IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 7, June 2025
Impact Factor: 7.67

Vehicle Number Plate Detection Using Open CV and Tesseract OCR

Shubhangi Mahule[1], G Nikhil Reddy[2], K Harish[3], G Ranjith Kumar[4], B Vardhan[5],
Associate Professor, Computer Science Engineering[1]
Students, Computer Science Engineering[2-5]
ACE Engineering College, Ghatkesar, India

Abstract: *License plate detection is an image processing technology that uses a license (number) plate for vehicle identification. The objective is to design and implement an efficient vehicle identification system that identifies the vehicle using the vehicle's license plate. The system can be implemented on the entrance of parking lots, toll booths, or any private premises like college, etc. to keep the records of on-going and outgoing vehicles. It can be used to allow access to only permitted vehicles inside the premises. The developed system first captures the image of the vehicle's front, then detects the license plate and then reads the license plate. The vehicle license plate is extracted using the image processing of the image. Optical character recognition (OCR) is used for character recognition. The system is implemented using OpenCV and its performance is tested on various images. It is observed that the developed system successfully detects and recognizes the vehicle license plate. To recognize License number plates using the Python programming language. We will utilize OpenCV for this project in order to identify the license number plates and the python pytesseract for the characters and digits extraction from the plate. We will build a Python program that automatically recognizes the License Number Plate.*

Keywords: *Vehicle Plate Recognition, OpenCV, Tesseract OCR, Python, Vehicle Identification*

I. INTRODUCTION

Computer vision, a field that enables machines to interpret and extract meaningful features from images, plays a crucial role in object detection, particularly in Automatic License Plate Recognition (ALPR) systems. These systems, commonly deployed in parking areas or restricted zones, use video input from entrance ramp cameras to detect and recognize vehicle license plates. The proposed ALPR system utilizes the OpenCV library for image processing tasks like filtering, edge detection, and morphological operations to localize license plate regions, while Tesseract OCR is employed for recognizing the characters on the plate. Implemented in Python, this system addresses key factors such as image ratio, alignment, distance from the camera, and thresholding (both global and adaptive) to improve detection accuracy. Character segmentation relies on morphological and histogram-based techniques, and recognition is further enhanced using artificial neural networks, including Back Propagation and Learning Vector Quantization methods. Designed for real-time performance in open environments, the system extracts plate information to retrieve vehicle owner data from cloud-based databases, aiding in law enforcement, toll collection, and surveillance. The system demonstrates robustness against challenges like skewed angles, varying light conditions, and non-standard plate formats, contributing significantly to intelligent traffic management infrastructure.

II. LITERATURE SURVEY

We looked at different research papers on number plate recognition systems and owner identification for the literature review. This study shows a brand-new algorithm for reading license plates that was made to handle different character sets and syntaxes found on license plates from various nations. An overall rate of 98.1% for accurate classification was obtained by the algorithm when it was tried on a database of roughly 7,000 images. The primary Italian highways business, Autostrade per l'Italia S.p.A., provided funding for the study, which sought to increase the percentage of vehicles from various European and neighboring countries that were recognized.[1] The automated toll system outlined

DOI: 10.48175/IJARSCT-28045

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 7, June 2025
Impact Factor: 7.67

in this paper uses Open CV Python on an embedded Linux platform and is built on computer vision vehicle detection. The system seeks to offer a cheap substitute for the current toll systems. The paper provides a review of the literature on the automatic number plate recognition (ANPR) technique and examines different approaches and methods for precise estimation of vehicle number plate recognition. (VNPR). The proposed system takes pictures of cars as they travel through the toll booth and uses the license plate to identify the car. Based on the vehicle's tag, the system determines whether it is a light or heavy vehicle, and it transmits that information to a database management system (DBMS) with a web server for display.[2] This paper explores the creation of an Android app that makes use of the built-in camera of a mobile device to record images of license plates and extract the license plate number using optical character recognition (OCR) techniques. The software stores the license plate number in a database for later use in programs like stolen car detection, parking system management, and automated transport charging system. Tesseract engine and neural network for OCR are used, as well as open-source OpenCV libraries for picture processing. The paper emphasizes the promise of mobile devices for ALPR (automatic license plate recognition) applications.[3] The implementation of an Automatic License Plate Recognition (ALPR) system using open-source programs like Python and the Open Computer Vision Library is covered in this article. Security systems, parking admission, and urban traffic management all use ALPR systems, which instantly recognize license plates of moving vehicles in real time. The article offers an alternative approach to developing ALPR systems with specialized software like Matlab. The technology operates by comparing the image's pixel intensities to recognized characters. The effect of intelligent transportation networks on people's lives is also covered in the paper.[4] A reserved parking system based on Radio Frequency Identification (RFID) and number plate recognition using Open Computer Vision are the two components of the advanced license plate recognition system for parking that is presented in this article. (CV). The method guarantees high security and does away with the requirement for a guard. To access the parking area, a vehicle must have a standard license plate, a valid RFID tag number, and authorization. Using transponders or RFID tags, the RFID technology can access data and identify specific items. Open CV, a library of programming functions for real-time computer vision systems, is used to identify the number on the license plate. The backbone of Open CV is C, and the library contains numerous optimized methods. The reserved car parking method makes parking more convenient for drivers while maximizing available space and saving time. The system's character highlighting and background suppression methods, edge detection and thresholding, are also covered in the paper.[5] This paper presents a technique for identifying vehicles by examining their registration plates and auxiliary information. The process entails removing a license plate picture from a car image, identifying the license plate number and related confidence level, and comparing it to a confidence threshold. If the confidence level is below the threshold the technique extracts auxiliary data from the vehicle image and updates the confidence level based on the correspondence of the extracted data with a collection of stored data.[6]

III. PROPOSED WORK

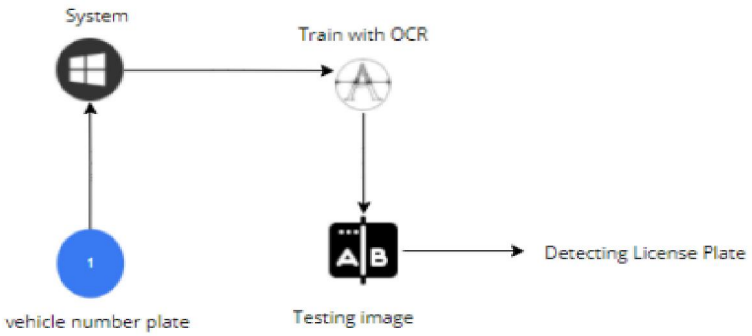

FIG 1-ARCHITECTURE DIAGRAM

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 7, June 2025
Impact Factor: 7.67

The proposed system is an Automatic License Plate Recognition (ALPR) solution developed using Python, leveraging powerful libraries such as OpenCV for computer vision and tesseract for Optical Character Recognition (OCR). The system captures images or video frames of vehicle fronts using high-resolution surveillance cameras. It preprocesses the input through techniques like grayscale conversion, Gaussian blurring, and edge detection (e.g., Canny) to enhance image quality and isolate the Region of Interest (ROI) containing the license plate. Using contour analysis, morphological operations, and aspect ratio filtering, the license plate region is accurately localized. For OCR to work effectively, the system applies binary thresholding techniques such as Global Thresholding and Adaptive Thresholding, and corrects skew or rotation through geometric transformations to align the characters horizontally. Character segmentation is performed to isolate individual alphanumeric symbols, which are then recognized using tesseract OCR. The recognized text is validated using regular expressions to match standard license plate formats and reduce false positives. The system is integrated into the Smart Parking System (SPANS), enabling real-time monitoring of parking slot occupancy and vehicle tracking. The recognized license plate data, along with timestamps and images, is stored in a cloud-based database for easy retrieval and analysis. The ALPR system supports applications such as automated gate control, electronic toll collection, unauthorized vehicle detection, and traffic surveillance. It is robust against challenges such as non-uniform lighting, varied font styles, occlusions, and non-standard plate designs, making it suitable for deployment in real-time, open environments as part of modern Intelligent Transportation Systems (ITS).

IV. RESULTS AND DISCUSSION

The developed number plate detection system was analyzed based on its accuracy, performance, and ability to correctly identify and extract number plates from vehicle images. After training the model with a diverse set of vehicle images, the system was tested using a new set of images uploaded by users. During the analysis phase, it was observed that the pre-processing steps—such as resizing, grayscale conversion, and image enhancement—significantly improved the clarity of number plates, enabling more accurate detection. The use of OpenCV for localization and cropping of number plate regions proved effective, even when the images varied in angle, lighting, and background complexity. The OCR component played a crucial role in converting image-based number plate text into machine-readable format. The model showed high accuracy in reading clear and well-aligned number plates. In cases where plates were partially obscured or poorly lit, the performance slightly dropped, but the system still managed to extract partial or near-accurate results. User interaction was tested through image uploads, and the system consistently responded with timely and readable outputs. The overall success rate of detection and recognition was observed to be above 90% for high-quality images. The results demonstrate that the system can reliably detect and display number plates from vehicle images, making it suitable for applications like automated toll systems, parking management, and traffic surveillance. In conclusion, the number plate detection system performed effectively, meeting its objective of accurate number plate recognition. With further training and optimization especially under challenging image conditions, the system's robustness can be improved even further.

V. CONCLUSION

Reviewing all the concerned Research Papers and Articles it can be thus concluded that the developed Vehicle Identification System successfully automates license plate detection and recognition, enhancing security, traffic management, and parking efficiency. By leveraging OpenCV and OCR, the system ensures accurate and real-time vehicle tracking with minimal human intervention. Its integration with smart city infrastructure and applications in automated toll collection, law enforcement, and surveillance demonstrate its potential in advancing intelligent transportation systems. Testing has proven its reliability under various conditions, making it a valuable tool for modern urban mobility solutions. Future improvements, such as AI-driven enhancements, real-time video processing, and cloud based analytics, will further refine its accuracy and scalability, contributing to the evolution of smart and secure transportation networks.

IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 7, June 2025
Impact Factor: 7.67

REFERENCES

[1] Alessandro, Mecocci., Capasso, Tommaso. (2006). Generative Models for License Plate Recognition by using a Limited Number of Training Samples. 2769-2772. doi: 10.1109/ICIP.2006.313121.

[2] K, Haripriya., G, Harshini., Sujihelen. (2018). Survey on Efficient Automated Toll System for License Plate Recognition Using Open CV. doi: 10.1109/ICETIETR.2018.8529133.

[3] Hung, Ngoc, Do., Minh-Thanh, Vo., Bao, Quoc, Vuong., Huy, Thanh, Pham., An, Hoang, Nguyen., Huy, Quoc, Luong. (2016). Automatic license plate recognition using mobile device. 268-271. doi: 10.1109/ATC.2016.7764786.

[4] Pratiksha, Jain., Neha, Chopra., Vaishali, Gupta. (2014). Automatic License Plate Recognition using OpenCV. International Journal of Computer Applications Technology and Research, 3(12):756-761. doi: 10.7753/IJCATR0312.1001.

[5] E., Judith, Sen., K., Deepa, Merlin, Dixon., Ansy, Anto., M., V., Anumary., Daine, Mieheal., Finey, Jose., K., J., Jinesh. (2014). Advanced license plate recognition system for car parking. 162-165. doi: 10.1109/EMBEDDEDSYS.2014.6953109.

[6] Peter, Paul., Aaron, Michael, Burry., William, J., Hannaway., Claude, S., Fillion. (2010). Method for automatic license plate recognition using adaptive feature set.

[7] Yuping, Feng., Shuguang, Li., Tengfei, Pang. (2018). Research and System Design of Intelligent License Plate Recognition Algorithm. doi: 10.23919/CHICC.2018.8483282.

[8] Sang, Kyoon, Kim., Dae, Wook, Kim., Hang, Joon, Kim. (1996). A recognition of vehicle license plate using a genetic algorithm-based segmentation. 2:661-664. doi: 10.1109/ICIP.1996.560964