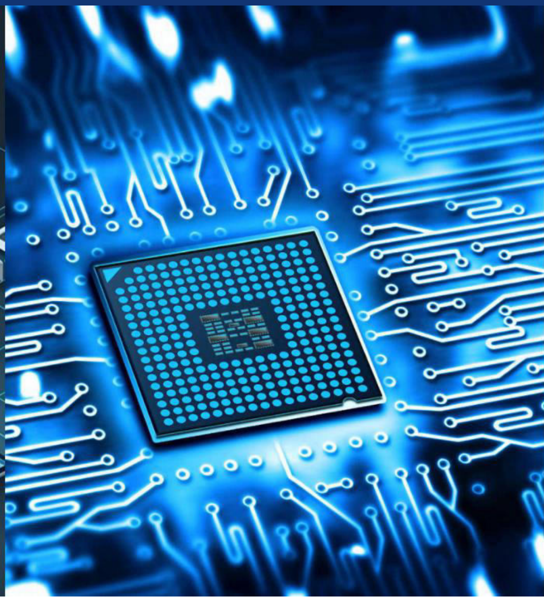
IJIRCCE

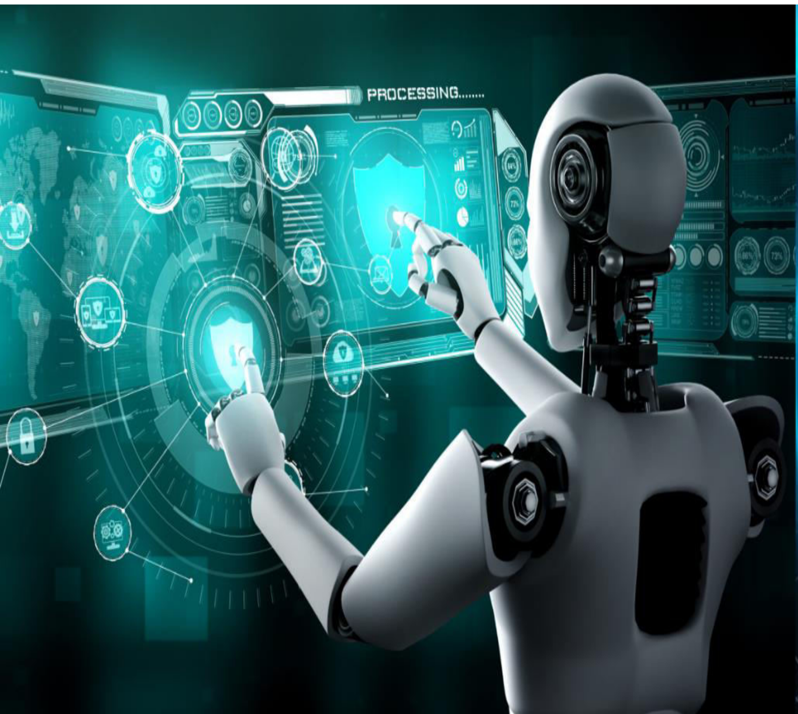
ISSN(O): 2320-9801

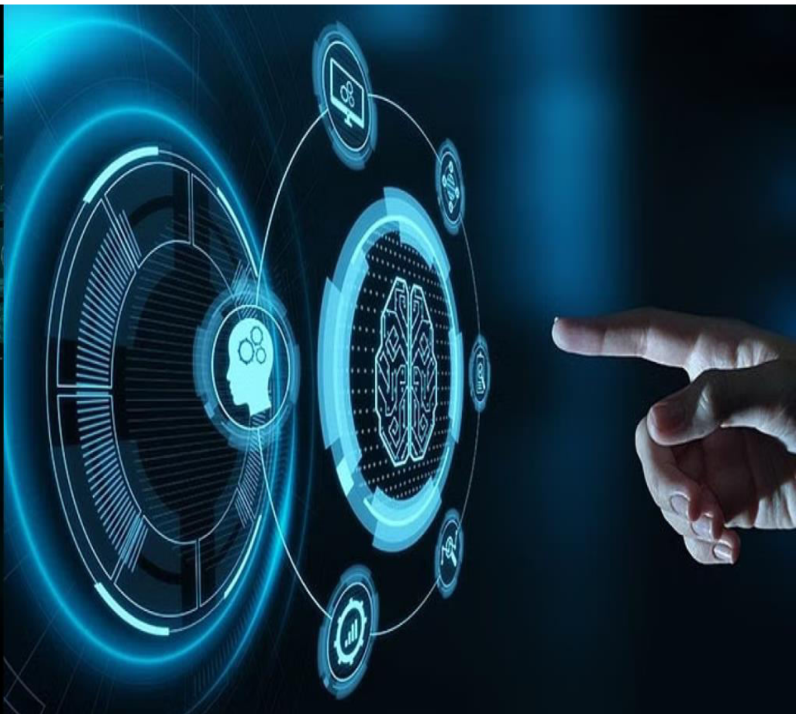
ISSN(P): 2320-9798



International Journal of Innovative Research in Computer and Communication Engineering

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)





Impact Factor: 8.771

Volume 13, Issue 5, May 2025

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305139

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Vehicle Identification via Plate

Rajarajeshwari

Assistant Professor, Dept. of ECE, SSM Institute of Engineering and Technology, Dindigul, India

L. Tharun Kumar, G.R.Pranavsankar, S.Vishwanathan

Final Year Students, Electronics and Communication Engineering, SSM Institute of Engineering and Technology, Dindigul, India

ABSTRACT: VEHICLE IDENTIFICATION VIA PLATE (VIP) is a crucial technology in intelligent transportation systems, enabling automated vehicle identification. This study explores the integration of OpenCV and Tesseract OCR to develop a robust LPR system. OpenCV is utilized for image preprocessing, including grayscale conversion, noise reduction, and contour detection. These steps facilitate accurate localization of license plates in diverse lighting and environmental conditions. After isolating the plate region, image thresholding and morphological operations enhance character clarity. Tesseract OCR, an open-source text recognition engine, is employed for extracting alphanumeric characters from the processed plate image. Techniques like resizing, padding, and contrast enhancement further improve OCR accuracy. The system demonstrates efficiency in recognizing plates from various angles and resolutions. It is tested on real-world datasets containing different vehicle types and plate styles. Performance metrics such as precision, recall, and processing time are evaluated. Results indicate high recognition rates in both day and night conditions. This implementation is scalable and cost-effective for parking systems, toll booths, and law enforcement. Limitations include occasional errors with dirty or heavily occluded plates. Future improvements may involve deep learning-based detection and multilingual OCR support. The framework offers a practical solution for real-time license plate recognition using accessible technologies.

KEYWORDS: This system automates vehicle identification using License Plate Recognition (LPR) and it enhances transportation monitoring and security systems.

I. INTRODUCTION

Vehicle Identification via Plate (VIP) is an advanced image processing and computer vision technique designed to automatically identify vehicles by detecting and recognizing their license plates. With the increasing demand for intelligent transportation systems, VIP has become a cornerstone technology in applications such as traffic law enforcement, toll collection, border control, and smart parking management.

Leveraging a combination of optical character recognition (OCR), machine learning, and real-time image acquisition, VIP systems can accurately extract vehicle identity information from images or video frames captured under various environmental and lighting conditions. This paper explores the methodologies, challenges, and innovations associated with VIP systems, aiming to provide a comprehensive understanding of their development, performance, and potential future directions.

II. PROBLEM STATEMENT

- **Environmental Challenges**: VIP systems often perform poorly under low light, rain, fog, or motion blur conditions.
- **Plate Variability**: Difficulty in recognizing plates with different fonts, colors, sizes, and regional formats.
- **Angle and Occlusion Issues**: Accuracy drops significantly when license plates are captured at sharp angles or partially blocked.
- **Real-Time Limitations**: Many systems are not optimized for real-time processing, especially with high-speed vehicles.
- **Security and Tampering**: Vulnerability to spoofed, damaged, or obscured license plates.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Thus, there is a critical need for a system that:
It can accurately detect and recognize vehicle license plates in real time. It should work reliably in different lighting, weather, and traffic conditions. The system must also handle various plate formats and camera angles. In addition, it should be secure, scalable, and adaptable for use in modern smart transportation systems.

III. OBJECTIVE

The main objective of this project is to develop an automated system capable of identifying vehicles through their license plates. It aims to accurately detect and extract the license plate area from images or video feeds using image processing techniques. The project focuses on applying Optical Character Recognition (OCR) to convert plate characters into machine-readable text. Another key goal is to store this information in a structured database along with timestamps and location data. The system should function effectively under various lighting, weather, and traffic conditions. Real-time processing and high accuracy are essential for practical deployment in surveillance and traffic control. The project also aims to assist in law enforcement, stolen vehicle detection, and access control. Lastly, it seeks to integrate the system with existing smart city and transportation infrastructure.

IV. LITERATURE SURVEY

Existing Techniques:

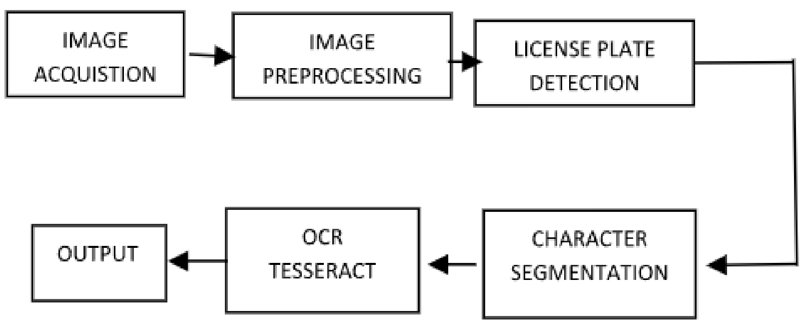
1. Some early methods use image processing like edge detection and thresholding to find the license plate.
2. Morphological operations help clean up the image and isolate the plate region.
3. Template matching is used to compare the plate characters with stored samples.
4. Machine learning techniques like SVM and k-NN improve recognition accuracy.
5. Deep learning methods like CNNs are now widely used for detecting and reading plates.

Limitations:

- The system may not work well in poor lighting or nighttime conditions.
- Blurry or low-resolution images can reduce accuracy.
- Different font styles and plate formats make recognition difficult.

Recent Research:
Lee et al. Real-Time License Plate Recognition Using OpenCV and Tesseract.
Hassan et al. License Plate Recognition Using OpenCV and Tesseract for Intelligent Transportation Systems.
Zhang et al. Enhancing License Plate Recognition with OpenCV and Tesseract for Real-Time Applications.

V. ARCHITECTURE



5.1. Image Acquisition

∟ Input: Image or video from a camera (e.g., CCTV, dash cam).
∟ Goal: Capture clear frames where vehicle plates are visible.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

5.2. Image Preprocessing

∟ Enhances image quality for better recognition.

∟ Common steps:
1. Grayscale conversion
2. Noise reduction (Gaussian blur, median filtering)
3. Contrast enhancement (histogram equalization)
4. Resizing or normalization

5.3. License Plate Detection

∟ **Goal**: Detect the region of the image that contains a license plate.

∟ Techniques:

Traditional: Edge detection + morphological operations

Deep Learning: Trained on annotated license plate datasets

5.4. Plate Image Segmentation

Splits the plate image into individual characters (used in traditional systems).
Modern deep learning models often skip this step.

5.5. Optical Character Recognition (OCR)

Recognizes characters from the plate.

Approaches:
- **Traditional**: Template matching, SVMs, etc.
- **Deep Learning**: CNNs, LSTMs, or CRNNs (Convolution Recurrent Neural Networks)
- End-to-end models like **CRNN** or **Transformer-based OCR** (e.g., TrOCR)

5.6. Post Processing
- Non-Maximum Suppression (NMS) to remove duplicate detections.
- Plate alignment or cropping for input to OCR stage.

5.7. Output
- ∟ Bounding box coordinates for the detected license plate region.
- ∟ Confidence score for each detection

VI. FUTURE ENHANCEMENT

∟ **Improve Accuracy in Bad Weather**: Use advanced AI models to better handle rain, fog, and low-light conditions.
∟ **Support for Multiple Languages**: Enhance the system to recognize license plates in various scripts (e.g., Arabic, Chinese, etc.).
∟ **Integration with National Databases**: Automatically match plate numbers with government or police records for real-time alerts.
∟ **Mobile LPR Apps**: Develop mobile-friendly LPR tools for law enforcement or private use on smart phones.
∟ **Real-Time Alerts**: Add features for instant notifications on stolen or unauthorized vehicles.
∟ **Use of Edge Computing**: Reduce processing time by analyzing data directly on local devices instead of cloud servers.
∟ **Adaptability to Non-Standard Plates**: Improve detection of customized or damaged license plates.
∟ **Vehicle Make and Color Detection**: Combine LPR with vehicle type, model, and color recognition for more detailed identification.

© 2025 IJIRCCE | Volume 13, Issue 5, May 2025| DOI:10.15680/IJIRCCE.2025.1305139

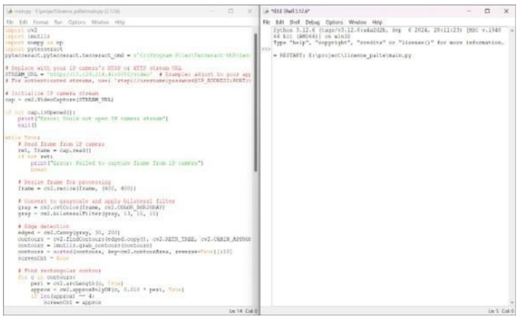
www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

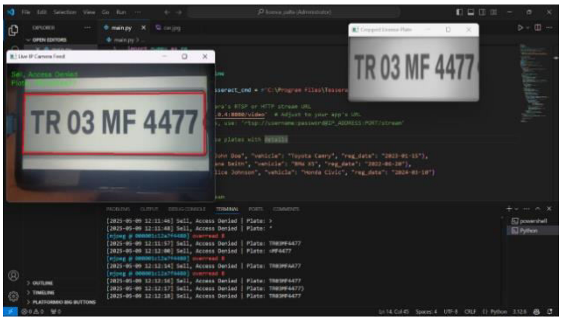
(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

VII. OUTPUT IMAGE

Coding View

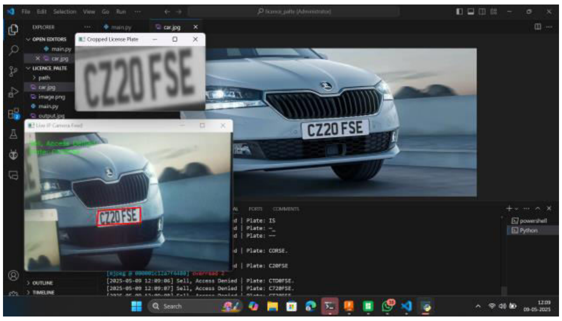


Process Image



Detected Image

Access Denied Image

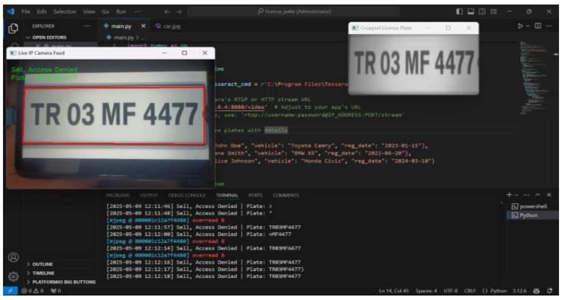


www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.771| ESTD Year: 2013|

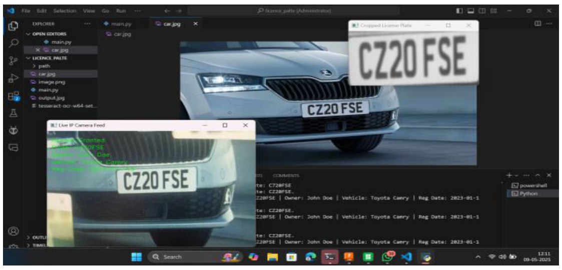
International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Analyzing Image



Final Output



VIII. CONCLUSION

In conclusion, vehicle identification through license plate recognition has emerged as a powerful and reliable technology for modern transportation systems. By automating the process of reading and identifying license plates, this system significantly enhances the efficiency of traffic management, law enforcement, toll collection, and parking systems. The integration of advanced image processing and machine learning algorithms has improved the accuracy and adaptability of recognition systems, allowing them to perform effectively under various environmental and lighting conditions. Moreover, the technology contributes to public safety by assisting in criminal investigations and enabling real-time vehicle tracking. As urban areas continue to grow and the demand for intelligent transportation solutions increases, license plate recognition systems are becoming an essential part of smart city infrastructure. Overall, this technology represents a major advancement in the automation and security of vehicular monitoring.

REFERENCE

1. Huang, X., Yang, S., Xiong, A., & Yang, Y. (2024). Enhanced YOLOv8 With VTR Integration: A Robust Solution for Automated Recognition of OCS Mast Number Plates. IEEE Access.
2. Anilkumar, Chunduru, Meesala Shobha Rani, and G. Srinivasa Rao. "Automated License Plate Recognition for Non-Helmeted Motor Riders Using YOLO and OCR." Journal of Mobile Multimedia 20.2 (2024): 239-265.
3. Attaluri, V., & Aragani, V. M. (2025). Sustainable Business Models: Role-Based Access Control (RBAC) Enhancing Security and User Management. In Driving Business Success Through Eco-Friendly Strategies (pp. 341-356). IGI Global Scientific Publishing.
4. Abreo, A., Mayur, C., & Sinha, S. (2024, April). AI Based Seamless Vehicle License Plate Recognition Using Raspberry Pi Technology. In 2024 IEEE 13th International Conference on Communication Systems and Network Technologies (CSNT) (pp. 387-392). IEEE.
5. Aljzaere, Hasan, Atul Chandra Nath, and Wolfram Hardt. "German License Plate Recognition System Using the YoloV8 Model and EasyOCR." 2024 IEEE CPMT Symposium Japan (ICSJ). IEEE, 2024.
6. Zhang, W., & Ji, W. (2024, October). Real-Time License Plate Positioning Algorithm Optimization and Hardware Implementation. In 2024 5th International Conference on Computer Engineering and Intelligent Control (ICCEIC) (pp.140-14).IEEE.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE
SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details