

Title: AI-Enabled Automated Animal Intrusion Detection and Deterrent System for Farmlands

Abstract:

This research proposes a solar-powered, AI-enabled system designed to autonomously detect and deter animal intrusions in agricultural fields. The system integrates real-time video processing through an AI camera, motion detection, species-specific auditory deterrents, a flashlight module for visual deterrence, and GSM communication for farmer alerts. By combining these technologies into a rugged, weather-resistant unit, the invention ensures minimal crop damage and reduces the need for human supervision.

1. Introduction

Crop damage due to stray or wild animal intrusions continues to be a major issue for farmers, especially in rural and semi-urban areas. Traditional scarecrows and manual guarding are inefficient and labor-intensive. The proposed invention automates threat detection, species classification, deterrence, and farmer notification in real-time without reliance on internet infrastructure.

2. System Architecture and Components

2.1 Hardware Modules:

- **AI Camera Module:** For real-time object recognition and night-vision monitoring.
- **Motion Sensor (PIR/Ultrasonic):** Initial movement detection trigger.
- **Flashlight Module:** High-lumen LEDs used to visually scare intruders.
- **Sound Generator:** Species-specific distress or predator sounds are played through a speaker.
- **GSM Module:** Sends real-time SMS alerts to farmers.
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Solar Panel & Battery Backup: Enables 24/7 operation without power grid dependence.

- **Weatherproof Housing:** Protects internal components from environmental conditions.
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3. Working Operation

The system begins in standby mode, monitoring the designated farm area using motion sensors. Upon detecting movement, the AI camera activates and uses object recognition algorithms to identify the entity. If the object is identified as an animal (e.g., boar, deer, cow), the system determines the species and activates two deterrents: a high-intensity flashlight flashes intermittently and a corresponding sound (like a predator call or animal distress signal) is played via the speaker. Simultaneously, an SMS alert is dispatched to the registered farmer's mobile number through the GSM module. Power is consistently supplied by the solar panel, with a rechargeable battery serving as backup during non-sunny hours.

4. Technical Innovations

- Species classification using offline-trained AI models.
 - Dual-layer deterrent (audio + visual).
 - GSM-based instant notification without internet reliance.
 - Renewable energy operation for sustainability.
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5. Use Cases

- **Agricultural Farms:** Primary use for crop protection.

- **Forest Border Villages:** To prevent wild animal-human conflict.
 - **Remote Monitoring Sites:** Where real-time alerting is necessary without internet.
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6. Estimated Component Costs (Per Unit)

Component	Estimated Cost (INR)
AI Camera Module	1800
PIR/Motion Sensor	120
Flashlight + Circuit	400
Audio Module + Speaker	300
GSM Module	250
Solar Panel + Battery	600
Enclosure and Wiring	300
Total Estimate	3770 INR

7. Conclusion

The AI-Enabled Animal Detection and Deterrent System introduces a modern, autonomous solution to age-old farming issues. It reduces the need for manual labor, provides early alerts, and offers sustainable, smart agriculture protection using edge-AI and IoT.

References

1. OpenCV + TensorFlow Lite for Edge AI Deployment
2. HC-SR501 PIR Sensor Datasheet
- 3.

SIM800L GSM Module Reference Guide

4.

Indian Council of Agricultural Research (ICAR) Reports on Crop Damage

5.

Wildlife Conflict Studies in India and Africa