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Animal Detector System for Forest Monitoring using OpenCV and Raspberry-pi

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Abstract: ***The presented prototype system offers a solution for tracking animals, assets, or people using only Global System for Mobile Communications (GSM) services. The development and application of living terrain by humans have led to harm to wild creatures, making it crucial to explore animal monitoring system technology. This project utilizes a GSM modem to send SMS notifications to the designated person, allowing for real-time tracking of the target. Such a system could have great significance in protecting and preserving wildlife in the face of rapid population and financial growth***
Keywords: Detection, Monitoring, YOLO,

I. INTRODUCTION

The importance of preserving wildlife cannot be overstated, as every living being on earth plays a vital role in the ecosystem. However, with the rapid growth of human society and the economy, wild animals are increasingly facing danger. In countries such as India, animal attacks are becoming more common due to the encroachment of humans into their habitats. Proper security measures and detection systems are crucial to not only save human lives but also to preserve the wildlife and their habitats. This is where an animal monitoring system comes into play, as it can aid in real-time tracking and monitoring of animals, assets, or people in a given area. By utilizing technology such as GSM services, we can develop a system that can alert designated personnel in the event of any suspicious activity or danger, thus enabling timely and effective action to protect the wildlife and the people. In this paper, we will discuss the prototype system for animal monitoring using GSM services and its potential impact on preserving wildlife

II. WORKING

A. YOLO Algorithm

Yes, that's correct! YOLO stands for You Only Look Once is a popular algorithm that is used for object detection in computer vision. It uses a neural network to predict the presence of objects in an image and their corresponding bounding boxes, all in one shot, hence the name "You Only Look Once."
YOLO is known for its speed and accuracy in detecting objects, making it a popular choice in applications such as self-driving cars, security systems, and image and video analysis. YOLO v3, the latest version of the algorithm, has improved accuracy and speed compared to previous versions.

B. What is YOLO?

Yes, that's correct! YOLO stands for "You Only Look Once" and it uses a convolutional neural network to perform object detection. YOLO detects objects in the form of a regression problem, where it predicts the bounding boxes, class probabilities for all objects present in an image. This means that YOLO can detect multiple objects in a one goes through a network, making it quicker and more efficient than other object detection algorithms that require multiple chances through the image.
Algorithm is trained on large datasets of labeled images using a combination of supervised learning and backpropagation techniques. Once the network is trained, it can detect objects in real-time by performing a single forward propagation through the network. Overall, YOLO is most powerful and most efficient object algorithm that has been used in a wide range of applications in computer vision, including self-driving cars, surveillance systems, and robotics.

C. Why YOLO Algorithm is important?

One of the major advantages of YOLO is its speed. Because it only requires a single forward pass through the network to detect objects in an image, YOLO can operate in real-time, making it well-suited for use in applications that require fast and accurate object detection.

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In addition to speed, YOLO is also known for its high accuracy. It uses a predictive technique that allows it to accurately identify and localize objects in an image, while minimizing background errors.

Finally, YOLO has excellent learning capabilities. By training on large datasets of labeled images, the algorithm can learn to recognize and classify objects in a wide range of settings and environments. This enables YOLO to generalize well to new images and detect objects with high accuracy, even in complex and cluttered scenes.

1) How the Yolo Algorithms Work?

- Residual blocks
- Bounding box regression
- IOU (Intersection Over Union)

Residual blocks are a key component of the YOLO algorithm. They allow the network to learn residual mappings, which can improve the accuracy of the predictions. Residual blocks were first introduced in the Reset architecture, and have since become a common feature in many state-of-the-art deep learning models.

Bounding box regression is another important aspect of the YOLO algorithm. It involves predicting the coordinates of the bounding box for each object in an image, along with a score that represents how likely it is that the object is present in box. The bounding box is represented as a set of attributes, including the width, height, class, and centre of the box.

Finally, IOU (Intersection over Union) is used in YOLO to evaluate the accuracy of the bounding box predictions. IOU is a measure of how much two bounding boxes overlap, and is used to determine whether a predicted box matches the ground truth box for a given object. This helps to eliminate false positives and improve the accuracy of the object detection.

2) Conclusion Of 3 Technologies

where the input image is divided into a grid of cells, and each cell is held responsible for detecting presence of objects in boundaries.

To do this, each grid cell predicts B bounding boxes that define the location and size of potential objects within the cell, as well as the confidence scores for each box. Additionally, each cell predicts the probability distribution of different object classes that might be present within its boundaries.

By making predictions simultaneously for all three object classes - dog, car, and bicycle - using a single CNN, the model can identify and localize multiple objects of different classes within an image. This approach is commonly used in detection tasks, and can be further optimized using techniques like non-maximum suppression to remove duplicate or overlapping detections.

D. Applications of YOLO

1) *Autonomous Driving:* Yes, YOLO (You Only Look Once) can be used in autonomous cars for object detection tasks to identify and track objects in real-time, such as other vehicles, pedestrians, traffic signs, and traffic lights. This can help in avoiding collisions and improving the safety of the autonomous driving system.

The YOLO algorithm is designed for real-time object detection and localization in images and video, making it suitable for use in autonomous driving applications where speed and accuracy are critical. Yes, a single neural network can be used to predict object bounding boxes and class probabilities directly from the full image. This is typically done using a type of CNN called an object detection network, without relying on region proposals or sliding windows.

By integrating YOLO into an autonomous driving system, the system can quickly and accurately identify and track objects in the car's surroundings, enabling the system to make informed decisions about speed, direction, and other driving parameters to ensure safe and efficient operation.

2) *Wildlife:* Yes, object detection algorithms like YOLO can be used to detect various animals in forests and wildlife habitats, which can be useful for wildlife rangers, researchers, and journalists who are studying or reporting on animal behavior.

Training a YOLO (You Only Look Once) model on a dataset of annotated wildlife images and videos can be a very effective way to perform object detection in these types of environments, the algorithm can learn to recognize and localize different animal species in various poses and lighting conditions. This can help wildlife rangers to monitor animal populations, track animal movements, and detect poaching activities in real-time. It can also help journalists to identify animals in their footage and provide accurate information to the public.

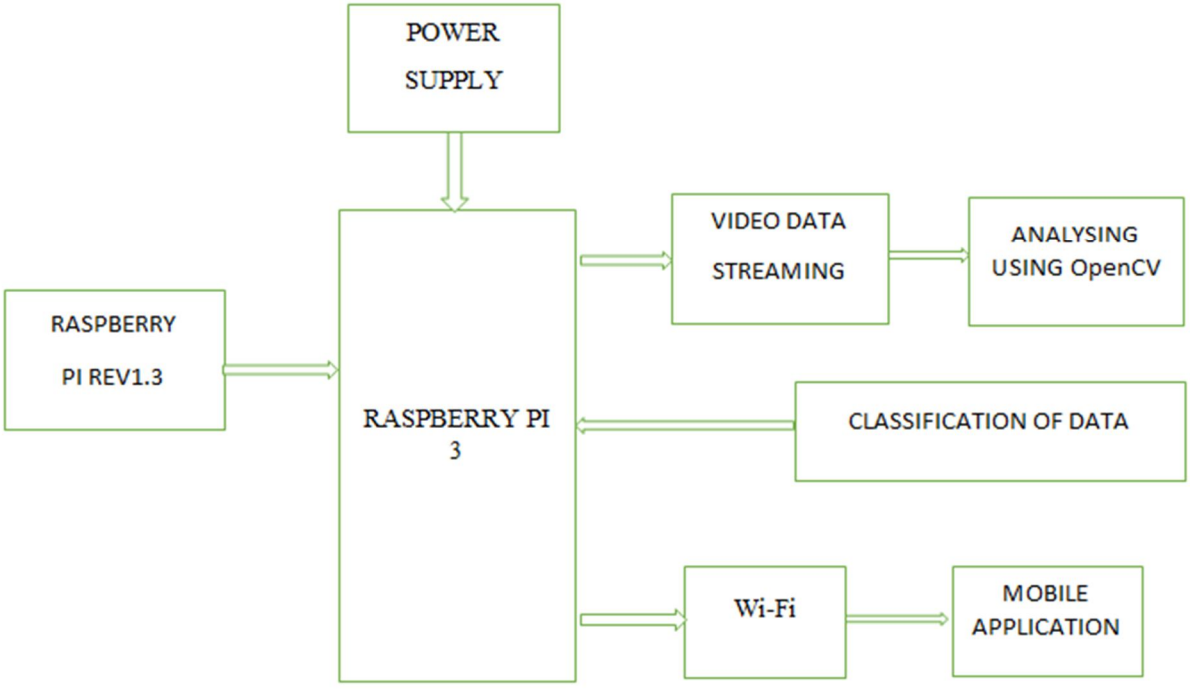
However, it is important to note that object detection in wildlife comes with its own set of challenges, such as varying lighting conditions, occlusions, and complex backgrounds. Furthermore, the use of object detection algorithms in wildlife research and conservation should be carried out with care and consideration for the welfare of animals and their habitats.

3) Security: Yes, YOLO (You Only Look Once) is indeed used in security systems to detect and track objects in real-time. It can be used to detect people who are passing through restricted areas for security reasons and alert security personnel to take action.

The YOLO algorithm is trained on large datasets of images and videos, which enables it to identify different types of objects, including people, with high accuracy. When a person passes through a restricted area, the algorithm can quickly detect their presence and send an alert to security personnel, who can then take appropriate action.

Using YOLO in security systems can help to improve the overall security of an area by providing real-time monitoring and detection of potential threats. This can help to deter criminals and prevent unauthorized access to restricted areas, ultimately making the area safer for everyone.

E. Block diagram

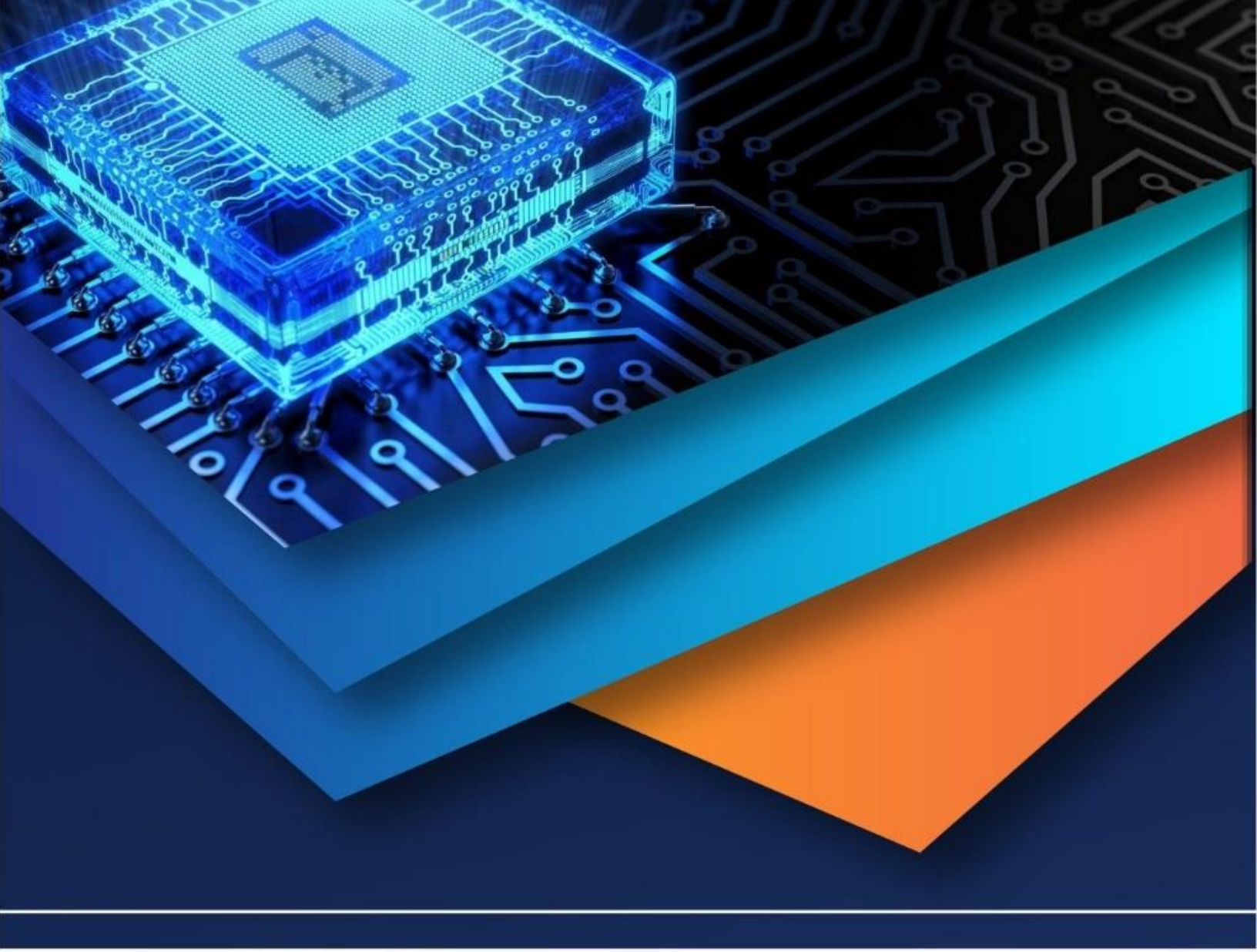


III. CONCLUSION

This paper is conclude that the we can build the low cost, easy to use and easy to maintain Animal detection and monitoring for wildlife protection, for small industries or business.

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