in correctional facilities for monitoring prisoners. By implementing geofences around the premises, authorities can detect and respond to any attempts to escape. This enhanced security measure ensures the safety of both the public and those incarcerated, minimizing the risk of dangerous situations.

In conclusion, geolocation prohibition devices provide a cutting-edge solution to address the need for efficient location-based monitoring and control. With their ability to create virtual boundaries and generate real-time alerts, these devices offer an effective and reliable alternative to traditional methods. Whether it's keeping track of livestock or preventing prisoner escapes, geolocation prohibition devices offer unparalleled usability, making them an invaluable asset in various industries and settings.

# II Technology Involved

### Geo-Fencing Technology

- Geo-Fencing is a type of location-based Technology. A mobile app or software uses the Global Positioning System (GPS), radio frequency identification (RFID), Wi-Fi or cellular data to define a virtual geographical boundary and trigger a targeted action when a device enters or exits that boundary. This boundary is known as a geofence.

### RF wireless system

- A radio frequency (RF) signal refers to a wireless electromagnetic signal used as a form of communication, if one is discussing wireless electronics. Radio waves are a form of electromagnetic radiation with identified radio frequencies that range from 3 kHz to 300 GHz.

# III Benefits

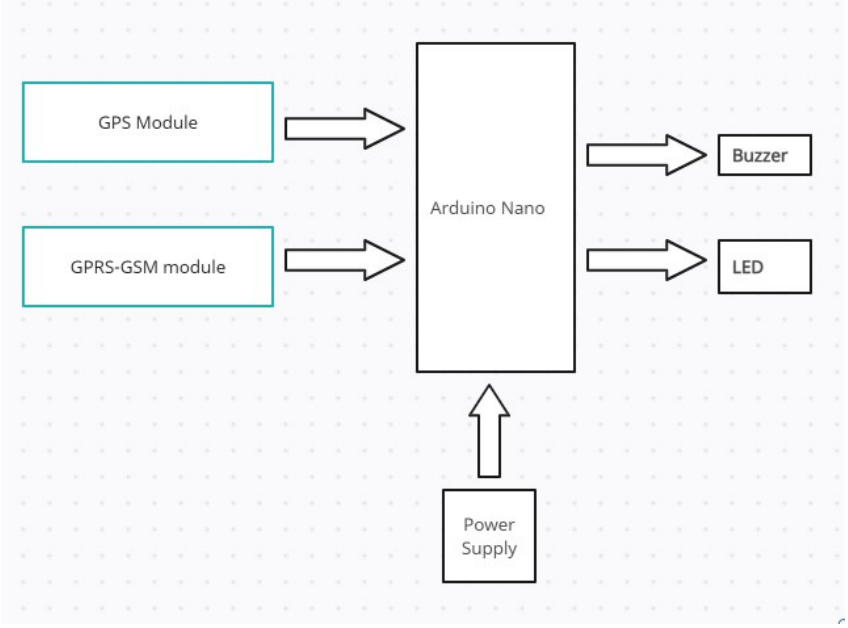
There are many benefits to using geolocation prohibition devices. For cattle farmers, these devices can help to prevent livestock from straying and getting lost. They can also help to identify animals that are sick or injured, and they can be used to track the movement of animals during roundups.

For prison authorities, geolocation prohibition devices can help to prevent prisoners from escaping. They can also be used to track the movement of prisoners during work details, and they can be used to identify prisoners who are engaging in unauthorized activities.

# Chapter 2

# Hardware Implementation

## I Block Diagram




## II Circuit Diagram

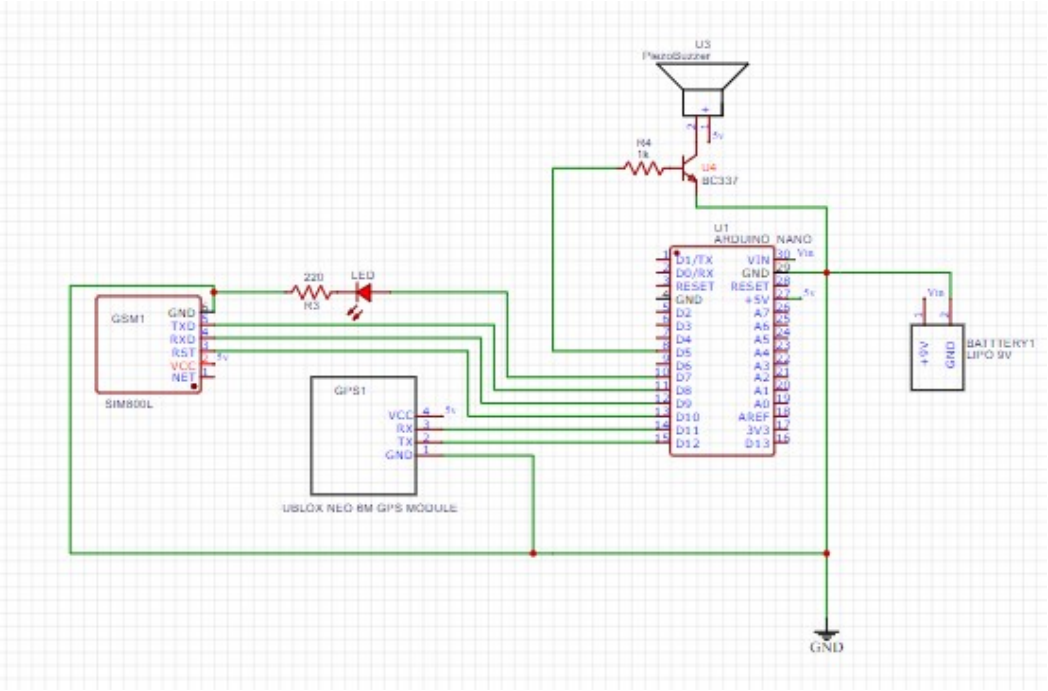



Fig 1: Circuit diagram of Geolocation prohibition device (Using EasyEDA)

## III Components used :-

a. Arduino Nano
b. Neo-6M GPS Module
c. SIM800L GPRS-GSM Module
d. Piezo Buzzer
e. NPN transistor (BC-337)
f. Light Emitting Diode (LED)
g. Resistor 1kΩ, 220Ω
h. Jumper wires
i. Breadboard

## IV Component description[6]:-

### a. Arduino Nano

Arduino Nano is a microcontroller board designed by Arduino.cc. The microcontroller used in the Arduino Nano is Atmega328, the same one as used in Arduino UNO. It has a wide range of applications and is a major microcontroller board because of its small size and flexibility.

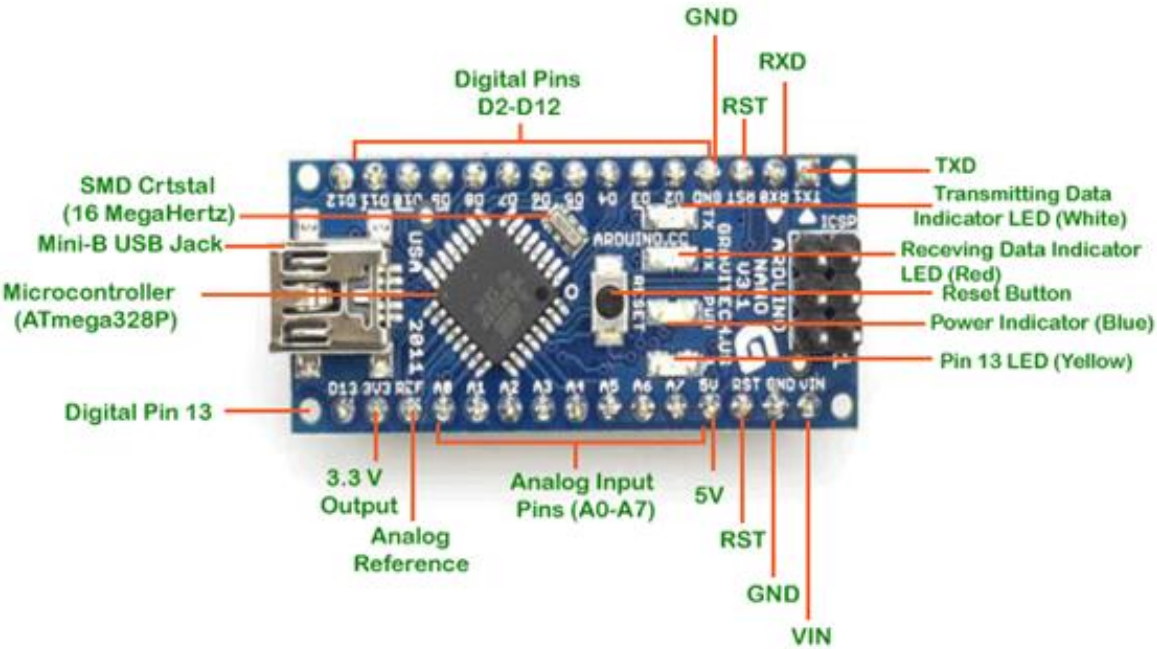



Fig. 2: Components and pins of Arduino Nano board

**Why Arduino nano?**

These boards are used to build Arduino Nano projects by reading inputs of a sensor, a button, or a finger and gives an output by turning motor or LED ON, or and some of the applications are listed below.

- Samples of electronic systems & products
- Automation
- Several DIY projects
- Control Systems
- Embedded Systems
- Robotics
- Instrumentation

**Features of Arduino Nano:**

- ATmega328P Microcontroller is from 8-bit AVR family
- Operating voltage is 5V
- Input voltage (Vin) is 7V to 12V
- Input/Output Pins are 22
- Analog i/p pins are 6 from A0 to A5
- Digital pins are 14
- Power consumption is 19 mA
- I/O pins DC Current is 40 mA
- Flash memory is 32 KB
- SRAM is 2 KB
- EEPROM is 1 KB
- CLK speed is 16 MHz
- Weight-7g
- Size of the printed circuit board is 18 X 45mm
- Supports three communications like SPI, IIC, & USART

**b. NEO-6M GPS Module**

The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability.

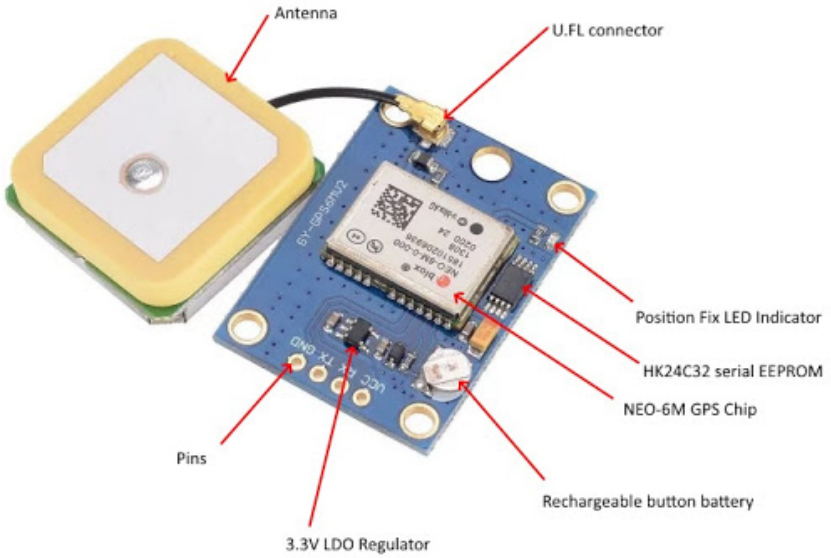



Fig 3: NEO-6M GPS Module (labelled)

**Why NEO-6M GPS Module?**

- The NEO-6M GPS engine on these modules is quite a good one, and it also has high sensitivity for indoor applications
- It used in applications requiring global positioning and navigation, like automotive vehicles, drones, pets, etc.

**c. SIM800L GPRS-GSM Module**

The SIM800L GSM/GPRS module is a miniature GSM modem that can be used in a variety of IoT projects. You can use this module to do almost anything a normal cell phone can do, such as sending SMS messages, making phone calls, connecting to the Internet via GPRS, and much more.


Fig 4: SIM800L GPRS-GSM Module (labelled)

**APPLICATION**:

GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate.

**d. Piezo Buzzer**

Piezo buzzer is a type of electronic device that's used to produce a tone, alarm or sound. It's lightweight with a simple construction, and it's typically a low-cost product

Fig 5: Piezo Buzzer

**e. NPN transistor (BC-337)**

BC337 transistor is used in different electronic circuits & basic electronic projects because of its characteristics. It is also used in audio preamplifier stages due to its high gain feature. In other techniques, it can also be used for switching small loads within electronic circuits.

Fig 6: BC-337 npn Transistor

**f. Light Emitting Diode (LED)**

A Light Emitting Diode (LED) is a special type of PN junction diode. The light emitting diode is specially doped and made of a special type of semiconductor. This diode can emit light when it is in the forward biased state. Aluminum indium gallium phosphide (AlInGaP) and indium gallium nitride (InGaN) are two of the most commonly used semiconductors for LED technologies.

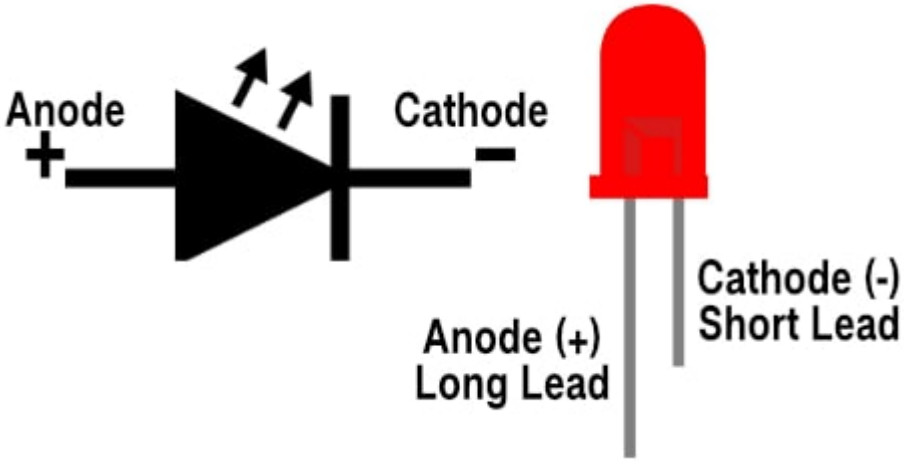



Fig 7: LED (Red)

**g. Resistors**

A resistor is a passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits. The main purpose of resistor is to reduce the current flow and to lower the voltage in any particular portion of the circuit.

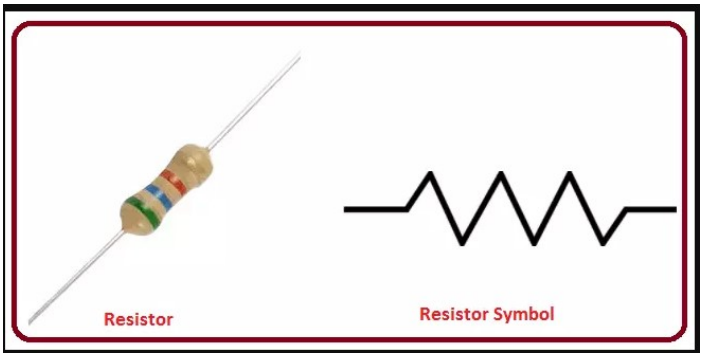



Fig 8: Pictorial and Symbolic Resistor

**h. Jumper wires**

Generally, jumpers are tiny metal connectors used to close or open a circuit part. They have two or more connection points, which regulate an electrical circuit board.

Their function is to configure the settings for computer peripherals, like the motherboard. Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering.

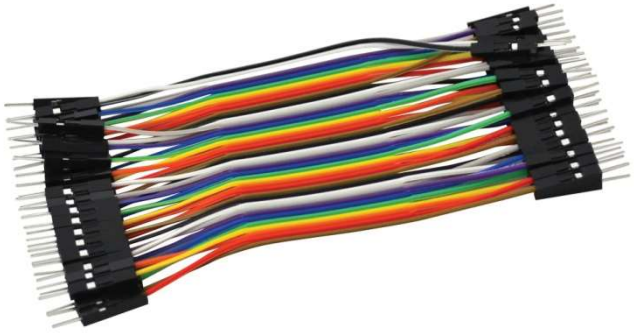


Fig 9: Male to Male Jumper Wires

**i. Breadboard**

The breadboard is a white rectangular board with small embedded holes to insert electronic components. We can also say that breadboard is a prototype that acts as a construction base of electronics. A breadboard is a solder less board. It means that the component does not require any soldering to fit into the board.

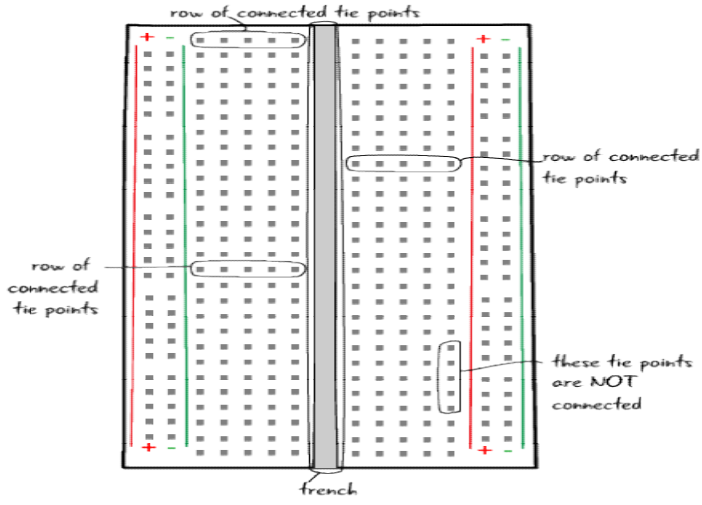



Fig 10: Breadboard

# V Components Connection

Components here are connected as listed below:

i. GND of the arduino is connected with the –ve terminal of the battery. Vin of the arduino is connected with +ve terminal of the battery.

ii. For GPS module: (GPS's pin to Arduino's pin)
   a. Vcc to +5V
   b. Rx to D11
   c. Tx to D12
   d. GND to GND

iii. For GSM module: (GSM's pin to Arduino's pin)
   a. GND to GND
   b. Tx to D8
   c. Rx to D9
   d. RST to D10
   e. Vcc to +5V

iv. For LED:
   a. –ve to D7
   b. +ve to 220Ω resistor to GND

v. For Buzzer:
   a. –ve to +5V
   b. +ve to npn transistor's collector
      I. Collector to buzzer +ve
      II. Base to 10 kΩ to D5 (Arduino pin)
      III. Emitter to GND (Arduino's)

# VI Schematic Diagram

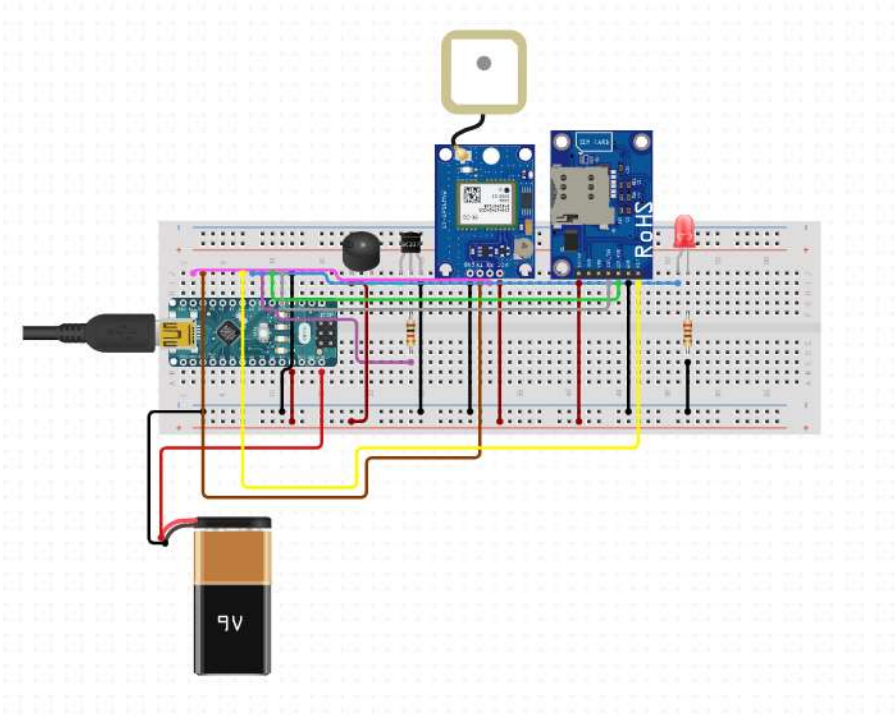



Fig 11: Schematic Diagram [1]

# Chapter 3

# Software Implementation

## I Software Description

### i. EasyEDA[2]

- EasyEDA is a web-based EDA tool suite that enables hardware engineers to design, simulate, share - publicly and privately - and discuss schematics, simulations and printed circuit boards.
- It allows the creation and editing of schematic diagrams, SPICE simulation of mixed analogue and digital circuits and the creation and editing of printed circuit board layouts and, optionally, the manufacture of printed circuit boards.

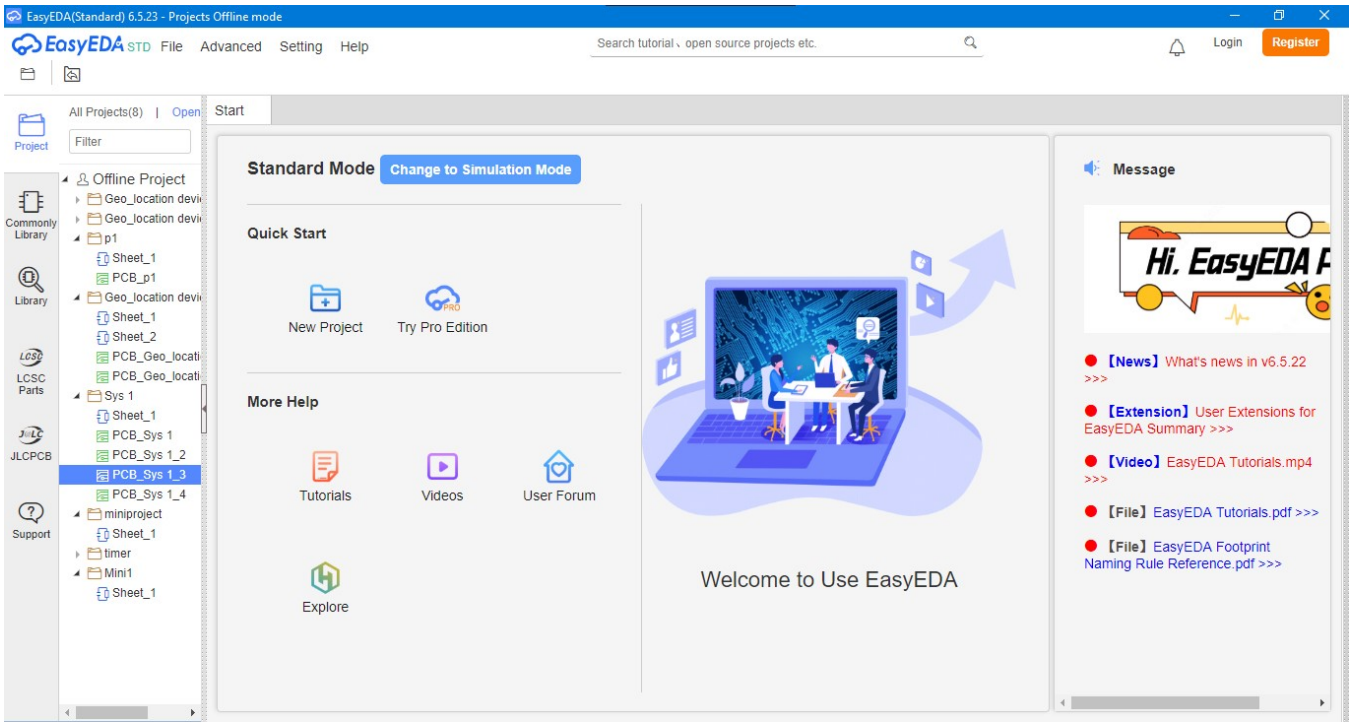



Fig 12: EasyEDA Homepage

### ii. Arduino IDE[3]

- The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards.
- It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment.

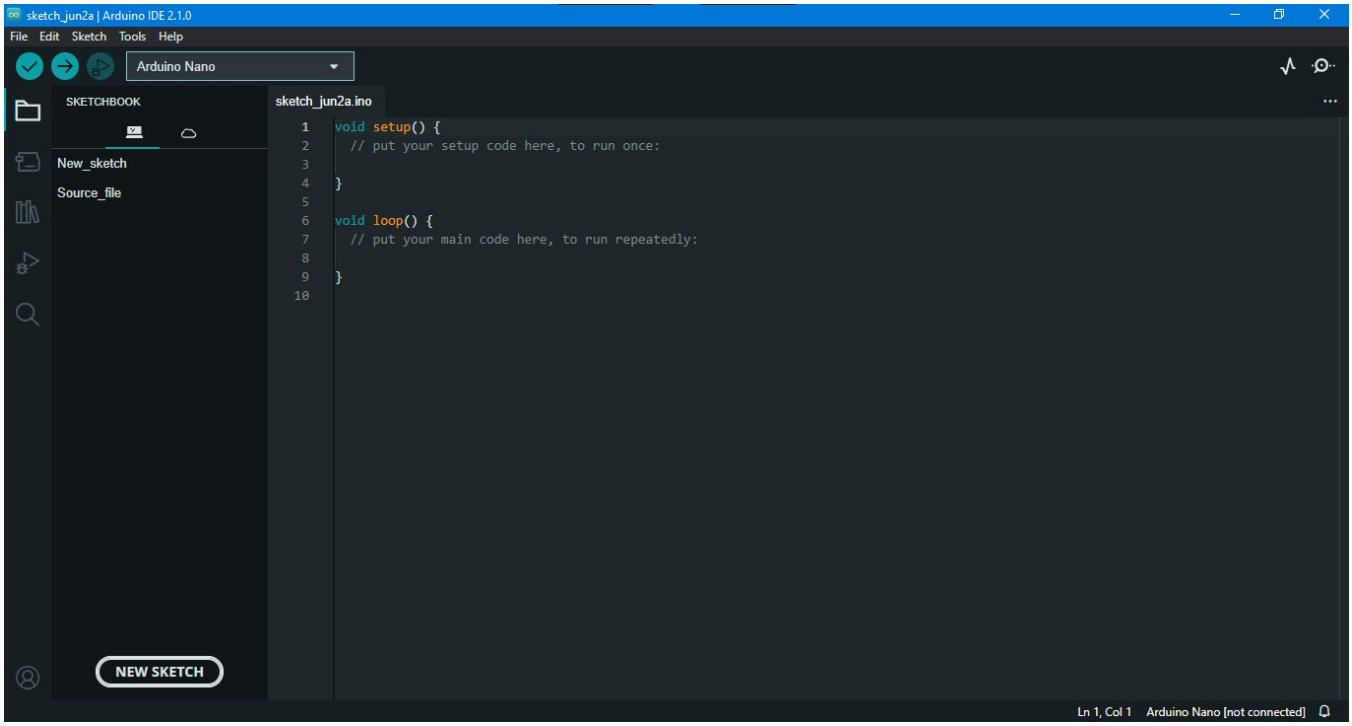



Fig 13: Arduino IDE Homepage

# II PCB Desiging (EasyEDA)

The circuit designing was done on **EasyEDA**.

**Requirement analysis and Component selection**

Appropriate component of desired values such as resistors, op amp, capacitors, power supply, Copper plate of preselected design parameters and other equipment were arranged before designing.

**In-System Front end design**

PCB layout is initially designed using a PCB design software. Altium Designer, Autodesk EAGLE, KiCad EDA, OrCAD are some commercially available software used for PCB design. The output of this design is usually in the form of a PCB schematic Gerber file. Gerber file encodes information including copper tracking layers, drill drawing, component notation, and other parameters. We are using *EasyEDA* for software design.

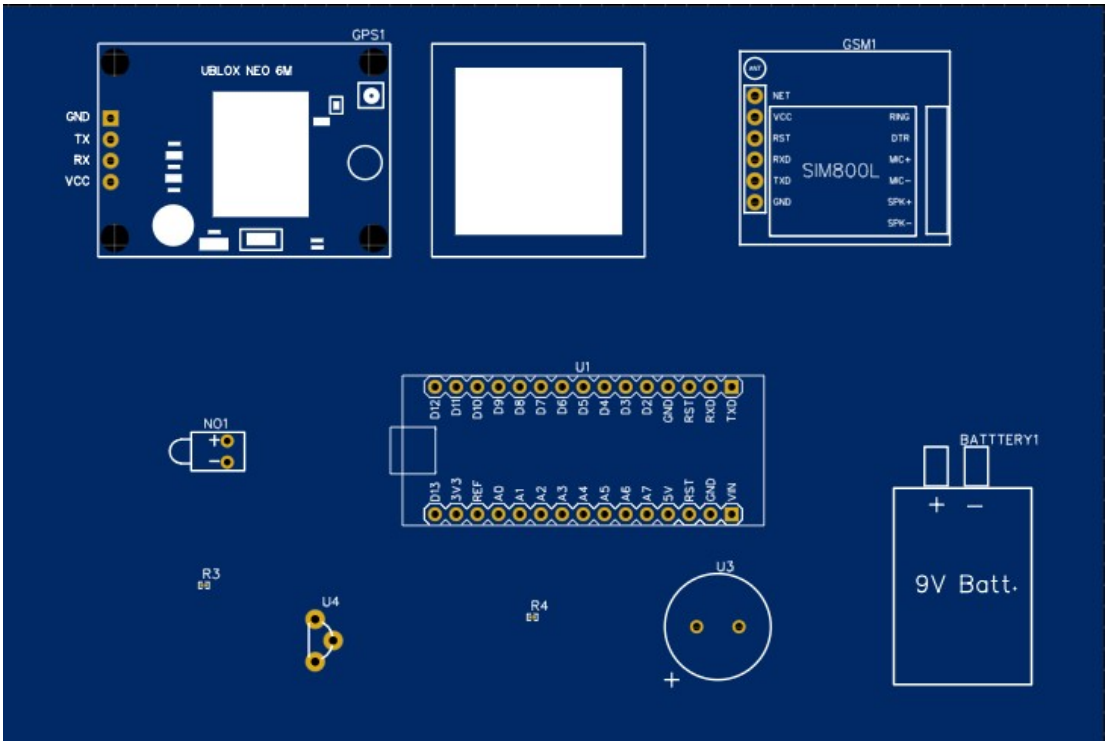



Fig 14: Front view of designed PCB

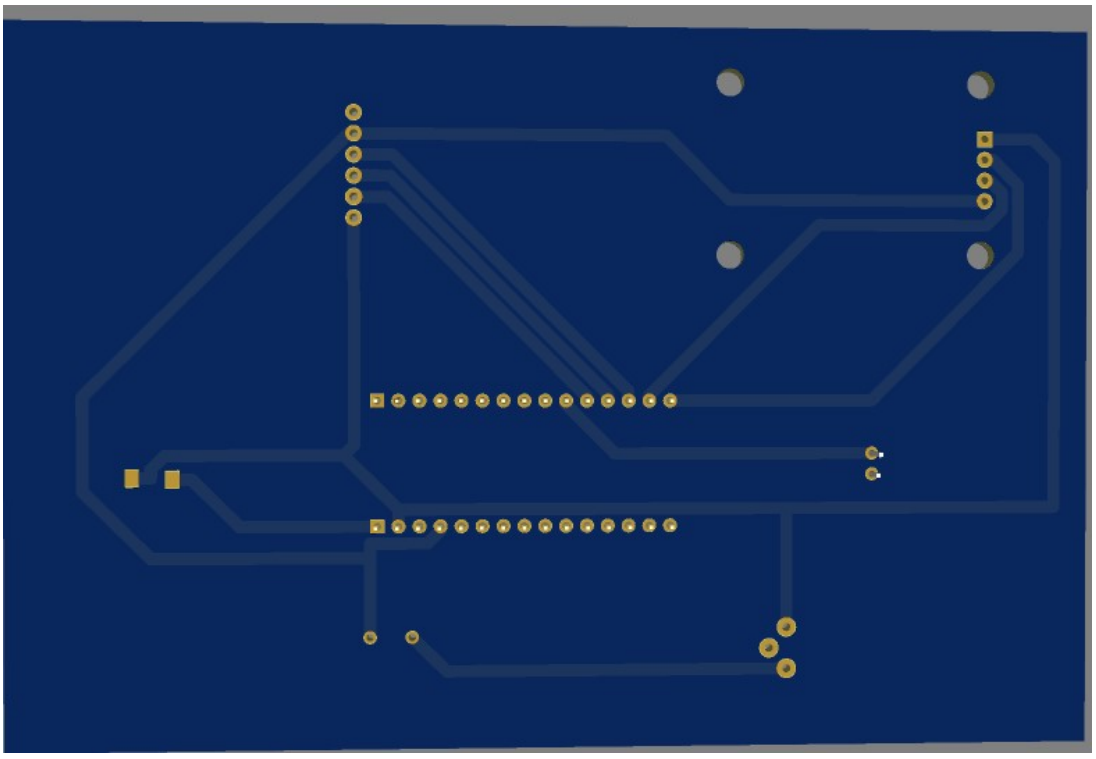


Fig 15: Back view of designed PCB

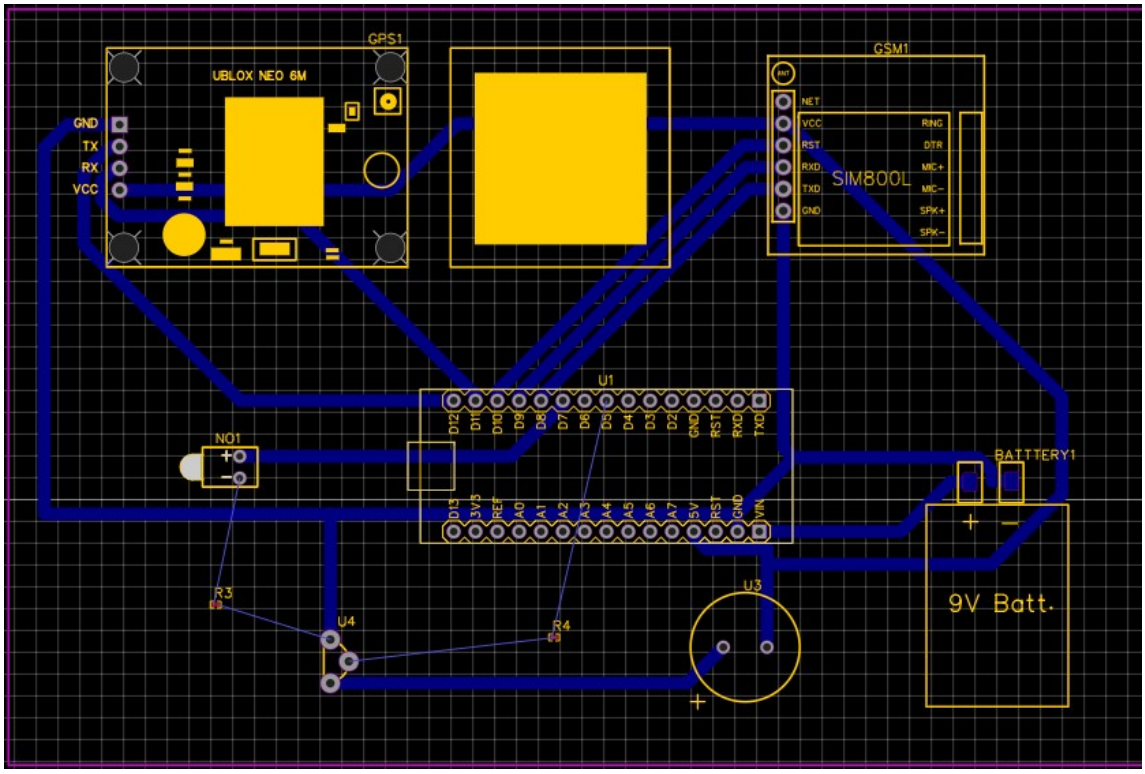
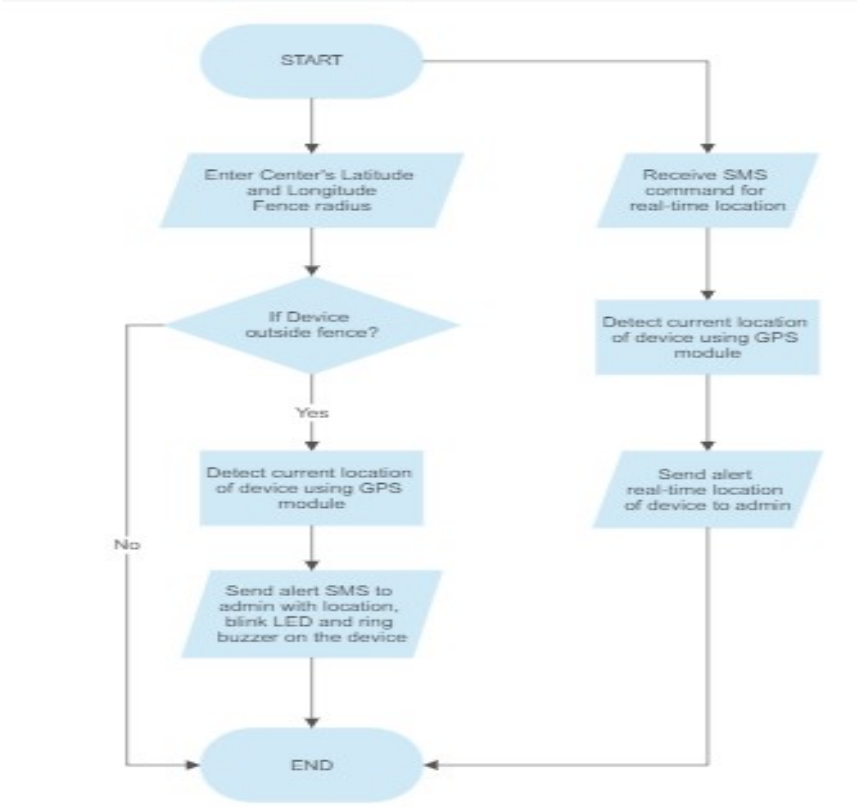



Fig 16: Copper Routing of PCB

## III Flow Chart



## IV Algorithm

1) Start
2) Enter center latitude, center longitude & fence radius
3) Check if device is inside fence area.
4) If yes, detect location of device and send alert message to admin with led blinking and buzzer ringing on device.
5) Else, End.
6) Provide command to device as SMS for real-time location.
7) Detect live location of device using GPS
8) Send location of device to admin.
9) END

## V Arduino Coding (Arduino IDE)

```
#include <SoftwareSerial.h>
#include <TinyGPS++.h>
SoftwareSerial sim800lSerial(9, 8); // RX, TX pins for SIM800L
SoftwareSerial gpsSerial(11, 12); // RX, TX pins for Neo 6M GPS module
TinyGPSPlus gps;
const float epicenterLatitude = 26.9289779376603; // Latitude of the epicenter
const float epicenterLongitude = 80.93838258728356; // Longitude of the epicenter
const float maxDistance = 50.0; // Maximum distance from the epicenter in meters
const int ledPin = 7; // Pin for the LED
const int buzzerPin = 5; // Pin for the buzzer
String adminPhoneNumber = "+917619958441"; // Admin's phone number
void setup() {
  sim800lSerial.begin(9600);
  gpsSerial.begin(9600);
  pinMode(ledPin, OUTPUT);
  pinMode(buzzerPin, OUTPUT);
  delay(1000);
  sendSMS(adminPhoneNumber, "Device started");
}
```

```
void loop() {
  while (sim800lSerial.available()) {
    char c = sim800lSerial.read();
    Serial.write(c);
    gpsSerial.write(c);
  }
  while (gpsSerial.available()) {
    if (gps.encode(gpsSerial.read())) {
      if (gps.location.isValid()) {
        float latitude = gps.location.lat();
        float longitude = gps.location.lng();

        if (isOutsideEpicenter(latitude, longitude)) {
          sendAlertSMS(latitude, longitude);
          blinkLedWithBuzzer();
        }
      }
    }
  }
}
bool isOutsideEpicenter(float latitude, float longitude) {
  float distance = TinyGPSPlus::distanceBetween(latitude, longitude, epicenterLatitude,
epicenterLongitude);
  if (distance > maxDistance) {
    return true;
  }
  return false;
}
void sendAlertSMS(float latitude, float longitude) {
  String message = "ALERT! Device is outside the predefined area.\n";
  message += "Location: ";
  message += "https://maps.google.com/?q=";
```

```
  message += latitude;
  message += ",";
  message += longitude;
  sendSMS(adminPhoneNumber, message);
}
void blinkLedWithBuzzer() {
  for (int i = 0; i < 5; i++) {
    digitalWrite(ledPin, HIGH);
    digitalWrite(buzzerPin, HIGH);
    delay(500);
    digitalWrite(ledPin, LOW);
    digitalWrite(buzzerPin, LOW);
    delay(500);
  }
}
void sendSMS(String phoneNumber, String message) {
  sim800lSerial.println("AT+CMGF=1"); // Set SMS mode to text
  delay(1000);
  sim800lSerial.println("AT+CMGS=\"" + phoneNumber + "\"");
  delay(1000);
  sim800lSerial.print(message);
  delay(100);
  sim800lSerial.println((char)26); // End of message character
  delay(1000);
}
```

# CHAPTER 4

# IMPLEMENTATION AND WORKING

The physical realization of the project is very vital. This is where the fantasy of the whole idea meets reality. The designer will see his or her work not just on paper but also as a finished hardware. After carrying out all the paper design and analysis, the project was implemented and tested to ensure it's working ability, and was finally constructed meet desired specifications.

## I. Implementation of Circuit

Firstly, implementation of the project is done on the breadboard . Step by step while test the components one by one, as per the circuit diagram before soldering of the circuit. The various circuits and stages were soldered in tandem to meet desired workability of project.

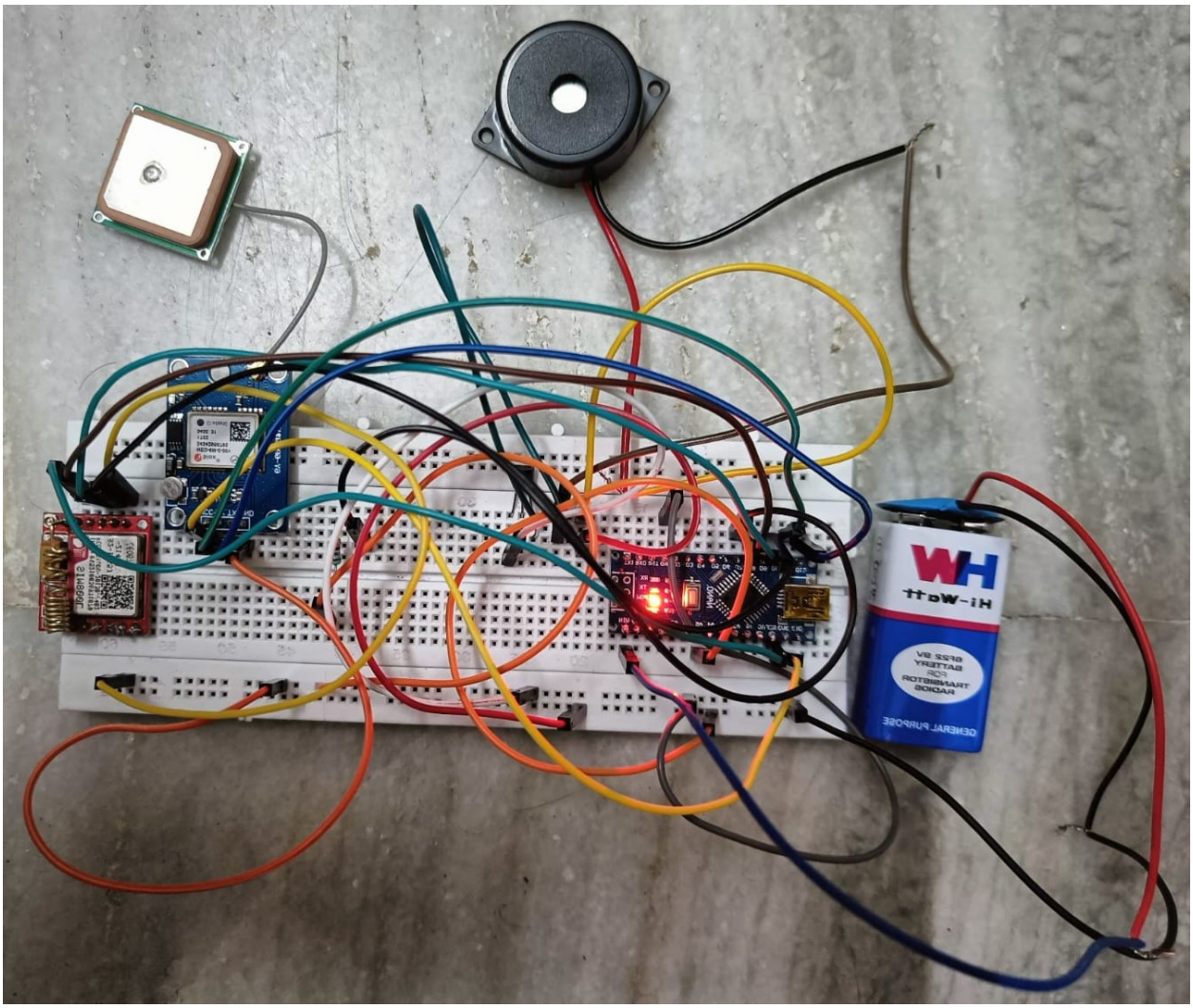


Fig 17: Breadboard Implementation of project

## II. Working of project

### i. Hardware Setup:

- The Arduino Nano initializes the GSM module, GPS module, and buzzer.
- It sets up the necessary configurations and parameters for proper communication with each module

### ii. Device Initialization:

- The Arduino Nano initializes the GSM module, GPS module, and buzzer.
- It sets up the necessary configurations and parameters for proper communication with each module

### iii. GPS Location Retrieval:

- The NEO 6M GPS module continuously receives signals from GPS satellites to determine the device's latitude and longitude coordinates.
- The Arduino Nano periodically queries the GPS module to obtain the current location information.

### iv. Geofencing Logic:

- The Arduino Nano compares the obtained GPS coordinates with predefined boundaries or coordinates that define the restricted area.
- If the device is within the restricted area, it proceeds to take appropriate action; otherwise, it remains in a standby state

### v. Prohibition Action:

- When the device detects that it is within the restricted area, it triggers the prohibition action.
- This action can vary based on your specific requirements. For example, it could send an SMS notification to a predefined number; activate the buzzer to emit an audible alarm, or both.

### vi. Alerting User:

- If an SMS notification is part of the prohibition action, the Arduino Nano uses the SIM800L GSM module to send an SMS message to the designated recipient.
- The message could include details such as the device's current location or any additional information you wish to include.

### vii. Audible Warning:

- Simultaneously with the SMS notification or as a standalone action, the Arduino Nano activates the buzzer to emit an audible alarm.

- The alarm helps alert the device user or nearby individuals about the violation of the geolocation restrictions.

**viii. Command detection (For on command real-time location retrival):**

- Monitor the incoming messages or commands received by the SIM800L GSM module.
- Check if the received command matches a predefined specific command that triggers location tracking.

**ix. Real-time location tracking:**

- If the specific command is received, retrieve the current GPS coordinates as described in step viii.
- Send the coordinates to a predefined recipient via SMS using the GSM module.
- Construct a message that includes the latitude and longitude information.

# CHAPTER 5
# ADVATAGES AND LIMITATIONS

## I. Advantages

- **Enhanced Security**: By using geolocation technology, the device can restrict or control the usage of a device within a specific geographical area. This can prevent unauthorized access to sensitive or restricted locations, ensuring enhanced security.
- **Real-Time Location Tracking**: The device can provide real-time location tracking, allowing you to monitor the movements of the device within the restricted area. This can be useful for tracking valuable assets, vehicles, or even individuals for safety and security purposes.
- **Immediate Notifications:** When the device detects a violation of the geolocation restrictions, it can send immediate notifications to predefined recipients. These notifications can be in the form of SMS messages, allowing quick response and appropriate action to be taken.
- **Versatile Applications:** Geolocation prohibition devices have a wide range of applications. They can be used to secure sensitive locations, control access to specific areas, prevent theft or misuse of valuable assets, track vehicles or equipment, and more.
- **Cost-Effective Solution:** Implementing a geolocation prohibition device can be a cost-effective solution compared to other security measures or physical barriers. It provides an additional layer of security without requiring extensive infrastructure or manpower.
- **Easy Integration:** Geolocation prohibition devices can be easily integrated with existing systems or security protocols. They can work alongside other security measures to create a comprehensive security solution.

## II. Limitations

- **Technical Challenges:** Geolocation tracking is a complex process that relies on multiple technologies, including GPS, Wi-Fi, and cellular networks. Developing a device that can effectively block or prohibit all forms of geolocation tracking is technically challenging. It may be difficult to account for all possible tracking methods and ensure consistent and reliable blocking.
- **Third-Party Dependencies:** Geolocation tracking often relies on data transmitted by third-party services or infrastructure, such as GPS satellites or cellular networks. Geolocation prohibition devices may be limited by the availability and reliability of these external systems. Additionally,

relying on third-party services introduces potential vulnerabilities that could be exploited by malicious actors.

- **Susceptibility to Device Tampering:** Determined individuals may attempt to tamper with the geolocation prohibition device by disabling or modifying its components. This can potentially bypass the restrictions or render the device ineffective.
- **Reliance on GPS Signal:** Geolocation prohibition devices depend on the availability and reliability of GPS signals. In areas with poor GPS reception, such as indoors or in dense urban environments, the accuracy and effectiveness of the device may be compromised.
- **Vulnerability to Signal Jamming:** Geolocation prohibition devices that rely on GPS or GSM signals can be vulnerable to signal jamming techniques. Malicious individuals can use signal jammers to interfere with the device's ability to receive or transmit signals, potentially bypassing the restrictions.
- **Limited Battery Life:** Devices that operate on battery power, such as portable geolocation prohibition devices, have limitations on their battery life. Continuous GPS tracking and communication via GSM can drain the battery quickly, requiring frequent recharging or replacement.

# CHAPTER 6
# CONCLUSION

Despite the drawbacks, geolocation prohibition devices offer a number of benefits for cattle farmers and prison authorities. These devices can help to prevent livestock from straying, prisoners from escaping, and unauthorized activities from taking place. As the technology continues to develop, the cost of these devices is likely to decrease and the ease of use is likely to increase. This will make geolocation prohibition devices even more attractive to cattle farmers and prison authorities.

In addition to the benefits listed above, geolocation prohibition devices can also help to improve animal welfare. By tracking the movement of animals, farmers and ranchers can identify areas where animals are stressed or uncomfortable. This information can then be used to make changes to the environment to improve the welfare of the animals.

Geolocation prohibition devices can also be used to help with research. For example, scientists can use these devices to track the movement of animals in the wild to learn more about their behavior and ecology.

Overall, geolocation prohibition devices are a valuable tool that can be used to improve animal welfare, increase productivity, and prevent crime.

# CHAPTER 7

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