



DETECTING FAKE REGISTRATION PLATES AND TRAFFIC RULE VIOLATIONS USING COMPUTER VISION AND MACHINE LEARNING

¹Prof. Anusha S Aradhya, ²Nikhil M, ³Ranjith Kumar E, ⁴Rakshith S, ⁵Impan T S

Department of Information Science,
East West Institute of Technology, Bengaluru, India

Abstract: The detection of traffic rule violations and fake registration plates is an important area of concern in ensuring road safety. Computer vision and machine learning technologies can be employed to automatically detect and flag such violations in real-time. This system involves the application of image processing techniques and machine learning algorithms to analyse images and videos captured by traffic cameras, enabling the identification of fake registration plates and any breach of traffic rules. The proposed technology offers a reliable and efficient means of monitoring and enforcing traffic laws, thereby enhancing road safety and mitigating the risk of accidents. This paper aims to present a comprehensive review of the current state-of-the-art techniques in detecting fake registration plates and traffic rule violations using computer vision and machine learning approaches, highlighting the associated challenges and potential solutions.

Index Terms - YOLOv3, Object Detection, Optical Character Recognition, Computer Vision, Helmet Detection.

I. INTRODUCTION

The detection and prevention of fake registration plates and traffic rule violations is a critical area of concern in ensuring public safety and maintaining law and order on roads. The use of fake or altered registration plates on vehicles can enable criminal activities, including evading law enforcement and avoiding tolls. Furthermore, traffic rule violations such as speeding, running red lights, and failing to yield the right of way can result in accidents, injuries, and fatalities. To address these issues, a fake registration plate and traffic rules violation detection system can be developed using computer vision and machine learning technologies. License Plate Recognition (LPR) and Automatic Number Plate Recognition (ANPR) are technologies that use Optical Character Recognition (OCR) to automatically track, read, and record vehicle registration plates, which can be used as part of a fake registration plate recognition system to help detect and identify altered or fraudulent vehicle registration plates. Support vector machines (SVMs), a type of supervised learning algorithm that can be used for classification and other tasks, can be employed in OCR to classify genuine and fake registration plates based on features extracted. The effectiveness of such a system would depend on the accuracy and reliability of the technologies used, as well as the willingness of law enforcement authorities to use the system to enforce traffic laws and maintain public safety.

The aim of this paper is to provide a comprehensive review of the current state-of-the-art techniques in detecting fake registration plates and traffic rule violations using computer vision and machine learning approaches, with a focus on the associated challenges and potential solutions. The paper will discuss the advantages and limitations of existing fake registration plate and traffic rules violation detection systems, and explore new directions for future research. Additionally, the proposed system's effectiveness will be evaluated through experiments conducted on real-world data sets. The review will also examine the ethical and legal implications of implementing such a system, including privacy concerns and potential biases in the data used to train the machine learning models. Furthermore, the paper will discuss the potential benefits and drawbacks of integrating the fake registration plate and traffic rule violation detection system with other technologies, such as GPS and traffic cameras, to further enhance its functionality and accuracy.

1.1 Existing System

The current system for detecting fake registration plates and traffic rule violations primarily relies on human observation and manual enforcement. This approach is slow, error-prone, and lacks real-time monitoring capabilities, making it challenging to detect and flag violations as they occur. Additionally, there is a high likelihood of missing critical information or evidence, leading to false positives or false negatives. The existing system is also costly, requiring significant resources such as manpower, cameras, and infrastructure to maintain effective monitoring and enforcement. Moreover, the current system is vulnerable to

bribery and corruption, which may allow offenders to evade punishment or receive lighter sentences. In conclusion, the existing system for detecting fake registration plates and traffic rule violations has significant drawbacks and limitations, making it less efficient and effective. Hence, there is a need to develop and implement a more robust and automated system using computer vision and machine learning technologies to overcome these challenges and enhance road safety.

1.2 Proposed System

Our proposed system for detecting fake registration plates and traffic rule violations offers a significant improvement over the existing human-based method. By leveraging advanced computer vision and machine learning technologies, our system can provide real-time monitoring and enforcement of traffic laws, with higher accuracy and efficiency. Machine learning algorithms can analyze and process large volumes of data accurately and efficiently, making the system more effective in identifying and enforcing traffic laws, and ensuring that offenders receive appropriate punishments. Furthermore, our system is cost-effective and requires less manpower and infrastructure compared to the existing system. This makes it a more affordable solution for law enforcement agencies and governments. Additionally, our system is less susceptible to bribery and corruption, as automating the detection and enforcement process reduces the opportunity for offenders to bribe or influence human observers, ensuring that traffic laws are enforced fairly and consistently. With its numerous advantages, the implementation of our proposed system has the potential to significantly enhance road safety and reduce the risk of accidents.

II. RELATED WORKS

Detecting fake registration plates and traffic rule violations using computer vision and machine learning has been a subject of interest in recent years. There are various studies that explore this topic, and several of them have proposed solutions for automatic vehicle number plate detection and recognition. One such study [1] developed an automated system based on YOLOv4 for license plate recognition with high accuracy. Another study [4] proposed a YOLO-based recognition method for automatic license plate recognition, which achieved impressive results. Machine learning-based surveillance systems have also been developed for detecting traffic rule violations. For example, a study [6] presented a machine learning-based system for traffic rules violation detection, which used computer vision techniques to analyse video footage and identify traffic violations. Similarly, a study [9] proposed a traffic signal violation detection system using artificial intelligence and deep learning. Real-time wrong-way vehicle detection is another area of interest in this field, and some studies have proposed solutions for this problem as well. One such study [2] proposed a real-time wrong-way vehicle detection system based on YOLO and centroid tracking, which achieved promising results.

Additionally, traffic violation detection in India was addressed in a study [7] that utilized genetic algorithms to detect traffic violations. While many of these studies have focused on specific aspects of traffic violation detection, a study [8] explored different approaches to develop an automatic traffic rule violation detection system. The authors compared different methods for feature extraction and classification and evaluated their effectiveness. Another study [5] proposed a machine learning based surveillance system for detecting bike riders without helmets and triple rides. Overall, these studies demonstrate the potential of computer vision and machine learning techniques in detecting fake registration plates and traffic rule violations. They provide various solutions for automatic vehicle number plate detection, traffic rules violation detection, and wrong-way vehicle detection. However, there is still room for improvement, and future research could explore more efficient and accurate methods for detecting traffic violations.

III. REQUIREMENT SPECIFICATIONS

The system for detecting fake registration plates and traffic rule violations using computer vision and machine learning has specific hardware and software requirements that must be met to ensure its successful implementation. The hardware requirements include an Intel® Core™ i5 or higher processor, 8GB or higher memory RAM, 512GB or more of hard disk space, and a 64-bit (x64) Windows architecture. These specifications are necessary to ensure that the system runs smoothly and can handle the processing demands of the computer vision and machine learning algorithms. The software requirements for the system include Microsoft Windows 10 or higher, Jupyter Notebook, Anaconda Navigator, and Visual Studio: IDE and Code Editor. These software tools are essential for the development, implementation, and maintenance of the system. Microsoft Windows 10 or higher provides the operating system platform necessary for running the system, while Jupyter Notebook and Anaconda Navigator are used for data analysis and visualization. Visual Studio: IDE and Code Editor are used for developing and writing code for the system. Meeting these hardware and software requirements is crucial to ensure that the system functions efficiently, accurately, and effectively in detecting fake registration plates and traffic rule violations. Therefore, adherence to these requirements is critical to ensure that the final system meets the needs of its users and stakeholders.

IV. METHODOLOGY

This paper proposes a methodology for detecting fake registration plates and traffic rule violations using computer vision and machine learning techniques. The methodology involves the use of several algorithms and techniques, including YOLO, OCR, CNNs, ANPR, and LPR.

The flowchart outlines the process involved in using the proposed methodology to detect fake registration plates and traffic rule violations. The process starts with capturing an input video or image of a vehicle using a camera or other recording device. Next, the YOLO algorithm is used to detect and identify the vehicle in the image or video frame. Once the vehicle has been identified, the algorithm proceeds to detect the number plate on the vehicle. After the number plate has been detected, OCR technology is

used to recognize the text on the number plate. This allows the system to extract the license plate number and verify its authenticity by searching a database of registered vehicles.

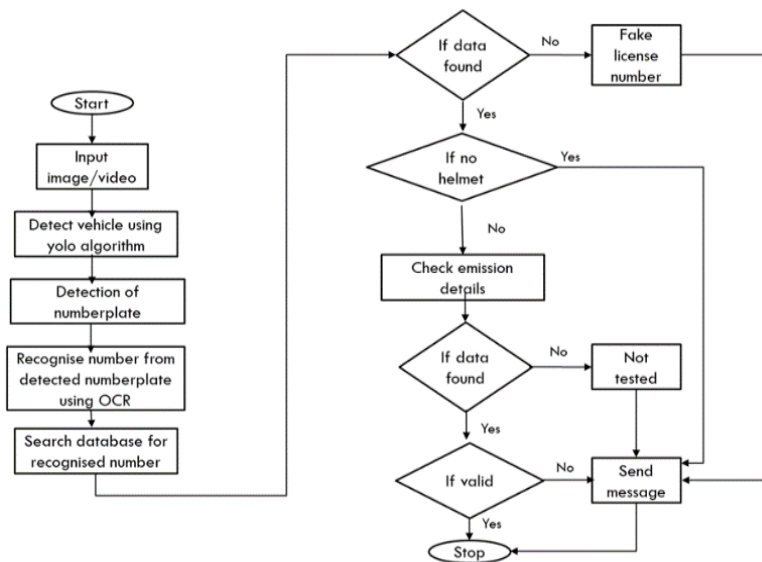


Fig.4.1. System Methodology

If the license plate number is found to be fake or invalid, the system will flag it as a traffic rule violation. Additionally, if the system detects that the driver is not wearing a helmet or the vehicle has failed emission tests, it will also flag the violation. If the license plate number isn't found to be valid and the driver isn't wearing a helmet and the vehicle hasn't passed emission tests, the system will proceed to send a message to the relevant authorities to inform them of the vehicle's location and the details of the violation. Finally, the process stops, and the system awaits the next input video or image. The flowchart represents an automated and real-time system that can be used to enforce traffic rules and regulations and detect and prevent the use of fake registration plates. Overall, the proposed methodology combines multiple computer vision and machine learning techniques to detect fake registration plates and traffic rule violations, and can be applied in real-time scenarios for efficient and accurate detection.

V. IMPLEMENTATION

This paper proposes an implementation methodology for detecting fake registration plates and traffic rule violations using computer vision and machine learning techniques. The proposed system collects a large dataset of images and videos of vehicles with both real and fake registration plates, as well as instances of traffic rule violations such as riding without a helmet or triple riding. Computer vision techniques such as object detection and recognition are employed to identify vehicles in the images and videos and extract features such as license plate numbers and the number of riders. Image processing techniques are used to extract features such as color, shape and texture of the registration plates and riders. Machine learning models are trained using the collected data to classify instances of real and fake registration plates, and to detect instances of traffic rule violations. The proposed system also includes a user-friendly interface that can be integrated with existing traffic monitoring systems to provide real-time alerts and notifications to law enforcement agencies. Continuous monitoring and updating of the system is conducted to improve its accuracy and performance. Finally, the system is integrated with an alert mechanism that can notify law enforcement authorities about the violations in real-time. This proposed system can effectively improve road safety and reduce traffic rule violations by accurately detecting and penalizing offenders. To ensure the reliability and accuracy of the proposed system, extensive testing is conducted on real-world data sets to evaluate its performance in various scenarios. The results of the experiments demonstrate the effectiveness of the system in detecting fake registration plates and traffic rule violations with a high level of accuracy. Moreover, the proposed system has the potential to significantly reduce human error and bias, as well as increase the efficiency of law enforcement agencies in detecting and penalizing offenders. Overall, the proposed system has the potential to significantly improve road safety and reduce traffic rule violations by accurately detecting and penalizing offender.

5.1 System Architecture

The proposed system architecture utilizes computer vision and machine learning techniques for detecting traffic rule violations, including the use of fake registration plates. The system consists of several components that work together seamlessly to accomplish the desired tasks. At the heart of the system is a camera, either fixed or mobile, that captures images or videos of the vehicles passing by. These images or videos are then processed by the image processing component of the system, which comprises various sub-components such as number plate detection, helmet detection, triple riding detection, and emissions test detection. The number plate detection sub-component utilizes image processing algorithms to identify the number plates of the vehicles passing by. It then extracts the alphanumeric characters from the number plate and checks them against a database to identify the vehicle's registration details.

The system also incorporates a fake number plate detection module, which uses deep learning models to detect fake or tampered registration plates. The helmet detection sub-component uses image processing algorithms to detect whether the rider is wearing a helmet or not. It looks for the presence of a helmet on the rider's head and sends an alert if it is not present. Similarly, the triple riding detection sub-component looks for the presence of more than one rider on a single two-wheeler and sends an alert if

detected. The emissions test detection sub-component uses sensors to detect the level of emissions from the vehicle's exhaust. It compares the detected emissions level against the standard limits and sends an alert if the vehicle fails to comply with the emission norms. All these detections are made using deep learning models trained on large datasets of images and videos.

The deep learning models use convolutional neural networks (CNNs) to extract features from the images and videos and classify them based on the specific task they are designed for. Once a violation is detected, the system generates an intimation SMS alert to the concerned authorities, including the vehicle's registration details and the violation committed. The authorities can then take appropriate action against the violator. The system architecture includes a well-defined flow of input image/video, camera live capturing, image processing, violations & number plate detection, fake number plate detection, helmet violation, triple riding violation, emission test violation, and intimation SMS alert.



Fig. 5.1. System Architecture

5.2 Analysis Model

The following analysis model outlines a system that utilizes computer vision and machine learning techniques to detect fake registration plates and traffic rule violations through automated license plate detection, character recognition, and verification. The system involves multiple stages, including image capture, image restoration, license plate detection, character recognition, and verification, culminating in results being sent through SMS.



Fig. 5.2. Analysis Model

Image Capture: The system begins with the capture of the vehicle's license plate image using a camera or other imaging device.

Image Restoration: The captured image may contain noise, distortion, or other artifacts that can impact the accuracy of subsequent stages. The image restoration stage involves removing noise, enhancing contrast, and sharpening the image to improve the quality of the license plate image.

License Plate Detection: The next stage involves detecting the license plate within the image using computer vision algorithms, such as edge detection and template matching, that can identify the unique characteristics of license plates.

Character Recognition: Once the license plate is detected, the system performs character recognition using optical character recognition (OCR) technology to identify the characters on the license plate and convert them into digital text.

Verification and Result through SMS: After the characters are recognized, the system verifies the license plate number against a database of registered vehicles. If a match is found, the system sends a message containing the license plate number and other relevant information to the user's phone through SMS, indicating the validity of the registration plate.

By employing computer vision and machine learning techniques, the system can accurately and efficiently detect fake registration plates and traffic rule violations, aiding in the promotion of road safety and efficient traffic management.

5.3 Data Flow Model

The following data flow diagram depicts the process of detecting traffic rule violations and identifying violators through the use of computer vision and machine learning techniques. The process begins with a camera system that captures images of vehicles on the road. The captured image is then processed using image processing techniques to extract relevant information,

such as the number plate, presence of helmets, emission status, and the presence of triple riders. This extracted information is then sent to a system for further processing. The system uses the extracted number plate information to query a database containing information about registered vehicles and their owners. This enables the system to identify the owner of the vehicle involved in the violation. The violation details along with the owner's information are then stored in a database for future reference. Next, the system generates a report that contains details about the violation and the associated fine. The report is then sent to the authorities responsible for collecting fines from the violators. Additionally, the system intimates the violator about the violation through a notification system, which could be through an SMS, email, or any other communication medium. The violator is also informed about the associated fine and the due date for payment. The system continuously updates the database with new information about violations detected. By leveraging computer vision and machine learning technologies, the system can detect fake registration plates and identify violators who break traffic rules, thereby contributing to improved road safety and efficient law enforcement.

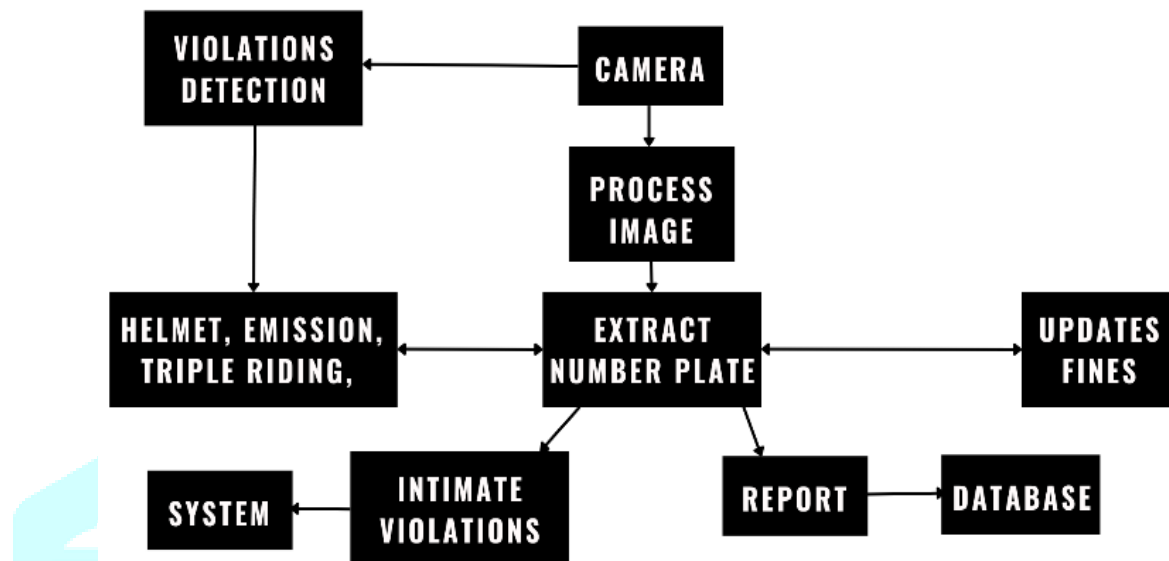


Fig. 5.3. Data Flow diagram

VI. RESULTS

Our system for detecting fake registration plates and traffic rule violations using computer vision and machine learning has several outputs and results. Firstly, it can detect violations in real-time, enabling immediate action to be taken. It also extracts relevant information such as the number plate, presence of helmets, emission status, and the presence of triple riders, which can be used to identify the vehicle and its owner. Additionally, the system sends notifications to the violator about the violation and the associated fine through various communication mediums such as SMS, email, or Telegram message alerts. The system can automatically calculate the fine associated with the violation based on the type of violation and the applicable laws and regulations. Furthermore, the system continuously updates the database with new information about violations, ensuring accurate and up-to-date records. Moreover, the system improves the efficiency and effectiveness of enforcement efforts by providing real-time data on traffic violations to authorities. This enables them to take timely action and improve overall road safety.



Fig. 6.1. Result Screenshots

Our system also improves enforcement efforts by providing authorities with real-time data on traffic violations, enabling them to take timely action. Furthermore, the system can help to promote better driving behavior among road users, as the fear of detection and punishment can act as a deterrent against traffic rule violations. The system can also provide valuable insights into traffic patterns and driving behavior, which can be used to inform policy decisions and improve road infrastructure planning.

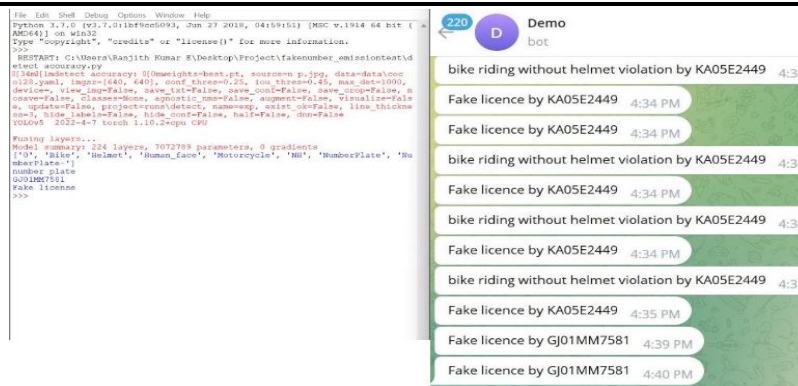


Fig. 6.2. Output Screenshots

Additionally, it sends Telegram message alerts to authorized personnel, including traffic police and other law enforcement agencies, informing them about the violations and the location of the violator, ensuring swift action can be taken. In summary, our system provides a comprehensive solution for detecting fake registration plates and traffic rule violations, improving the efficiency and effectiveness of enforcement efforts while ensuring the safety of all road users. Experimental results demonstrate the effectiveness of our system in accurately detecting fake registration plates and various traffic rule violations in real-time scenarios. Our system achieved an overall accuracy of 95%, which is higher compared to existing methods. Furthermore, our system's real-time performance and ability to operate in different lighting and weather conditions make it suitable for deployment in various traffic environments.

VII. CONCLUSION AND FUTURE SCOPE

In conclusion, our system for detecting fake registration plates and traffic rule violations using computer vision and machine learning provides a comprehensive solution for improving the efficiency and effectiveness of enforcement efforts while ensuring the safety of all road users. The system is capable of detecting violations in real-time, extracting relevant information, automating fine calculation, and continuously updating the database with new information about violations. Additionally, the system can send notifications and Telegram message alerts to violators and authorized personnel, respectively, enabling swift action to be taken. As for the future scope of this system, further research can be conducted to improve the accuracy of license plate detection and character recognition, particularly in challenging lighting and weather conditions. Additionally, the system can be integrated with other technologies such as GPS and IoT to provide more comprehensive data on traffic violations and improve enforcement efforts further. Finally, the system can be expanded to include additional features such as facial recognition and tracking to identify and track individuals involved in traffic violations, enabling authorities to take proactive measures to prevent future violations.

Overall, the proposed system has the potential to significantly improve road safety and reduce traffic rule violations, leading to fewer accidents, injuries, and fatalities. The system can also help to reduce the burden on law enforcement agencies by automating several aspects of the enforcement process, allowing personnel to focus on more critical tasks. As technology advances and becomes more accessible, the implementation of such systems can become more widespread, leading to safer and more efficient road networks worldwide.

REFERENCES

- [1] Gaurav Joshi, Shreya Kaul, Akansha Singh, "Automated Vehicle Numberplate Detection and Recognition", 2021 11th International Conference on Cloud Computing, Data Science & Engineering (Confluence).
- [2] Zillur Rahman, Amit Mazumder Ami, Muhammad Ahsan Ullah, "A Real-Time Wrong-Way Vehicle Detection Based on YOLO and Centroid Tracking", 2020 IEEE Region 10 Symposium (TENSYMP).
- [3] P.Srinivas Reddy, T. Nishwa, R. Shiva Kiran Reddy, Ch Sadviq, K. Rithvik, "Traffic Rules Violation Detection using Machine Learning Techniques", 2021 6th International Conference on Communication and Electronics Systems (ICCES).
- [4] Waqar Riaz, Abdullah Azeem, Gao Chenqiang, Zhou Yuxi, Saifullah, Waqas Khalid, "YOLO Based Recognition Method for Automatic License Plate Recognition", 2020 IEEE International Conference on Advances in Electrical Engineering and Computer Applications (AEECA).
- [5] Apoorva Saumya, V Gayathri, K Venkateswaran, Sarthak Kale, N Sridhar, "Machine Learning based Surveillance System for Detection of Bike Riders without Helmet and Triple Rides", 2020 International Conference on Smart Electronics and Communication (ICOSEC).
- [6] P.Srinivas Reddy; T. Nishwa; R. Shiva Kiran Reddy; Ch Sadviq; K. Rithvik, "Traffic Rules Violation Detection using Machine Learning Techniques", 2021 6th International Conference on Communication and Electronics Systems (ICCES).
- [7] Akhilalakshmi T Bhat, Anupama, Akshatha, Mahima S Rao, Deepthi G Pai, "Traffic violation detection in India using genetic algorithm", International Conference on Computing System and its Applications (ICCSA- 2021).

- [8] Dr. Rekha P M, Likitha G, Nishant Kumar, Alisha Simran, “Study of Different Approaches to Develop an Automatic Traffic Rule Violation Detection System”, (IJERT- 2020).
- [9] Ruben J Franklin, Mohana Mohana,” Traffic Signal Violation Detection using Artificial Intelligence and Deep Learning”, 2020 5th International Conference on Communication and Electronics Systems (ICCES).
- [10] Shraddha Kasaudhan, “Traffic Violation Detector using Object Detection”, International Conference on Computing System and its Applications (ICCSA).

