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Research Article

Object Detection with Database Sever using Yolov4-Tiny

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ABSTRACT

Object Detection robots have been researched and actively developed over the decades because of their vast applications in numerous fields like industries, hospitals, the Military, Hotels etc. it can efficient on human oversight as human as limitation. Different techniques like robot control algorithm, target detection, Object Detection and obstacle avoidance are necessary for the robot to execute. Several Object-Detection robotic procedures are suggested, just like the employment of ultrasonic sensors, infrared sensors, laser range sensors, voice recognition sensor cameras, and so on. During this paper, we will try and present and object detection model which and detect unknown object in parking and forward to user further it can be also use for car number plate detection and its application, which and help for development of smart city.

Keywords: Object Detection, object identification, store data to database, autonomous, human safety, robot application.

INTRODUCTION

Object detection Technology has increased appreciably in past couple of years. Such innovations were only a dream for some people a couple of years back. But in this rapid moving world, now it has been developing and greatest project like Chandrayaan-3 which works on object detection technology robot such as “An Object Detection Robot” that can interact and co-exist with them. The development of robot technology has surged significantly due to its applications in industrial, medical, and military fields. In various challenging environments such as underground mining, war zones, medical facilities, construction sites, and space exploration, object detection is crucial. This task involves identifying objects of interest within images. Until recently, this required powerful computers due to the complexity of the models and the extensive mathematical computations involved.

However, platforms like Edge Impulse have significantly lowered the entry barrier for beginners. Now, it's possible to easily train an object detection model in the cloud. Deploying this model to an ESP32 camera, though, remains a bit more complex.

Introducing object detection in an automated parking management system represents a pivotal leap in modernizing and optimizing the parking experience. Object detection, a cutting-edge technology leveraging artificial intelligence and computer vision, revolutionizes the traditional parking paradigm by introducing real-time, intelligent monitoring and management of parking spaces.

In the realm of parking management, the integration of object detection serves as a transformative solution addressing various challenges encountered in urban or congested parking environments. By employing advanced algorithms and sensors, this system can instantaneously recognize, analyze, and respond to the presence or absence of vehicles within a parking facility.

It can also help to identify the unknown object present in the parking area. These all features can lead to the mission of smart city which was introduced by our prime minister in 2015.it is also useful in governments project to find unknown object in the area.

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The core principle of object detection within automated parking lies in its ability to accurately identify and track vehicles as they enter, navigate, and exit parking spaces. This technology enables the system to precisely pinpoint available spots, efficiently guide vehicles to these openings, and dynamically manage parking space allocation in a seamless and optimized manner.

The introduction of object detection in automated parking systems doesn't solely focus on enhancing convenience for drivers. It fundamentally aims to redefine the efficiency, safety, and sustainability of parking facilities. By leveraging real-time data and intelligent decision-making, it streamlines traffic flow, minimizes congestion, enhances safety measures, and maximizes space utilization.

This integration embodies the convergence of sophisticated technology and practical application, promising a future where parking management transcends its traditional constraints. The introduction of object detection heralds an era of smart, responsive, and user-centric parking solutions that not only revolutionize the parking experience but also contribute significantly to the broader vision of smart cities and efficient urban infrastructure.

LITERATURE SURVEY

From the above abstract after reading multiple paper, I have come to the conclusion that. after many reach the only thing done is that the object detection using different technique. but after object detection what? So, the gap which was find by me is no further application in real life use. So, I have tried to use in parking system which can help to build smart city Ans for human safety.

Drawbacks find outs:
only object detection done No application or future scope
sensors failure, Obstacles avoid error
Accuracy and Reliability: Many traditional object detection methods, such as sensor-based systems, may suffer from inaccuracies and false positives/negatives. Similarly, computer vision and deep learning approaches may struggle in challenging conditions like poor lighting, occlusions, or adverse weather conditions, leading to decreased reliability.

Processing Speed: Some object detection algorithms, especially those based on deep learning, can be computationally intensive, leading to slower processing speeds. In real-time parking scenarios, delays in detecting and notifying users about available parking spots can diminish user satisfaction and efficiency.

Cost: Implementing sophisticated object detection systems, especially those leveraging advanced computer vision or deep learning techniques, can be expensive. The cost of hardware, software, and infrastructure required for deployment may pose a barrier to widespread adoption, particularly in smaller parking facilities or municipalities with limited budgets.

Gap analysis (to be implemented):
Camera and computer vision can use to implement human target or object detection
Camera and computer vision can use to implement human target detection.
real time location of robot and human is missing
This literature survey provides insights into the state-of-the-art techniques for object detection in parking systems and the integration of user notification systems. It serves as a valuable resource for researchers, developers, and practitioners seeking to understand and improve parking management solutions.

METHODOLOGY

Methodology use for yolo v4-tiny is FRN to make the final prediction, and finally formed two prediction scales of 26×26 and 13×13. In Yolov4-Tiny, the input image size is 416×416, and then multi-scale detection is carried out by fusing FPN idea, and two detection layers are output.

In this work, an improved target detection method based on Yolov4-Tiny is proposed. (hereinafter referred to as Yolov4-Tiny-Bi). The backbone network adopts CSPDarknet53-tiny, and the head uses a spatial pyramid pool and the improved BiFPN is introduced to make most use of the multi-scale information between different layers. Figure 2 shows the network structure.

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YOLOv4-Tiny is limited to two prediction scales, namely 13x13 and 26x26, resulting in only two feature maps being generated from the deeper network. However, deeper networks tend to overlook shallow edge information, leading to a loss of feature semantics as the network depth increases. With each layer, there is a certain degree of feature loss, necessitating the integration of features across different levels to enrich semantic information.

To address this, BiFPN maximizes the utilization of features between shallow and deep networks by conducting bidirectional fusion of network features, both bottom-up and top-down. Consequently, an enhanced version of BiFPN replaces the original FPN to facilitate more effective feature integration and preservation of semantic information across network layers.

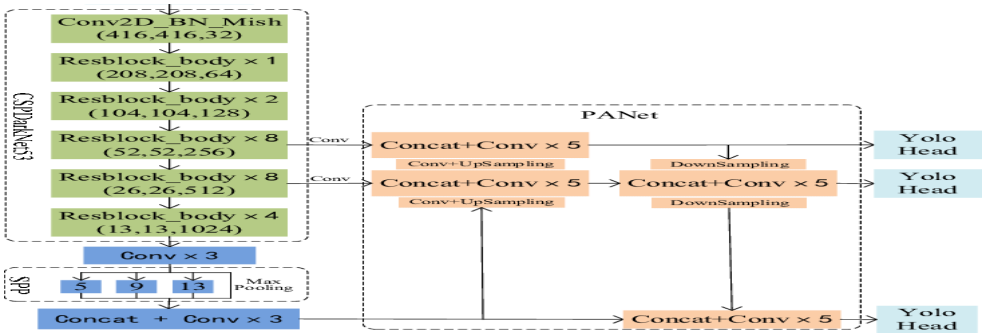

Figure 1: Network architecture Yolov4-tiny-Bi

BiFPN (Figure 3) use the idea of bidirectional fusion to construct a bottom-up and top-down bidirectional channel to carry out bidirectional fusion of information from diverse layers of the trunk network, so as to alleviate the loss of feature information caused by too many network layers.

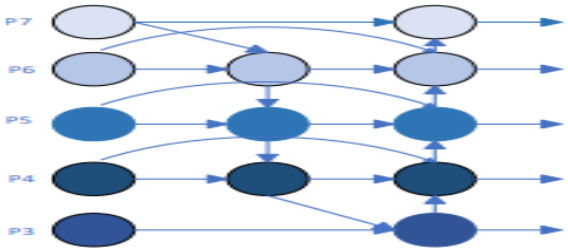

Figure 2: Network architecture of improved BiFPN

IMPLEMENTATION

Hardware tools required are as follows:

1.Raspberry Pi Module 4:

The Compute Module 4 by Raspberry Pi embodies the essential components of a Raspberry Pi 4 board in a more condensed package, offering additional features such as optional onboard flash storage. Its compact design and functionality render it ideal for various deeply embedded applications, commonly employed across industrial automation, consumer electronics, and beyond

2.ESP32 CAM Module

ESP32 is a camera module mostly used for Iot project, it comes with integrated microcontroller along with Wi-Fi and Bluetooth.

It is useful for capturing images and video, and can be programed by using Arduino

3.ESP CAM Module Programmer: this module basically uses to program the ESP32 cam Module

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4. Arduino UNO: - This serves as the core of our project, issuing commands to subordinate components that operate based on human interaction. Additionally, it provides feedback to both the components and the user, facilitating communication between humans and robots. Its specifications include an 8-bit CPU, 16 MHz clock speed, 2 KB SRAM, 32 KB flash memory, and 1 KB EEPROM.

5. Adafruit Motor Shield:

The Adafruit Motor Shield offers a convenient and efficient solution for controlling various motors, including DC motors, servos, and stepper motors. It can manage up to 2 stepper motors, 4 DC motors, and 2 servos simultaneously.

6.HC-06 Bluetooth Module:

HC-05 Wireless Bluetooth Module: The HC-05 module allows you to easily integrate Bluetooth functionality into your Arduino project. With this module, you can use your Android phone to control various devices, such as switches and LEDs.

7.Servo Motor:

The TowerPro SG90 9g Mini Servo is a digital servo motor capable of 180° rotations. It excels in receiving and processing PWM signals quickly and efficiently.

8. Arduino Nano:

The Nano board is quite similar to the Arduino Uno in terms of pin configuration and features, but it has gained popularity for its compact size. In designing embedded systems, smaller components are often preferred, making the Nano an excellent choice. Arduino boards, including the Nano, are widely used to build various electronic projects.

The software comprises of the following:

1.The project code is written using Arduino IDE version 1.8.1. The Arduino Integrated Development Environment (IDE) is a cross-platform application available for Windows, macOS, and Linux, utilizing functions from C and C++.

2. Another software in use is MySQL Workbench, which serves as a unified visual tool catering to database architects, developers, and DBAs. It offers functionalities such as data modeling, SQL development, and a wide array of administration tools for server configuration, user management, backups, and beyond

3.Python Software:

Python is an object-oriented programing language which support multiple programing paradigms.it is user friendly. Python is a versatile, high-level programming language known for its emphasis on code readability through significant indentation. It features dynamic typing and garbage collection, and supports various programming paradigms such as structured, object-oriented, and functional programming.

4. List of all database and server:

a. Apache: it is like a gate keeper which allows or handle incoming PHP request

to install Apache command “sudo apt-get install apache2-y”

An Apache server, in the context of PHP, refers to the Apache HTTP Server (commonly called Apache), which is an open-source web server software. It is one of the most widely used web server systems in the world. When paired with PHP, Apache serves as the backbone for delivering dynamic web content.

b. Install/Configure PHP:

PHP is a versatile programming language employed for crafting dynamic and interactive websites, widely utilized across a spectrum of web applications ranging from e-commerce platforms to CRM systems such as HubSpot and Salesforce. PHP, an acronym for PHP Hypertext Preprocessor, empowers developers to create dynamic web experiences seamlessly. to install php in raspberry pi “sudo apt-get install libapache2-mod-php”

c.Php my admin:

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phpMyAdmin is a sever or web server which perform or can handle data base online

it is written in php. phpMyAdmin is a freely available software tool crafted in PHP, designed specifically for managing MySQL or MariaDB database servers effortlessly. With phpMyAdmin, you can efficiently execute various administration tasks, including database creation, query execution, and user account management, streamlining database administration processes.

RESULTS & DISCUSSION

The result shows that we are able to detect object using esp32 cam and using python yolov4 tiny. We are also able to show the data which has been stored in database. we have also done the gate opening system using same architecture.

The results achieved by implementing object detection in automated parking management systems are transformative and multifaceted, leading to several significant outcomes:

Optimized Parking Utilization: Object detection enables real-time identification of available parking spaces, maximizing space utilization within the parking facility. This optimization results in increased capacity and more efficient use of the available area.

Reduced Congestion and Traffic Flow: By guiding drivers to open parking spots swiftly, the system minimizes traffic congestion within the parking facility. This streamlined flow of vehicles leads to reduced waiting times and smoother traffic movement.

Improved User Experience: Drivers benefit from a more convenient and hassle-free parking experience, as the system provides accurate information about available parking spots through user-friendly interfaces. This improvement enhances overall satisfaction and loyalty.

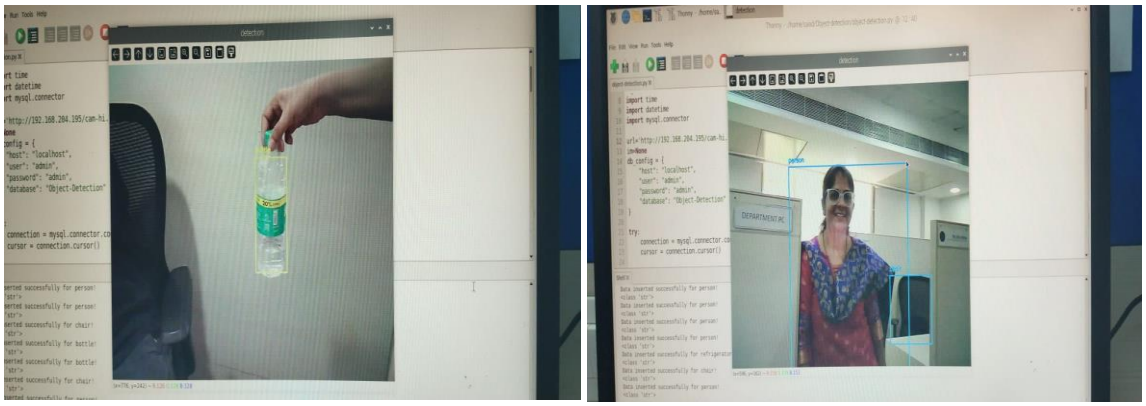

Figure 3: result 1

Figure 4: result 2

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CONCLUSION

In conclusion, implementing object detection in parking systems to identify both expected objects and unfamiliar items brings about several key benefits. Firstly, it enhances security by enabling the detection of suspicious or unauthorized items within parking areas, thereby reducing the risk of theft, vandalism, or other security breaches. Secondly, it optimizes parking management by accurately identifying available spaces and efficiently guiding drivers to vacant spots, thus reducing congestion and improving the overall parking experience. Additionally, object detection facilitates the monitoring of parking regulations and enforcement of rules, ensuring compliance and enhancing safety for both pedestrians and vehicles. Overall, integrating object detection technology into parking systems represents a significant step towards achieving enhanced security, efficiency, and convenience in parking facilities.

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