SAEDS

Smart Automated

Elephant Deterrent System

Electrical and Electronics Engineering

HNDE - Labuduwa

Presented by **Group 01**

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Content

Introduction of **Project**

Human-elephant conflict (HEC) in Sri Lanka has intensified due to deforestation and habitat loss, resulting in significant human and elephant casualties. Traditional electric fences are proving ineffective, costly, and lack early warning systems. A proposed Smart Electric Fence System uses laser sensors, remote monitoring, sirens, and automatic deterrents like “Ali Dong” crackers to detect and respond to elephant intrusions more efficiently and sustainably.

Problem: Rapid habitat loss causes elephants to enter villages, leading to deaths and property damage; in 2024 alone, 388 elephants and 155 people died due to HEC.

Limitations of Current Solutions: Conventional electric fences consume high energy, are easily breached, and don’t offer timely alerts to villagers.

Proposed Solution: The Smart Electric Fence System integrates laser sensors, automated deterrents, sirens, and real-time alerts to optimize energy use, notify authorities and villagers, and ensure rapid response to elephant intrusions.

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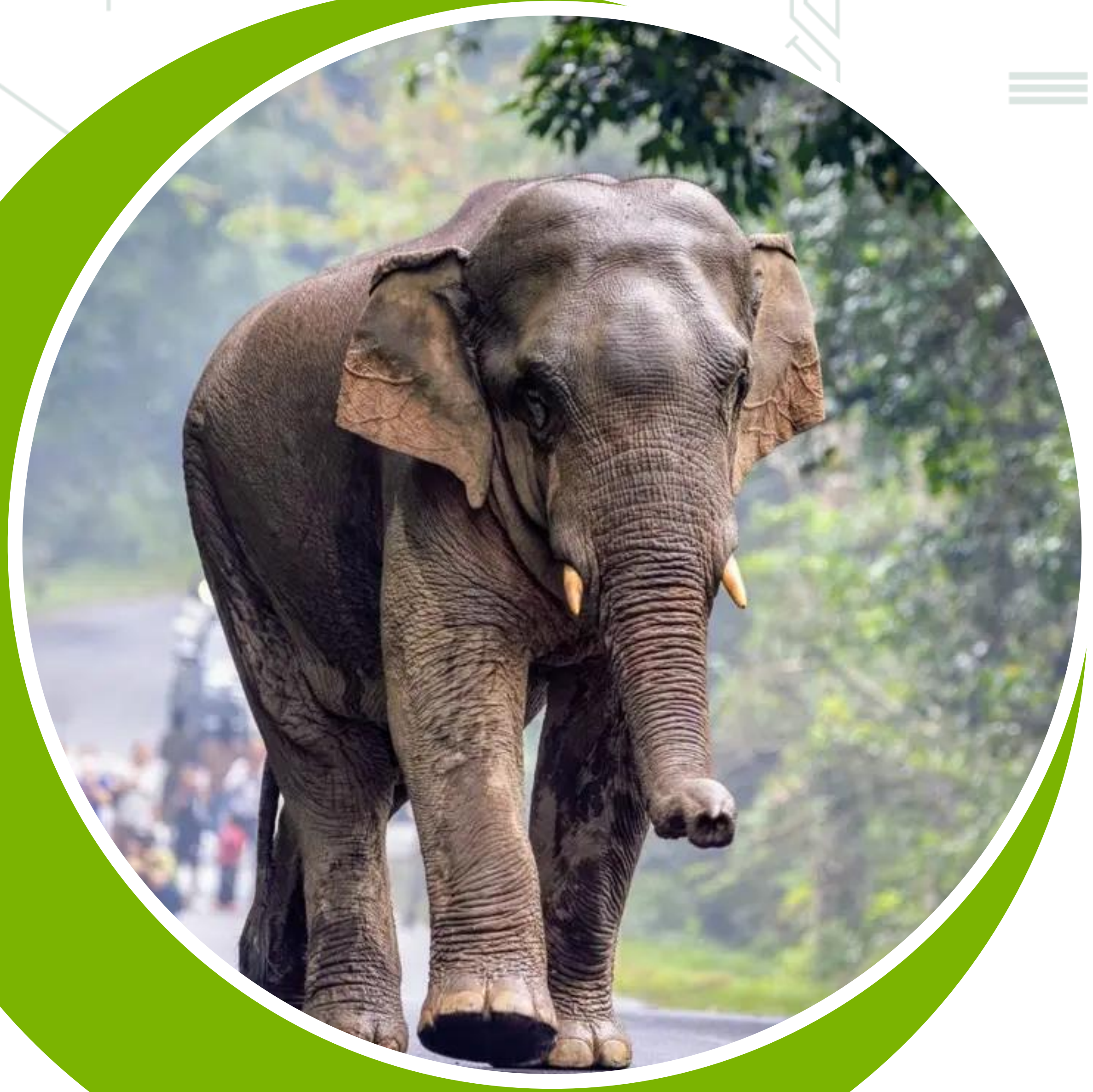
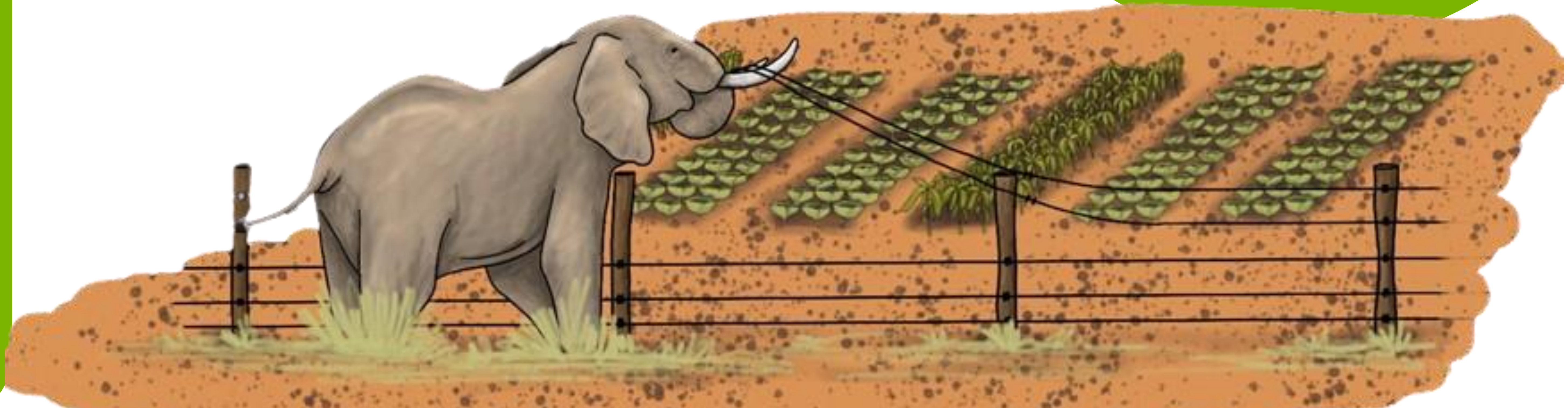
Project Scope

It is necessary to identify whether the animal came to the relevant limit. A laser torch is used for this purpose. Breakdown of the laser beam is used to detect whether an animal has reached the fence by ringing an auto siren. The power is supplied to the elephant fence through an inverter circuit and also transmitter and receiver is used to create a remote-control link. Rechargeable batteries and small nichrome cores are used to get a spark to activate the crackers.

Project
Aim

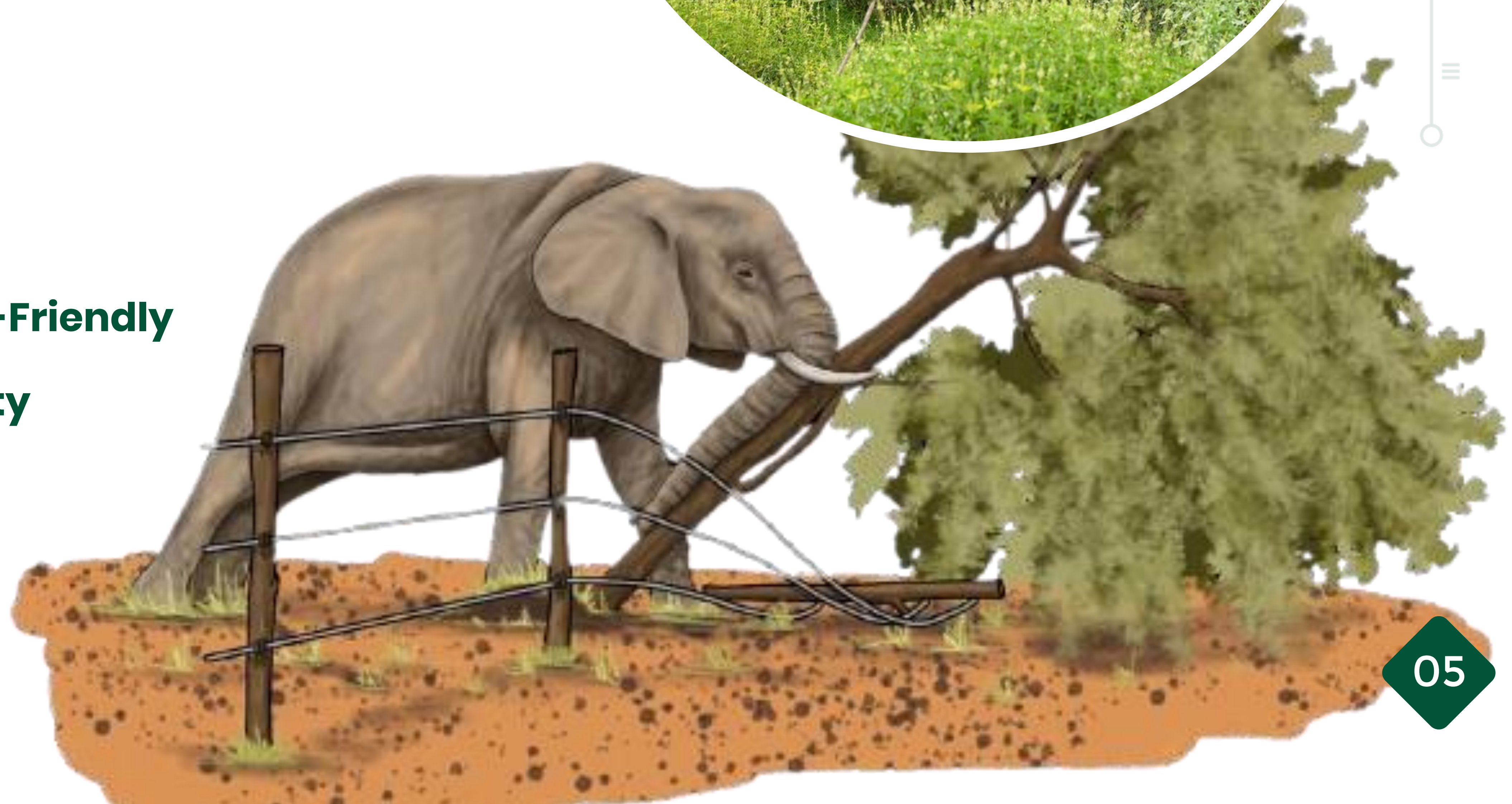
The AIM of this project is to develop a technological system to prevent wild elephants from entering villages, thereby reducing crop destruction, property damage, and threats to human lives.



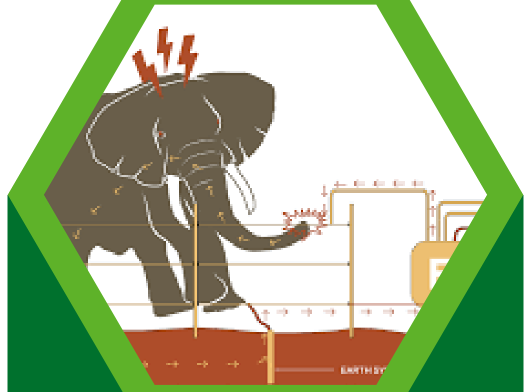


Project Objectives

- Reduce Human-Elephant Conflict (HEC)
- Smart Detection & Response system for effective deterrence.
- Energy Efficiency
- Remote Alerts
- Damage Prevention
- Non-Lethal & Conservation-Friendly
- Improved Community Safety
- Scalable & Cost-Effective
- Intelligent Siren Placement
- Breach Tracking



Similar Systems

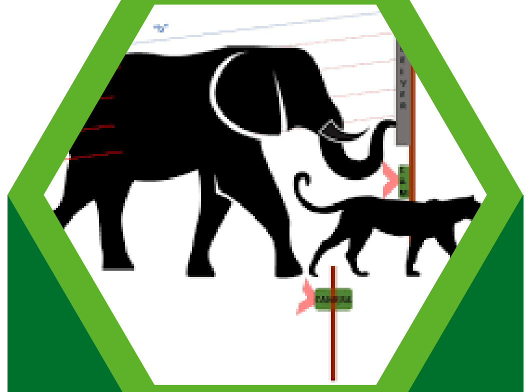


Traditional Electric Fences

Electrified barriers around villages or farmland.

Camera Trap & Thermal Imaging

Cameras installed near conflict zones; AI identifies elephant presence.



Acoustic Infrared and Laser Sensor System

Detects movement or heat signatures of elephants.

Acoustic Sensors

Microphones detect elephant vocalizations or movement sounds.

GPS Collaring and Tracking

Elephants fitted with GPS collars; their movements are tracked.

Beehive Fences

Fences interlinked with live beehives.

Sound & Light Deterrent Systems

Alarms, spotlights, or crackers activated when elephants are detected.

Project
Components

ARDUINO MEGA BOARD

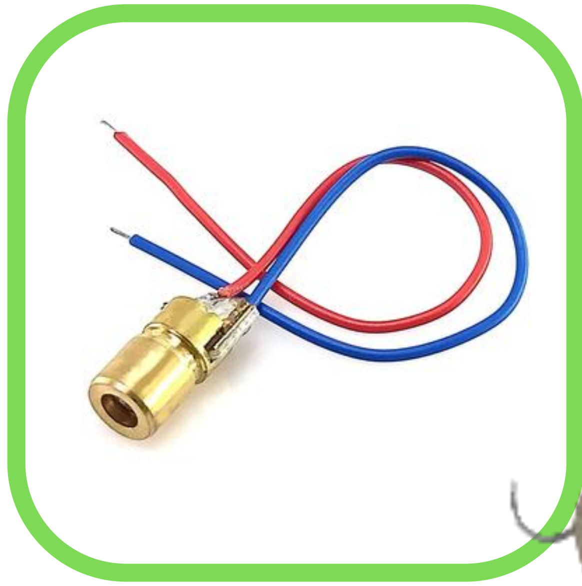
ARDUINO UNO BOARD

SIM900A GSM MODULE

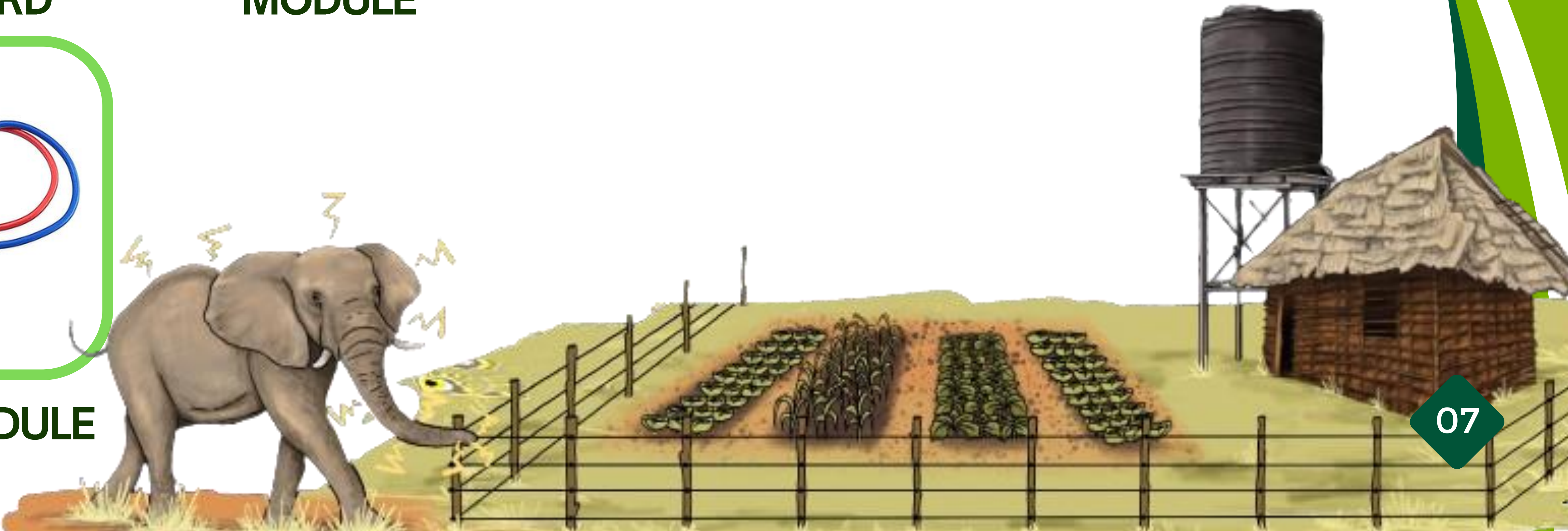
GPS MODULE

BUZZER

LDR

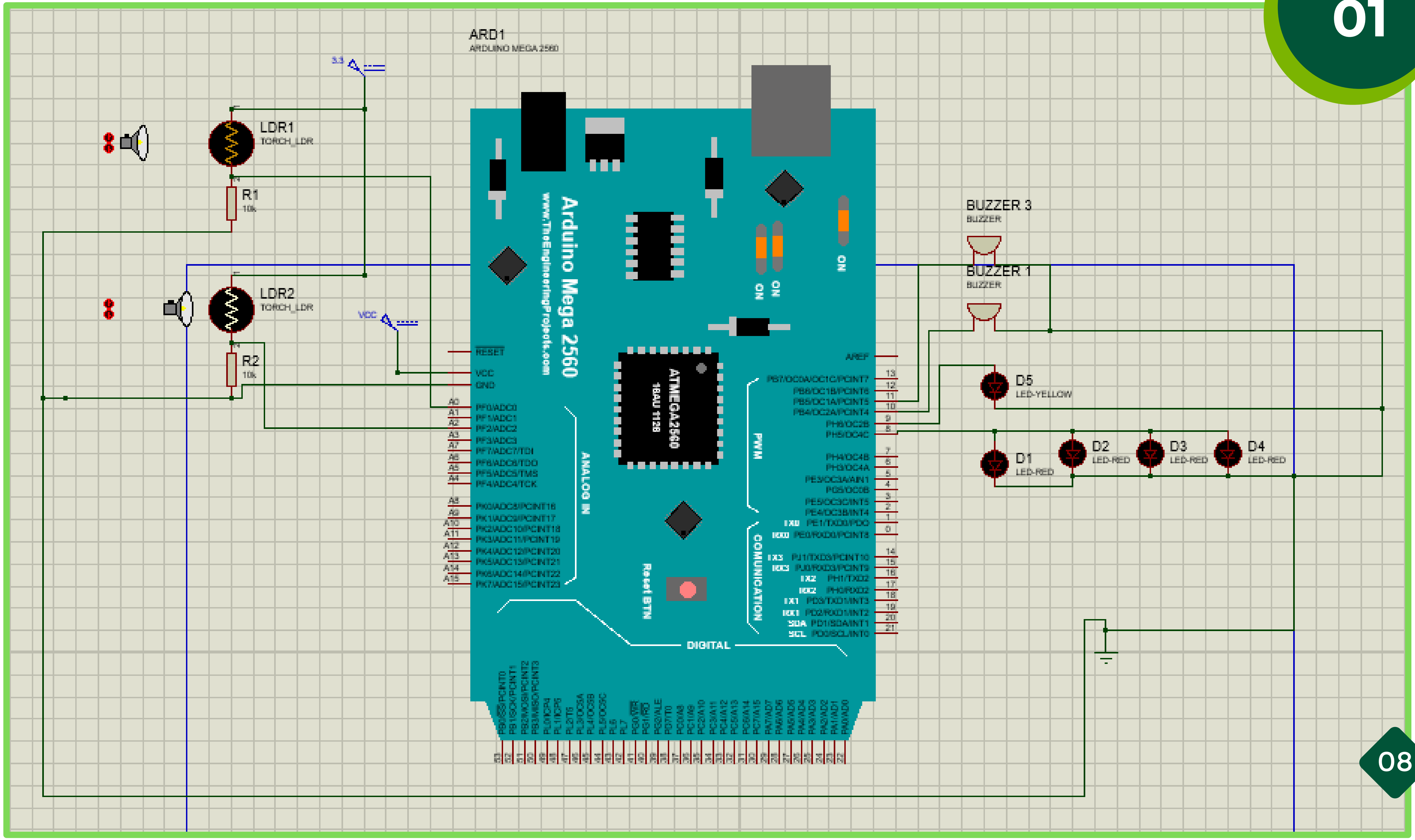


LASER MODULE



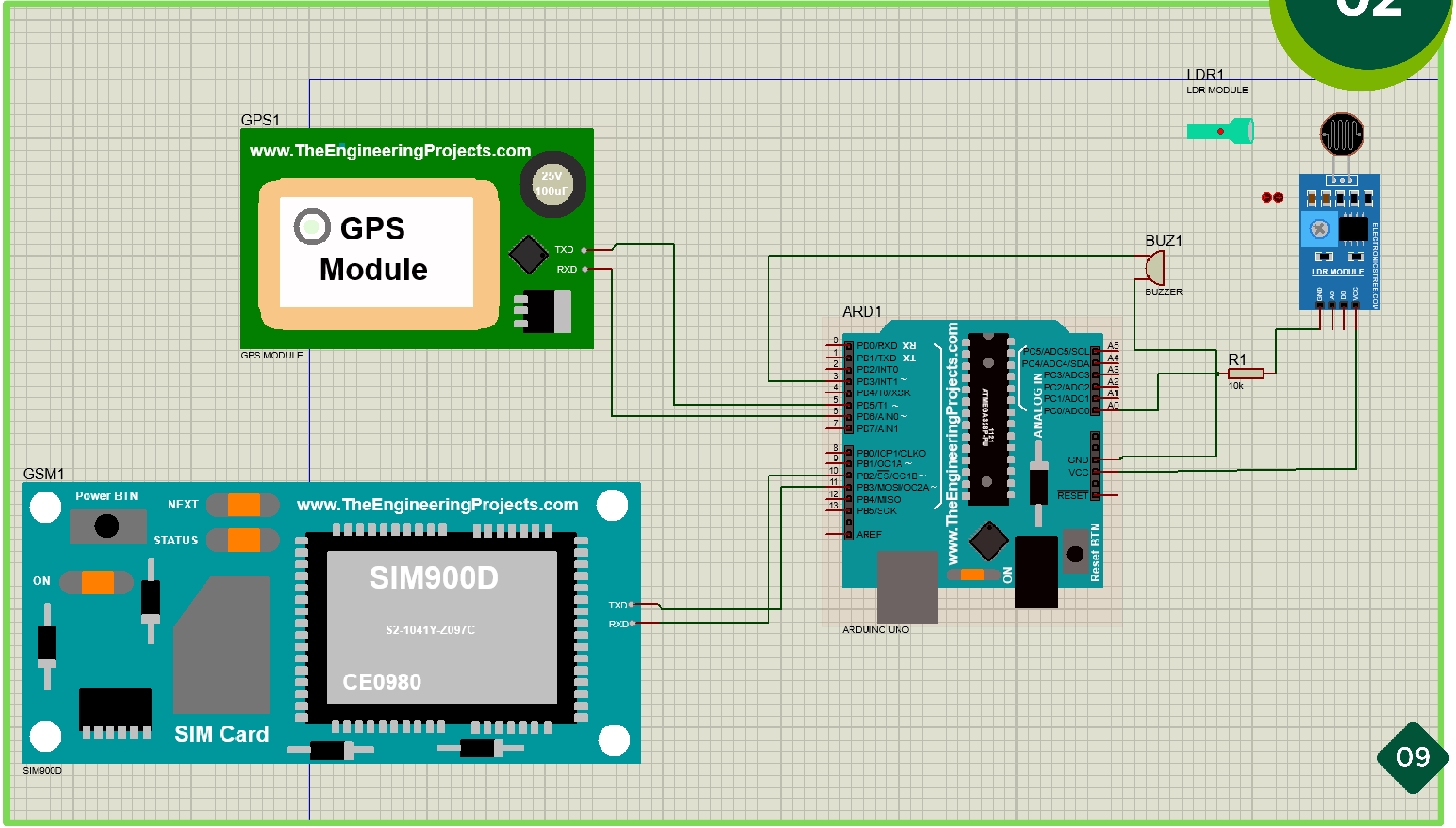
Circuit **Diagrams**

Circuit 01



Circuit Diagrams

Circuit 02



Arduino Code

ARDUINO

Code 01

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sketch_may28a | Arduino IDE 2.3.5

File Edit Sketch Tools Help

Arduino Mega or Mega 2560

sketch_may28a.ino

```
// Pin Assignments for Arduino Mega
const int ldrPin = A0;       // LDR1 connected to analog pin A0
const int ldrPin2 = A2;      // LDR2 connected to analog pin A2
const int ledPin = 8;        // LED1 connected to digital pin 8
const int ledPin2 = 9;       // LED2 connected to digital pin 9
const int buzzerPin = 10;    // Buzzer1 connected to digital pi
const int buzzerPin2 = 11;   // Buzzer2 connected to digital pi
const int threshold = 130;   // Darkness threshold for LDR1
const int threshold2 = 500;  // Darkness threshold for LDR2
void setup() {
  pinMode(ledPin, OUTPUT);
  pinMode(ledPin2, OUTPUT);
  pinMode(buzzerPin, OUTPUT);
  pinMode(buzzerPin2, OUTPUT);
  Serial.begin(9600);  // Start serial communication
}
void loop() {
  int ldrValue = analogRead(ldrPin);   // Read the value from LDR1
  int ldrValue2 = analogRead(ldrPin2); // Read the value from LDR2
  Serial.print("LDR1 Value: ");
  Serial.println(ldrValue);
  Serial.print("LDR2 Value: ");
  Serial.println(ldrValue2);
  // LDR1 logic
  if (ldrValue < threshold) {
    digitalWrite(ledPin, HIGH);
    tone(buzzerPin, 1000);
  } else {
    digitalWrite(ledPin, LOW);
    noTone(buzzerPin);
  }

  // LDR2 logic
  if (ldrValue2 < threshold2) {
    digitalWrite(ledPin2, HIGH);
    tone(buzzerPin2, 1500);
  } else {
    digitalWrite(ledPin2, LOW);
    noTone(buzzerPin2);
  }

  delay(100); // Small delay
}
```

Output

Ln 20, Col 32 Arduino Mega or Mega 2560 [not connected]

Arduino Code

ARDUINO

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sketch_may28a | Arduino IDE 2.3.5

File Edit Sketch Tools Help

Select Board

sketch_may28a.ino

```
#include <SoftwareSerial.h>
#include <TinyGPS++.h>
#define LDR_PIN A0
#define THRESHOLD 600         // Adjust based on lighting conditions
#define BUZZER_PIN 3          // Buzzer connected to pin 3
#define LASER_PIN 8           // Laser connected to pin 8
SoftwareSerial SIM900A(5, 6);  // RX, TX pins for SIM900A
SoftwareSerial GPS(11, 10);    // RX, TX pins for GPS module
TinyGPSPlus gps;
// Phone numbers
const char* phoneNumbers[] = {"+94765473876", "+94703052181"};
const int numPhones = sizeof(phoneNumbers) / sizeof(phoneNumbers[0]);
bool buzzerActive = false;
unsigned long buzzerStartTime = 0;
bool messageSent = false;
void setup() {
  Serial.begin(9600);
  while (!Serial);
  Serial.println("Arduino with SIM900A, GPS, and Laser is ready");
  SIM900A.begin(9600);
  GPS.begin(9600);
  Serial.println("SIM900A and GPS started at 9600");
  delay(1000);
  Serial.println("Setup Complete!");
  pinMode(BUZZER_PIN, OUTPUT);
  digitalWrite(BUZZER_PIN, LOW);
  pinMode(LASER_PIN, OUTPUT);
  digitalWrite(LASER_PIN, HIGH);  // Keep laser always ON
  Serial.println("Laser is always ON");

  SIM900A.println("AT+CMGF=1");
  delay(1000);
}

void loop() {
  int ldrValue = analogRead(LDR_PIN);
  Serial.print("LDR Value: ");
```

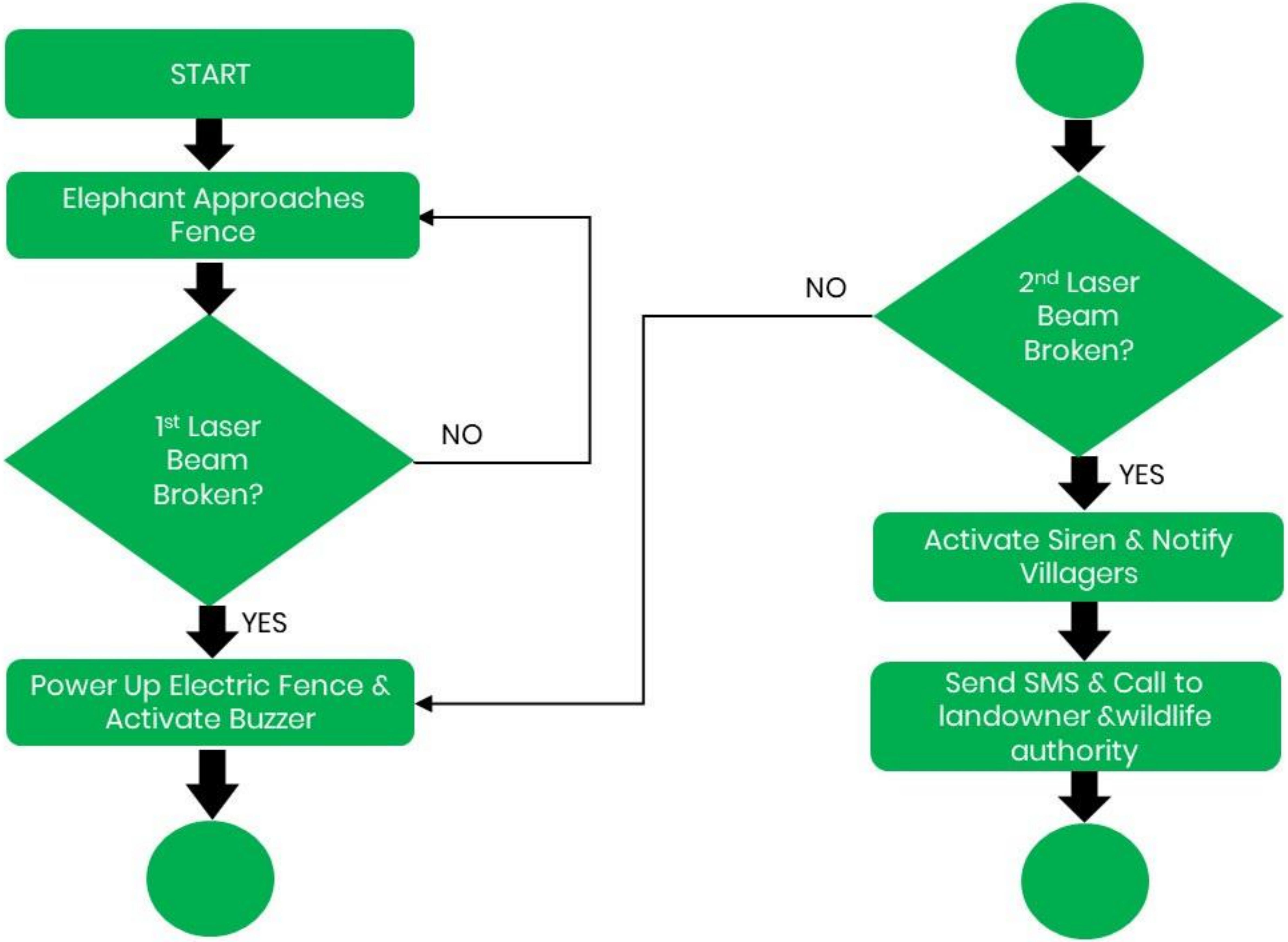

void loop() {
  int ldrValue = analogRead(LDR_PIN);
  Serial.print("LDR Value: ");


```
  Serial.println(ldrValue);

  if (ldrValue < THRESHOLD) {
    Serial.println("Darkness detected!");

    // Start buzzer if not already active
    if (!buzzerActive) {
      digitalWrite(BUZZER_PIN, HIGH);
      buzzerStartTime = millis();
      buzzerActive = true;
      Serial.println("Buzzer ON for 15 seconds");

      // Get GPS location and send call/SMS once
      if (!messageSent) {
        String location = getLocation();
        Serial.println("Location: " + location);

        for (int i = 0; i < numPhones; i++) {
          makeCall(phoneNumbers[i]);  // Ring for 15 seconds
          delay(2000);
        }

        for (int i = 0; i < numPhones; i++) {
          sendMessage(phoneNumbers[i], "Darkness detected! Location: " + location);
          delay(2000);
        }

        messageSent = true;
        Serial.println("Messages sent.");
      }
    }

  // Turn off buzzer after 15 seconds
```

Ln 26, Col 33   No board selected

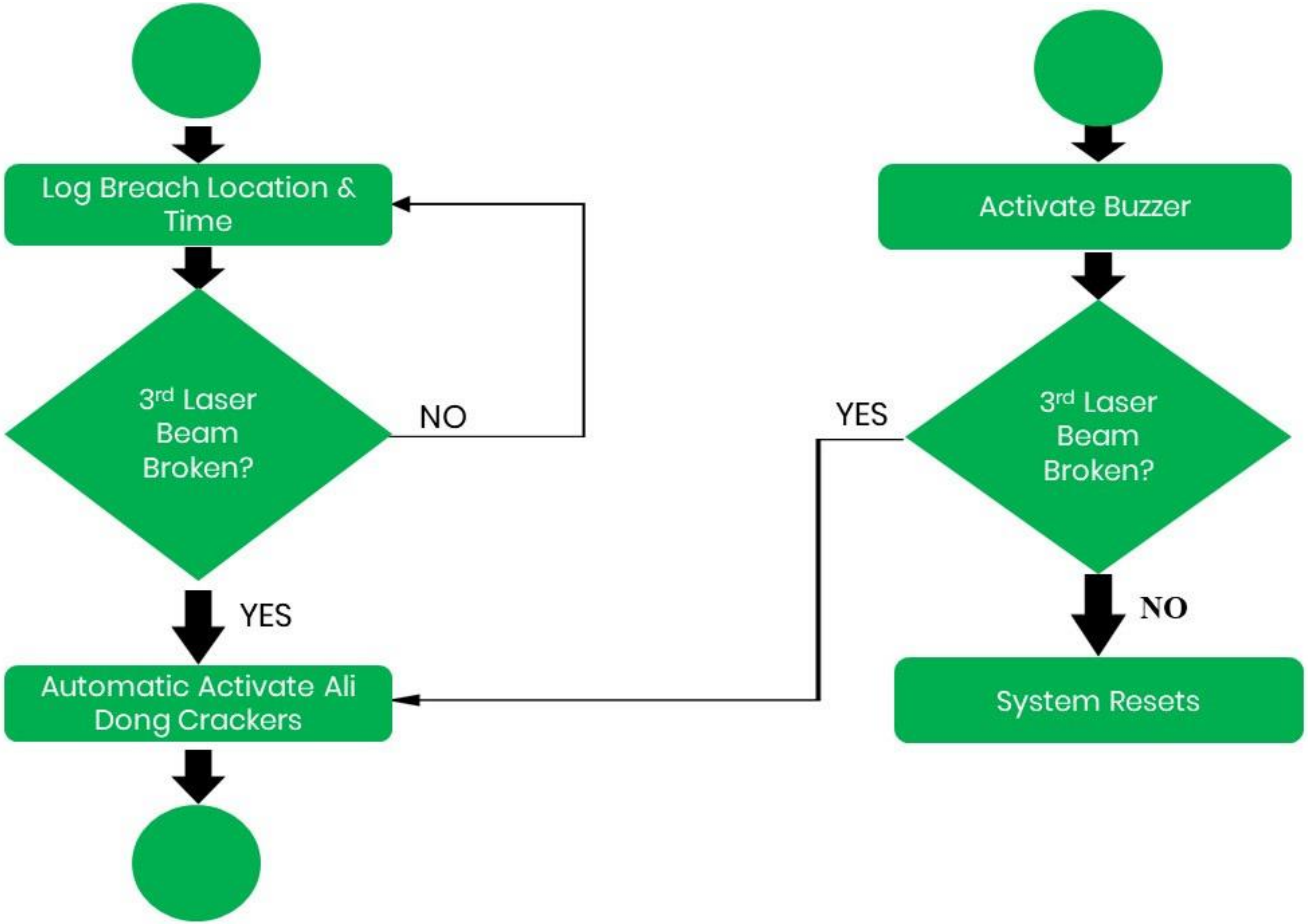
Working Process

Flow Chart



Working Process

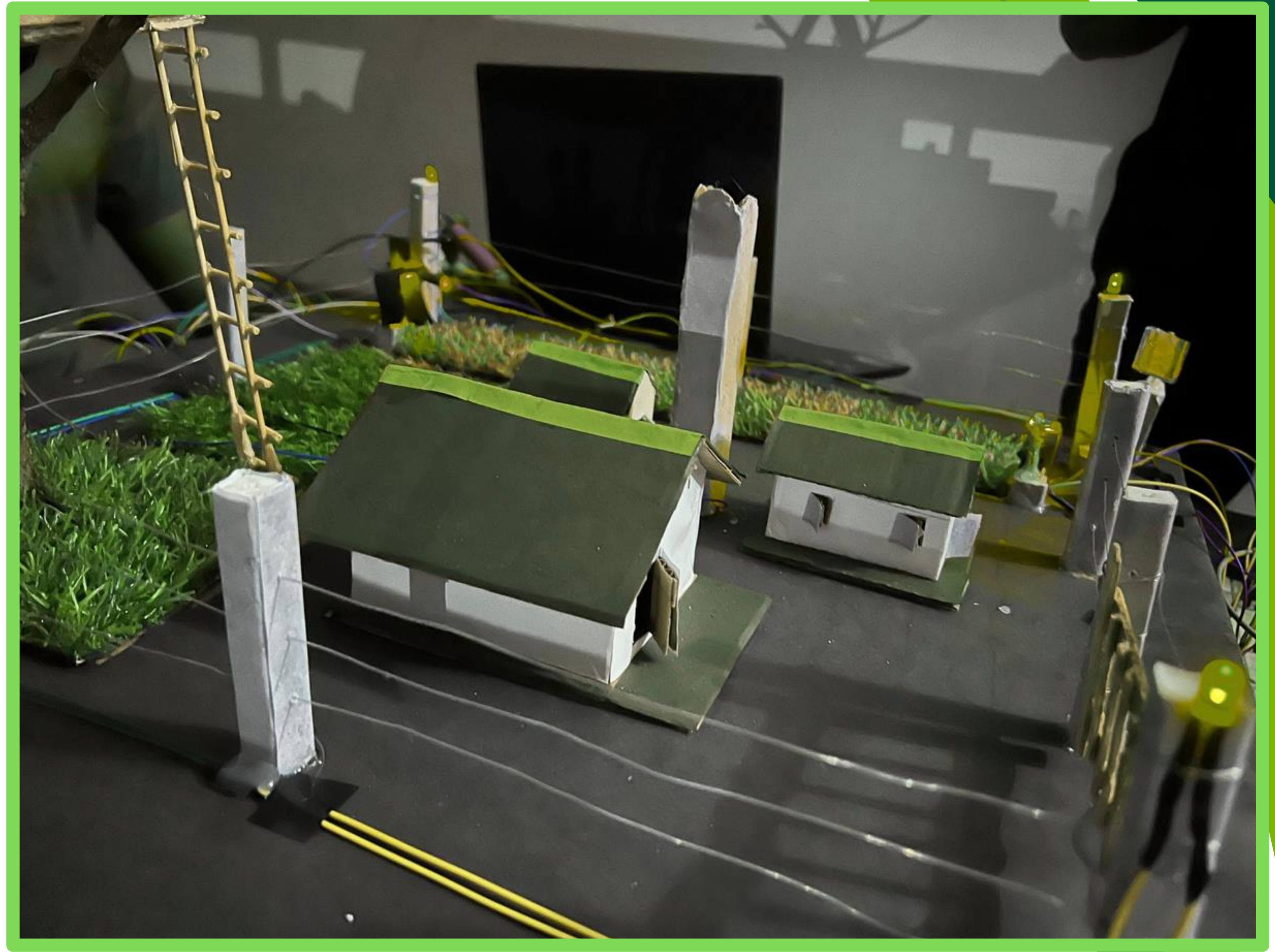
Flow Chart



Methodology

01.Laser 1 (Initial Detection Layer)

- **Purpose:** Detect elephant approach and activate primary deterrent.
- **Process:**
  a. Laser beams are installed at a pre-defined distance (e.g., 10–15m) from the electric fence.
  b. When an elephant interrupts Laser 1:
     - The Arduino microcontroller triggers the electric fence (activated only at this stage to save energy).
     - A low-intensity warning sound (inaudible to humans) may play to deter the elephant.



Methodology

02.Laser 2 (Secondary Alert Layer)

- **Purpose:** Detect fence breach and escalate response.
- **Process:**

  Laser 2 is placed just behind the electric fence. If broken:
  - Confirms the fence has been breached.
  - The system:
    - **Activates a high-decibel siren (strategically placed to alert villagers but not panic them).**
    - **Sends automated SMS/calls to:**
      - **Landowner.**
      - **Wildlife agency (with GPS coordinates of breach).**
    - **Logs the exact time/location of the breach.**

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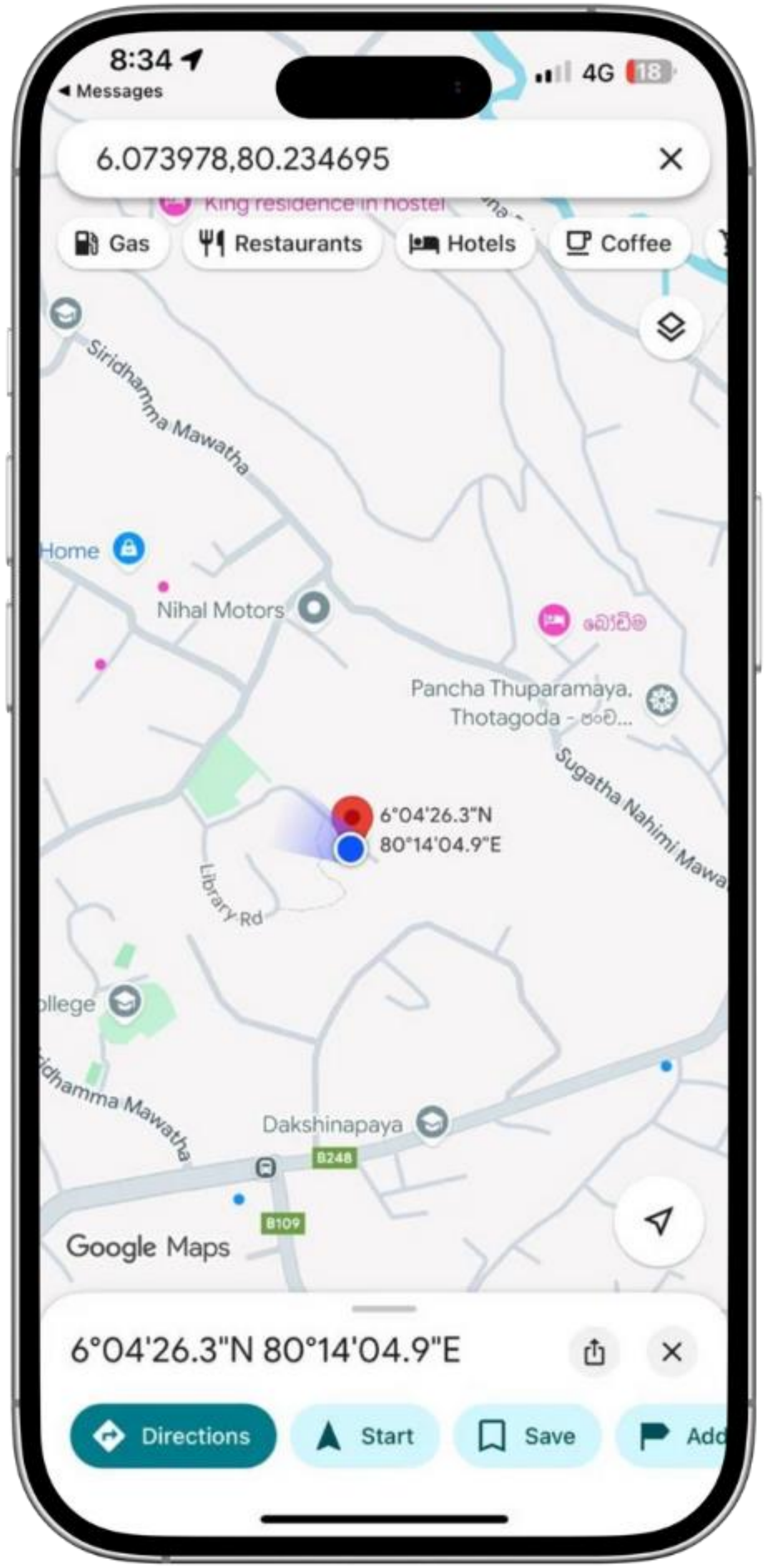
8:34
Messages
4G 18
6.073978,80.234695
King residence in hostel
Gas
Restaurants
Hotels
Coffee
Siridhamma Mawatha
Home
Nihal Motors
Pancha Thuparamaya, Thotagoda
Sugatha Nahimi Mawa
6°04'26.3"N
80°14'04.9"E
Library Rd
llege
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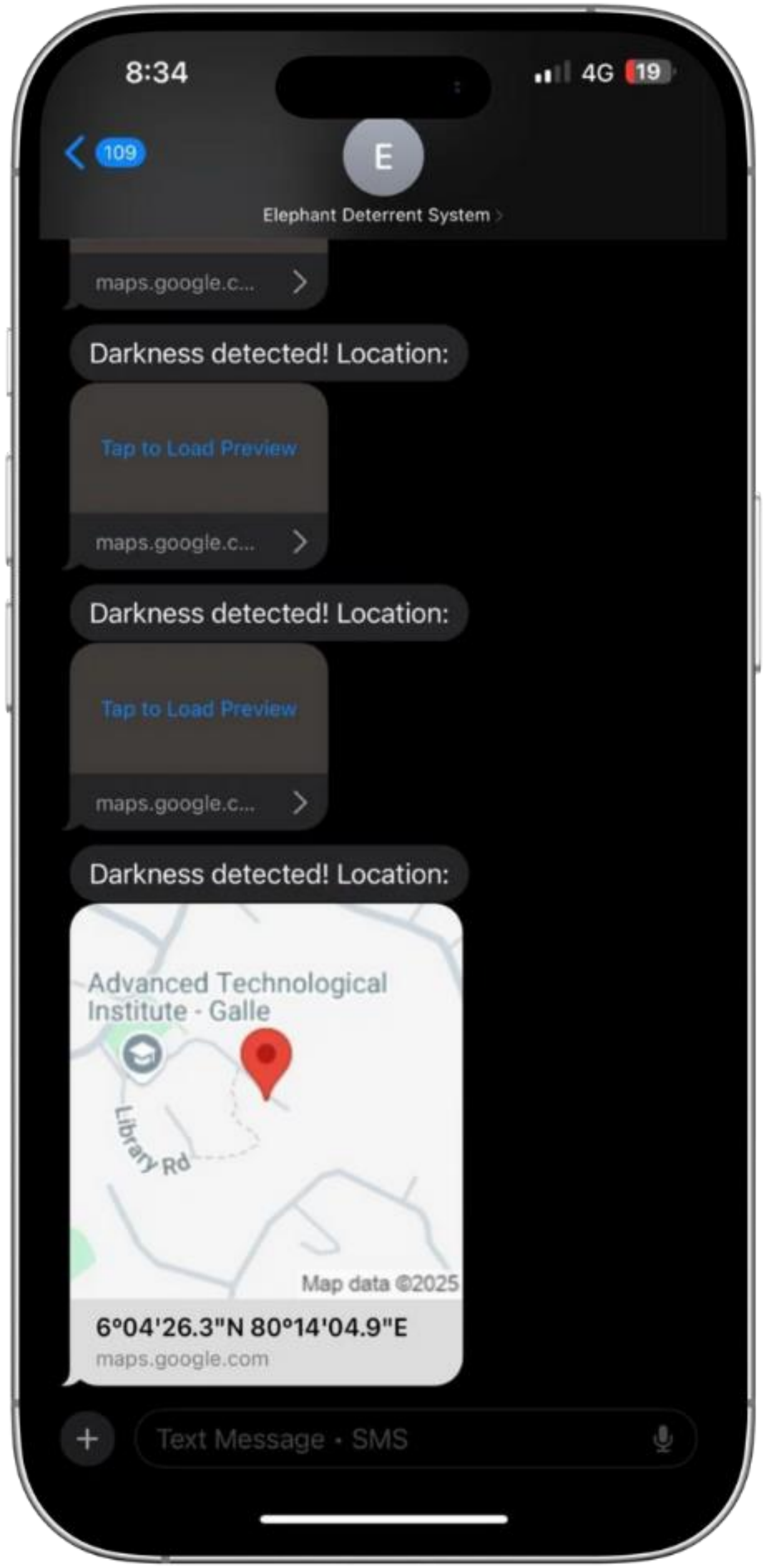
B248
B109
Google Maps
6°04'26.3"N 80°14'04.9"E
Directions
Start
Save
Add


8:34
4G 19
109
E
Elephant Deterrent System
maps.google.c...
Darkness detected! Location:
Tap to Load Preview
maps.google.c...
Darkness detected! Location:
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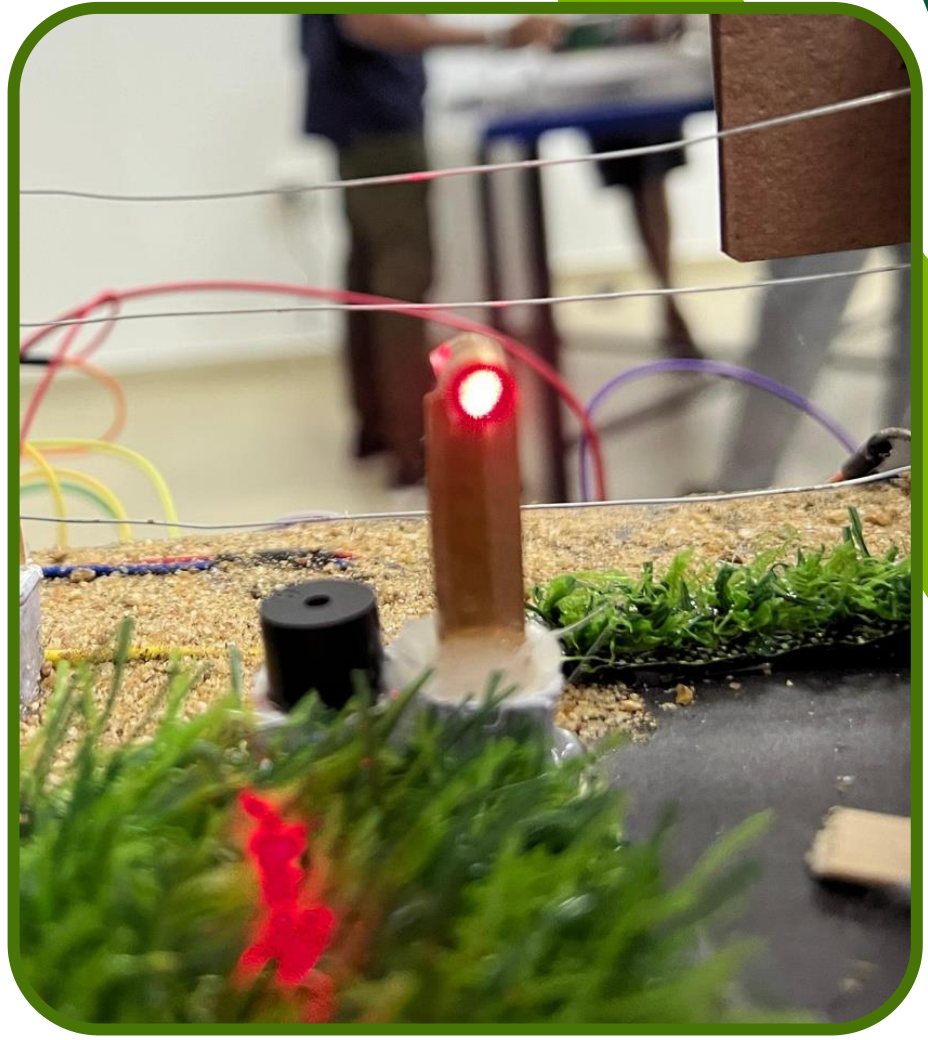
Darkness detected! Location:
Advanced Technological Institute - Galle
Library Rd
Map data ©2025
6°04'26.3"N 80°14'04.9"E
maps.google.com
Text Message · SMS

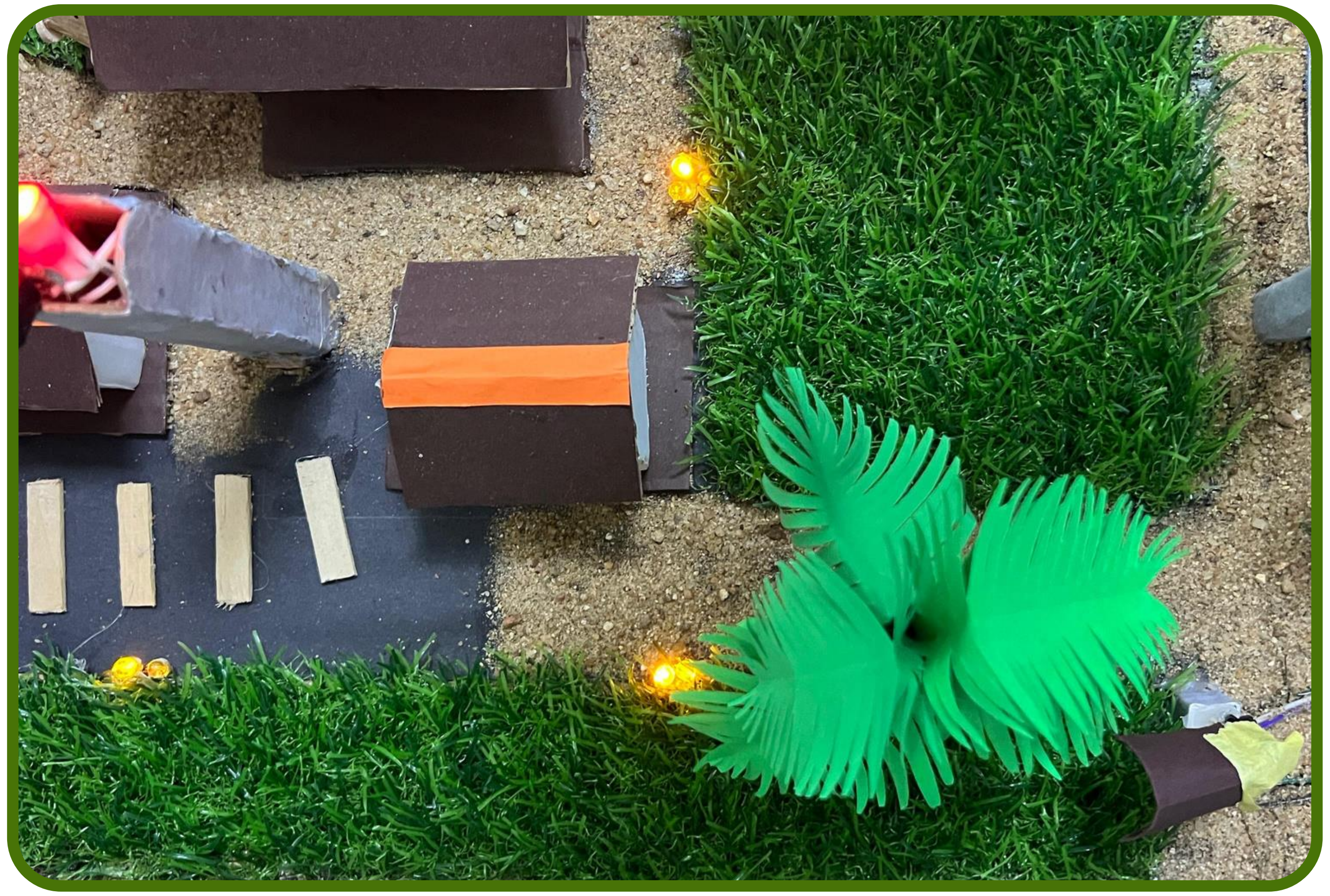

8:35
3G 18
phant Deterrent Syste
Message
Remind Me
Decline
Accept

Methodology

03.Laser 3 (Village Proximity Layer)

- **Purpose:** Final defense near villages/crops.
- **Process:**
  - Laser 3 is placed closer to protected areas (e.g., crops/village boundary). If broken: Activate "Ali Dong" crackers.





Project
Time Plan

Task	Feb	March				April				May					June			
Weeks	1	2	3	4	5	6	7	8	9	10	11	12	19	20	14	15	16	17
Selection Of Project & Preliminary Research																		
Literature Review & Methodology																		
Design & Planning																		
Implementation																		
Testing & Optimization																		
Documentation																		
Final Presentation Preparation																		
Final Presentation & Submission																		
Final Demonstration																		
Project Closure																		

Project Cost Analyze

Serial Number	Components	Quantity	Price
1	Arduino Uno Board	1	2100
2	Arduino Mega Board	1	4350
3	SIM 900A GSM Module	1	2750
4	GPS Module	1	1650
5	Laser Module	3	690
6	LDR	3	195
7	Buzzer	3	195
8	LED	15	75
9	3.7v Battery	2	700
10	5V 2A Adapter	1	650
11	Resisters(10k , 220)	20	20
12	Dot Board, Circuit wire, Lead, Headers.. etc	-	370
13	Other	-	3750
Total			**15985**

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Future Developments

Solar-Powered and Energy -Efficient Upgrades

Integrate solar panels with battery storage to power the system, making it sustainable for remote areas.

- Benefits:
    - Eliminates grid dependency.
    - Reduces operational costs and environmental impact.

CCTV Monitoring with AI-Based Detection

Add IP cameras with edge AI to:

- Visually confirm elephant presence (reducing false alarms).
- Classify elephants vs. other animals using machine learning.
- Record intrusions for analysis.

- **Benefits:**
    - Higher accuracy in detection.
    - Evidence for wildlife conflict studies.

Future Developments

Multi-Sensor Fusion (Advanced Detection)

Combine lasers with:

- Seismic sensors (to detect elephant footsteps).
- Infrared cameras (for night-time detection).
- Acoustic sensors (to identify elephant vocalizations).

- **Benefits:**
  - Redundancy improves reliability.
  - Works in all weather/light conditions.

Mobile App for Real-Time Monitoring

Develop a companion app (Android/iOS) for landowners/wildlife agencies to:

- Receive instant breach alerts with GPS maps.
- View system status (battery, sensor health).
- Remotely activate deterrents (e.g., "Ali Dong" crackers).

- **Benefits:**
  - Improved user engagement and faster response times.

Project
Resources

ARDUINO

PROTEUS

MS OFFICE

References

[1] ResearchGate. (2023). Elephant Deterrent System Using Fiber Bragg Grating (FBG) Sensing Technology.

[2] ResearchGate. (2023). Reducing Human-Elephant Conflict: Do Chillies Help Deter Elephants from Entering Crop Fields?

[3] ResearchGate. (2023). The Human-Elephant Conflict in Sri Lanka: History and Present Status.

[4] ResearchGate. (2023). Automated Virtual Elephant Fence Based on Detection, Alarming, and Coordinated Redirection of Wild Elephants.

[5] ResearchGate. (2023). An Automated Vision-Based Method to Detect Elephants for Mitigation of Human-Elephant Conflicts.

[6] ResearchGate. (2023). A Solution for the Elephant-Human Conflict.

[7] ResearchGate. (2023). IoT-Enabled Smart Elephant Detection System for Combating Human Elephant Conflict.

[8] ResearchGate. (2023). Elephant Intrusion Warning System Using IoT and 6LoWPAN.

Q&A
Session

Open for Questions and Discussion

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Thank You For Your Attention.