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Intelligent Crop Protection System With Yolov11 Based Animal Recognition

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Abstract
The automated agricultural land protection system is an intelligent solution that protects crops from animal intrusions with minimal human supervision. It continuously monitors the field boundary, detects approaching animals, and analyzes their presence to confirm whether they pose a threat. Once an intrusion is identified, the system processes data in real time to quickly decide on preventive actions. It then triggers visual alerts for farmers and emits adaptive, non-harmful warning sounds to scare animals away, maintaining the deterrent until the threat is gone. By combining sensing, intelligent analysis, and automated deterrence, the system reduces crop loss, supports sustainable farming, and is especially useful for large or remote fields where manual surveillance is difficult.

Keywords: *Animal Detection; Computer Vision; Deep Learning; Object Detection; YOLO*

1. Introduction

Human–wildlife conflict is an increasing global concern, especially in regions close to forests. Wild animals often enter villages and farmlands searching for food and water, leading to crop damage, economic loss, and sometimes danger to human life (Redmon et al., 2016; Bochkovskiy et al., 2020). Traditional monitoring systems rely heavily on human observation, which is inefficient and unreliable during night hours or in remote monitoring conditions. Recent developments in artificial intelligence and computer vision have enabled automated detection systems that can identify objects in images and videos with high accuracy (Jocher et al., 2023). Deep learning models [1], particularly object detection algorithms, have demonstrated significant success in recognizing multiple objects in real time. Machine vision systems have become increasingly effective for automated inspection and recognition tasks across diverse applications, as documented in comprehensive reviews of advancements in the field (Birari et al., 2023; Rajan et al., 2023).

1.1.Objectives of the Study

- To develop a real-time wild animal detection system using deep learning techniques, specifically leveraging state-of-the-art YOLO architecture;
- To reduce human–wildlife conflict through intelligent, autonomous monitoring and early warning systems;
- To develop a cost-effective and scalable surveillance solution suitable for deployment in remote agricultural and forest-border regions.
- To design an automated alert triggering mechanism that activates deterrent systems through microcontroller integration when animals are detected;

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1.2.Originality and State of the Art

Unlike prior works that primarily address either algorithm design or conceptual system architectures in isolation the present work delivers an integrated, end-to-end real-time implementation combining state-of-the-art YOLO object detection with practical microcontroller-based alert mechanisms [2].

2. Method

The proposed system uses computer vision and deep learning to detect animals from real-time video input. The system consists of four major components: camera input, deep learning detection model, serial communication module, and alert system. The camera captures continuous video frames, which are processed by the YOLO object detection model. The trained model identifies animals in each frame and generates bounding boxes with class labels and confidence scores. If the confidence score is above a predefined threshold, the detected animal class is identified. Once an animal is detected, a signal is transmitted through serial communication to an Arduino microcontroller. The microcontroller activates an alarm or buzzer to alert nearby individuals. Full-stack integration: Seamless connection between computer vision pipeline, serial communication, and hardware actuators (microcontroller, buzzer) Real-world applicability: Tailored specifically for agricultural field protection and wildlife monitoring in remote Indian rural contexts, addressing practical deployment constraints; Practical deterrence mechanism: Beyond detection, the system implements automated alert generation through Arduino microcontroller integration, providing immediate protective response rather than post-hoc analysis. Multi-species recognition: Detection and classification of ten distinct animal species in a single unified framework, providing comprehensive threat identification [3].Shows Table 1 Dataset , Animals Classes ID Used for Detection Figure 1 Outputs,

Table 1 Dataset , Animals Classes ID Used for Detection

Animal Name	Class Id
Buffao	A
Elephant	B
Rhino	C
Zebra	D
Cheetah	E
Fox	F
Jaguar	G
Tiger	H
Lion	I
Panda	J

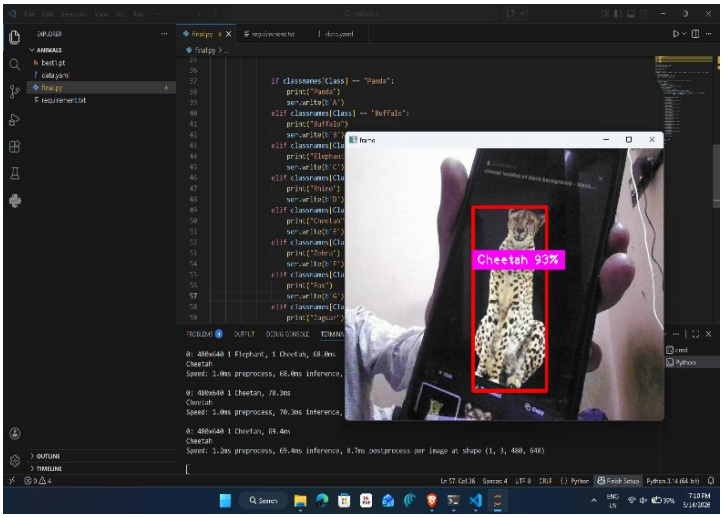

Figure 1 Outputs

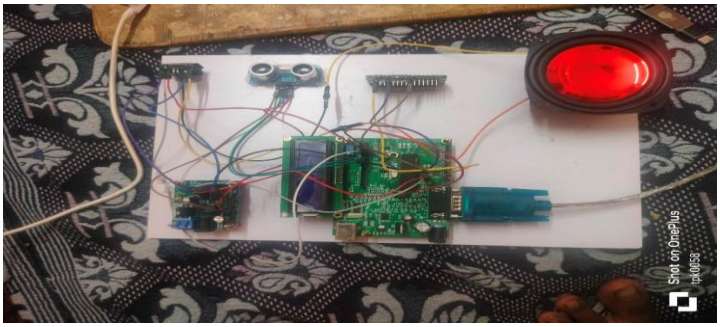

Figure 2 Prototype

3. Results And Discussion

3.1.Results

The developed system successfully detects animals

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from a live video stream using the trained YOLO model. The model identifies animals with bounding boxes and displays their class names along with confidence scores. When an animal is detected, the system sends a command through serial communication to the Arduino board, which activates an alert mechanism. The system performs detection in real time and can identify multiple animals simultaneously within a single frame. The detection results demonstrate that YOLO provides efficient and accurate recognition suitable for wildlife monitoring applications.

3.2.Discussion

The proposed system demonstrates the effectiveness of deep learning techniques in wildlife monitoring applications. YOLO-based detection provides fast processing speed, enabling real-time operation essential for practical field deployment. The integration with Arduino allows the system to trigger alerts automatically when animals are detected, eliminating dependency on human presence. However, detection accuracy depends on the quality and diversity of the dataset used for training. Environmental factors such as lighting conditions, camera quality, weather, and animal behavior variability can influence detection performance. Animals partially obscured by vegetation or at extreme angles may result in reduced confidence scores.

Conclusion

This project presents a real-time wild animal detection and alert system using the YOLO object detection algorithm and computer vision techniques. The system detects multiple animal species from live video streams and automatically triggers an alert mechanism through an Arduino microcontroller. The proposed approach provides an effective solution for wildlife monitoring and helps reduce human–wildlife conflicts. The system demonstrates reliable detection performance and can be further enhanced with additional features such as:

- Human detection filtering to reduce false positives
- Mobile notifications and web-based alerts for remote monitoring
- Cloud-based monitoring systems for managing multiple sites
- Predictive analysis for anticipating animal movement patterns
- Integration with IoT platform

Acknowledgements

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References

For general YOLO background: “YOLO-based models enable fast and accurate real-time object detection suitable for surveillance applications (Redmon et al., 2016; Bochkovskiy et al., 2020).” For “similar work to my project”:
“Several recent works have applied YOLO variants for animal intrusion detection in farmland environments (Wild animal intrusion detection system using YOLO, 2023; Animal intrusion detection system using YOLO v5 algorithm, 2024; Yolov8 based animal intrusion detection for crops protection, 2025).” For showing state of the art / originality: “Most existing studies focus on detection and alerting via messages or emails, often using cloud or IoT-based notification systems (Real-time wildlife intrusion detection system using IoT and YOLOv8, 2024; Protecting crops from animals using YOLO, 2025). In contrast, the present work combines real-time detection with a directly integrated Arduino-based deterrent mechanism, designed as a low-cost solution for small and marginal farmers.

Journal reference style

[1]. Redmon, J., Divvala, S., Girshick, R., &

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Farhadi, A. (2016). You Only Look Once: Unified, Real-Time Object Detection. IEEE Conference on Computer Vision and Pattern Recognition.

[2]. Bochkovskiy, A., Wang, C. Y., & Liao, H. Y. M. (2020). YOLOv4: Optimal Speed and Accuracy of Object Detection.

[3]. Jocher, G., et al. (2023). Ultralytics YOLOv8 Documentation.