

HEC-SENSE AI APP

HEC-SENSE AI App is an AI-powered wildlife protection system designed to reduce **human–elephant conflict** in farmland areas using a combination of **computer vision, zone-based intelligence, and IoT-ready architecture**.

Addressing Human-Elephant Conflict

Human-elephant conflict (HEC) poses significant challenges, particularly in agricultural regions where farmland borders wild habitats.

- **Crop Damage:** Elephants foraging in farmlands lead to devastating crop destruction, impacting farmer livelihoods.
- **Farmer Safety:** Encounters can be dangerous, resulting in injuries or fatalities for both humans and elephants.
- **Ethical Dilemma:** Traditional deterrence methods are often harmful or ineffective, necessitating humane alternatives.



Our solution aims to provide an automated, humane method to mitigate these conflicts.

Solution Overview: AI-Powered Protection

Our system leverages advanced AI and IoT technologies to create a non-invasive barrier between elephants and agricultural areas.



AI Monitoring System

Continuous, intelligent elephant detection using real-time camera feeds.



Zone-Based Decisions

Dynamic response mechanisms activated based on elephant proximity to farmland.



Automated Deterrence

Humane, non-lethal actions triggered to safely guide elephants away.

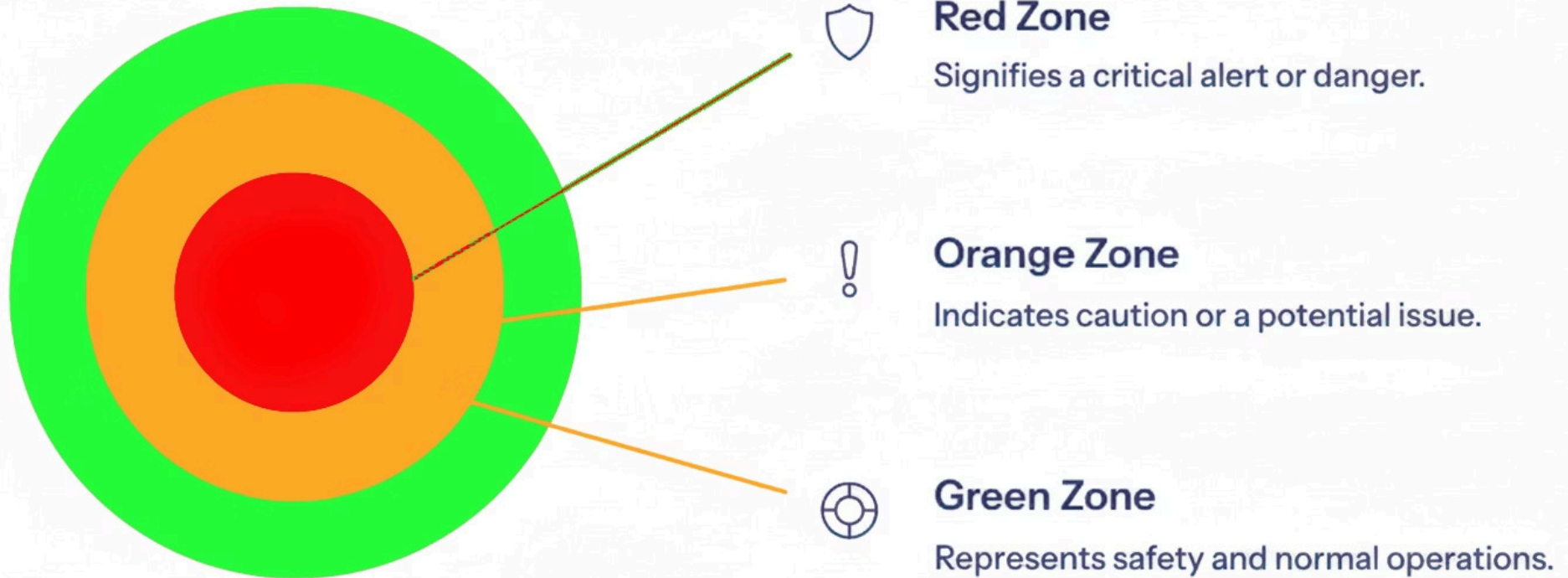


Web Monitoring Platform

Centralized dashboard for real-time status, alerts, and system management.

The Zone-Based Detection Concept

Farmland areas are segmented into three distinct zones, each dictating a specific system behavior to ensure a safety-first, non-harmful approach. This tiered approach allows for proactive and escalating responses, minimizing stress on both animals and farmers.



Green Zone: Safe Monitoring

When an elephant is detected approaching the farmland while still at a safe distance, the system activates preventive deterrence mechanisms.

- **Distance:** Elephant is at a safe distance, but approaching
- **Action:** Preventive deterrence mechanisms are activated – lights, firecrackers, warning sounds, flashlights, and bee sounds to discourage further approach
- **Function:** The system proactively deters the elephant before it gets closer, using non-harmful sensory stimuli to guide it away



This phase conserves energy and avoids unnecessary disturbance, maintaining a natural environment.

Warning Zone: Alert Stage

As elephants approach the critical boundary, the system shifts into a preparatory alert mode.



- **Proximity:** Elephant is nearing the farmland perimeter.
- **Action:** Internal warnings are generated, and the system prepares deterrence mechanisms.
- **Function:** This stage allows for early intervention, giving the system time to ready its response without immediate activation, preventing panic.

The goal is to gently encourage the elephant to change direction before reaching the farm.



Red Zone: Active Deterrence

Upon detecting an elephant inside the farmland, immediate and humane deterrence actions are triggered.

Acoustic Deterrents

Simulation of firecracker sounds and bee buzzing to startle and disorient without harm.

Visual Deterrents

Flashing lights create a sudden, unexpected visual stimulus to encourage retreat.

Real-time Alerts

Notifications are sent via the web application, informing farmers of the incursion.

The primary objective is to safely push the elephant out of the zone, prioritizing animal welfare.

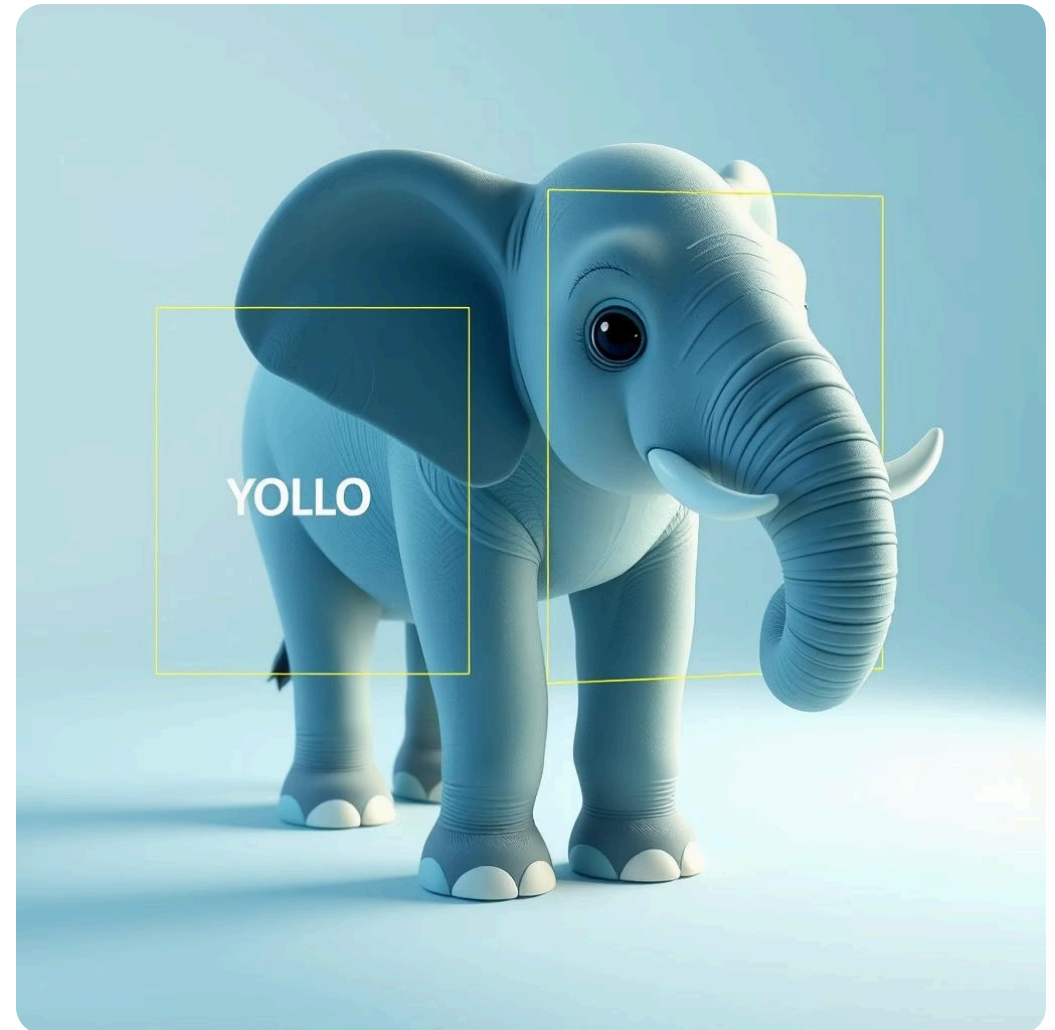
AI Model Details: Powering the Detection

The core of our system is a sophisticated AI detection model, specifically designed for robust elephant identification.

Model: Our detection model is trained using the YOLO (You Only Look Once) framework, known for its efficiency and accuracy in real-time object detection.

Specialization: The model has been fine-tuned with a vast dataset of elephant images, optimizing its ability to distinguish elephants from other wildlife and environmental elements.

Application: It seamlessly integrates with live camera feeds, processing visual data instantaneously to determine the presence and location of elephants.



This ensures reliable and rapid detection, critical for timely deterrence activation.



Current Deployment Status: Development & Testing

Our system is currently in the rigorous testing phase, operating on standard computing platforms.

- **Platform:** The system is running on laptops, providing a flexible environment for development.
- **Purpose:** This setup is ideal for comprehensive model testing, validating detection accuracy, and verifying the logic of our zone-based response system.
- **Usability:** It serves as a fully functional demonstration and development unit, showcasing the system's capabilities before field deployment.

This phase ensures all components are robust and reliable for real-world application.

The Web Application: Real-time Control & Insights

The web-based application provides users with an intuitive interface for monitoring and managing the system from anywhere.

- **Live Camera Monitoring:** Access real-time video feeds from deployed cameras.
- **Zone Status Display:** Clear visual indicators for Green, Warning, and Red zones.
- **Alert Logs:** Detailed records of all detected elephant movements and triggered actions.
- **System Status:** Overview of system health, battery levels, and connectivity.



This centralized hub empowers farmers with crucial information for informed decision-making.

Hardware Requirements: NVIDIA GIST 10 & Jetson Nano

The HEC-SENSE AI system relies on real-time detection and analysis, which demands significant computational power. To efficiently process live video feeds and execute sophisticated AI models in challenging environments, we leverage specialized NVIDIA hardware tailored for AI inference.



NVIDIA Jetson Nano

- Compact, energy-efficient edge AI processor.
- **Key Specifications:** ARM-based processor, 4GB memory, and very low power consumption.
- **Benefits:** Portable, cost-effective, and perfectly suited for remote farmland locations with limited power infrastructure.
- **Use Case:** Sufficient for single to dual camera feeds, providing reliable real-time detection at the edge.

Price Tag: \$869 USD (approximately LKR 280,500)

Future Work: PPT 2 Development



Memory-Based Learning Backend

- User annotation system for deterrent effectiveness
- Select optimal methods (flashlight, alarm, firecracker)
- Train model on real-world feedback



Hardware Integration & IoT

- Arduino communication via PyFirmata
- LED control integration
- Flashlight Deployment
- Buzzer/sound speaker integration

Thank You

