Traffic Violation Detection System

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1. Introduction

In India, our detection system faces challenges when it comes to making rulings, especially in traffic cases involving accused persons living in different regions of the country. One major problem is deciding whether to transfer the case to the nearest court to the accused's location. This would involve revoking their arrest warrant and starting the proceedings afresh. Unfortunately, due to this uncertainty, our court cannot issue a judgment as it is unsure where the accused person's new location will be. Consequently, this leads to further delays in the overall process.

There are several problems with the existing system. First, there is a heavy workload for enforcement agencies to submit traffic evidence to be presented in court. This means that they must bring all the traffic evidence to court so that the court can view the evidence and the warrant of arrest for the accused person. This creates a clear burden for the enforcement agencies.

1.2. Problem Statement

In India, traffic law violations are a common and dangerous issue that affects everyone. As urbanization rapidly expands in the modern era, there has been a significant increase in motor vehicles and related traffic problems. To address these violations, the traffic law violation system is divided into three legal categories: petty violation, misdemeanor, and felony. Enforcing these violations typically requires evidence, particularly on the road.

In India, the implementation of traffic law violations follows several acts in criminal and civil law, including the Road Transport Act 1987, Criminal Procedure Code, and The Evidence Act. Throughout the years, there have been numerous traffic violation cases that have resulted in convictions by the court. Offenses related to summonses, such as parking vehicles in dangerous conditions or driving motorcycles without a valid license, are particularly common.

To handle these traffic cases, enforcement agencies in India usually need to request the Public Prosecutor to issue a warrant of arrest for the accused individual to appear in court.

With the increasing number of vehicles and since the world is moving rapidly into automation, it is very difficult to have an effective traffic violation system through manual methods. These manual methods are ticketing the traffic violators and maintaining a record of the violations and vehicles of the convicts. But people are moving to automatic systems and there must be automation in each and every system. The manual methods are very time-taking and those methods also have numerous drawbacks. Now it is seen that a good number of countries are shifting to automated traffic violation systems. This system involves installing a number of cameras at various locations of a city. These cameras capture the images of the vehicles and they must have a defined vehicle speed. Now with the technology in image processing and discrete event simulation and state machines, a system is developed to mimic the automated ticketing system and automate it. The simulation developed on this concept has great potential for our project.In this digital era, we have an effective system for every aspect of life. About the current traffic violation system, most of the countries in the world have an effective system, though not all of these

systems are computerized. But these countries are the ones to look for, computerization is the future of effective systems and our project is a computerized approach to a country's effective traffic violation system.

It is observed that a large number of incidents have occurred very frequently which involved getting hold of a stolen vehicle after committing a violation. This vehicle was never taken into custody and it was moving freely throughout the country without any fear of being caught. The vehicle lifters and vehicle snatchers also commit traffic violations and later change the number plates of the stolen vehicles. All of the above-mentioned incidents make it very difficult for the traffic authorities to catch the vehicle convicts and it is believed that due to the liberty of free movement, these criminals have become more aggressive and they are traffic violators. At present, there is no system to pinpoint the recent activities of a vehicle or the current location of it, which is obviously of great importance if there is a check to arrest the vehicle convicts. The traffic authorities will then convey or hand over the charge of such a check to the police in case of serious vehicle convicts who are involved in crimes and now they have to have recent information of the vehicle convicts to perform the task. This project will provide a solution to all the above problems along with the ease of maintaining the system.

Traffic violations are increasing to an alarming level worldwide. Due to a lack of effective systems and unavailability of traffic police, violations are done in a huge majority. Most developed countries have an effective traffic violation system that is implemented and maintained through computerized methods. These methods and systems help to keep track of the traffic violators by generating and maintaining useful information for the traffic authorities. This system will help to eliminate the major drawbacks in the existing traffic violation system by designing an effective system. This will ultimately be for the advantage of the common man in abiding by the traffic laws and rules without the fear of their own safety and security of their vehicles.

1.2. Objectives

To comprehend the road traffic rules and subsequently decrease the ratio of traffic law infringements, there is a need for an automatic system for violation detection. At this stage, we can only find violations for limited traffic laws. Our system can detect vehicle and traffic violations with reasonable accuracy. Assigned tasks include detection of over speeding. A speed estimation functionality is yet to be implemented for this to be tested. Detection of red light violation by vehicles. This also includes speed estimation for stopping vehicles and an indirect detection of red light jumping by the time gap between stopping and vehicle headlight glow. Detection of moving and stationary violations at dedicated lanes. These can be used for detecting violations at bus lanes, no-overtake zones, and move left/right for specific lanes. For vehicle detection, we have installed a motion-based background subtraction using Mixture of Gaussian and Adaptive Gaussian Mixture segmentation. Although this method is better than frame differentiation, still it is unable to distinguish between shadows and vehicles, and inaccurate segmentation causes inaccurate detection. An alternative method can be to use the Hough transform for lane detection and then use the coordinates for motion history image and hence to wrap around the violations. Red light violation detection is yet to be implemented. This involves changing and testing various parameters in the Haar features and Viola-Jones object detection. Although the detected vehicle squares are reasonably accurate, still this method is quite slow. For checking dedicated lanes violation, we have used a very simple object tracking by using the mean of object dimension coordinates and presenting it on consecutive frames. A reasonably good accuracy was achieved. But we understand that this method

is not foolproof and still a lot more has to be done in vehicle tracking.

1.3. Scope of the Study

Traffic violation is a common type of road safety problem. It can be categorized into two types: actions committed by drivers that are illegal according to the law, without resulting in an accident, and actions committed by drivers that are legal but result in an accident. Both types are violations, but drivers may not realize they are committing a violation. Various forms of traffic violations make it difficult for police to always be on time in preventing such violations on the roads. Therefore, it is necessary to apply systems that can help police monitor and provide information on traffic violations. One method that could be used is by using a tool or system that has the ability to identify different forms of traffic violations. Computer vision is becoming a new method to be applied in such tools or systems. A tool or system that combines computer vision or artificial intelligence with a camera is a fitting method that shows good prospects. With this tool, the identification of traffic violations can be done automatically. YOLO (You Only Look Once) is one of the modern methods based on deep learning algorithms. OpenCV is a library that supports the development of computer vision. One advantage of OpenCV is that it has many robust features, easy-to-use functions, and can be integrated with various other libraries. This research aims to build a traffic violation detection system by utilizing YOLO V3 as the neural network type and using OpenCV to create a detection model and system, as shown in Fig 1. The concept of traffic violation detection will be a detailed description of the proposed research technique, and this research is expected to apply an automatic traffic violation monitoring system that helps police implement penalties for drivers who commit traffic violations.

Red Light Violation:

This system employs computer vision techniques to detect vehicles that cross red lights at intersections.

Using a point-in-quadrilateral algorithm, it defines a specific zone where vehicles should stop at a red light.

When a vehicle breaches this zone, its presence is detected, and its license plate is captured using image processing.

The system logs the license plate information of vehicles violating the red light, enabling authorities to take necessary action.

Helmet Detection:

Utilizing YOLOv3, this system identifies motorcyclists without helmets on public roads.

Once a motorcyclist is detected in the video feed, the system extracts the region of interest containing the motorcyclist.

It then analyzes this region to determine if a helmet is present. If not, it flags the violation.

The system records the license plate of the violating motorcyclist, aiding law enforcement in enforcing helmet laws and ensuring rider safety.

Speed Detection:

Employing a cascade classifier, this system detects vehicles moving through a predefined area, typically on highways or roads with speed limits.

It utilizes two lines with predefined coordinates, marking the start and end points of a section of road.

When a vehicle passes through these lines, the system measures the time taken, calculating the vehicle's speed.

If a vehicle exceeds the predetermined speed limit, its license plate is recorded, enabling authorities to address speeding violations effectively.

Triple Riding Detection:

This system combines helmet detection and vehicle detection algorithms to identify instances of triple riders on motorcycles.

After detecting a motorcycle with riders, the system analyzes the number of individuals present.

If three individuals are detected, indicating a violation of traffic regulations, the system logs the license plate information of the motorcycle.

By recording instances of triple riding, authorities can enforce laws related to passenger limits on motorcycles, promoting road safety.

Each of these violation detection systems contributes to enhancing road safety and traffic law enforcement by automatically identifying and recording violations, thereby assisting authorities in taking appropriate actions to ensure compliance with traffic regulations.
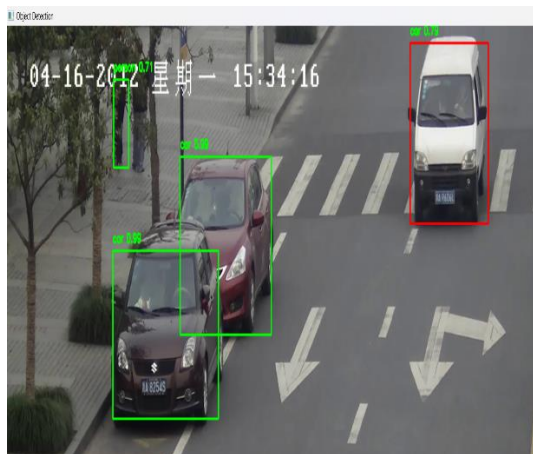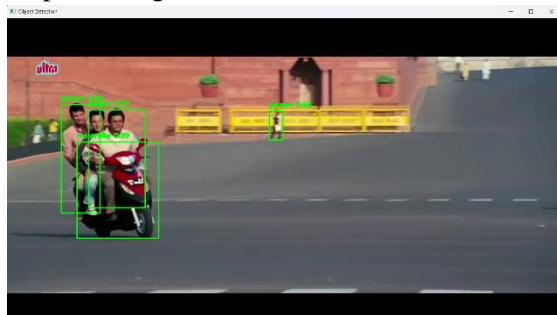
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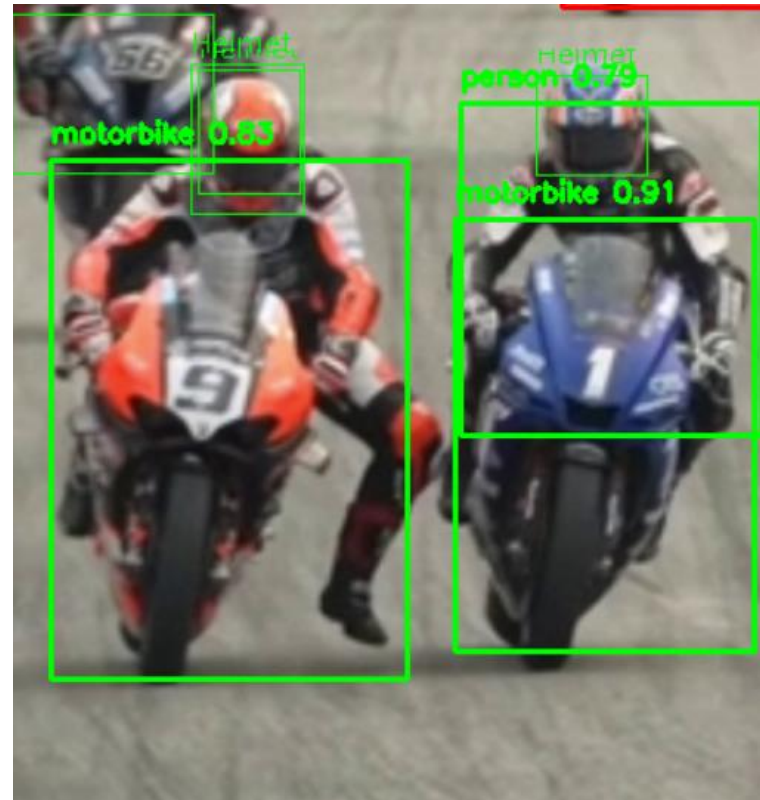
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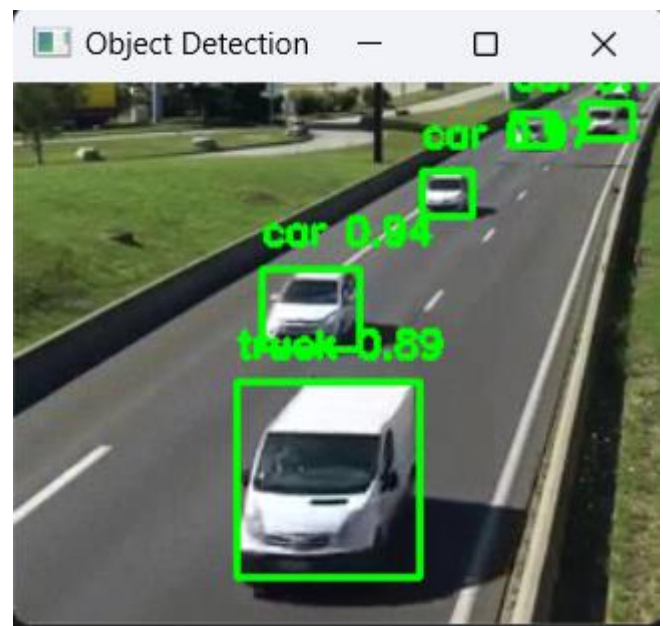
Red Light Violation:-

Triple Riding Detection: -

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Online Resources:

ResearchGate (www.researchgate.net): You can find numerous research papers, articles, and discussions related to traffic violation detection systems.

Google Scholar (scholar.google.com): Search for academic papers, conference proceedings, and patents related to your topic