Smart Detection For Violation of Traffic Rules using YOLOv5 And OpenCv

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Abstract- *In the trending fast pace lifestyle, we all are moving and tend to be moving faster. However, moving faster has its own limitation and advantages too. In the case of vehicles, road accidents are more common due to fast travelling. During the year 2022, the total of 3.6 lakh road accidents happened. To control the road accidents, we need to spot the reason and origin of the accident and in maximum cases it is because of violation of traffic rules. To automatically detect the violation of traffic rules, we use techniques like YOLOv5, OpenCV, CNN, etc. In our project we use YOLOv5 algorithm to detect vehicle which performs traffic violations and then we extract the details from the vehicle's number plate using OpenCV. Once we find the details of vehicle, we can able to spot the person who violated the traffic rules and the further formalities like sending summon to his/her address can be done. We use YOLOv5 because it is an algorithm which detect objects in real time and it has more pros like smaller in size, faster, accurate, simple and reliable than the rest of the versions of YOLO.*

Keywords- YOLOv5 (You Only Look Once version 5), OpenCV (Open Computer Vision), CNN (Convolutional Neural Network), Traffic Rules Violation, OCR (Optical Character Recognition), Road accidents

I. INTRODUCTION

The real problem in our daily lifestyle regarding transportation is how safe are our roads to travel and how long we should follow the rules while traveling. This leads to the utmost possibility of road accidents occurrence in the first place. Rapid urbanization, overpopulation, increase of vehicles in the metropolitan and growing cities leads to commotion and to reach their beloved destination people normally tend to take a risk by speeding in an accident prone zone, violating the rules which leads to accident.

According to a report in the year 2020 there were 3.6 lakh road accidents and among them 1.3 lakh lost their lives in it. To rectify the issues, violation detection system is needed which should be automated. Thus, traffic police or other authority who uses it can find the violated vehicle and take action against it faster. The implementation must be easy since the authorities monitor roadways always. Three types of violation can be detected by this system namely, Triple riding, Helmet detection and lane detection. We use YOLOv5 for object detection and OpenCV techniques to identify and enhance the image's quality. WE use OCR (Optical Character Recognition) to extract text from the images.

II. LITERATURE REVIEW

From the literatures we surveyed, most papers used YOLO in parking system, Genetic algorithm[3] for violation detection which has most accuracy but longer runtime than other YOLO models. A journal used YOLOv3[1] to spot the vehicles violated traffic rules, but it is heavier than YOLOv5. Another journal used ANPR for recognizing the number plate [2], [3]. One of the journal used YOLOv2 for Two-wheeler detection and YOLOv3 to detect the number plate [7]. YOLOv5 used in helmet detection which had a best result in low light and small streets [8]. Genetic algorithm [3] with Optical Character Recognition is used to spot the traffic violation detection resulted in 98% accuracy since the genetic algorithm used to construct a special genetic set of rules with respect to the feed we give as input[10].

III. EXISTING SYSTEM

In existing system, A police officer who takes pictures and gives them as an input to the system and which the system is then recognizes the violation of the report and this system takes longer time to execute the charge.

Limitations in Manual Traffic detection system are Balancing the load in network which cannot pass data to long distance because some route require more energy and some route require less energy. It's hard to minimizing the delay in communication while broadcasting the message and monitor the traffic and it may leads us too many errors in maintaining traffic. controlling the traffic will be very difficult. Large network may cause the threat of data loss since all the data will be submitted in the official website where the possibility of missing some vehicle details may occur.

IV. PROPOSED SYSTEM

We use YOLOv5 which is a CNN which had trained with custom datasets by Ultralytics. Then we use Computer vision techniques to register the objects name and what objects the system need to find by giving the input. It is done by combining both YOLO and OpenCV where the object detection and the rule violation will be recorded in real time and saved in the database. But to go further deeper and make easier for the traffic police we planned to save the identity of the vehicle by extracting the characters from the number plate by using OCR. To increase the accuracy and efficiency of the software numerous amount of datasets are needed to train the appropriate needed software which detects the situation and announces the violation report. We use YOLOv5 because of its size and

a) System Architecture efficiency.

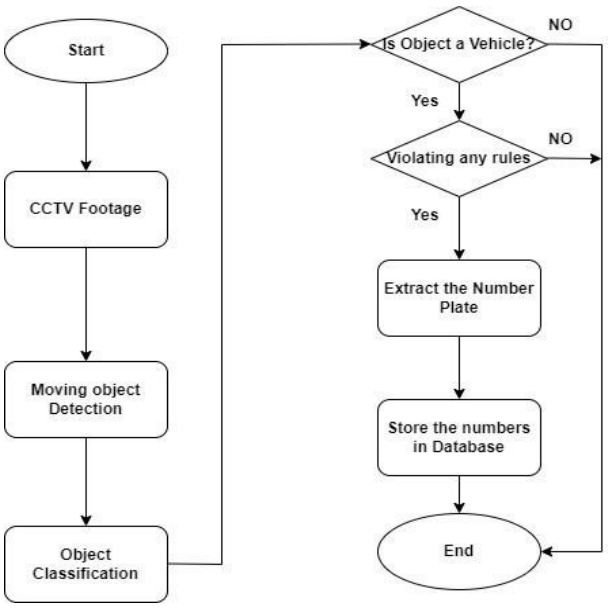

Figure 1: System Architecture

i) YOLOv5

YOLO (You Only Look Once) this version was introduced by Ultralytics in June 2020. This is the most advanced 4-object identification algorithm currently available [3]. This is a novel CNN that detects objects with great accuracy in real time[5].This approach uses a one- stage neural network to process the entire image, split it into parts, And predict bounding boxes and probabilities for each component [8].These bounding boxes are weighted by expected probabilities [10]. This method is “one look at the image” in the sense that it makes predictions only through forward propagation through the neural network [5]. It then returns the items found after non-maximal suppression (this ensures that the object detection algorithm identifies each object exactly once).

As YOLOv5 is a single-stage object detector, it has three important parts like any other single-stage object detector.

- Model Backbone
- Model Neck
- Model Head.

For the detection of objects we use YOLOv5 and a sample video from Pixels website was given as input in which the algorithm trained in Ultralytics using COCO dataset recognized objects like person, car, truck, etc.

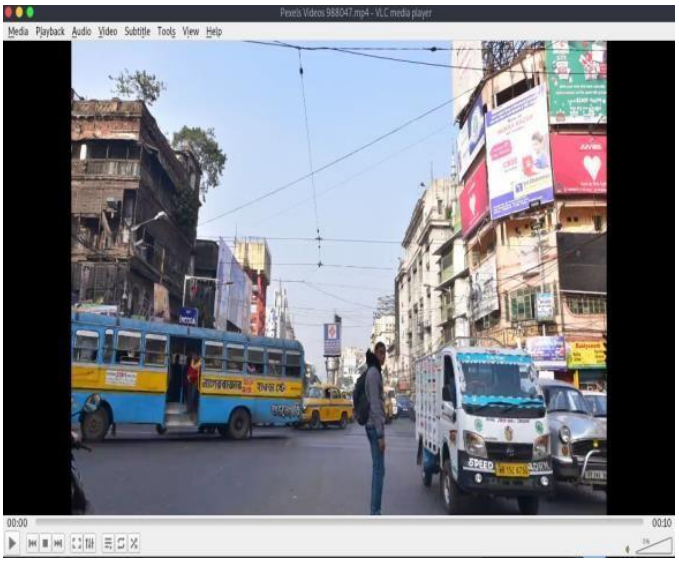

Figure 2: Input video

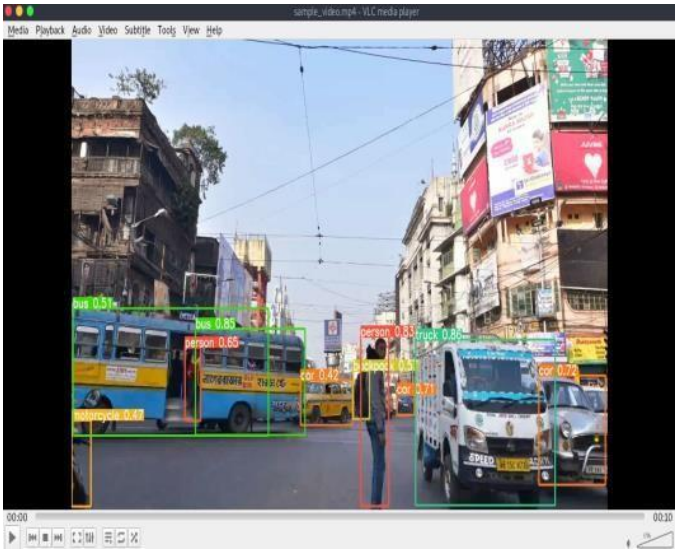

Figure3: Output video

ii) **OpenCV**

Object detection is a computer vision technique in which a software system can detect, locate, and trace the object from a given image or video[10]. The special attribute about object detection is that it identifies the class of object (person, table, chair, etc.)[9] and their location-specific coordinates in the given image[2]. The location is pointed out by drawing a bounding box around the object[6]. The bounding box may or may not accurately locate the position of the object. The efficiency of the algorithm is defined by the capability of finding the object inside the image [4]. Face detection is One of the examples is face detection. The object detection algorithms will be pre-trained or can be trained from scratch[8].We use pre-trained weights from models and fine-tune them as per our needs and different tasks. The number plate extraction is done by Computer Vision and OCR which is tested in Google colab

Figure 4: Input Image

Figure 5: Extracted Text

V. CONCLUSION

The designed algorithm was effectively able to detect the type of violation specified on this project which are denying traffic signal. The convergence of detection for the violation of traffic rules mentioned is dissimilar, since it has a different threshold condition. The system provides detection for traffic signal violation. Further, in a specific time a single data can be processed by the system. Also, the runtime of the program is a bit slow, and it can be improved by usage of a computer with specifications of a hi-end processor or a good GPU over other advanced image processing techniques. Since, this may improve the program efficiency by neglecting other unnecessary steps done in a background difference method. A OpenCV algorithm may be done instead of providing more intelligence to the system. The future work for this system maybe depend on penalty percentage of the particular vehicle and more the vehicle comes under the radar of penalty the vehicle owner may get legally summoned.

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