Real-time moving object detection and tracking using yolo algorithm

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Abstract - The main aim of this project is to develop a cost and application-efficient solution where the objects can be detected and tracked at the same time using a camera while they are in motion through machine learning and radar principle which can be used for military and surveillance purposes. This can be implemented with the help of a camera that is connected to a PC and is used to detect and track the object when it is positioned within giving the signal to the camera. To determine the distance of the captured image, an ultrasonic sensor is used which is mounted on the servomotor. This can be achieved by using software called python. Object detection and tracking are widely used in many fields such as video surveillance, traffic management systems, human-computer interaction applications, motion capture systems for electronic games, and vehicle navigation.

Index Terms - Python, you only look once(YOLO), NumPy, OpenCV, Object detection and tracking

I. INTRODUCTION

Object detection refers to detecting an object in an image or a single frame of a video. Object tracking refers to the ability to estimate the location of an object in an image sequence or a consecutive frame. To track an object the object should be accurately detected in a single image that represents a snapshot of the scene. Yolo is a single-shot detector. To process an image, a fully convolutional nezural network is used. An object detection and tracking system aim is to detect the object and capture the motion of an object. This system calculates object-based information such as the orientation of the object, shape, and distance of the object. For object detection and processing of the image, python software is used. The algorithm used in this is the yolo algorithm which detects and recognizes multiple objects in a picture in real-time with the application of Artificial intelligence and deep learning. YOLO algorithm is used to detect and track multiple objects when it is positioned within the sight of the camera that is connected. It is a predictive technique that provides high speed of detection and accurate results. This application can be used in the military, intelligence monitoring, home security system, human-machine interface, virtual reality, motion analysis, and for other security purposes.

A.YOLO ALGORITHM: YOLO, 'You Only Look Once'. This is an algorithm that detects and recognizes multiple objects in an image or sequence of an image frame in real time. It is the fastest algorithm to detect the object. It is fast and efficient, which allows it to process images in real-time.

B. PYTHON: Python is a high-level programming language. Python is easy to read and maintain. It uses to create web applications on a server.

C. Object Detection: Object Detection is used to detect the object in an image. It identifies and locates the objects in an image or video. There are some best object detection algorithms; they are YOLO, R-CNN, and Mobile Net.

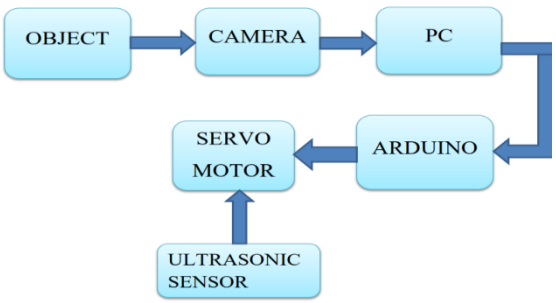
D. Object Tracking: Object Tracking is used to track the movement of an object in an image or image frame in a video. It is the task of estimating or predicting the positions and other relevant information of moving objects in a video

E. OpenCV: OpenCV is an open-source computer vision. It provides a real-time computer vision library and tools.

F. NumPy: NumPy stands for Numerical Python. It is an open-source python library. It uses mathematical operations on arrays.

II. IMPLEMENTATIONMETHODOLOGY

BLOCK DIAGRAM:



The image is captured by the camera which sends the image frames to the PC and detects the object and displays object name. Arduino which is connected to PC sends commands to run the servomotor. Servomotor starts rotating on which an ultrasonic sensor is mounted. The ultrasonic sensor which used to calculate the distance and angle of the detected object.

COMPARISON TABLE:

YOLO	R-CNN	SSD
It uses little processing memory.	It needs a lot of storage and processing power for detection and is slower than SSD and R-CNN.	It is slower when it contains more convolution compared to YOLO.
It is faster than the R-CNN family and SSD.	It is slower than SSD and YOLO.	It is faster than the R-CNN family but slower than YOLO.
The accuracy of detection is high compared to SSD and R-CNN.	The accuracy of detection is less compared to YOLO and SSD.	The accuracy of detection is less as compared to YOLO and R-CNN.
It takes less time to detect the objects.	It takes more time to detect the objects compared to YOLO and SSD.	It takes less time to detect the object compared to YOLO.
YOLO has a higher choice even when the object size is small.	It can't detect multiple objects.	When the object size is tiny and the performance is low.

Hardware setup:

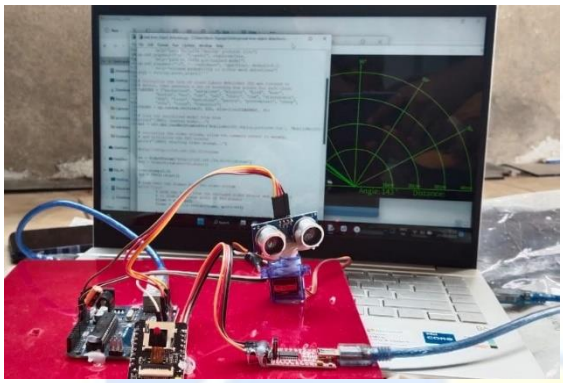


Figure. Hardware Design

Yolo is a computer vision technique in which visual objects can detect and tracked using python software, OpenCV, and NumPy libraries. The dataset configuration and weights files are from the darknet software and trained in google colab. The entire process is in the python idle. For detecting and tracking an object esp32 cam and webcam are used to capture and process the image. It specifies the specification and confidence level of an object. The ultrasonic sensor measures the distance and angle of an object.

III. SIMULATION RESULTS AND ANALYSIS:

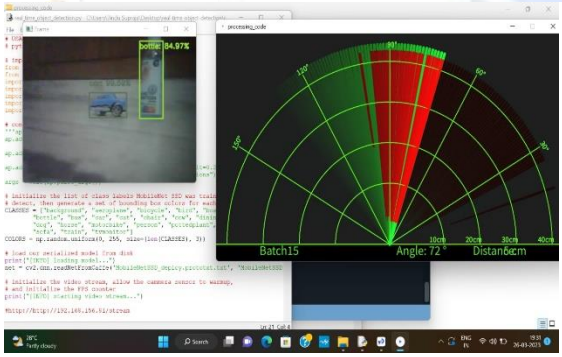


Figure. Output 1

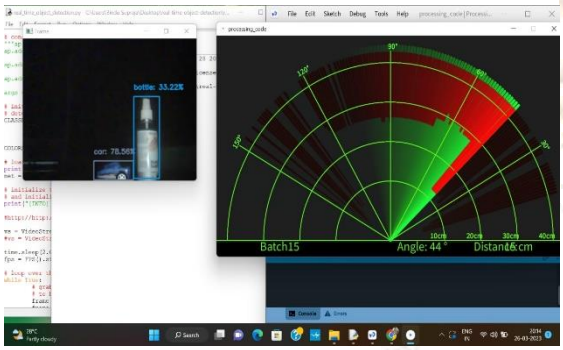


Figure. Output 2

IV. CONCLUSIONS:

This project is to develop a system that can detect and track moving objects using YOLO (you only look once) algorithm. This algorithm is successfully implemented using a machine learning tool, Google Colab. The input for this project is given in two ways, image and video sequence which are captured by the camera. As a result, the algorithm can detect and track the moving objects that emerged fully within the camera view range. The proposed system can be implemented further using raspberry pi as it is a microprocessor and has a camera module WLAN adapter, so it doesn't need any hotspot or wifi from external devices. Our system is limited to 20 objects like objects and vehicles, this can be expanded to multiple objects or can be reduced for a specific object with different number of dataset images.

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V. REFERENCES

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