



## Virtual Traffic Police

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***Abstract – The proposed model of controlling traffic rule violations using ANPR techniques and image manipulation techniques for plate localization and character recognition is an efficient and cost-effective solution to address the increasing number of traffic rule violations. By using a camera-based PC system to capture video, the ANPR system can identify the vehicle number from the number plate quickly and accurately. Once the number is recognized, the SMS-based module is used to notify vehicle owners about their traffic rule violations. This can help in creating awareness among the drivers and also ensure that they are held accountable for their actions. Additionally, an SMS is sent to the Regional Transport Office (RTO) to track the report status, which can help in monitoring and enforcing traffic rules. Overall, the proposed model is a step towards automating traffic management systems and reducing the burden on human resources while ensuring road safety and efficient traffic management.***

### I. INTRODUCTION

In recent years, automation has become increasingly important in day-to-day life, with efforts in moving object detection and tracking leading to reliable and efficient applications in various fields. However, challenges such as illumination change, dynamic background, camouflage, and occlusion continue to hinder progress. Object tracking in low-resolution video presents additional obstacles, as discriminative details are lost, resulting in inaccurate object tracking and inefficient event

detection. Despite these challenges, low-resolution video has benefits, such as low storage, transmission, and processing time. This paper proposes an algorithm that can detect unusual events in low-resolution video, with a typical application being the enhancement of ATM security using a rolling

average background subtraction technique to segment foreground objects from scenes with dynamic backgrounds. The proposed approach does not require a classifier or training dataset but uses statistical property standards. Furthermore, the paper presents a solution for traffic rule violations by using a camera and number plate recognition application to capture images of number plates of vehicles that break traffic signals and send SMS alerts to the offender. The system, called "VIRTUAL-POLICE," uses image processing technology and ultrasonic sensors to detect lanes and vehicles and identify rule violators, making it easier for police to catch violators and reduce bribery and dishonesty.

### II. PROBLEM DESCRIPTION

To achieve this goal, the system could use a combination of advanced computer vision techniques and machine learning algorithms. The system would need to be capable of detecting and tracking vehicles in real-time, even when they are moving slowly or temporarily stopped and then become foreground again. The system should be able to adapt to different traffic environment conditions,

including changes in lighting and occlusions caused by other vehicles or objects in the environment.

### III. RELATED WORK

[1] Automated number plate recognition (ANPR) systems have become increasingly important in managing traffic and enforcing traffic laws. One of the main benefits of these systems is their ability to identify stolen or unauthorized vehicles, which helps to reduce crime. In addition, ANPR can also help to reduce traffic congestion and improve safety on the roads by identifying violations such as speeding or running red lights. [2] Many different methods have been developed for number plate recognition, and this paper provides a review of some of these methods as well as proposing a new algorithm. The proposed algorithm is based on a feed-forward neural network that uses an efficient and precise neuron with a transfer function based on an approximation of the Hyperbolic Tangent Activation Function. The network is configured with 189x160x36 layers and was able to maintain a 98.2% accuracy in recognizing characters in noisy and imperfect images of license plates. [3] Advanced driving assistant systems and autonomous vehicles rely heavily on computer vision algorithms for their navigation and control. These algorithms require high-speed processing capabilities, and they are essential for ensuring the safety and comfort of passengers. The paper describes an algorithm that detects road boundaries and painted lines accurately and efficiently using a combination of Hough Transform, Canny edges detector, least-square method, and Kalman filter. The algorithm minimizes the adaptive region of interest and predicts the future road boundaries' location and lines parameters. The simulation scenarios are run on a realistic simulator of vehicles' dynamics, road infrastructures, and sensors behaviors, and the processing is done in real-time using a dedicated product for parallel computing. This type of research is crucial for developing intelligent and autonomous vehicles that can navigate roads safely and efficiently. [4] This paper describes a system for recognizing license plates on vehicles using image processing techniques. The system has four main steps: preprocessing the captured image, extracting the license plate region, segmenting the characters on the license plate, and recognizing each character. The preprocessing step involves adjusting the brightness of the

image, removing noise using filters, and converting the image to grayscale. The license plate region is extracted by finding the edges in the image and cropping it into a rectangular frame. Segmentation is critical for accurate character recognition, and the system uses a bounding box method to segment all characters on the license plate. Finally, template matching is used to recognize each character. The system aims to improve road safety by helping to identify vehicles that violate traffic rules, are stolen, or enter restricted areas. [5] Overall, this system would significantly reduce the need for manual license plate identification and streamline the parking process, making it more efficient for both the customers and the parking facility management. [6] The characters are then recognized using character recognition techniques, and the license plate information is stored in a database. When a vehicle enters or exits a parking lot, the license plate is automatically recognized and the parking fee is calculated based on the duration of the stay. This eliminates the need for manual checking and calculation of parking fees, which can be time-consuming and prone to errors. The system can also be integrated with payment gateways to enable cashless transactions. Overall, automatic number plate recognition technology has the potential to enhance security and improve efficiency in various settings where vehicles are involved. [7] Once the image has been enhanced, the next step is to extract the number plate region from the image. This is typically done using techniques such as edge detection and morphological operations to locate the edges of the number plate. Once the edges have been identified, the number plate region can be isolated and extracted from the rest of the image. [8] This statement suggests that the automatic number plate recognition system has a certain level of robustness to noise in the input images. Specifically, it is able to handle noise levels up to 20%, meaning that the input image can contain up to 20% noise and the system will still be able to correctly extract the license plate region. Additionally, the statement mentions that the system has a recognition rate of 85%, which means that the system is able to accurately recognize the license plate characters in 85% of the input images. [9] This statement suggests that the automatic number plate recognition system has a certain level of robustness to noise in the input images. Specifically, it is able to handle noise levels up to 20%, meaning that the input image can contain up to 20% noise and the system will still be able to correctly extract the license plate

region. Additionally, the statement mentions that the system has a recognition rate of 85%, which means that the system is able to accurately recognize the license plate characters in 85% of the input images. [10] Detecting and estimating vehicle speed at night can be a challenging task due to poor lighting conditions. However, CCTV cameras can be utilized for this purpose. One of the methods used for detecting and estimating vehicle speed at night is the normalized cross-correlation technique. This technique compares the intensity values of two consecutive frames captured by the CCTV camera and calculates the correlation between them. By measuring the displacement between the two frames, the speed of the vehicle can be estimated. [11] The license plate recognition algorithm consists of three main steps: license plate location, character segmentation, and recognition. The edge detection algorithm is used for license plate location, where the edges of the license plate are detected using image processing techniques. The vertical projection method is then used for character segmentation, where the characters on the license plate are segmented based on the vertical histogram of the license plate image. Finally, the template matching method is used for character recognition, where templates of characters are matched with the segmented characters to recognize the license plate number.

#### IV. IMPLEMENTATION

Utilization refers to the application or execution of a certain action, thought, model, plan, specific, standard, estimation, or system. It involves declaring and implementing a computer or programming process through programming and programming action. Different executions or implementations may exist for a given specification or standard.

##### Modules

- Data Collection
- Python OpenCV
- Object Detection
- YOLOv5
- TensorFlow

##### Modules description

###### • Data Collection

It seems like there are two different technologies mentioned here - a smart camera and a web camera. It would be helpful to clarify which one will be used in the project for data collection.

Assuming a web camera will be used, it can capture still images or video footage which can be processed for data analysis. The camera can be placed at a fixed location to capture traffic on a road or parking lot. Alternatively, it can be mounted on a moving vehicle to capture data while driving.

The collected data can include vehicle counts, vehicle speed, license plate numbers, and other relevant information depending on the specific goals of the project. The data can be stored locally on a computer or uploaded to a cloud-based storage solution for further analysis.

###### • Python OpenCV

OpenCV is used with a normal camera in our project virtual traffic police by implementing image processing algorithms to detect and track vehicles, helmets, and traffic signs in real-time video streams captured by the camera. For instance, OpenCV is used to detect the position of the vehicles and track their movement in the video stream, identify lane violations, detect traffic signs, and detect vehicles violating traffic rules such as red-light violations, triple ridding, signal jumping, and vehicles parked in no parking. Using OpenCV also provides cost-effective and easily scalable solutions for traffic surveillance and monitoring. The video stream from the camera can be analyzed in real-time on a computer system using OpenCV algorithms, and violations can be detected and reported to the authorities. This can help in reducing the need for physical traffic police and improving the overall efficiency of traffic management systems.

###### • Object Detection

Object detection is used in virtual traffic police by using computer vision techniques. The camera captures the video feed of the traffic and then the video frames are processed in real-time to detect various objects such as vehicles, helmets, traffic lights, etc. This can be achieved using object detection algorithms

such as YOLO. Once the objects are detected, their positions and other features can be extracted and analyzed to identify if any traffic rule violation has occurred, such as running a red light or crossing a stop line. This information can then be used to alert the traffic police and take appropriate actions.

- **YOLOv5**

The YOLO system (You Only Look Once) manages object recognition in an alternate way. It takes the whole picture in a solitary case and predicts the bounding box arranges and class probabilities for these containers. The greatest favorable position of utilizing YOLO is its eminent speed – it's fantastically quick and can process 45 casings for each second. YoloV5 is a deep learning model for object detection and is used in virtual traffic police to detect and track vehicles violating traffic rules. YoloV5 can be trained on a dataset of traffic violation images to recognize different types of violations such as red-light violation, driving without helmet, illegal parking, etc. Once trained, the YoloV5 model can be integrated with a normal camera in the virtual traffic police system. The camera can capture live video footage of the traffic and send it to the YoloV5 model for object detection. The model can identify and track the vehicles in the video and classify them based on their actions, such as violating a traffic rule. The virtual traffic police system can then take appropriate actions, such as sending an alert to the authorities or capturing an image of the license plate for further action. Using YoloV5 in virtual traffic police has several benefits, including the ability to detect violations in real-time, reduced need for human intervention, and increased accuracy in identifying violations. However, it requires a significant amount of training data and computing resources to train the model, and may not be as effective in low-light or high-traffic situations.

- **TensorFlow**

TensorFlow is a popular machine learning framework that is used for object detection tasks, such as identifying vehicles and pedestrians in traffic footage. Using TensorFlow can enable automated detection of traffic violations, making it easier for law enforcement to identify and punish offenders. To use TensorFlow for object detection, a few steps need to be followed. First, a dataset of images or videos with labeled objects (e.g., vehicles, pedestrians) needs to be created or obtained. This dataset is used to train a machine learning model, which is then used to identify

objects in real-time traffic footage. Once the model is trained, it can be integrated into a traffic surveillance system that uses a normal camera to capture traffic footage. The system can process this footage in real-time using the trained model to detect traffic violations, such as vehicles running red lights or triple ridding. In summary, using TensorFlow can enable automated object detection and real-time traffic violation detection, helping to improve road safety and reduce traffic violations.

## V. CONCLUSION

In this project, we tried to develop a n automated traffic video surveillance system with the help of OpenCV and object detection. The automation of rules violations is necessary to reduce the number of violations occurring which in turn reduces the number of accidents on the road as people become more alert while driving due to stringent laws and monitoring. In the end, we found out that the accuracy of violation detection is 93% in our study and that of number plate recognition is 51%. Here in this thesis, the methods for traffic surveillance have been presented and the work on motion detection, license plate extraction and character recognition is carried out. In motion detection, a study on different background subtraction available in the literature has been studied and their performance tests on the different video test sequence are given. The fitness coefficient and error coefficient is also calculated for all the methods. It should be noted that robust motion detection is a critical task and its performance is affected by the presence of varying illumination, background motion, camouflage, shadow, and etc.

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