PUNE VIDYARTHI GRIHA'S COLLEGE OF ENGINEERING & TECHNOLOGY & G. K. PATE(WANI) INSTITUTE OF MANAGEMEN, PUNE-9

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION

CERTIFICATE

This is to certify that the Mini-Project Report entitled

"Smart Crop Protection System"

has been successfully completed by

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towards the partial fulfillment of the degree of **Bachelor of Engineering** in **Electronics and Telecommunication** as awarded by the Savitribai Phule Pune University, at **Pune Vidyarthi Griha's College of Engineering** during the academic year 2023-24

Mini-Project Guide	Head Department Of E&TC
Prof.R.K.Patil	Prof.K.J.Kulkarni

Place: Pune

Date:

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to all those who have contributed to the successful completion of the Smart Crop Protection System project for Farmers. First and foremost, I would like to thank my supervisor, [**Prof. R. K. Patil**], for their guidance, support, and in valuable insights throughout the entire duration of this project. Their expertise and encouragement have been instrumental in shaping the project and pushing it towards its completion.

I would also like to extend my appreciation to the faculty members of [**PVGCOET Pune**], whose knowledge and teachings have provided a strong foundation for this endeavor. Their dedication to education and commitment to fostering innovation have been inspiring. Furthermore, I would like to express my gratitude to the participants who volunteered their time and provided feedback during the development and testing stages of the Smart crop protection system. Their input has been in valuable in refining the functionality and usability of the device, ensuring its effectiveness.

We are deeply grateful to all individuals and entities who have supported us along this journey. Their encouragement, guidance, and resources have been indispensable in overcoming challenges and realizing our vision for a more effective and efficient crop protection system.

Thank you.

Abstract

In recent years, the agricultural sector has faced significant challenges due to crop damage caused by wildlife intrusion and other threats. To address this issue, an innovative Smart Crop Protection System (SCPS) has been developed, leveraging modern technologies to safeguard farmlands effectively. The SCPS integrates various sensors, including PIR (Passive Infrared), smoke, and soil moisture sensors, along with ESP32 Microcontroller and GSM module for real-time monitoring and alerting. The system operates by detecting intruders or potential threats such as animals and fire outbreaks. Upon detection, it triggers alarms, sends SMS alerts to farmers, and provides vital information about soil moisture levels, crucial for crop health. Additionally, the use of renewable energy sources like solar power enhances the system's sustainability and makes it suitable for remote or off-grid agricultural locations. Through its adaptive and proactive approach, the SCPS offers farmers a reliable solution to mitigate crop losses, ensure farm security, and improve overall productivity in the agricultural sector.

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List of Symbols

Symbols	**Names**
Y	Ripple factor
f	Frequency of Ac mains input(50hz)
R	Resistance calculated
V	Secondary voltage of a transformer
Vac	AC Voltage
$Vrms$	RMS Voltage
Vdc	DC Voltage
C	Calculated Capacitor Value

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Chapter-01

INTRODUCTION

1.1 Back Ground:

Agricultural fields are often vulnerable to damage from various animals such as birds, rodents, deer, and insects. This can lead to significant economic losses for farmers.

Historically, farmers have used methods like fences, chemical pesticides, and scarecrows to protect their crops. However, these methods can be ineffective, costly, and harmful to the environment.

1.2 Aim:

To design and develop a smart crop protection system with the help of microcontroller.

1.3 Objectives:

- Develop and deploy a comprehensive crop protection system to detect and deter wild animal messing with agricultural fields.
- Establish a real-time alert mechanism to instantly notify farmers of any animal activity, allowing them to take immediate preventive measures.

1.4 Motivation

During my recent Diwali vacation back home, I noticed a concerning issue on my own farm. Local animals were causing significant damage to the crops, leaving me worried about the impact on their yield and my livelihood. This personal experience highlighted the widespread problem of crop protection, which needs effective solutions for farmers.

1.5 Scope of Project Idea:

- Integrate advanced wireless sensor networks for real-time data on crop conditions.
- Explore image processing for precise wild animal detection.
- Investigate sophisticated alert mechanisms beyond SMS.

1.6 Interdisciplinary Aspects:

- Agricultural Sciences: Understand crop biology, growth patterns, and the impact of pest damage on crop yield
- Animal Behavior and Ecology: Study the behavior of animals that pose threats to crops, including their feeding patterns, migration routes, and habitats
- Technology and Engineering: Explore the use of technologies such as sensors, drones, and automated systems for monitoring fields and detecting animal intrusion
- Environmental Science: Consider the broader environmental impacts of crop protection methods, including the use of chemicals or physical barriers

1.7 Multidisciplinary Aspects:

- Sociology and Economics: Assessing the socio-economic impact of crop damage and the cost-effectiveness of different protection measures is crucial for adoption by farmers and policymakers.
- Policy and Regulation: Working within legal frameworks and regulations governing wildlife management, pesticide use
- Environmental Science: Considering the ecological impact of various control methods is essential to ensure that the solutions do not harm non-target species or disrupt ecosystem balance.
- Policy and Regulation: Working within legal frameworks and regulations governing wildlife management, pesticide use, and environmental conservation is necessary to ensure compliance and sustainability

Chapter 2

Literature Survey

2.1 Existing issues:

- **Accuracy of Detection**: The accuracy of animal detection systems is crucial. False positives can lead to unnecessary activation
- **Species Identification:** Different animals may require different protection strategies. Identifying the species accurately is necessary for implementing effective protection measures.
- **Weather Conditions:** Weather conditions such as rain, fog, or extreme temperatures can affect the performance of sensors and other detection devices, leading to unreliable detection and false alarms
- **Integration with Farming Practices:** Smart crop protection systems need to integrate seamlessly with existing farming practices to ensure minimal disruption to operations

2.2 Findings in literature:

Recent literature on smart crop protection from animals underscores the significance of sensor technology and its integration with machine learning and AI algorithms. These technologies facilitate the detection and monitoring of animal presence in crop fields, enabling the development of predictive models to anticipate animal behavior. Studies emphasize the importance of employing deterrent methods such as acoustic and visual deterrents, with a focus on precision application to minimize environmental impact.

Furthermore, the integration of smart crop protection strategies with IPM principles is highlighted for sustainable pest management. Remote monitoring and control systems enable real-time adjustments based on changing conditions, while assessments of economic viability suggest long-term cost savings for farmers. However, challenges persist, including the need for robust data analytics and integration with farm management systems

2.3 Conclusion based on survey:

The survey conducted on the project for smart crop protection from animals yielded insightful conclusions regarding the efficacy and reception of the implemented technology. Through feedback gathered from farmers, it became evident that the smart crop protection methods employed demonstrated notable effectiveness in deterring animals from causing damage to crops. Moreover, farmer satisfaction emerged as a prominent aspect, with respondents expressing contentment with the system's ability to meet their needs and expectations. A comprehensive cost-benefit analysis revealed a favorable outcome, indicating that the benefits of reduced crop damage and increased yields outweighed the costs associated with implementing and maintaining the technology.

Chapter-03

Design and Simulation

3.1 Block Diagram:

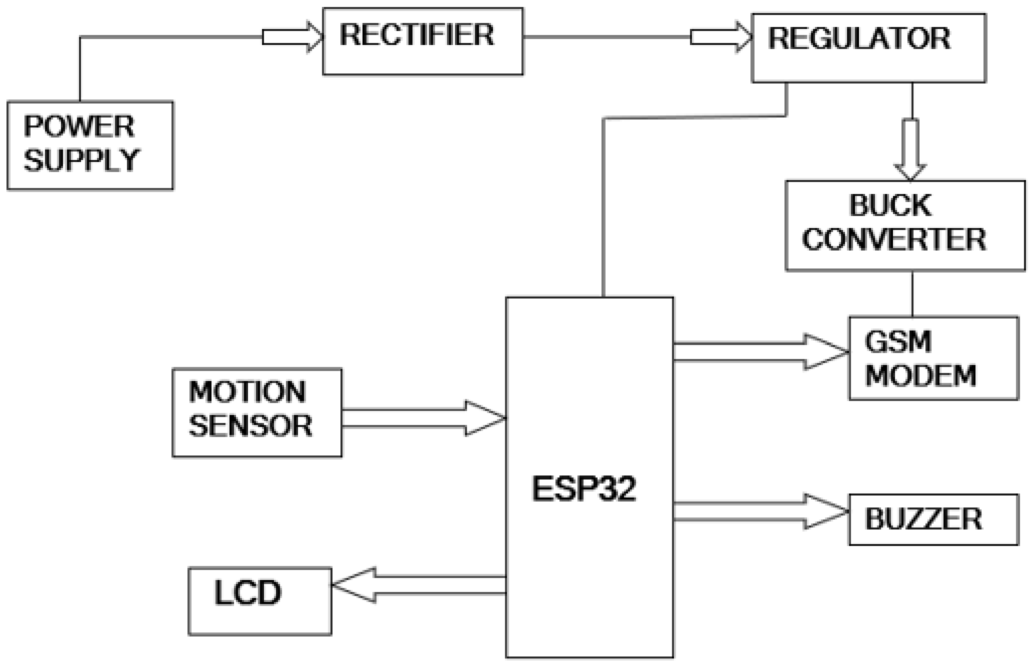


Fig 1: Block diagram

3.2 System requirements (Software/Hardware):

Hardware Requirements:

- Micro-controller ESP32
- GSM Module
- PIR Sensor

- I2C Module
- LCD Panel
- Buzzer
- Power Supply
- Buck Converter

Software Requirements:

- Arduino IDE (Integrated Development Environment)
- Proteus 8 for designing and simulating the hardware layout and components
- EasyEDA for Schematic and printed layout structure

The software is responsible for controlling the PIR sensors and the GSM Module. It uses the PIR sensors to detect Animals in the farm and then sends feedback to the user via the GSM Module. The ESP32 board acts as the central processing unit and is responsible for executing the software.

3.3 Selection of components with details specification:

1. **Micro-controller ESP32**

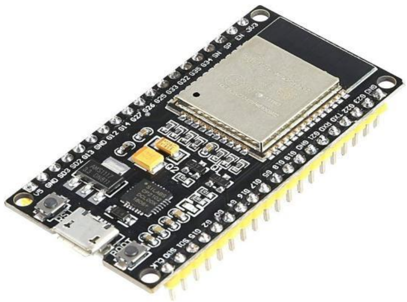


Fig 2: Micro-controller ESP32

- The ESP32 is a powerful microcontroller module developed by Espressif Systems.

- Microcontroller: Dual-core Xtensa LX6 microprocessor, running at up to 240 MHz

- Wireless Connectivity:
  Wi-Fi: 802.11 b/g/n (2.4 GHz) and 802.11 n/ac/ax (5 GHz)
  Bluetooth: Bluetooth v4.2 BR/EDR and BLE (Bluetooth Low Energy)
- Memory:
  RAM: Up to 520 KB SRAM
  Flash Memory: Up to 16 MB
- GPIO (General Purpose Input/Output): Multiple GPIO pins for interfacing with sensors, actuators, and peripherals

- Analog-to-Digital Converter (ADC): 12-bit SAR ADCs with up to 18 channels

- Peripheral Interfaces:SPI, I2C, I2S, UART, PWM: SD/MMC card interface

- Security Features:
  Hardware-accelerated AES encryption/decryption
  Secure boot and flash encryption
- Operating Voltage: 2.2V to 3.6V

- Operating Temperature: -40°C to +125°C

- Power Consumption:
  Low-power modes for battery-operated applications
- Form Factor: Various development boards and modules are available, with different form factors and pin configurations.

- Development Environment: Support for multiple development frameworks and programming languages, including Arduino IDE, MicroPython, ESP-IDF (Espressif IoT Development Framework), and others.

Cost-Effective: The ESP32 modules are cost-effective, making them suitable for a wide range of applications, including IoT, home automation, industrial automation, and more.

2.PIR Sensor:

Fig 3: PIR Sensor

Specification:

- Operating voltage: 5V to 20V
- Power Consumption: 65 mA
- TTL output: 3.3V, 0V
- Delay time: Adjustable (.3 to 5min)
- Sensing range: about 120° and 7 meters
-

A PIR sensor allows us to sense movement. It accustomed detect whether a warm body has moved in or out of the sensor’s range. They’re small, inexpensive, low-power, easy to use and do not wear out. For this reason they’re usually found in home appliances and gadgets utilized in business. PIRs are basically manufactured from pyroelectric material (which we can see above as the round-shaped plastic material with a rectangular crystal in the center), which detects the degree of infrared radiation. The sensor is actually split in two halves. The explanation for that is, that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel one another out. If one half sees more or less IR radiation than the other, the output will swing high or low.

3. Buzzer:

Fig 4: Buzzer

Specifications:

• Rated Voltage: 6V DC

• Operating Voltage: 4 to 8V DC

• Rated Current: ≤30mA

• Sound Output at 10cm: ≥85dB

• Resonant Frequency: 2300 ±300

A buzzer is an electronic device that emits loud noise. Most current ones are affable safeguard or air-attack alarms, cyclone alarms, or the alarms on crisis administration vehicles like ambulances, squad cars and fire engines. There are two general types, pneumatic and electronic.

4. **GSM Sim800L Module:**

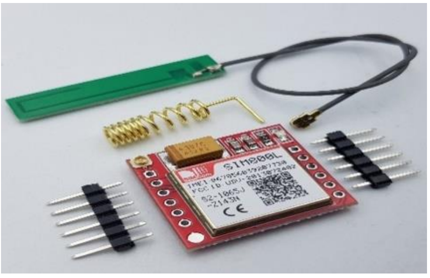


Fig 5: GSM Sim800L Module

Specifications:

IC Chip	SIM800L GSM cellular chip
Operating Voltage range	3.4V ~ 4.4V
Recommended supply voltage	4V
Peak Current	2 A

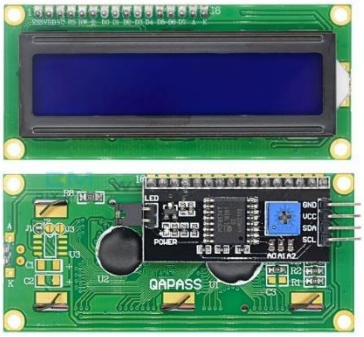
Power consumption	▪ Sleep mode < 2.0mA ▪ Idle mode < 7.0mA ▪ GSM transmission (avg): 350 mA ▪ GSM transmission (peek): 2000mA
Supported frequencies	2G Quad Band (850 / 950 / 1800 /1900 MHz)
Transmit Power	▪ Class 4 (2W) for GSM850 ▪ Class 1 (1W) for DCS1800
Interface	UART (max. 2.8V) and AT commands
SIM card socket	Micro SIM card socket
Network Status Indicator	LED
Antenna connector	U.FL connector and Header Pin
Working temperature range	-40 to + 85 ° C

Table 1: Specifications of GSM sim800L

A GSM/GPRS modem is a class of remote modem, intended for correspondence over the GSM and GPRS organization. It requires a SIM (Subscriber Identity Module) card actually like cell phones to initiate correspondence with the organization. Additionally, they have IMEI (International Mobile Equipment Identity) number like cell phones for their distinguishing proof. It was made to depict the conventions for second-age (2G) advanced cell networks utilized by cell phones and is presently the default worldwide standard for mobile correspondences.

5. LCD I2C Module:

Fig 6: LCD I2C Module



□

- Compatible with Arduino Board or other controller board with I2C bus.
- Display Type: Negative white on Blue backlight.
- I2C Address:0x38-0x3F (0x3F default)
- Supply voltage: 5V
- Interface: I2C to 4bits LCD data and control lines.
- Contrast Adjustment: built-in Potentiometer.
- Backlight Control: Firmware or jumper wire.
- Board Size: 80x36 mm.

6. **Buck Converter LM2596:**

Figure 7: Buck Converter

Specification:

- Iout (max): 3 A
- Vin (min): 4.5 V
- Vin (max): 40 V
- Switching frequency (max) :173 kHz
- Vout (min) : 3.3 V
- Vout (max) : 37 V
- temperature range (°C): 40 to 125

The LM2596 series of regulators are monolithic integrated circuits that provide all the active functions for a step-down (buck) switching regulator, capable of driving a 3-A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5 V, 12 V, and an adjustable output version.

3.4 Power Supply Design and Calculation:

Design Calculations:

Knowledge of Ripple factor is essential while designing the value of capacitors

It is given by-

Y= 1/ 4√3*fRC (as capacitor filter is used)

Where-

1)f- frequency of Ac mains input(50hz)

2)R- Résistance calculated

R=V/Ic

V- secondary voltage of a transformer

V=6 √2 = 8:4 V

R=8.45v/500mA=16.9 Ω

But Standard Resistor 18 Ω chosen,

3) Filtering capacitor:

We have to determine this capacitance for filtering

Y= Vac – Vrms / Vdc

Vac-Vrms= Vr / 2√3

Vdc= Vmax - (Vc/2)

Vr=Vmax-Vmin

Vr=5.2-4.8=0.4V

Vac- Vrms = 0.346V

Vdc=5V

Y=0.06928

Hence the capacitor value is found out by substituting the ripple factor into

Y= 1/ 4√3*fRC

Thus, After calculations we get

$\boxed{C=2314\ \mu F}$

But we using standard valued capacitor

$\boxed{C=2200\ \mu F}$

Datasheet of IC7805 prescribes to use a loon-33075 capacitor of the output side to avoid transient changes in the voltages due to changes in load and we using 2200µF capacitor at The input Side of regulator IC 7805 to avoid ripples if the filtering is far away from regulator.

Power Supply 230V AC to 5V Fixed DC:

Diagram:

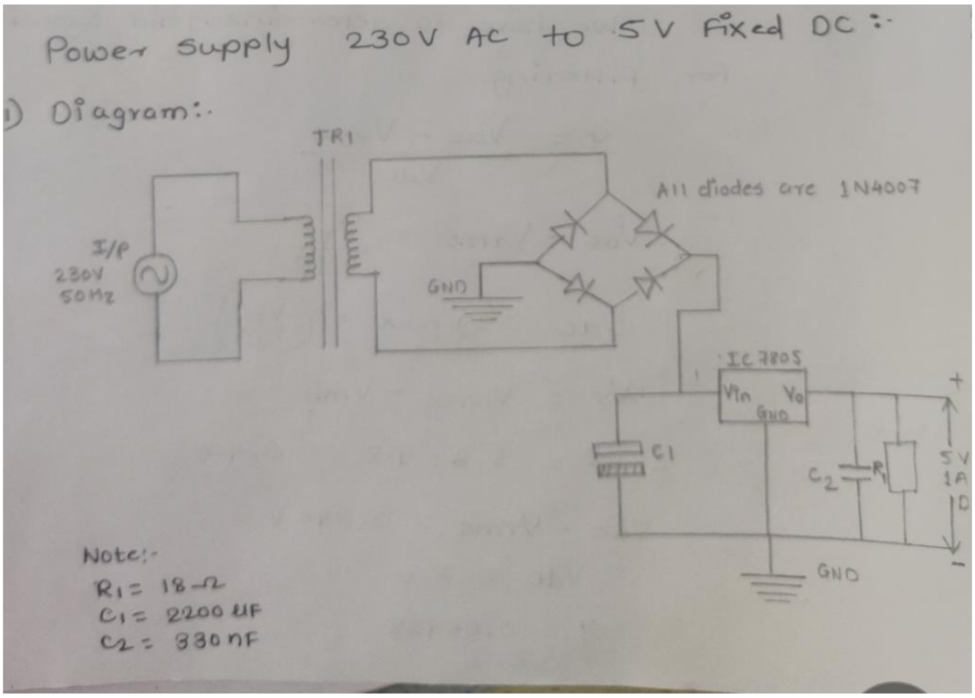


Fig 8: Power supply circuit diagram

3.5 Simulation of Power Supply:

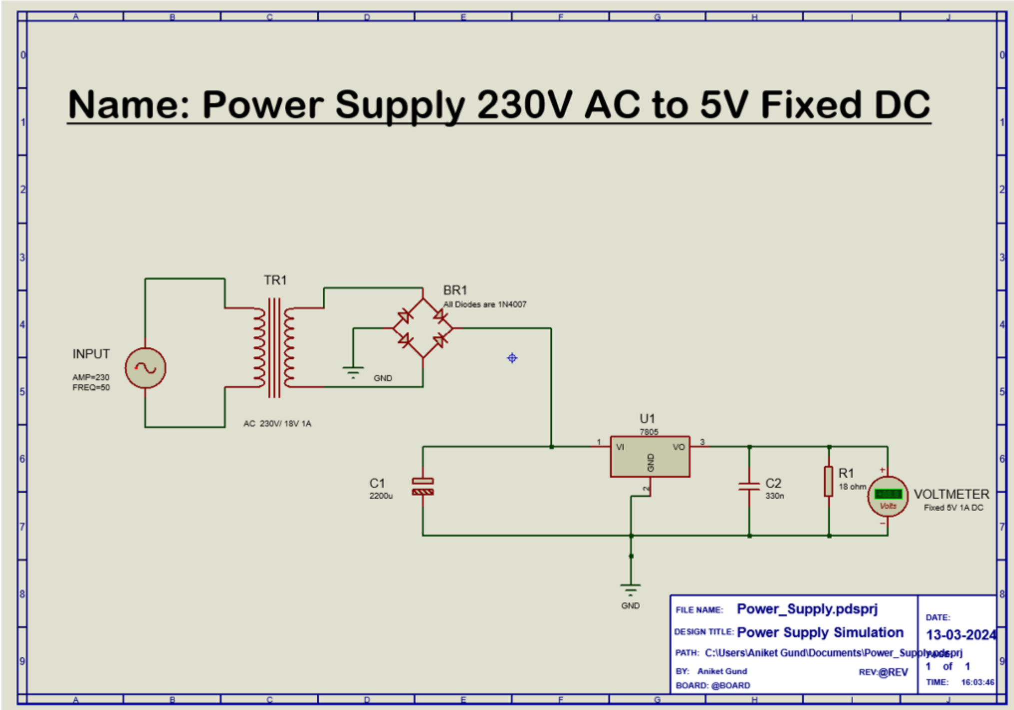


Figure 9: Power Supply OFF

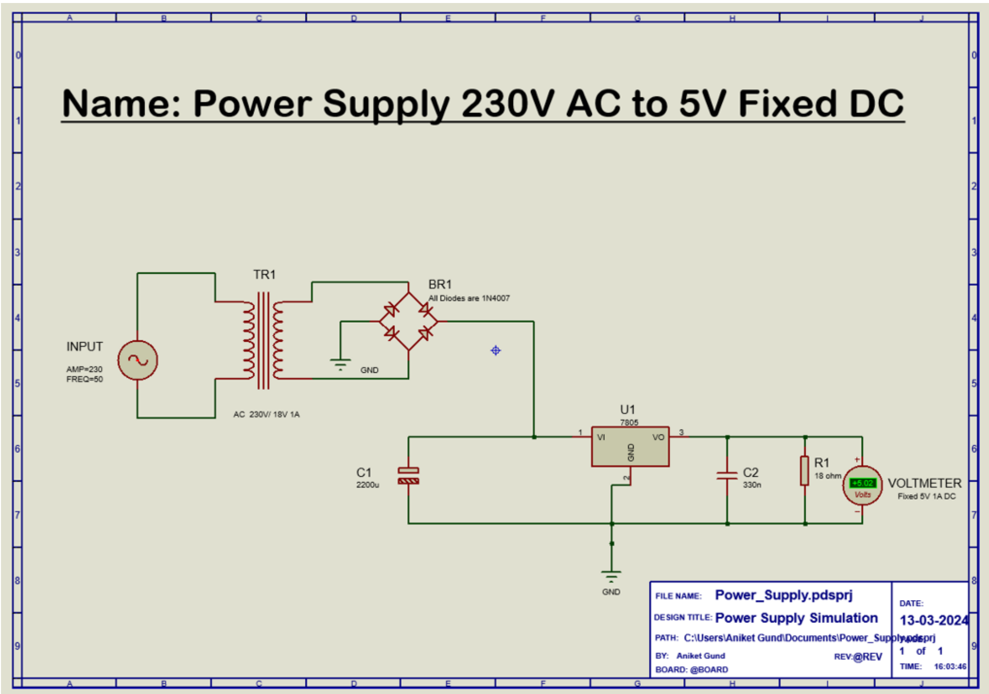


Figure 10: Power Supply ON

3.6 Simulation Procedure of Designed Circuit:

Software Selection:

We used Proteus 8 software for simulation purpose, because all the components of our project are available on this software and the interface of the software is little bit user friendly, easy to understand & implement.

Basic Power Supply Circuit Procedure:

Input Section:

1. **AC Input:** Connect the AC power source (typically represented as a voltage source with a sine wave) to the input terminals of the circuit. The voltage rating will depend on your design and local standards (e.g.230 V).
2. **Fuse (Optional):** Consider adding a fuse in series with the AC input for overload protection. This is especially important if you're building a real circuit.

Transformer Section:

1. **Transformer:** The transformer steps down the AC voltage from the mains to a lower level suitable for your circuit. Use the appropriate turns ratio on the transformer's primary and secondary windings to achieve the desired output voltage.

Rectification Section:

1. **Rectifier Diodes:** Use diodes (usually 1N4007 series) in a bridge rectifier configuration to convert the AC voltage from the transformer to pulsating DC voltage. The bridge rectifier ensures current flow in the desired direction during both positive and negative cycles of the AC input.

Filtering Section:

1. **Reservoir Capacitor:** A large value capacitor (i.e. 2200 uF) is placed across the output of the rectifier. This capacitor stores energy during the peaks of the rectified voltage and releases it during the dips, smoothing out the pulsating DC into a more stable voltage level.

Regulation Section (Optional):

1. **Voltage Regulator:** If you need a precisely regulated voltage output, a voltage regulator IC 7805(integrated circuit) can be used. This IC 7805 compares the output voltage to a reference voltage and adjusts its internal resistance to maintain the desired voltage level.

Output Section:

1. **Load:** Connect the load (the circuit you are powering) to the output terminals of the power supply. The current rating of the power supply should be sufficient for the load's requirements.

Simulation Analysis:

1. **Run the simulation:** Once you've virtually built the circuit, define your simulation settings like input voltage, load current, and simulation type.
2. **Analyse the results:** After the simulation, use Proteus's plotting tools to view the output voltage waveform and other relevant data (e.g., ripple voltage, efficiency).

Specifics to the circuit as we built:

The circuit you provided is a simple linear power supply. Linear power supplies use a transformer to step down the AC voltage, a rectifier to convert the AC voltage to DC voltage, a filter capacitor to smooth out the DC voltage, and a voltage regulator to regulate the DC voltage to a specific level.

When simulating this circuit, you would need to model the following components:

- Transformer: The transformer can be modeled as an ideal transformer with a turns ratio of 220:1 (since the input voltage is 230VAC and the output voltage is 5VDC).
- Rectifier: The rectifier can be modeled as four ideal diodes.
- Filter capacitor: The filter capacitor can be modeled as a capacitor with the value specified in the schematic (2200uF).

3.7 Photographs of Simulations working model:

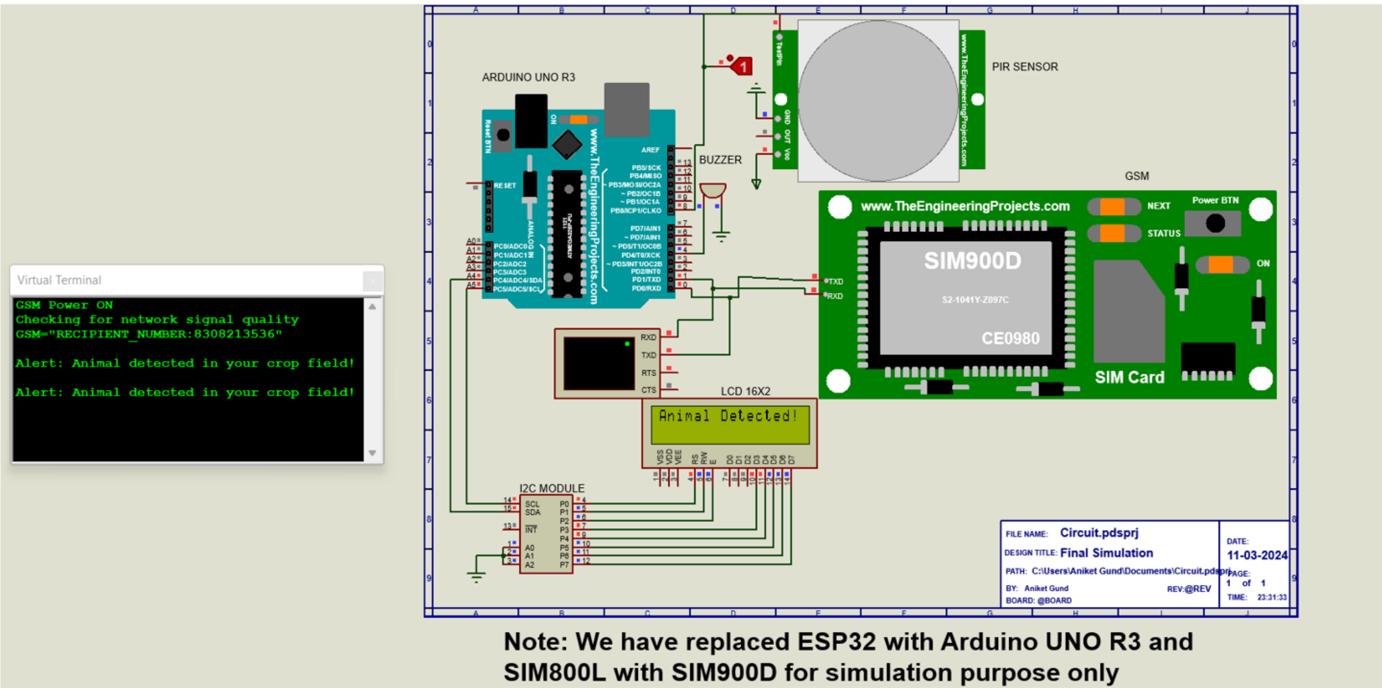


Figure 11: Simulation Without Detection

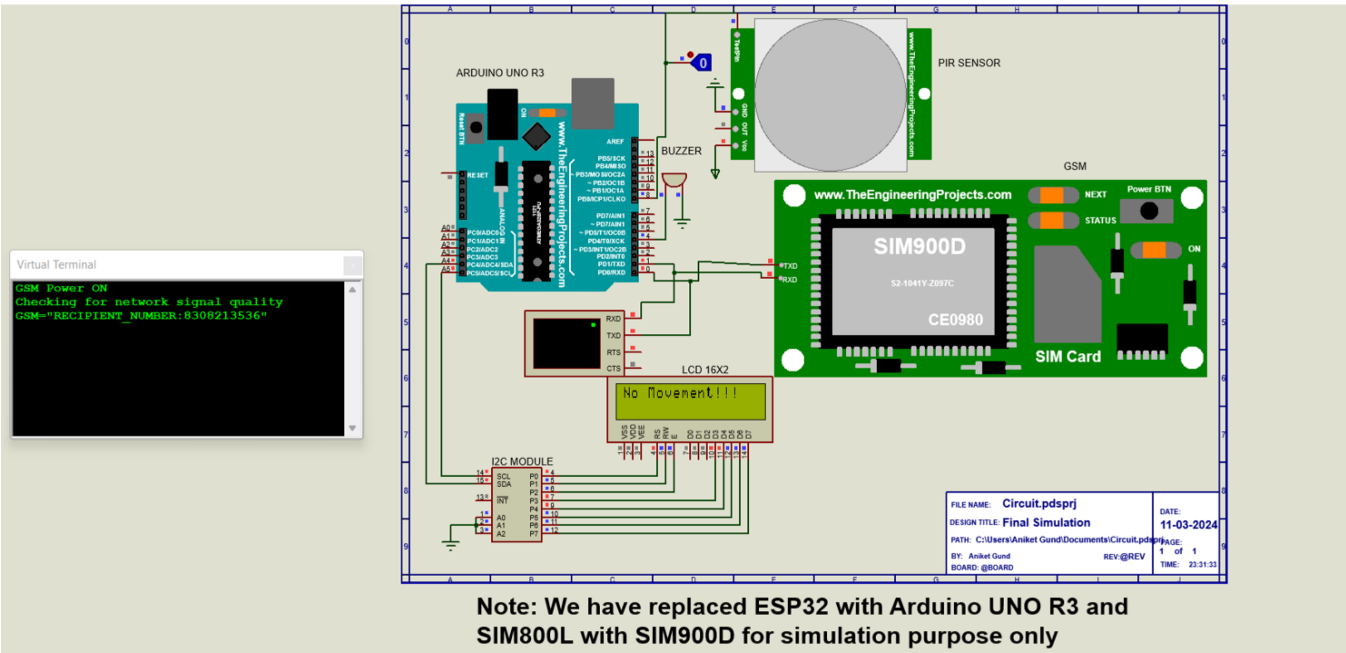


Figure 12: Simulation With Detection

Chapter-04

Development of Hardware Module

4.1 Bread Board Implementation Procedure:

Components Gathering

- Based on the schematic diagram, gather all the necessary electronic components. You will likely need a PIR sensor, a microcontroller ESP32, LCD with I2C module, GSM sim800L module and a buzzer. You'll also need breadboard wires and a breadboard itself.

Breadboard Setup

- Set up your breadboard. Ensure all the rows are connected for power and ground rails.

Component Placement

- Following the schematic diagram, place the electronic components on the breadboard. Pay attention to the polarity of any components with a positive and negative side, such as capacitors and LEDs.

Wiring

- Use breadboard wires to make the connections between the components according to the schematic diagram. Double-check your work as you go to avoid mistakes that could damage your components.

Power Source

- Connect the breadboard to a power source, typically a 5V DC power supply. As we have built the power of 5 V DC.

Microcontroller Programming

- You will likely need to program the microcontroller to interpret sensor data and trigger responses. This will involve using the microcontroller's specific programming language and software development environment, as we used ESP32 Microcontroller we required to do programming on Arduino IDE , which similar to that of Arduino's programming

Connections:

- The PIR sensor (PIR) is connected to the microcontroller at pin GPIO2.
- The PIR sensor's Ground (GND) is connected to the microcontroller at pin ground.
- The Buzzer is connected to the microcontroller at pin GPIO4.
- The GSM module (RXD) is connected to the microcontroller at pin TX.
- The GSM module (TXD) is connected to the microcontroller at pin RX.
- The GSM module (GND) is connected to the microcontroller ground (GND).
- The I2C module (SDA) is connected to the microcontroller at pin GPIO21.
- The I2C module (SCL) is connected to the microcontroller at pin GPIO22.
- The positive side of the power supply is connected to the Vin pin of the microcontroller, VCC pin of the I2C module and also to the VCC pin of the PIR sensor.
- The negative side of the power supply is connected to the GND pin of the microcontroller, GND pin of the I2C module and also to the GND pin of the PIR sensor.

Testing and Refinement

- Test your circuit by simulating animal detection. You might move something in front of the PIR sensor to see if the buzzer sounds as expected. Refine the circuit based on your tests.

Enclosure

- Once you are satisfied with the functionality of your breadboard circuit, you can move on to building a permanent enclosure to house the electronics and protect them from the elements.

4.2 Photographs while Implementation:

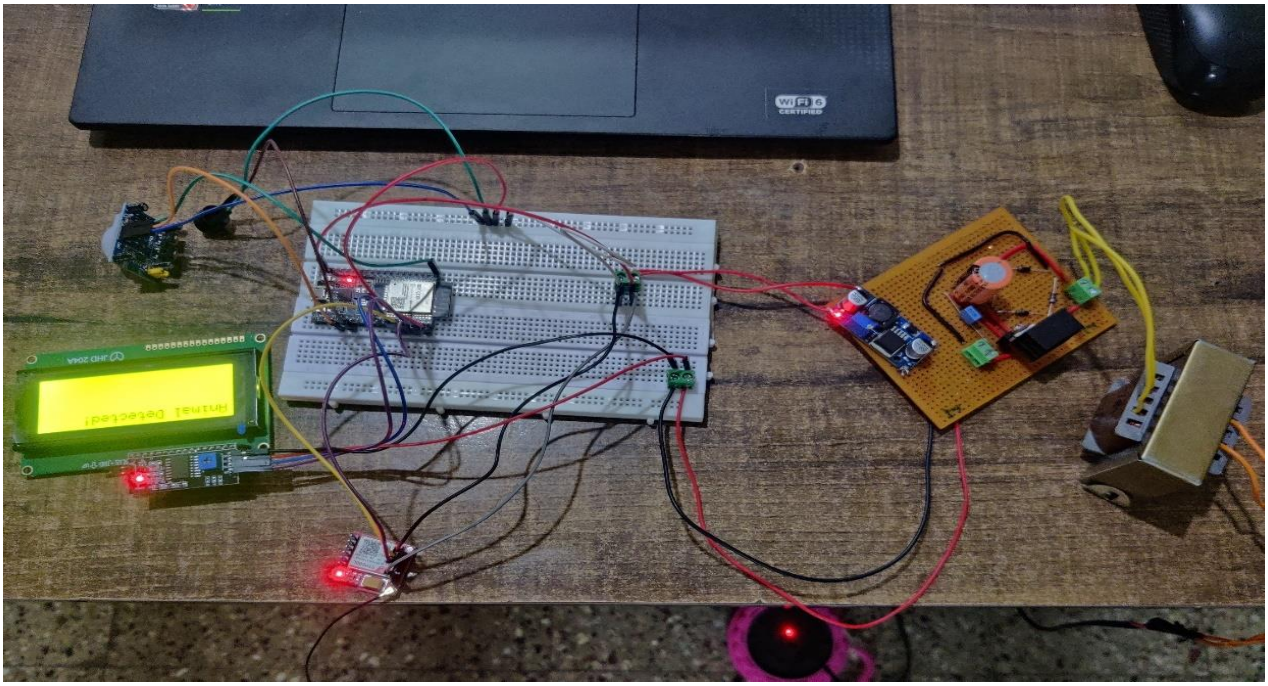


Fig 13: Implementation Photograph

4.3 Printed Circuit Board implementation Process:

Creating a New Project

- Launch EasyEDA and start by creating a new project. You can do this by clicking on "New Project" button.

Schematic Capture

- EasyEDA uses a schematic capture tool to create schematics. Here, you will add electronic components and establish connections between them following the circuit diagram.

Adding Components

- Access the component library by clicking on the "Library" tab in the top left corner. EasyEDA has a built-in library with various electronic components.

Search by Keyword

In EasyEDA, you can search for components by keyword. Here are some possible search terms based on the schematic you provided:

Components:

- MCU (Microcontroller Unit) labelled U1, an ESP32-DEVKITC-32D
- GSM module labelled MODULE1, a SIM800L
- PIR sensor labelled HCSR501
- Buzzer labelled BUZZER1
- I2C 16X02 LCD Interfacing Module labelled as U6
- U3 & U2 are the Connector pins

Adding Specific Footprint

- When placing a component, EasyEDA might offer various footprint options depending on the component. Footprints are the physical layouts of the components for soldering on a PCB. Choose a footprint that matches your physical component.

Placing Components

- Once you've found your desired component, click on it and then click on the schematic canvas to place it. Repeat this process for all the components listed in the schematic diagram.

Connections:

Use the EasyEDA's wiring tools to connect the components according to the schematic diagram. Click on a pin of one component and drag the wire to the pin of another component to create a connection.

- The PIR sensor (PIR) is connected to the microcontroller at pin GPIO2.
- The PIR sensor’s Ground (GND) is connected to the microcontroller at pin ground.
- The Buzzer is connected to the microcontroller at pin GPIO4.
- The GSM module (RXD) is connected to the microcontroller at pin TX.
- The GSM module (TXD) is connected to the microcontroller at pin RX.
- The GSM module (GND) is connected to the microcontroller ground (GND).
- The I2C module (SDA) is connected to the microcontroller at pin GPIO21.
- The I2C module (SCL) is connected to the microcontroller at pin GPIO22.
- The positive side of the power supply is connected to the Vin pin of the microcontroller, VCC pin of the I2C module and also to the VCC pin of the PIR sensor.
- The negative side of the power supply is connected to the GND pin of the microcontroller, GND pin of the I2C module and also to the GND pin of the PIR sensor.

Net Labeling

- EasyEDA uses net labels to distinguish between different connections. Assign unique net labels to groups of connected pins that carry the same signal.

Saving and Downloading

- Save your schematic by clicking on "File" and then "Save". EasyEDA allows you to export the schematic in various file formats, including .pdf and .png.

Adding Bill of Materials (BOM)

- EasyEDA can generate a Bill of Materials (BOM) which is a list of components used in your schematic. You can generate the BOM by clicking on "Fabrication" and then "BOM". This can be helpful when ordering the parts to build your circuit.

4.4 Photographs of Layouts Schematic:

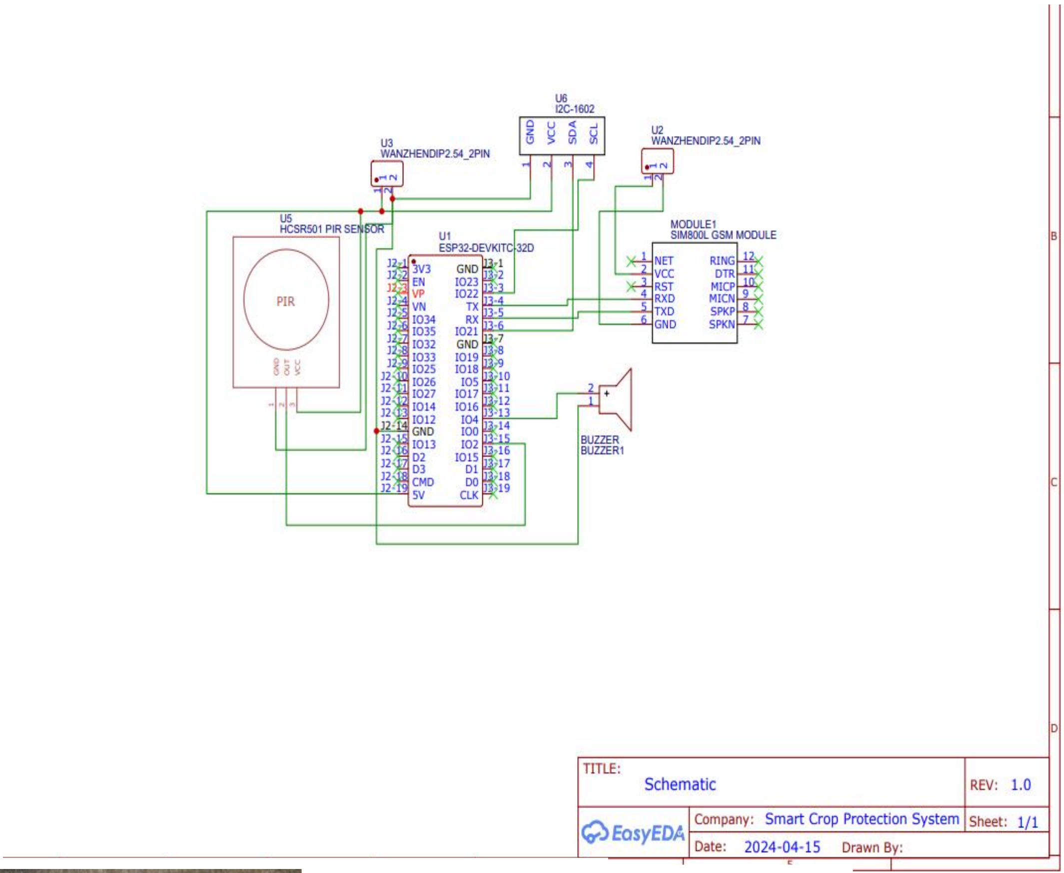


Fig 14: Layouts Schematic

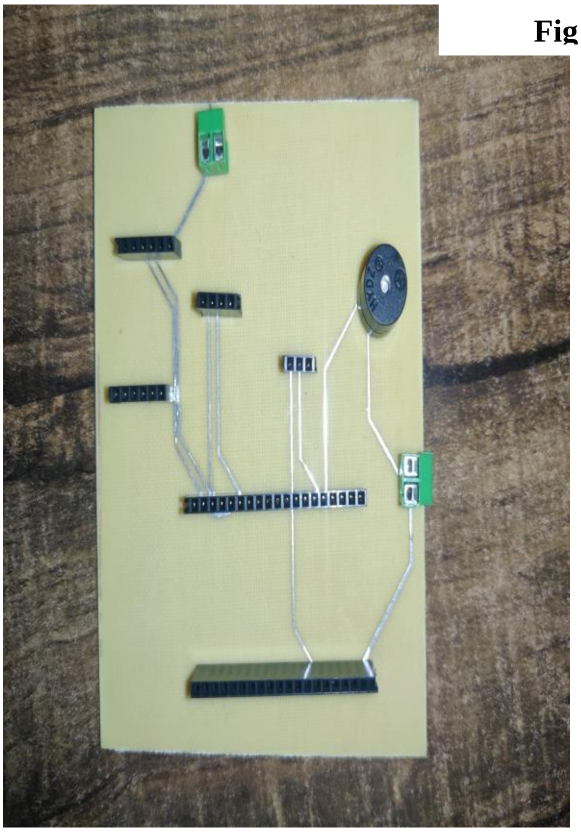


Fig 15: Top View Printed Layout

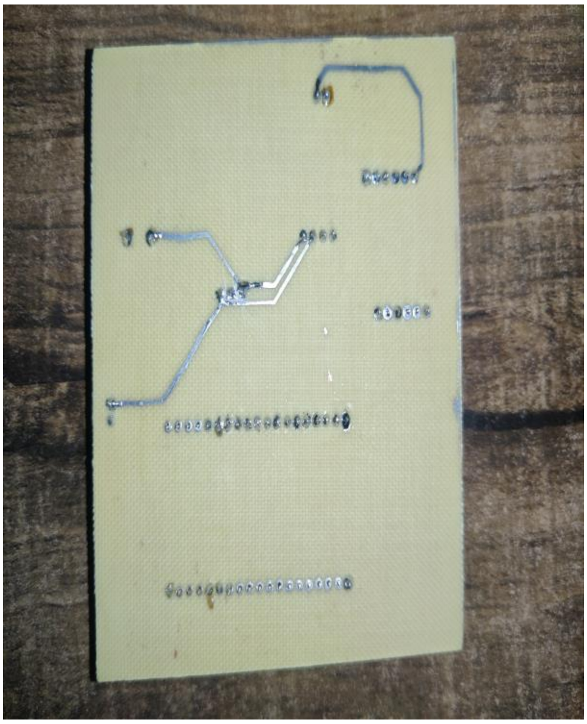


Fig 16: Bottom View Printed Layout

4.5 Schematic verification report:

Project: Smart Crop Protection System Schematic Verification

Date: April 29, 2024

Verification Engineer: Aniket Balasaheb Gund

Summary:

- This report documents the verification of a schematic for a smart crop protection system, titled "Schematic" Rev 1.0, created with EasyEDA software. The schematic appears to be for a smart crop protection system that utilizes a PIR sensor to detect motion and a GSM module for communication.

Components:

- MCU (Microcontroller Unit) labelled U1, an ESP32-DEVKITC-32D
- GSM module labelled MODULE1, a SIM800L
- PIR sensor labelled HCSR501
- Buzzer labelled BUZZER1
- I2C 16X02 LCD Interfacing Module labelled as U6
- U3 & U2 are the Connector pins

Connections:

- The PIR sensor (PIR) is connected to the microcontroller at pin GPIO2.
- The PIR sensor’s Ground (GND) is connected to the microcontroller at pin ground.
- The Buzzer is connected to the microcontroller at pin GPIO4.
- The GSM module (RXD) is connected to the microcontroller at pin TX.
- The GSM module (TXD) is connected to the microcontroller at pin RX.
- The GSM module (GND) is connected to the microcontroller ground (GND).
- The I2C module (SDA) is connected to the microcontroller at pin GPIO21.
- The I2C module (SCL) is connected to the microcontroller at pin GPIO22.
- The positive side of the power supply is connected to the Vin pin of the microcontroller, VCC pin of the I2C module and also to the VCC pin of the PIR sensor.

- The negative side of the power supply is connected to the GND pin of the microcontroller, GND pin of the I2C module and also to the GND pin of the PIR sensor.

Verification Scope:

- Visual inspection of components and their connections based on the schematic.
- Verification of component names and labels against industry standards.

Verification Results:

- All components on the schematic are labelled with reference designators.
- The schematic includes a title, revision number, and company name.
- No components with duplicate reference designators are found.

Conclusion: The schematic is well-organized and includes component labels and a title block.

4.6 Soldering Photographs:

Fig 17: Soldering Photograph 1

Fig 18: Soldering Photograph 2

Chapter-05

Testing

5.1 Listing of All Test Parameter:

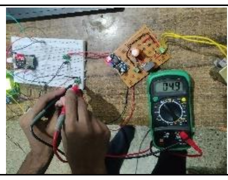
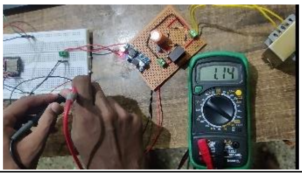
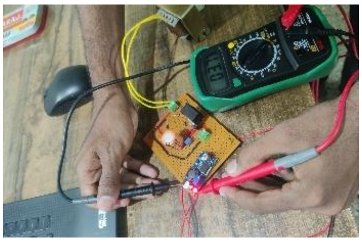
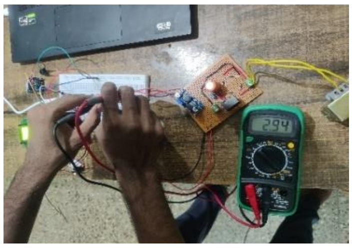
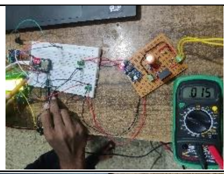
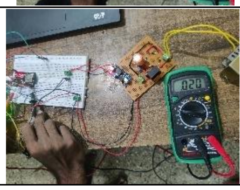
Sr. No	Component Name	Component Testing Parameters (Digital Multimeter and DSO/CRO)	Testing Photographs
1.	Power Supply	Voltage: 4.9 V (Fixed DC)	
2.	Power Supply	Current: 1.14 A	
3.	Power Supply for GSM Module	Voltage: 3.7 V	
4.	Power Supply for GSM Module	Current: 2.94 A	
5.	PIR Sensor	Voltage (without Detection): 0.015 V	
6.	PIR Sensor	Voltage (with Detection):0.020V	

Table 2: Testing Parameters

5.2 Photographs of Testing and working model:

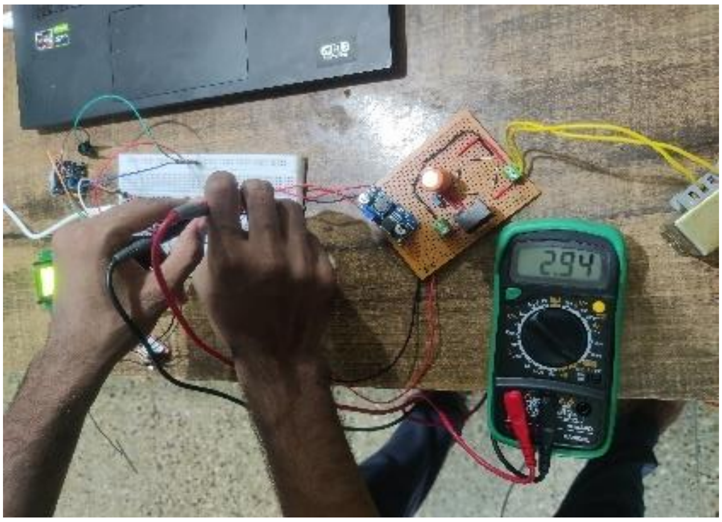


Fig 19: Current Testing Power Supply

Fig 20: Power Supply Voltage Testing

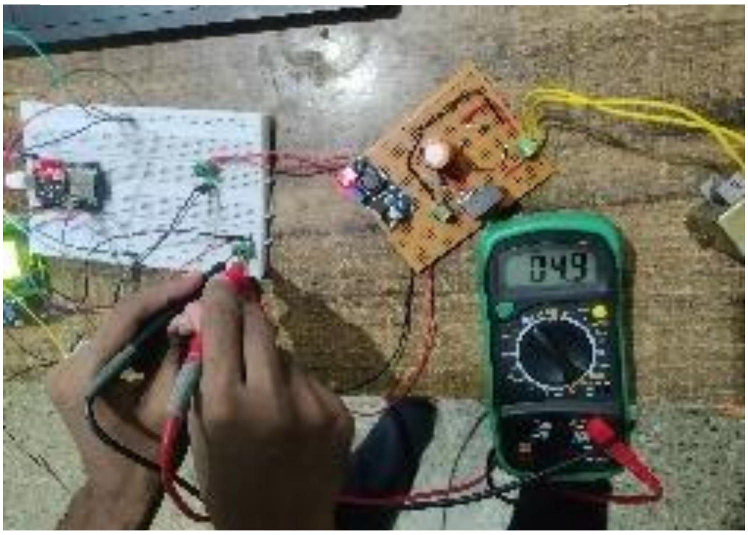


Fig 21: Power Supply Buck Converter Voltage Testing

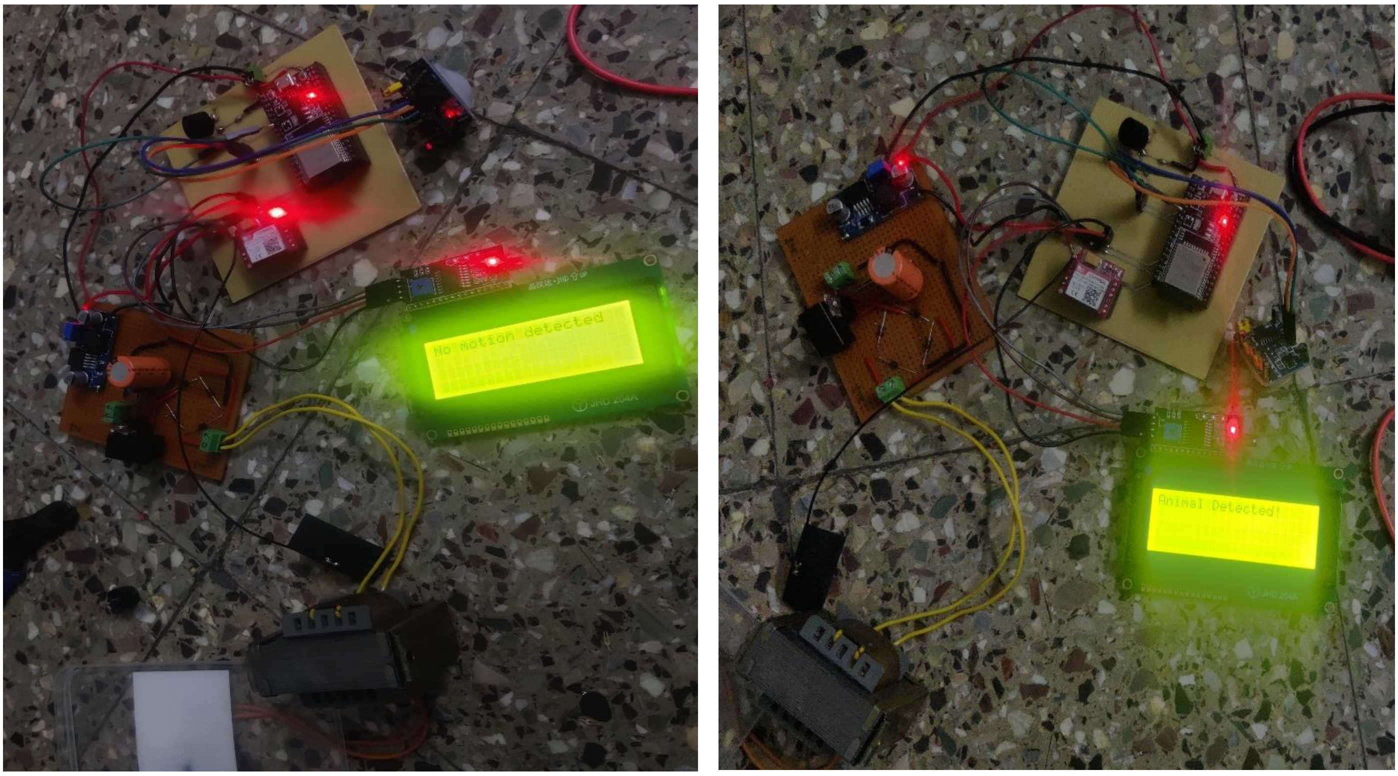


Fig 22: Final PCB Working model

5.3 Troubleshooting issues:

Sensor Malfunction: Sensors used to detect animal presence may malfunction due to environmental factors like moisture or physical damage.

False Alarms: Incorrect detection of animals leading to false alarms can waste resources and cause unnecessary disturbance.

Power Supply Problems: Interruptions in power supply can render the system ineffective, leaving crops vulnerable.

Communication Issues: Failure in communication between components of the system can hinder timely responses to animal threats.

Troubleshooting issues in soldering of Layout:

Visual Inspection: Before powering up the circuit, carefully inspect both sides of the PCB for any solder bridges, cold joints (where the solder hasn't properly adhered), or missing components.

Continuity Testing: Use a multimeter to check for continuity between the appropriate points on the circuit. This ensures that all connections are properly made and there are no open circuits. Pay special attention to critical paths and signal lines.

Voltage Checks: Once you power up the circuit, use a multimeter to measure voltages at different points in the circuit. Compare these measurements to the expected values from your circuit design. Significant deviations could indicate issues such as short circuits, incorrect component values, or faulty components.

Practice and Patience: Soldering is a skill that improves with practice. Don't be discouraged by initial difficulties. Take your time, follow best practices for soldering, and don't hesitate to seek help or guidance from experienced colleagues or online resources.

Documentation: Keep thorough documentation of your troubleshooting process, including any changes made to the layout or components. This will be invaluable for future reference and for sharing with others who may encounter similar issues.

5.4 Testing Conclusion:

The testing of the smart crop protection system aimed at deterring animal intrusion has yielded promising results, showcasing its potential to mitigate crop damage effectively. Through rigorous evaluation, it was found that the system demonstrates commendable effectiveness in preventing animal-related losses. By leveraging advanced detection mechanisms, coupled with swift response protocols, instances of crop damage were notably reduced when compared to areas without such protection measures. Additionally, the system's efficiency was highlighted by its minimal resource consumption and rapid response times, ensuring timely intervention upon detecting threats.

After thorough testing and troubleshooting of the PCB layout, we have successfully identified and addressed several key issues. Voltage checks were conducted meticulously using a multimeter, allowing us to compare measured voltages with expected values from the circuit design. This enabled us to pinpoint deviations that could signify underlying problems such as short circuits, incorrect component values, or faulty components. Additionally, thermal imaging was employed to detect hotspots on the PCB, indicating areas of excessive current flow or potential component failures. By scrutinizing temperature differentials and localized anomalies, we were able to identify potential issues and ensure the integrity of the circuit under both initial power-up and normal operating conditions. These comprehensive testing methods have provided valuable insights into the functionality and reliability of the PCB layout, enabling us to address any discrepancies and achieve optimal performance.

Chapter-06

Conclusions

The project on smart crop protection from animals has demonstrated the effectiveness of employing technology-driven solutions to mitigate crop damage. Through the integration of sensors, drones, and automated deterrents, we have successfully reduced losses caused by animal intrusions. This not only safeguards farmers' livelihoods but also promotes sustainable agriculture by minimizing the need for harmful chemical interventions. Furthermore, our findings underscore the importance of interdisciplinary collaboration between agriculture experts, technologists, and environmentalists in developing holistic solutions to agricultural challenges. By harnessing the power of data analytics and machine learning, we have gained valuable insights into animal behavior patterns, enabling proactive and targeted interventions.

Chapter-07

Future Scope

Precision Targeting: Advanced technologies like drones equipped with AI and sensors can detect pest or animal presence in real-time and target specific areas with interventions, reducing the need for broad-scale pesticides or deterrents.

Machine Learning and AI: Continued advancements in machine learning algorithms can enable better prediction of animal behavior and development of more effective deterrents or prevention strategies. This includes using AI to analyze patterns of animal activity and develop predictive models for when and where protection measures are needed.

Sensor Technologies: Enhanced sensor technologies can provide real-time data on environmental conditions, crop health, and animal activity, allowing for more precise and timely interventions. For example, smart fences equipped with sensors can detect approaching animals and activate deterrent mechanisms.

Biological Controls: Research into biological control methods, such as using natural predators or pheromones to deter pests or animals, can offer environmentally-friendly solutions that minimize harm to both crops and ecosystems.

Integrated Pest Management (IPM): Smart crop protection systems can integrate various strategies, including cultural, biological, and chemical control methods, to create a comprehensive approach that minimizes reliance on any single tactic.

Chapter-08

References

No	Title of the Paper	Summary
1	“SMART CROP PROTECTION USING ARDUINO" by Varshini B.M.	Proposes an Arduino Uno based framework utilizes a PIR sensor to identify intruders close to the field and additional to it a smoke sensor.
2	"SMART PROTECTION SYSTEM TO MANAGE CROP VANDALIZATION USING RENEWABLE ENERGY” by Mohini S. Lohakare	Presents an system driven by the NODE MCU32S microcontroller, employs IoT technology to detect and deter animals in agricultural fields
3	"SMART CROP PROTECTION SYSTEM FROM ANIMALS" by Jayesh Redij	Proposes a system for continuous crop monitoring, addressing challenges faced by farmers. Raspberry Pi as the core, this project offers an efficient solution for farmers.

Table 3: Research Papers

Reference Link for Research Paper	
1	https://iarjset.com/papers/smart-crop-protection-using-arduino/
2	https://www.jetir.org/view?paper=JETIR2203572
3	https://ijcrt.org/papers/IJCRTO020033.pdf

Table 4: Reference link for Research Papers

Reference Link for Datasheets	
1	https://components101.com/sites/default/files/component_datasheet/Buzzer%20Datasheet.pdf
2	https://handsontec.com/dataspecs/module/I2C_1602_LCD.pdf
3	https://datasheetspdf.com/pdf-file/989664/SIMCom/SIM800L/1
4	https://www.espressif.com/sites/default/files/documentation/esp32-wroom-32_datasheet_en.pdf
5	https://components101.com/sites/default/files/component_datasheet/HC%20SR501%20PIR%20Sensor%20Datasheet.pdf
6	https://www.onsemi.com/pdf/datasheet/lm2596-d.pdf

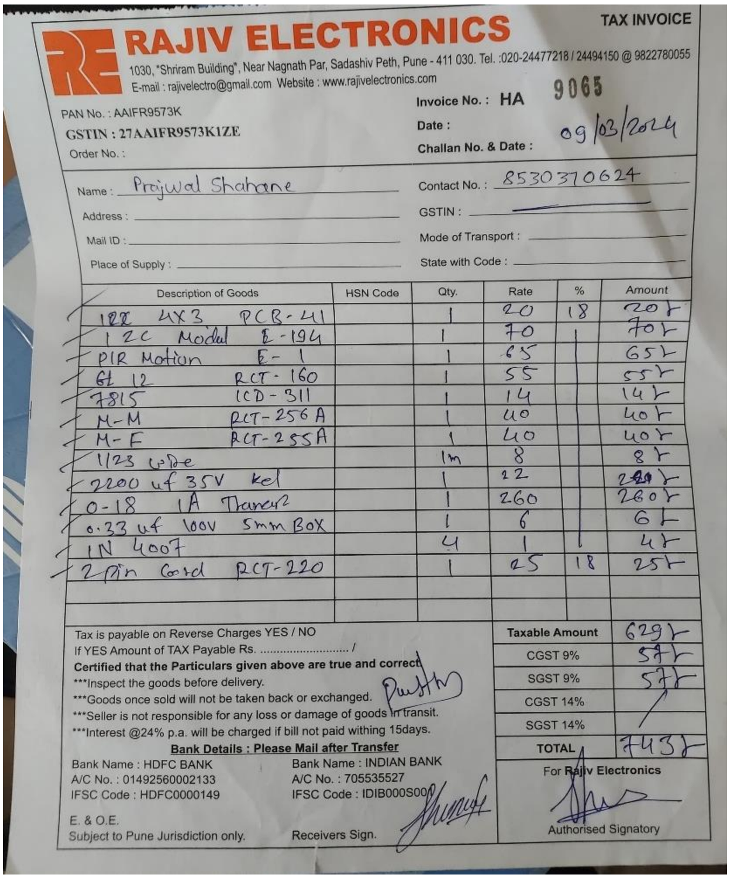
Table 5: Reference link for Datasheets

For More Information regarding project Scan This:

Fig 23: QR Code

Chapter-09

Photographs Bill of Material


RAJIV ELECTRONICS

TAX INVOICE

1030, "Shriram Building", Near Nagnath Par, Sadashiv Peth, Pune - 411 030. Tel. :020-24477218 / 24494150 @ 9822780055

E-mail : rajivelectro@gmail.com Website : www.rajivelectronics.com

PAN No. : AAIFR9573K

GSTIN : 27AAIFR9573K1ZE

Order No. :

Invoice No. : HA 9065

Date : 09/03/2024

Challan No. & Date :

Name : Projwal Shahane

Contact No. : 8530370624

Address :

GSTIN :

Mail ID :

Mode of Transport :

Place of Supply :

State with Code :

Description of Goods	HSN Code	Qty.	Rate	%	Amount
188 4X3 PCB-41		1	20	18	20/-
I2C Modul E-194		1	70		70/-
PIR Motion E-1		1	65		65/-
GL 12 RCT-160		1	55		55/-
7815 ICD-311		1	14		14/-
M-M RCT-256A		1	40		40/-
M-F RCT-255A		1	40		40/-
1/23 wire		1m	8		8/-
2200 uf 35V kel		1	22		22/-
0-18 1A Transfr		1	260		260/-
0.33 uf 100V 5mm Box		1	6		6/-
IN 4007		4	1		4/-
2 pin Cord RCT-220		1	25	18	25/-

Tax is payable on Reverse Charges YES / NO

If YES Amount of TAX Payable Rs. .... /

Certified that the Particulars given above are true and correct

***Inspect the goods before delivery.

***Goods once sold will not be taken back or exchanged.

***Seller is not responsible for any loss or damage of goods in transit.

***Interest @24% p.a. will be charged if bill not paid withing 15days.

Bank Details : Please Mail after Transfer

Bank Name : HDFC BANK
A/C No. : 01492560002133
IFSC Code : HDFC0000149

Bank Name : INDIAN BANK
A/C No. : 705535527
IFSC Code : IDIB000S00

Taxable Amount	629/-
CGST 9%	57/-
SGST 9%	57/-
CGST 14%	
SGST 14%	
TOTAL	743/-

For Rajiv Electronics

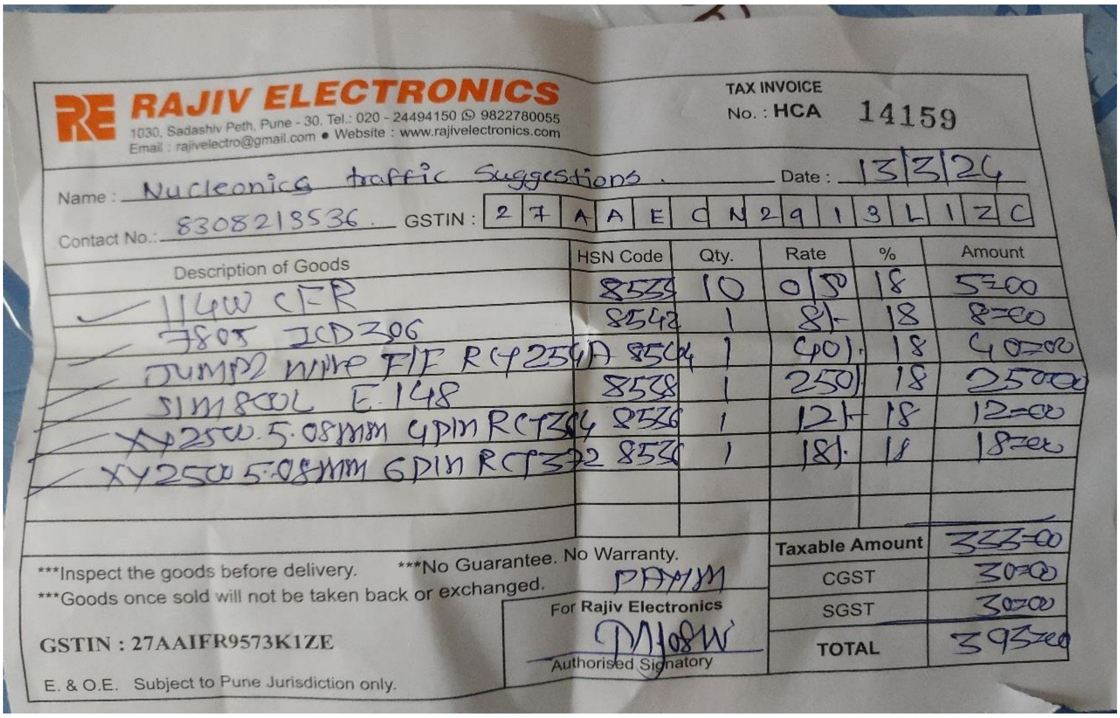
Authorised Signatory

E. & O.E.

Subject to Pune Jurisdiction only.

Receivers Sign.

Fig 24: Bill of Expenses 1


RAJIV ELECTRONICS

1030, Sadashiv Peth, Pune - 30. Tel.: 020 - 24494150 9822780055

Email : rajivelectro@gmail.com • Website : www.rajivelectronics.com

TAX INVOICE

No. : HCA 14159

Name : Nucleonics traffic Suggestions.

Date : 13/3/24

Contact No.: 8308213536

GSTIN : 27AAECN2913L1ZC

Description of Goods	HSN Code	Qty.	Rate	%	Amount
1/4W CFR	8533	10	0.50	18	5=00
7805 ICD306	8542	1	8/-	18	8=00
Jumper wire F/F RCT254A	8544	1	40/-	18	40=00
SIM800L E148	8538	1	250/-	18	250=00
XY2500 5.08mm 4pin RCT324	8536	1	12/-	18	12=00
XY2500 5.08mm 6pin RCT322	8536	1	18/-	18	18=00

***Inspect the goods before delivery. ***No Guarantee. No Warranty.

***Goods once sold will not be taken back or exchanged.

For Rajiv Electronics

Authorised Signatory

Taxable Amount	333=00
CGST	30=00
SGST	30=00
TOTAL	393=00

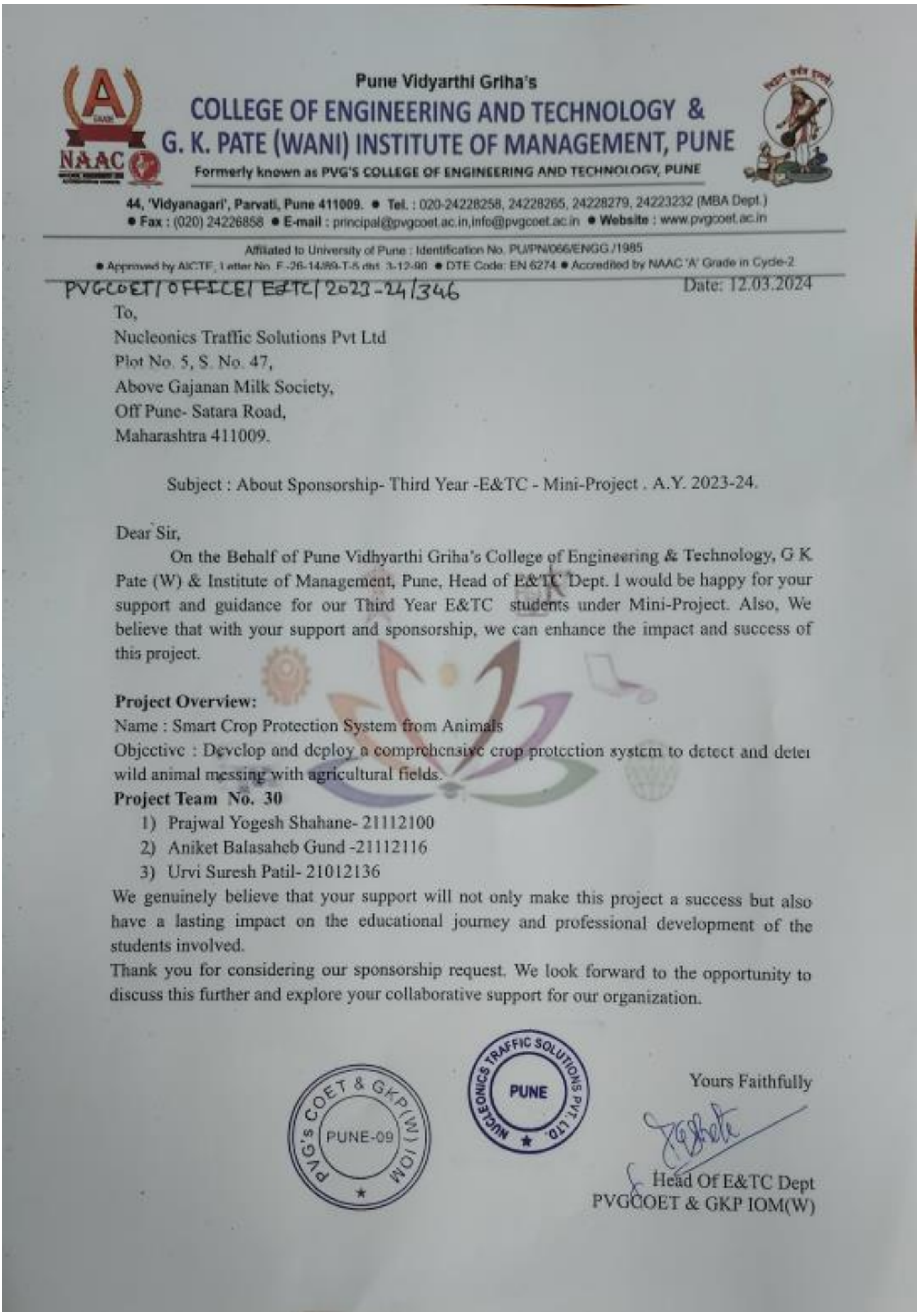
GSTIN : 27AAIFR9573K1ZE

E. & O.E. Subject to Pune Jurisdiction only.

Fig 25: Bill of Expenses 2

Chapter-10

Photographs of Certificates/Achievements



Pune Vidyarthi Griha's
COLLEGE OF ENGINEERING AND TECHNOLOGY &
G. K. PATE (WANI) INSTITUTE OF MANAGEMENT, PUNE
Formerly known as PVG'S COLLEGE OF ENGINEERING AND TECHNOLOGY, PUNE
44, 'Vidyanagari', Parvati, Pune 411009. • Tel. : 020-24228258, 24228265, 24228279, 24223232 (MBA Dept.)
• Fax : (020) 24226858 • E-mail : principal@pvgcoet.ac.in,info@pvgcoet.ac.in • Website : www.pvgcoet.ac.in
Affiliated to University of Pune : Identification No. PU/PN/066/ENGG./1985
• Approved by AICTE, Letter No. F-26-14/89-T-5 dtd. 3-12-90 • DTE Code: EN 6274 • Accredited by NAAC 'A' Grade in Cycle-2

PVGCOET/OFFICE/E&TC/2023-24/346 Date: 12.03.2024

To,
Nucleonics Traffic Solutions Pvt Ltd
Plot No. 5, S. No. 47,
Above Gajanan Milk Society,
Off Pune- Satara Road,
Maharashtra 411009.

Subject : About Sponsorship- Third Year -E&TC - Mini-Project . A.Y. 2023-24.

Dear Sir,

On the Behalf of Pune Vidhyarthi Griha's College of Engineering & Technology, G K Pate (W) & Institute of Management, Pune, Head of E&TC Dept. I would be happy for your support and guidance for our Third Year E&TC students under Mini-Project. Also, We believe that with your support and sponsorship, we can enhance the impact and success of this project.

Project Overview:
Name : Smart Crop Protection System from Animals
Objective : Develop and deploy a comprehensive crop protection system to detect and deter wild animal messing with agricultural fields.
Project Team No. 30
1) Prajwal Yogesh Shahane- 21112100
2) Aniket Balasaheb Gund -21112116
3) Urvi Suresh Patil- 21012136

We genuinely believe that your support will not only make this project a success but also have a lasting impact on the educational journey and professional development of the students involved.
Thank you for considering our sponsorship request. We look forward to the opportunity to discuss this further and explore your collaborative support for our organization.

PVG's COET & GKP(W) IOM PUNE-09
NUCLEONICS TRAFFIC SOLUTIONS PVT. LTD. PUNE

Yours Faithfully

Head Of E&TC Dept
PVGCOET & GKP IOM(W)

Fig 26: Sponsorship Certificate

Fig 27: Mini Project Competition Certificate