

EADS: ECO ACOUSTIC DETERRENT SYSTEM

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Abstract - This project introduces an automated, non-lethal animal deterrent system designed to mitigate human-wildlife conflict at the forest-residential interface. The device is strategically positioned 15 meters from a perimeter fence, creating a buffer zone. It utilizes a proximity sensor with a 10-meter detection radius to identify wild animals, such as elephants or wild boars, that approach the area. Upon detection, the system activates a multi-frequency sound generator that emits high-intensity, species-specific auditory signals. This tailored acoustic response is designed to disorient and safely deter the animal, encouraging it to retreat into its natural habitat without causing harm.

The primary objective is to provide a humane and sustainable solution for protecting both human communities and wildlife. By proactively preventing animal incursions, the device reduces property damage and the risk of dangerous encounters, thereby promoting peaceful coexistence. The integration of sensor technology and targeted acoustic deterrence offers an effective way to safeguard human settlements while ensuring the well-being of local wildlife populations.

1. INTRODUCTION

Human-wildlife conflict has become a serious and growing problem in many parts of the world, especially in regions close to forests, farmlands, and rural settlements. Expansion of human habitation into forest areas, deforestation, and climate change have forced wild animals to move closer to human environments in search of food and water. This often results in crop destruction, property damage, injuries, and sometimes loss of human and animal life. Traditional protection methods such as electric fencing, firecrackers, manual guarding, and physical barriers are either harmful, expensive, unreliable, or ineffective in the long term.

To address this issue in a safe, intelligent, and non-invasive manner, EADS – Eco Acoustic Deterrent System is proposed. EADS is an AI-based wildlife detection and deterrence system that uses computer vision, real-time monitoring, and eco-friendly acoustic signals to identify animal intrusions and respond appropriately. The system is designed to detect animals automatically, alert authorities instantly, and deter animals without causing physical harm.

The core of the system uses a camera and a deep learning object detection model (YOLO – You Only Look Once) to continuously analyze live video frames. When an animal such as a dog, cow, elephant, bear, or horse enters the camera's field of view, the model identifies the species along with a confidence score. This real-time detection eliminates the need

for continuous human monitoring and reduces response time significantly.

Once an animal is detected, the system performs multiple actions simultaneously. First, the detection event is recorded with a timestamp, confidence level, and GPS-based location for future reference and analysis. Second, an instant alert message is sent to the ranger or responsible authority using a Telegram bot, ensuring rapid awareness of the situation. Third, the system activates an eco-acoustic deterrence mechanism, where species-specific sound signals or animal sounds are played through speakers. These sounds are designed to scare animals away naturally without causing injury, stress, or long-term harm.

In addition, the system is designed to operate continuously with minimal human intervention, making it suitable for remote forest boundaries and agricultural buffer zones. By combining artificial intelligence, sensor technology, and automated alert systems, EADS acts as a smart monitoring and protection tool. It helps authorities respond quickly to wildlife movements while ensuring that animals are safely guided away from human settlements without the use of harmful deterrent methods.

2. MODULE DESCRIPTION

1. The Camera Module

The capturing and identification of the animals takes place in this module.

2. Data Log for the Authorities

A detailed log with GPS location and other important details regarding the detected animal is recorded.

3. Module for common people

The main module that sends alert to the common people. The instant delivery of notification to the public is made possible through this module.

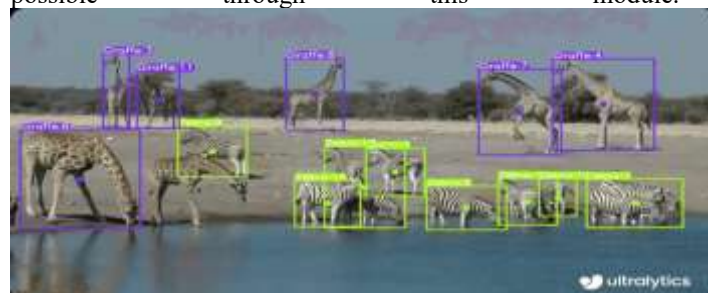


Fig 1: YOLO model

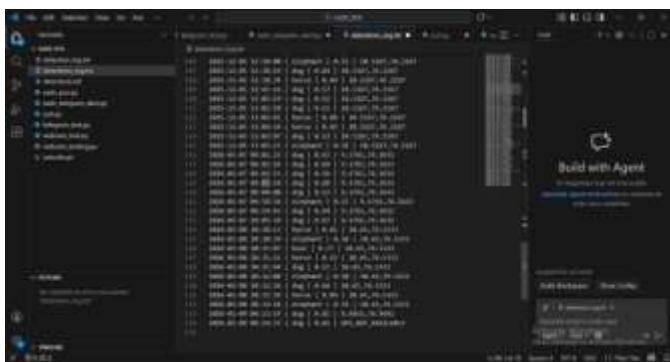


Fig 2:log for authorities

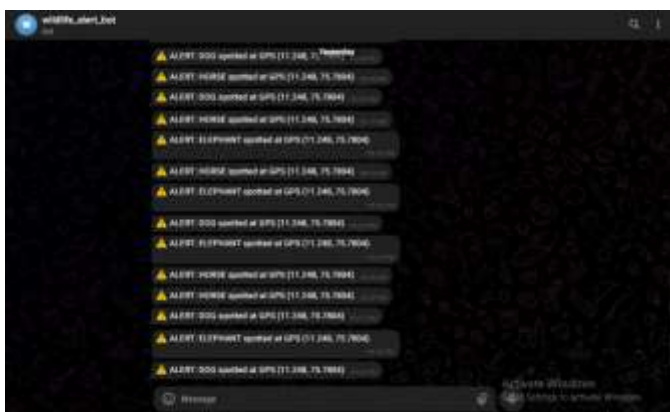


Fig 3:Telegram log for common people

3.PHASES



Fig 4:EADS device



Fig 5:Animals approaching the device



Fig 6:EADS device deterring animals

Future scope

The future of this EADs project is centered on turning the "buffer zone"—the thin line between the forest and the village—into a responsive, high-tech safety corridor. As the project scales, the hardware will evolve from standalone units into a synchronized "smart barrier" that blankets the entire boundary. By using Internet of Things (IoT) technology, each device will act as a relay point, sharing detection data across the network. If an elephant is spotted at one end of the village, the entire chain of devices will activate in a coordinated sequence, creating a directional "sound path" that steers the herd away from crops and back toward the deep wild, effectively preventing a crisis before the animals even see a human home.

A key application in the next phase of the project is the use of adaptive AI to solve the problem of "habituation," where animals eventually ignore constant noises. Future iterations of our device will use machine learning to "study" the elephants' reactions. If the system detects that a herd is not retreating to the sound of bees, it will automatically switch to a different frequency or an ultrasonic pulse to maintain the psychological boundary. This makes the project much more effective than traditional electric fences, as it replaces a physical wall that can be broken with an intelligent deterrent that changes and adapts to the animal's intelligence.

Beyond immediate protection, the project's long-term value lies in its ability to provide "security-as-a-service" for rural communities. The application will extend to a full-scale monitoring system where village leaders receive real-time data on their smartphones about herd movements and device health. This same EADs platform can be updated with new software to detect the sounds of illegal logging or poaching, turning the deterrent units into forest guardians. By lowering the cost of protecting farms and reducing the need for dangerous nighttime patrols, the EADs project will transform the buffer zone from a place of fear into a managed space of sustainable, high-tech coexistence.

CONCLUSION

To fully grasp the impact of the EADs project, it is essential to look at how it bridges the gap between high-end technology and practical field application. The system operates as a complete loop of detection, decision-making, and action. It begins with "passive monitoring," where the device stays in a low-power state until its sensors pick up the massive heat signature or low-frequency rumble of an approaching elephant. This initial step is crucial because it

ensures the device remains operational for weeks on solar power without needing human intervention or battery swaps.

Once triggered, the "intelligence" of the project takes over through a process called Edge AI. Instead of sending data to a far-away cloud server, the device processes the image or sound right there on the spot. This allows for an instantaneous reaction, which is vital when an elephant is only meters away from a farmer's crop. By accurately identifying the species, the project avoids the "crying wolf" effect; the village isn't woken up by alarms for a passing dog or a wandering cow, ensuring that when the system does engage, the community knows it is a serious event.

The final stage is the "behavioral shift" caused by the deterrents themselves. The project is designed to be a psychological tool rather than a physical one. By using high-fidelity speakers to play sounds that elephants are biologically programmed to avoid—like the sound of a disturbed beehive—the device taps into the animal's natural survival instincts. Because the system is programmed to vary its response, the elephants do not become "bored" or accustomed to the noise. This makes the EADs project a dynamic solution that learns and changes over time, offering a level of protection that a static, unmoving fence simply cannot provide.

Ultimately, this project is about data as much as it is about deterrence. Every time the device is triggered, it logs the time, the species, and the success of the retreat. This information creates a digital map of wildlife movement, allowing the project to expand into a predictive tool. In the future, the project won't just react to an elephant that is already there; it will help villagers anticipate migration patterns weeks in advance, truly achieving the goal of a peaceful, managed coexistence between the wild and the village.

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