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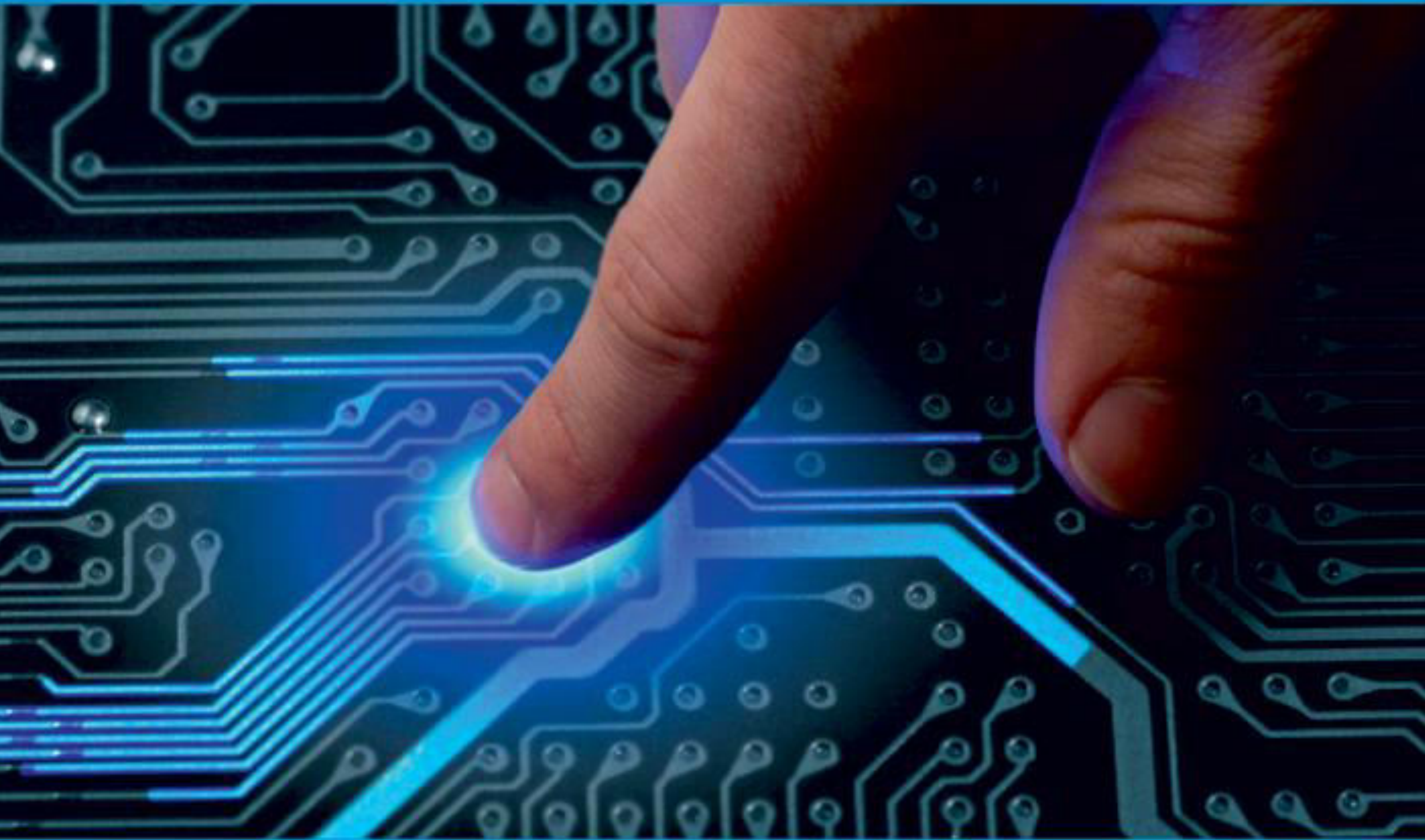

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Creating Alert Messages Based on Wild Animal Detection

Logeswari V, Naga Satvika KS [2], Indhu N[3], Manogna N[4], Praveena.D[5]

Department of Information Technology, RMD Engineering College, Tiruvallur, Tamil Nadu, India[1]

Department of Information Technology, RMD Engineering College, Tiruvallur, Tamil Nadu, India[2]

Department of Information Technology, RMD Engineering College, Tiruvallur, Tamil Nadu, India[3]

Department of Information Technology, RMD Engineering College, Tiruvallur, Tamil Nadu, India[4]

Associate Professor, Department of Information Technology, RMD Engineering College, Tiruvallur, Tamil Nadu, India[5]

ABSTRACT: The "Wildlife Animal Activity Detection in Autonomous Car" project represents a cutting-edge endeavor aimed at revolutionizing the safety and performance of autonomous vehicles. At its core, this project seeks to address the pressing issue of wildlife encounters on roads, a significant challenge that poses risks to both vehicle occupants and wildlife alike. The primary focus of this project is on leveraging sophisticated computer vision algorithms, particularly YOLO (You Only Look Once) models, to detect wildlife animals in close proximity to autonomous vehicles. By employing YOLO models, renowned for their accuracy and efficiency in object detection tasks, the system aims to identify wildlife animals with precision, even at specific distances from the vehicle. This capability is essential for providing timely alerts to autonomous vehicle systems, enabling proactive measures to avoid potential collisions or accidents. To facilitate real-time processing of video data and enable seamless integration with autonomous vehicle systems, the project utilizes OpenCV (Open Source Computer Vision Library). OpenCV serves as the backbone for video processing, enabling the system to analyze incoming video streams from onboard cameras and detect wildlife animals efficiently. In addition to visual detection, the project incorporates auditory cues in the form of voice alerts to immediately notify vehicle occupants of the presence of wildlife animals. These voice alerts serve as a critical safety feature, ensuring that occupants are promptly informed and prepared to respond appropriately to potential hazards on the road.

KEYWORDS*:* YOLO, Open CV ,voice alerts ,wildlife

I.INTRODUCTION

As the prevalence of autonomous vehicles continues to rise, it becomes increasingly imperative to confront the distinctive challenges they encounter when traversing through wildlife-rich regions. Wildlife crossings and unpredictable animal behavior present substantial safety hazards not only to passengers but also to the animals themselves. In response to this pressing issue, this project endeavors to develop a sophisticated wildlife detection and alert system tailored to address these challenges comprehensively. At its core, the system relies on cutting- edge technologies to enhance safety and mitigate risks associated with wildlife encounters on the road. Central to its functionality is the utilization of YOLO (You Only Look Once), a state-of-the-art object detection algorithm renowned for its accuracy and efficiency. YOLO enables precise and real-time detection of wildlife animals,ensuring timely alerts and proactive measures to avoid potential collisions or accidents with YOLO, the system leverages OpenCV (Open Source Computer Vision Library) for real-time video analysis. OpenCV serves as the backbone of the system, facilitating the processing of video streams from onboard cameras mounted on autonomous vehicles.

This enables the system to continuously monitor the surrounding environment for wildlife activity and detect potential hazards in real-time.

1.1 IMAGE

An image is a two-dimensional picture, which has a similar appearance to some subject usually a physical object or a

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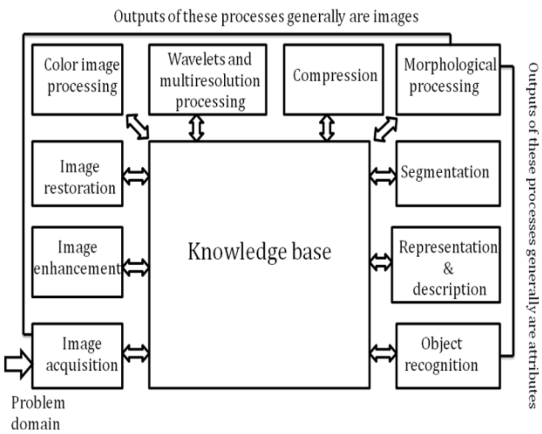
person. Image is a two-dimensional, such as a photograph, screen display, and as well as a three- dimensional, such as a statue. They may be captured by optical devices—such as cameras, mirrors, lenses, telescopes, microscopes, etc. and natural objects and phenomena, such as the human eye or water surfaces. The word image is also used in the broader sense of any two- dimensional figure such as a map, a graph, a pie chart, or an abstract painting. In this wider sense, images can also be rendered manually, such as by drawing, painting, carving, rendered automatically by printing or computer graphics technology, or developed by a combination of methods, especially in a pseudo-photograph.

II. IMAGE PROCESSING

Digital image processing, the manipulation of images by computer, is relatively recent development in terms of man's ancient fascination with visual stimuli. In its short history, it has been applied to practically every type of images with varying degree of success. The inherent subjective appeal of pictorial displays attracts perhaps a disproportionate amount of attention from the scientists and also from the layman. Digital image processing like other glamour fields, suffers from myths, mis-connect ions, mis-understandings and mis-information. It is vast umbrella under which fall diverse aspect of optics, electronics, mathematics, photography graphics and computer technology. It is truly multidisciplinary endeavor ploughed with imprecise jargon.

Several factor combine to indicate a lively future for digital image processing. A major factor is the declining cost of computer equipment. Several new technological trends promise to further promote digital image processing. These include parallel processing mode practical by low cost microprocessors, and the use of charge coupled devices (CCDs) for digitizing, storage during processing and display and large low cost of image



There are 3 types of images used in Digital ImageProcessing. They are

1. Binary Image 2.Gray Scale Image3.Colour Image

III.BINARY IMAGE

A binary image is a digital image that has only two possible values for each pixel. Typically the two colors used for a binary image are black and white though any two colors can be used. The color used for the object(s) inthe image is the foreground color while the rest of the image is the background color.

Binary images often arise in digital image processing as masks or as the result of certain operations such as segmentation, thresholding, and dithering. Some input/output devices, such as laser printers, fax machines,and bi-level computer displays, can only handle bi-level images.

IV. GRAY SCALE IMAGE

A grayscale Image is digital image is an image in which the value of each pixel is a single sample, that is, it carriesonly intensity information. Images of this sort, also known as black -and-white, are composed exclusively of shades of gray(0-255), varying from black(0) at the weakest intensity to white(255) at the strongest.

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Grayscale images are often the result of measuring the intensity of light at each pixel in a single band of the electromagnetic spectrum (e.g. infrared, visible light, ultraviolet, etc.), and in such cases they are monochromatic proper when only a given frequency is captured. But also they can be synthesized from a full color image.

Grayscale images are often the result of measuring intensity of light at each pixel in a single band of electromagnetic spectrum(e.g infrared, visible light, ultraviolet etc) and in such cases they are mono chromatic proper when only a given frequency is captured.

V. COLOUR IMAGE

A (digital) color image is a digital image that includes color information for each pixel. Each pixel has a particular value which determines its appearing color. This value is qualified by three numbers giving the decomposition of the color in the three primary colors Red, Green and Blue. Any color visible to human eye canbe represented this way. The decomposition of a color in the three primary colors is quantified by a number between0 and 255. For example, white will be coded as R = 255, G = 255, B = 255; black will be known as (R,G,B) = (0,0,0); and say, bright pink will be : (255,0,255).
In other words, an image is an enormous two-dimensional array of color values, pixels, each of them coded on 3 bytes, representing the three primary colors. This allows the image to contain a total of 256x256x256 = 16.8million different colors. This technique is also known as RGB encoding, and is specifically adapted to human vision.

VI. MODULES

6.1 INPUT

In the context of computer vision and machine learning, the term "input" refers to the data or information provided to a system for processing. This data could come in various forms, such as images, videos, or sensor readings.In the case of object detection tasks like YOLO (You Only Look Once), the input typically consists of images or video frames containing objects that the system needs to detect and classify.

6.2 PRE-PROCESSING

Pre-processing involves a series of operations performed on the input data to prepare it for further analysis or processing. In the context of computer vision, pre-processing steps may include tasks such as resizing,normalization, noise reduction, or image enhancement. These operations help improve the quality and consistency of the input data, making it more suitable forsubsequent analysis by algorithms like YOLO.

6.3 FEATURE EXTRACTION

Feature extraction is the process of identifying and selecting relevant characteristics or patterns from the input data that are informative for the task at hand. In computer vision tasks like object detection, feature extraction involves identifying distinctive visual attributes or descriptors in the input images that can be used to distinguish between different objects.

These features could include edges, corners, textures, or color histograms, depending on the specific requirementsof the task and the algorithms being used.

6.4 TEST IMAGE

A test image is a sample image or data point used to evaluate the performance of a computer vision system or algorithm. In the context of object detection, test images typically contain objects of interest that the system is tasked with detecting and classifying. Test images are essential for assessing the accuracy, robustness, and generalization capabilities of object detection algorithms like YOLO under various conditions and scenarios.

6.5YOLO

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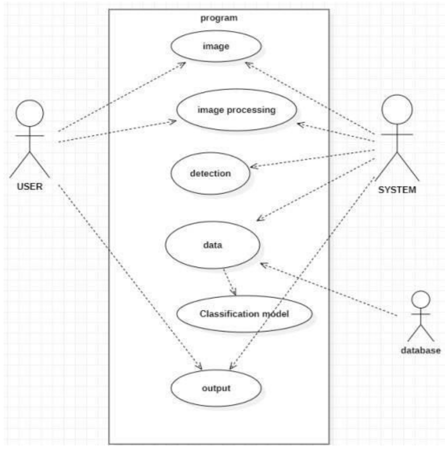
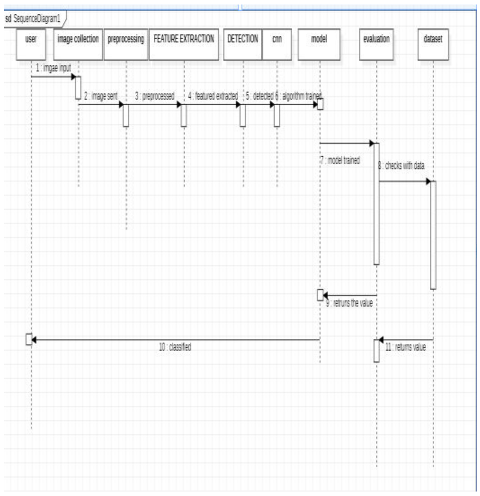
YOLO (You Only Look Once) is a popular object detection algorithm known for its speed and accuracy. Unlike traditional approaches that require multiple passes over an image, YOLO processes the entire image in a single feedforward pass through a convolutional neural network (CNN), enabling real-time object detection. YOLO divides the input image into a grid of cells and predicts bounding boxes and class probabilities for objects within each cell. This efficient architecture makes YOLO well-suited for applications requiring fast and accurate object detection, such as autonomous driving, surveillance, and robotics.



Use Case Diagram



Sequence Diagram

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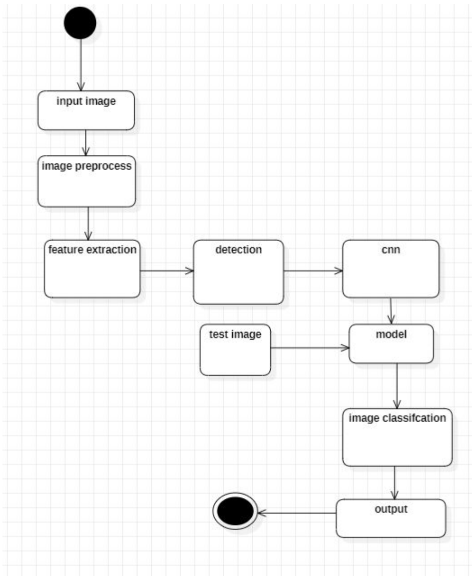

Activity Diagram

VII. PROPOSED SYSTEM

The proposed system represents a significant advancement in addressing the safety challenges posed by wildlife encounters in autonomous vehicles. By leveraging state-of-the-art computer vision models, specifically YOLO (You Only Look Once), the system aims to accurately detect wildlife animals with precisionand efficiency. YOLO's renowned object detection capabilities enable the system to identify wildlife in real-time, even in complex and dynamic environments characteristic of wildlife-rich areas.

Complementing YOLO, the system integrates OpenCV (Open Source Computer Vision Library) for real-time video analysis. OpenCV serves as the backbone of the system, facilitating the processing of video streams captured by onboard cameras mounted on autonomous vehicles. This allows the system to continuously monitor the surrounding environment for wildlife activity and detect potential hazards in real-time, enhancing situational awareness and enabling proactivemeasures to mitigate risks.

Furthermore, the inclusion of voice alerts adds another layer of safety by notifying passengers about detected wildlife animals. These voice alerts serve as immediate notifications, ensuring that occupants of autonomous vehicles are promptly informed of potential hazards. Byproviding real-time information to passengers, the system empowers them to react prudently and take appropriate actions to avoid wildlife-related accidents. In addition to voice alerts, the system incorporates IoT (Internet of Things) technology to enable SMS alerts, allowing for remote monitoring and timely intervention. Through IoT-based SMS alerts, designated contacts such as vehicle operators or wildlife conservationists can receive instant notifications of wildlife activity detected by the system. This facilitates proactive measures and timely interventions to ensure the safety of both passengers and wildlife

Overall, by combining these components, the proposed system offers an enhanced level of safety for autonomous vehicles operating in wildlife-rich environments. It provides passengers with real-time information to make informed decisions and react appropriately to potential hazards, while also enabling designated contacts to take proactive measures to mitigate risks. Ultimately, the system aims to reduce the risk of wildlife-related accidents, contributing to safer and more sustainable transportation in natural environments.

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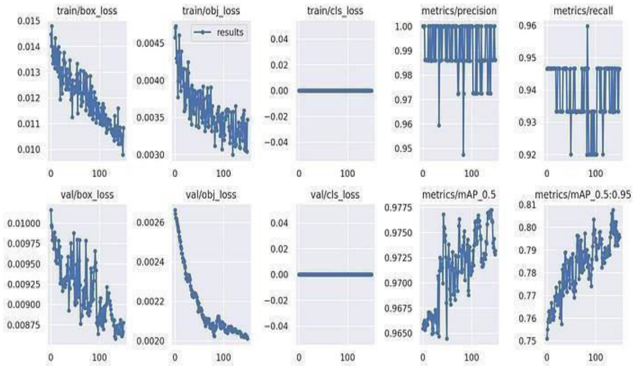
VIII. RESULTS

As, we can see below, during fine tuning stage the metricesand losses are improving



Inference Results Image

IX.CONCLUSION

In conclusion, the "Wildlife Animal Activity Detection inAutonomous Car" project stands as a testament to innovation, safety, and ecological responsibility in the realm of autonomous transportation. By harnessing the power of state-of-the-art computer vision technology, wehave successfully developed a robust system that addresses the critical issue of wildlife collisions on our roads.

Through meticulous design and implementation, our system not only enhances safety for passengers and drivers but also plays a pivotal role in protecting biodiversity and preserving fragile ecosystems. By providing real-time alertsand proactive measures to mitigate risks associated with wildlife encounters, we are not only safeguarding human lives but also minimizing the impact of vehicle collisions onwildlife populations.

This project represents a significant milestone in the evolution of autonomous vehicles, as it underscores our commitment to responsible technological innovation. By integrating cutting-edge technologies with a deep sense of environmental stewardship, we have paved the way for saferand more ecologically conscious transportation systems.

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As we look to the future, our dedication to refining and deploying this system remains unwavering. We are committed to collaborating with stakeholders, researchers, and policymakers to ensure the widespread adoption and implementation of our wildlife detection system. Together, we can continue to make our roads safer, our ecosystems healthier, and our communities more sustainable for generations to come grazing, or resting.

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