##### A Mini Project/Internship Report on

##### SMART FENCING TO PROTECT THE CROPS FROM WILD ANIMALS

###### A Dissertation submitted to JNTU Hyderabad in partial fulfillment of the academic requirements for the award of the degree of

**Bachelor of Technology**

**in**

## ELECTRONICS & COMMUNICATION ENGINEERING

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#### CERTIFICATE

## This is to certify that the Mini Project/ Internship report entitled "SMART FENCING TO PROTECT CROPS FROM WILD ANIMALS" being submitted by M.Divya(22H51A04H0), K.Rushikesh (22H51A04G1), M.Rudra simha (22H51A04G8)

## in partial fulfillment for the award of Bachelor of Technology in ELECTRONICS & COMMUNICATION ENGINEERING is a record of bonafide work carried out under my guidance and supervision. The results embodied in this project report have not been submitted to any other University or Institute for the award of any Degree.

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We hereby declare that the project work titled **"**SMART FENCING TO PROTECT CROPS FROM WILD ANIMALS **"** is an original work carried out by us in partial fulfillment for the award of Bachelor of Technology in ELECTRONICS & COMMUNICATION ENGINEERING. This project report has been prepared based on our research and findings and has not been submitted to any other university or institute for the award of any degree or diploma.

We confirm that the work presented in this report is authentic and free from any form of plagiarism. Any references or sources used have been duly acknowledged.

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SMART FENCING TO PROTECT CROPS FROM WILD ANIMALS

# **ABSTRACT**

This project aims to develop a Smart Fencing System to protect crops from wild animals using Arduino, LCD with I2C, IR sensors, motor driver, DC motor, and buzzer. The system provides real-time monitoring and automated response to intrusions, ensuring effective crop protection. The system detects animal movement near the fence and triggers deterrent mechanisms while alerting the user through an audible buzzer. This proactive approach enhances the effectiveness of traditional fencing methods by providing automated and immediate responses to potential threats.

Crop damage caused by wild animals is a major challenge faced by farmers, particularly in regions bordering forests or wildlife habitats. Traditional fencing methods often fail to provide effective or sustainable solutions due to high maintenance costs and limited adaptability. This paper proposes a Smart Fencing System designed to protect agricultural fields using a combination of modern technologies including motion sensors, infrared cameras, machine learning-based animal detection, and IoT-enabled alert systems. The smart fence detects the presence of animals near the field perimeter, classifies them using trained models, and triggers appropriate deterrents such as sound alarms, flashing lights, or mild electric pulses. Real-time notifications are sent to farmers via mobile applications or SMS, enabling rapid response. The system is solar-powered, cost-effective, and environmentally friendly, aiming to minimize human-wildlife conflict and safeguard both crops and animals.

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# **CHAPTER 1**

**INTRODUCTION**

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**CHAPTER 1**

**1.1.Introduction:**

The concept of IoT was introduced by a member of RFID development community in the year 1999. After it became more famous to the practical world because of rapid growth in mobile devices, embedded systems, cloud computing, ubiquitous computing and data analytics. The IoT technology can play a crucial role to improve the quality of lives in the application fields like transport, home appliances, healthcare, natural hazards and industrial automation [1]. In several areas, surveillance plays a major role, be it at home, hospitals, schools, public places, farmlands, etc. This lets us track a certain area and prevent fraud, and also provides evidence in the event of these incidents happening. Surveillance of farmlands or agricultural land is very important in order to prevent unauthorized persons from gaining access to the field and also to protect the field from animals. Different strategies aim only at surveillance that is mainly for human intruders, but we appear to overlook that the biggest enemies of these farmers are the animals that eat the crops.

In the states of Tamil Nadu, Himachal Pradesh, Punjab, Haryana, Kerala and many other states, the issue of wildlife attack on crops i.e. crop vandalization is becoming very common. Wild animals such as monkeys, elephants, wild pigs, deer’s, wild dogs, bison, nilgais, feral animals such as cows and buffaloes and even birds such as parakeets do a lot of harm to crops by running over them, eating them and vandalizing them entirely. This leads to low crop yield and substantial financial loss for farmland owners. This problem is so severe that due to such regular attacks on animals, the farmers often prefer to leave the areas barren. This system allows us to keep these wild animals away from the farmlands and also provides flexibility for surveillance. It was found that the smell of rotten egg helps prevent the wild pigs and deers from eating the crops, so farmers spray the rotten egg solution manually on their fields, and firecrackers are used to fend off the wild elephants that eat the crops. Depending on the need, the system is automated so there is no manual labor, thus saving time and also avoiding crop loss.

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**1.2.Problem Statement:**

Crop damage caused by wild animals is a major challenge for farmers, especially those living near forests or wildlife reserves. Animals such as wild boars, deer, elephants, and monkeys frequently enter farmlands, leading to significant crop loss, economic hardship, and increased human-wildlife conflict. Traditional fencing methods, These methods also lack the ability to detect and respond to threats in real time.Therefore, there is a need for a smart, cost-effective, and non-lethal fencing system that can automatically detect animal intrusions, alert farmers, and deter animals without causing harm—helping to protect crops, ensure farmer safety, and promote peaceful coexistence with wildlife.

**1.3. Project Objective:**

The main objective of this project is to design and implement an **Smart fencing to protect crops from wild animals**. The specific goals include:

### **1. To detect the presence of wild animals near the farm boundary**

### **2. To identify and classify animals using intelligent systems**

### **3. To deter animals using safe,non-lethel methods**

### **4. To notify farmers through real-time alerts**

### **5. To ensure energy-efficient and sustainable operation**

**1.4 Project Scope and Limitataions:**

The smart fencing project aims to protect crops from wild animals using sensors, cameras, and automated deterrents like lights, alarms, and sprinklers. It will detect animal movement, send real-time alerts to farmers via mobile apps or SMS, and run on solar power for use in remote areas. The system is scalable and designed for different field sizes.However, it has limitations such as possible false alarms due to weather or small animals, limited sensor range in dense areas, reliance on solar power, and the need for regular maintenance. Poor network connectivity and animal adaptation to deterrents can also reduce effectiveness over time.

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**CHAPTER 2**

**LITERATURE SURVEY**

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SMART FENCING TO PROTECT CROPS FROM WILD ANIMALS

**CHAPTER 2**

**LITERATURE SURVEY**

**2.1 Motion sensor and camera based systems**

**2.1.1 Introduction**

In Motion sensor and camera-based systems are an effective smart fencing solution used to protect crops from wild animals. These systems rely on motion detectors, such as Passive Infrared (PIR) or thermal sensors, to detect movement near the farm boundary. Once motion is detected, cameras—often infrared or thermal-enabled for night vision—are activated to capture images or video of the intruder. Advanced versions use artificial intelligence to analyze the footage in real time and identify the type of animal, allowing farmers to take appropriate action.

In addition to monitoring, these systems can trigger deterrent mechanisms such as flashing lights, sirens, or pre-recorded predator sounds to scare the animal away. The entire system can be connected to a mobile application or web dashboard, enabling farmers to receive real-time alerts via SMS or notifications. All detected events are usually logged either on local storage or cloud platforms, helping farmers analyze animal movement patterns over time.

**2.1.2 Merits,Demerits,Challenges:**

**2.1.2.1 Merits**

**1. Low Cost:**

* Ensures Basic motion sensors (e.g. PIR) are relatively inexpensive.

**2. Easy installation:**

* Simple setup and deployment; often plug-and-play.

**3. Quick Response:**

* Immediate triggering of alarms, lights, or sounds upon detecting movement

**4. Low power consumption:**

* Especially PIR sensors,which are energy-efficient and can be solar-powered.

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**2.1.2.2 Demerits**

**1.**.**Low Specificity:**

* More Cannot distinguish between animals, humans, or moving vegetation (e.g. swaying trees).

**2**. **False Alarms:**

* High false-positive rate in windy or rainy conditions..

**3.** **Limited Use in Fog:**

* Basic PIR sensors may struggle in low visibility.
  + - 1. **Challenges**

**1**. **Sensor calibration:**

* Requires optimal placement and fine-tuning for effective operation.

**2.** **Environmental Interferance:**

* Heat, wind, or moving foliage can trigger false alerts.

**3.** **Animal Habituation:**

* Animals may get used to non-lethal stimuli like lights or sound and stop reacting.

**2.1.3. Implimentation of Low-Latency and Pipelined Transmitter Designs**

**2.1.3.1 Gather Components:**

* PIR Motion Sensor (e.g., HC-SR501)
* ESP32-CAM (camera + controller in one)
* Buzzer / Flash Light (deterrent)
* Relay Module (to control buzzer/light)
* Power Supply (battery/solar or USB)
* Wi-Fi or GSM (for alerts)

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**2.1.3.2 Connect Hardware:**

* PIR OUT → ESP32 GPIO13
* Buzzer → ESP32 GPIO12 (via relay)
* Camera is built-in
* Power ESP32 with 5V supply
* Mount all parts in a waterproof box

**2.1.3.3 Program Controller (ESP32-CAM):**

* Write code to:
* Detect motion
* Take a photo
* Send alert (via \*Telegram, \*\*email, or \*\*Blynk\*)
* Trigger buzzer/light for a few seconds

**2.1.3.4 Test and Optimize**:

* Walk near sensor to trigger it
* Check alert arrives on your phone
* Confirm buzzer/light activates
* Adjust sensor sensitivity and position

**2.1.3.5 Output:**

* Motion detected
* Photo captured
* Alert sent
* Deterrent activated

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SMART FENCING TO PROTECT CROPS FROM WILD ANIMALS

* 1. **Smart Mesh fencing**

**2.2.1 Introduction**

The Smart mesh fencing is an advanced crop protection system that integrates physical fencing with a network of sensors embedded in the mesh or wire. These sensors detect pressure, vibrations, or tampering caused by animals trying to breach the fence. The data from these sensors is transmitted wirelessly through a mesh network to a central receiver, which then sends real-time alerts to farmers via mobile apps or SMS. This early warning system allows for quick response before animals enter the field. Smart mesh fencing is energy-efficient, often solar-powered, and can automatically activate deterrents such as lights or alarms when a breach is detected. It offers continuous monitoring of fence integrity, helping locate damaged sections promptly, and is scalable to suit various farm sizes. Although it requires higher initial investment and technical expertise for installation and maintenance, it provides a non-lethal, animal-friendly, and highly effective way to safeguard crops, especially in wildlife-prone or conservation-adjacent areas.

**2.2.2 Merits,Demerits,Challenges:**

**2.2.2.1 Merits**

**1. Real-time Intrusion Alerts:**

* Instantly notifies farmers of animal attempts to breach the fence.

**2. Early Detection:**

* Detects pushing, climbing, or tampering before animals enter the field.

**3. Non-lethal and Eco-friendly:**

* Safer alternative to electric fencing; does not harm animals.

**4. Continuous Monitoring:**

* Keeps track of the fence's structural integrity and alerts if damaged.

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* + - 1. **Demerits:**

**1.High Initial Cost:**

* Expensive to install compared to conventional fencing.

**2. Complex Setup:**

* Requires technical knowledge for sensor placement and network configuration.

**3. Maintenance Requirements:**

* Sensors and network nodes need regular inspection and upkeep.

**4. Vulnerability to Environmental Damage**:

* Sensors may be affected by extreme weather, moisture, or dust.
  + - 1. **Challenges**

**1.Power Supply Management:**

* Keeping all sensors powered (especially in remote areas) requires a reliable solar + battery setup.

**2. Network Connectivity:**

* Wireless mesh networks must be stable; signal loss can affect alert delivery.

**3. Cost Justification for Small Farms:**

* May not be economically viable for small-scale farmers without subsidies.

**2.2.3 Implementation** **of** **Smart Mesh fencing**

**2.2.3.1 Plan the Fence:**

* Mark the field boundary.
* Decide sensor points (every 10–20 meters).

**2.2.3.2 Gather Components:**

* Vibration or pressure sensors
* ESP32/Arduino\* (one per sensor)
* LoRa/Zigbee/Wi-Fi modules\* (for wireless mesh)
* Central gateway\* (ESP32/Raspberry Pi)

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**2.2.3.3 Set Up Wireless Mesh:**

* Use LoRa or Zigbee to connect all nodes.
* Messages are relayed to a central controller/gateway.

**2.2.3.4 Install in the Field:**

* Mount nodes on the fence in waterproof boxes.
* Test for detection and wireless range.

**2.2.3.5 Alert System**

* Central unit sends SMS or app alerts when intrusion is detected.
* Optional: Activate siren/light via relay.
  1. **Solar powered smart Electric Fencing:**

**2.3.1Introduction:**

Solar-powered smart electric fencing is a sustainable and effective solution for protecting crops from wild animals.

* + 1. **Merits,Demerits,Challenges:**

**2.3.2.1 Merits:**

* Energy Efficient
* Low running cost
  + - 1. **Demerits:**
* High initial Investment
* Weather Dependent
  + - 1. **Challenges:**
* Connectivity Issues

**2..3.3 Implementation:**

Survey the land, install solar-powered energizer and fence wires with smart sensors, test voltage, train users, and perform regular maintenance.

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**CHAPTER 3**

**PROPOSED SYSTEM**

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**CHAPTER 3**

**PROPOSED SYSTEM**

**3.1.Objective of proposed model:**

The objective of the proposed smart fencing model is to provide a reliable, real-time system to protect crops from wild animal intrusion using a combination of motion sensors and camera-based technology. The system aims to detect animal movement near field boundaries, identify threats accurately, and immediately alert farmers through mobile notifications or alarms.

**3.2.Block Daigram:**

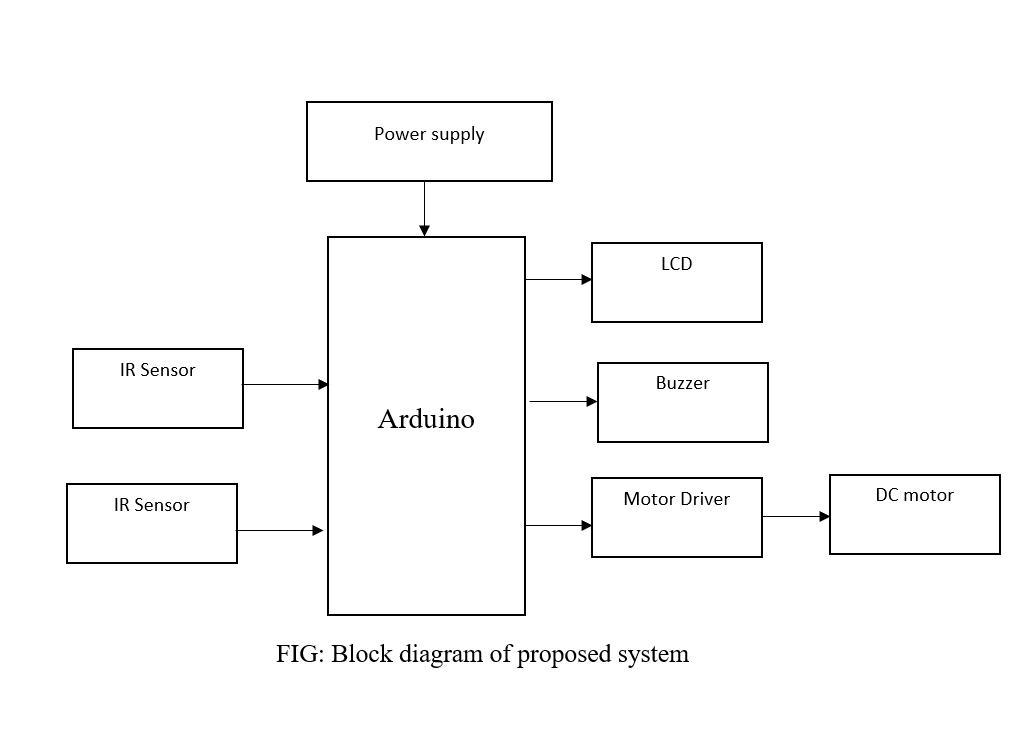


FIG 3.2 :BLOCK DIAGRAM OF PROPOSED SYSTEM

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### 3.3.Designing:

The proposed smart fencing system is designed using a modular approach, combining PIR motion sensors and camera modules integrated with microcontrollers like ESP32 or Raspberry Pi. Motion sensors are strategically placed along the perimeter to detect movement, which then activates the camera to capture images or videos. These components communicate through Wi-Fi, LoRa, or GSM networks to a central controller that processes data and sends real-time alerts to the farmer’s mobile device. The system is powered by solar panels with battery backup for uninterrupted operation. Additional components such as buzzer alarms or flashing lights act as deterrents to scare away animals upon detection. The design ensures scalability, energy efficiency, and ease of maintenance while offering non-lethal, eco-friendly protection for crops.

**3.4 stepwise implementation:**

**1. Survey Field:**

Identify animal entry points and fence layout.

**2. Select Components:**

Motion sensors, camera (ESP32-CAM), microcontroller, deterrents, power supply.

**3. Assemble Hardware:**

Connect sensors and camera to controller, add buzzer/light via relay.

**4. Program System:**

Write code to detect motion, capture image, send alert, and trigger deterrents.

**5. Install on Field:**

Mount sensors and devices in waterproof boxes along the fence.

**6. Test & Calibrate:**

Simulate intrusion, check alerts and camera, fine-tune settings.

**7. Maintain:**

Check power, clean devices, and update firmware regularly.

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**CHAPTER 4**

**RESULTS AND DISCUSSION**

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**CHAPTER 4**

**RESULTS AND DISCUSSION**

**4.1 Performance metrices:**

|  |  |
| --- | --- |
| Metric | Description |
| Detection Accuracy | Detection rate |
| Detection Time | Time to detect instrusion |
| Deterrence rate | % of animals repelled |
| Detection Range | Max detection Distance |

**4.2 Working principle:**

Smart fencing for crop protection operates on the principle of detecting and deterring wild animals using modern sensor and communication technologies. These fences are equipped with motion sensors, infrared detectors, thermal cameras, or vibration sensors to continuously monitor the boundary of the farmland. When an animal approaches or touches the fence, the sensors detect its presence and send signals to a control unit, which processes the data to determine if it's a genuine threat. In advanced systems, AI-enabled cameras can identify the type of animal and reduce false alarms. Once a threat is confirmed, the system activates deterrent mechanisms such as flashing lights, ultrasonic sound, or low-voltage electric pulses to scare the animal away.

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**4.3 Inputs of the project:**

|  |  |
| --- | --- |
| Component | Function |
| Sensors | Detect animal movement |
| cameras | Animal recognition |
| Microcontroller | Control instructions |
| Power supply | Power for system |

**4.4 Outputs of the project:**

|  |  |
| --- | --- |
| Output | Description |
| Instrusion Alerts | Real-time SMS |
| Reduced crop loss | Lower damage from animals |

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CHAPTER 5

**CONCLUSION**

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**CHAPTER 5**

**CONCLUSION AND FUTURE ENHACEMENT**

The smart fencing system offers an effective, eco-friendly, and non-lethal solution to protect crops from wild animal intrusions. By integrating motion sensors, cameras, and real-time alert mechanisms, it enables early detection and timely response to prevent crop damage. The use of solar power and wireless communication makes it suitable for remote and rural areas. Overall, this smart system enhances farm security, reduces human-wildlife conflict, and supports sustainable agriculture by minimizing losses and promoting coexistence.

The proposed smart fencing system provides a practical, intelligent, and sustainable solution to the long-standing problem of crop damage caused by wild animals. By integrating motion sensors, cameras, wireless communication, and automated deterrents, the system ensures early detection and immediate response to animal intrusion. This minimizes losses for farmers, reduces the need for constant manual surveillance, and avoids harmful or lethal measures.Its design is cost-effective, scalable, and adaptable to different terrains and farm sizes. The use of solar power makes it ideal for remote rural areas where electricity is limited.

Additionally, real-time alerts through mobile applications or SMS allow farmers to respond quickly without being physically present, making the system convenient and efficient.Moreover, the non-lethal nature of the system supports wildlife conservation efforts by deterring animals without harming them, promoting coexistence between humans and wildlife. With continued improvements such as AI-based animal recognition and cloud-based monitoring, smart fencing has the potential to revolutionize farm protection practices and contribute to more secure and sustainable agriculture in the future.

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**APPENDIX**

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SMART FENCING TO PROTECT CROPS FROM WILD ANIMALS

**PROGRAM CODE:**

#include <LiquidCrystal.h>

// Pins

const int ir1 = 2, ir2 = 3;

const int buzzer = 4, motor1 = 5, motor2 = 6;

// LCD(RS, E, D4, D5, D6, D7)

LiquidCrystal lcd(7, 8, 9, 10, 11, 12);

void setup() {

pinMode(ir1, INPUT); pinMode(ir2, INPUT);

pinMode(buzzer, OUTPUT); pinMode(motor1, OUTPUT); pinMode(motor2, OUTPUT);

lcd.begin(16, 2);

}

void loop() {

if (digitalRead(ir1) == LOW || digitalRead(ir2) == LOW) {

lcd.setCursor(0, 0);

lcd.print("Animal Detected");

digitalWrite(buzzer, HIGH);

digitalWrite(motor1, HIGH);

digitalWrite(motor2, LOW);

delay(3000);

} else {

lcd.setCursor(0, 0); lcd.print("Area Secure ");

digitalWrite(buzzer, LOW);

digitalWrite(motor1, LOW); digitalWrite(motor2, LOW);

}

}

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