WILDLIFE ANIMAL DETECTION IN RESIDENTIAL AREA

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ABSTRACT

The "Wildlife Animal Detection in Residential Areas" project aims to bolster the safety and efficiency of residential areas by integrating advanced computer vision techniques. Focusing on the detection of wildlife near homes at specific distances, the project utilizes the YOLOv3 model. In addition, it employs OpenCV for real-time video processing and incorporates voice alerts for immediate driver notification. In addition to employing OpenCV for real-time video processing, our system integrates voice alerts for immediate driver notification upon detecting wildlife nearby. The camera module's integration enables the precise and prompt detection of wild animal intrusion, which, when discovered, notifies the users through notifications so that they can notify the authorities without endangering the animals in the process. The device's functionality is also assessed by analyzing real-world data, which is helpful in securing living areas. Let's examine this cutting-edge device in more detail and show how it can lower the hazards of wildlife incursions into residential areas. Moreover, IoT-based SMS alerts enable remote monitoring, ensuring homeowners and local authorities are informed of wildlife activity in residential vicinities.

Keywords: Wildlife animal detection, YOLOv3, OpenCV, IoT, SMS alerts, Real-time video processing

1.INTRODUCTION

The results indicate that current responses to wild animal intrusions into residential areas are insufficient. These incursions offer an increasing threat to people's safety and property, ranging from potential life-threatening hazards to damage to private property. Since humans have hurt these animals in the process, it is important to protect both people and animals. This emphasizes how urgent the necessity is. In light of the gravity of this problem, we propose a state-of-the-art system in this look that uses the You Only Look Once (YOLO) framework in conjunction with the Internet of Things (IoT) to detect wildlife in residential areas.

1.1 BACKGROUND OF THE PROJECT

Existing methods for dealing with wildlife in residential areas are often reactive and rely on human intervention. There is a lack of proactive, technology-driven solutions to monitor wildlife activities and provide timely alerts to residents and authorities. This project tries to offer strong and effective ways to enhance house defense and get past the difficulties brought on by encounters with wildlife by combining technology and actual facts. This research addresses this problem by proposing a system that utilizes recent technology and deep learning techniques such as OpenCV, YOLOv3 and embedded technology to detect and monitor wildlife in real-time.

2. LITERATURE SURVEY

Despite developments in camera trap technology, picture processing remains a barrier in wildlife monitoring. Overcoming the challenges associated with manual classification, Yolov3 Machine Learning guarantees precise animal prediction. Despite its good animal prediction capabilities, wildlife monitoring suffers from difficulties in handling diverse landscapes and degraded image quality. We examined several publications on the subject around which our own study has been developed. They are detailed below.

Author: Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi, Unified, Real-Time Object Detection addresses the features of YOLOv3 algorithm.YOLO is a unified model for object detection. This model is simple to build and can be trained directly on complete images. Unlike classifier-based techniques, YOLO trains on a loss function that directly correlates to detection performance, and the entire model is trained together.

Rashmi Jayakumar Animal Detection Using Deep Learning Algorithm gives a detailed explanation about Convolutional Neural Network (CNN) method to recognize wild animals. The algorithm classifies animals efficiently and with a high degree of accuracy, and the image of the detected animal is displayed for a better result, allowing it to be used for other purposes such as detecting wild animals in a pre-recorded videos and images.

Shivam M. Butale1, Kanchan D. Dongare2, Suraj T. Sawant Detection and classification of animals using Machine Learning and Deep Learning. This project implements the animal detection and identification steps using the following techniques: extreme Gradient Boosting (xgboost), Particle Swarm Optimization (PSO), Convolutional Neural Network (CNN).

Gyanendra K. Verma and Pragya Gupta,Wild Animal Detection from Highly Cluttered Images Using Deep Convolutional Neural Network. This system is proposed to monitor wildlife and identify wild animals from extremely crowded natural photos and it provides low recognition rates and high false positive rates result makes it difficult to locate wild animals.

3.OBJECTIVE AND METHODOLOGY

3.1 Proposed work

As autonomous vehicles become increasingly prevalent, it is crucial to address the unique challenges they face when navigating through wildlife-rich areas. Wildlife crossings and unexpected animal behavior pose significant safety risks to both passengers and animals. This project addresses this issue by developing a comprehensive wildlife detection and alert system. The system utilizes YOLOv3 for accurate animal detection, OpenCV for real-time video analysis, voice alerts for in-car notifications, and IoT-based SMS alerts for remote monitoring and intervention.

3.2 Objectives of the Proposed Work

1. Human Safety and Property Protection:

To avoid confrontations between people and wildlife, identify and keep an eye out for potentially dangerous wildlife species (such as bears, cougars, and poisonous snakes) near residential areas. To notify local authorities and residents of the presence of wildlife in order to reduce the possibility of harm or property damage.

2. Wildlife Conservation and Management:

To keep an eye on animal populations and evaluate the distribution and abundance of these species in residential settings. In order to priorities conservation efforts and advance biodiversity conservation, identify important habitat regions within residential zones.

3. Understanding Human-Wildlife Interactions:

To examine trends in the behavior and migration of animals in residential areas as well as patterns of interactions between humans and wildlife and to examine the elements (such as habitat fragmentation and food availability) that lead to conflicts between humans and wildlife in order to create effective mitigation plans.

4. Public Awareness and Education:

To inform locals on the value of coexistence, the ecological roles played by the local wildlife species, and these topics. To inform locals on the best ways to cut down on attractants and lessen the likelihood of human-wildlife confrontations.

5. Policy and Urban Planning:

To incorporate wildlife data and habitat factors into land-use planning procedures to help inform decisions about urban planning and development. To promote laws and rules that promote wildlife-friendly urban planning, foster the development of green spaces, and establish wildlife corridors.

6. Scientific Research and Data Collection:

To aid in scientific research and wildlife management initiatives, gather information on the distribution, migrations, and behaviors of animals in residential areas.To participate in the creation of conservation plans and models of species distribution that are adapted for use in urban and periurban settings.

7. Community Engagement and Collaboration:

To encourage cooperation between municipal officials, wildlife experts, and residents to handle issues pertaining to wildlife and put into practice efficient management plans. In order to foster environmental awareness and stewardship, encourage community participation in citizen science projects and wildlife monitoring programs.

8.Mitigation of Negative Impacts:

To create and put into action preventive strategies to lessen the detrimental effects of human activity such as pollution, habitat degradation, and car crashes—on wildlife populations. To use non-lethal deterrents and management strategies to reduce confrontations and promote harmony between people and wildlife. By focusing on these goals, wildlife animal detection initiatives in residential areas can support biodiversity conservation and sustainable urban ecosystem management while enhancing human and wildlife safety and well-being.

3.3 *METHODOLOGY OF THE PROPOSED WORK*

A methodical approach to data collection, wildlife presence analysis, and conflict mitigation is part of the methodology for wildlife animal detection in residential settings. Below is a summary of the methodology:

1.Surveillance and Monitoring:

Placements of acoustic devices, motion sensors, and surveillance cameras are planned to blend in with the surrounding natural ecosystems and residential areas. These tools record the vocalizations, behaviours, and movements of wildlife, offering insightful data for research.

2.Data Collection and Analysis:

Patterns of wildlife activity are found by methodically analyzing data gathered from monitoring devices. To identify the many kinds of wildlife present, their abundance, and their behavior, this entails examining video footage, deciphering sound recordings, and interpreting sensor data.

3.Species Identification and Classification:

Modern technologies, such machine learning algorithms, are used to automatically identify and categories the many wildlife species that are recorded in the data. This makes it easier to distinguish between benign species and potentially harmful ones, allowing for more focused management approaches.

4.Geospatial Mapping and Analysis:

Geographic Information Systems (GIS) and other geospatial analysis tools are used to map the distribution of animals, transportation corridors, and places with high levels of human-wildlife interaction. To identify important places for action, spatial data are overlaid with information on land use, residential infrastructure, and habitat quality.

5.Risk Assessment and Mitigation Strategies:

Risk assessments are carried out to appraise the probability and possible outcomes of confrontations between humans and wildlife in residential areas. Based on the results, mitigation plans are created and put into action to reduce risks to people's safety and property while also safeguarding wildlife populations.

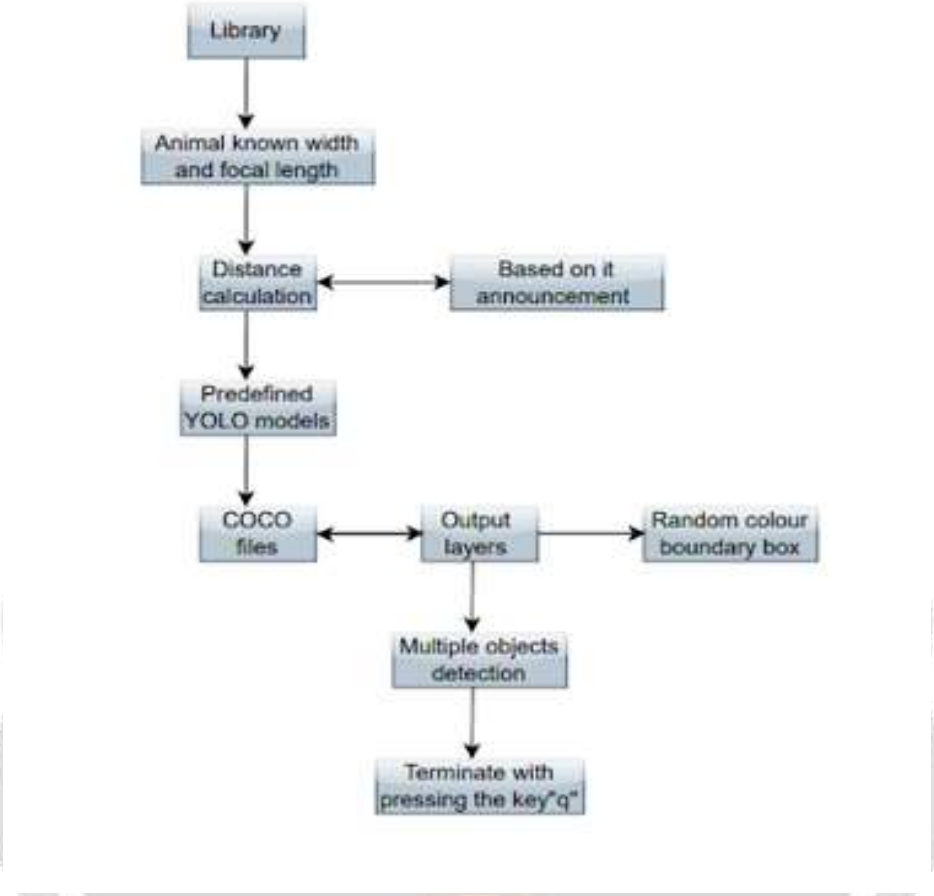
6.Community Engagement and Participation:

Through public awareness campaigns, educational programs, and citizen science activities, community members actively participate in animal detection operations. It is encouraged for locals to share observations and report wildlife occurrences in order to promote a sense of stewardship and group responsibility for wildlife management.

7.Adaptive Management and Continuous Improvement:

The methodology includes an adaptive management approach, in which management plans are modified in response to stakeholder feedback and emerging trends, and monitoring data is routinely examined. The pursuit of perpetual enhancement guarantees the efficacy and adaptability of wildlife detection endeavors to evolving environmental circumstances.

3.3 BLOCK DIAGRAM



4.SPECIFICATION OF TOOLS & TECHNIQUES

1.ESP8266:

A self-contained SOC with an integrated TCP/IP protocol stack, the ESP8266 Wi-Fi Module allows any microcontroller to connect to your Wi-Fi network. Either an application can be hosted on the ESP8266, or it can delegate all Wi-Fi networking tasks to another application processor. Through its GPIOs, this module may be integrated with sensors and other application-specific devices with minimal work required up front and minimal loading during runtime thanks to its robust on-board processing and storage capabilities.

Because of its high level of on-chip integration, it requires very little external circuitry; in fact, the front-end module is made to take up little space on the PCB.

The ESP8266 has an integrated self-calibrated radio that enables it to function in all operational situations, supports Bluetooth coexistence interfaces and APSD for VoIP applications, and doesn't require any other RF components.

2.LCD DISPLAYS:

Consumers employ a variety of display devices. Among the most advanced display devices they use are LCD panels. That will be the most straightforward and dependable output device you employ once you figure out how to interface it. Furthermore, not all projects based on microcontrollers can utilize a debugger. Thus, outputs can be tested using LCD monitors. Naturally, to take use of this final option, you

must be rather proficient with these tools. With its LCD controller integrated circuit (IC), Hitachi has achieved a significant milestone. This IC is built on the architecture that Hitachi introduced.

3.ISD1820 VOICE RECORDER AND PLAYER:

The Voice Record Module is built upon the ISD1820, a multiple-message recorder/player. It provides non-volatile storage, real single-chip voice recording, and a 10-second playback time. This module is simple to operate; it can be controlled by either an on-board push button or a microcontroller, such as an Arduino, STM32, Chip Kit, or another. You can easily control record, playback, repeat, and other functions with them.

4.RESULT AND DISSCUSION

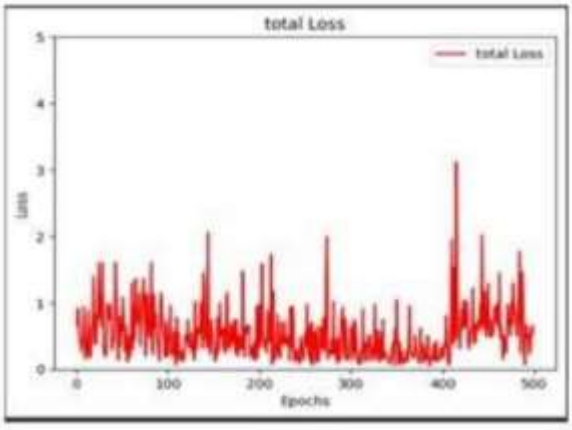
YOLOv3 has been utilized by researchers to find various objects of interest. But the purpose of this project is to examine the behavior of the YOLOv3 neural network in animal detection.

Image	Size (pixel)	Edge Detection Method			YOLOv3
		Canny	Laplacian	Sobel	
1	640 x 360	True	True	True	True
2	840 x 507	True	False	True	True
3	780 x 440	False	False	False	False
4	800 x 600	True	True	True	True
5	340 x 340	False	False	False	True
6	750 x 500	False	False	True	True

4.1 *YOLOv3 results are validated for animal recognition using a template matching approach.*

4.1 Loss in the system

The mean squared error (MSE)loss is the loss function employed in the model. During training, a drop in both the IOU loss and total loss indicates that the model is becoming more accurate in identifying items. Reduced losses signify increased object detection accuracy.



4.1.1 Total loss

4.2 RESULT OF THE PROPOSED WORK

Python is a great choice for developing and deploying deep learning systems because of its adaptability, abundance of libraries, and user-friendliness. Anaconda Navigator is a potent tool for managing Python environments, packages, and development workflows. To guarantee reproducibility and prevent dependency conflicts, we can build isolated Python environments with particular package versions. Packages may be found and installed in a matter of minutes by using search parameters like name and version.

4.2.1Elephant recognized by real time camera

4.2.2 Zebra recognized by real time camera

4.2.3 Grizzly bert recognized by real time camera

4.2.4 Polar bear recognized by real time camera

4.2.5 Giraffe recognized by real time camera

4.2.6 Black bear recognized by real time camera

The outcomes of a wildlife animal detection project in a residential area would normally include the overall effect on wildlife-human interactions, the accuracy of the detections, any false positives or false negatives encountered, and the effectiveness of the detection system in identifying and monitoring wildlife activities. Insights regarding the kinds of species that frequent the area, their movement patterns, and any potential interventions or measures required to lessen conflicts or guarantee the safety of both humans and animals could also be included.

5.CONCLUSION

Discovering wildlife and alerting people about it improves safety, encourages coexistence with animals, supports conservation efforts, and advances knowledge and appreciation of the natural world. With its excellent accuracy and speed, the YOLO v3 algorithm shows significant potential for real-time animal detection in residential environments. The variety of species, the environment, and the frequency of false positives can all affect how effective it performs. Keeping detection reliable in a variety of environmental situation and alerting people to save the lives of both human and wildlife are two challenges. Its performance could be further enhanced by additions like adding more training data and combining with complementary technologies. Enhancing the algorithm's relevance and usefulness in particular regions can also involve tailoring it to identify regional animal species.

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