

Moving Vehicle Registration Plate Detection System Using OCR

Sanket S. Tabhane¹, Dr. Anuja A. Khodaskar², Tejas J. Sonkusare³, Isha R. Sinkar⁴,
Swapnali G. Sapkal⁵, Yash N. Zagade⁶

¹²³⁴⁵Students of Final year, Department of Computer Science & Engineering, Sipna College of Engineering and Technology, Amravati, Maharashtra, India

⁶Assistant Professor, Department of Computer Science & Engineering, Sipna College of Engineering and Technology, Amravati, Maharashtra, India

Abstract - The system titled "Moving Vehicle Registration Plate Detection System Using OCR" presents a comprehensive study on the development of an automatic license plate recognition system for moving vehicles. Through the integration of sophisticated image processing techniques, optical character recognition (OCR) technologies, and machine learning models, the project seeks to address the difficulties involved in real-time vehicle plate identification and recognition. The proposed system architecture involves the use of morphological operations for character extraction, noise reduction, and character segmentation, followed by OCR for character recognition. Additionally, it highlights the challenges related to dynamic environmental conditions and real-time processing requirements in the context of moving vehicle number plate registration. The system aims to contribute to the advancement of intelligent transportation system and vehicular access control through efficient and accurate license plate recognition.

Key Words: - OCR, Character extraction, Noise reduction, Real-time processing

1. INTRODUCTION

The development of a Moving Vehicle Registration Plate Detection System using Optical Character recognition is a critical area of research in the field of computer science and engineering. This system aims to address the growing need for efficient and accurate license plate recognition in various application, including traffic monitoring, automatic toll payment, and parking lot access control. The integration of OCR technology and advanced algorithms presents a promising solution to the challenges posed by dynamic environmental conditions, high-speed vehicle movement, and diverse license plate design. It also delves into the system architecture, highlighting the stages involved in the recognition process, such as data pre-processing, character segmentation, and optical character recognition. Additionally, the paper discusses the integration of machine learning models, security measures, and optimization techniques for resource efficiency. The proposed system architecture aims to achieve real-time performance, to

dynamic environmental conditions, and robust security measures.

1.1 Objectives of the paper

- Developing a Moving Vehicle Registration Plate Detection System using OCR technology.
- Integrating advanced image processing algorithms and machine learning models for efficient license plate recognition.
- Addressing challenges related to real-time vehicle plate detection and recognition.
- Implementing morphological operations for character extraction, noise reduction, and character segmentation.
- Enhancing the system's efficiency and accuracy in recognizing license plates under dynamic environmental conditions.
- Contributing to the advancement of intelligent transportation systems and vehicular access control through innovative license
- Plate recognition techniques.

1.2 SCOPE OF THE PAPER

The system investigates "Moving Vehicle Number Plate Detection," centering on the development and implementation of a comprehensive system for real-time identification of vehicle license plates. The study explores the system's architecture, methodologies, and practical application. It delves into various components such as image processing, object detection, and optical character recognition techniques employed in the system. The paper discusses the system's features, including its ability to detect moving vehicles, accurately localize license plate regions within the captured frames, and extract alphanumeric character from the license plates using advanced OCR algorithms. Additionally, it examines the collaborative efforts and assignments undertaken to enhance the system's accuracy and efficiency.

2. LITERATURE REVIEW

1. DTK SOFTWARE

Introduction: First of all, A web-based program called DTK LPR Solution (Automatic License Plate

Recognition/License Plate Recognition) can identify license plates from a range of video sources, such as: B.. IP cameras, video files, video capture devices, and custom video sources (plugins). A fast and stable LPR engine enables accurate disc recognition from real-time video with resolutions up to 1920 x 1080 (Full HD) and supports many disc formats from different countries. DTK LPR solutions are developed using the DTK LPR SDK, which is based on the latest computer vision technologies and algorithms.[1]

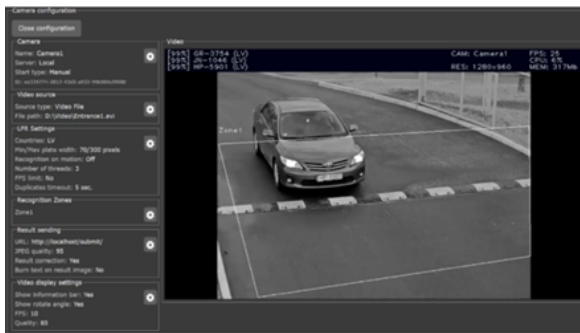


Fig. 1. DTK SOFTWARE

Working: The LPR Management/Database Server serves as a centralized hub storing recognition results, rule configurations, license plate lists, and system parameters. Users can access it from any device with a web browser to remotely manage and configure cameras, access lookup databases, and configure data retention conditions. The LPR Service performs license plate recognition without a user interface, configured through the Management/Database server, and can be installed on various platforms. It provides plate text, country code, confidence percentage, plate coordinates, vehicle movement direction, JPEG frame image, camera name, and server name to the central Management/Database server.

2. VehiScan® - Automatic Number Plate Recognition System

Introduction: VehiScan is a state-of-the-art automatic license plate recognition system that allows vehicles to be identified by capturing and recognizing the license plate of a moving vehicle and transmitting entry and exit timestamps to a database in real time. . This is an advanced license plate recognition system using computer vision technology that can automatically identify vehicles using images provided by video surveillance cameras.[2]



Fig. 2. VehiScan@- Automatic Number Plate Recognition System

Working: Vehant's ANPR system is comprised of an optical character recognition system, advanced software algorithms based on artificial intelligence, and related hardware.. OCR is based on state-of-the-art pattern recognition, artificial intelligence, image processing technology, and integrated proprietary license plate recognition algorithms. The equipment captures an image, uses optical character reading tools to select the license plate location and associated symbols in the image, and converts the image into a visually readable format. Our license plate recognition system is very useful for vehicle monitoring. The ANPR system can be integrated with another camera that captures images of drivers, expanding personnel's decision-making capabilities for access control, security, and traffic management. The Vehiscan system can also be integrated with other physical access control devices such as boom gates and sliding gates to ensure seamless access.

3. Intellivision - AI and Video Analytics for Smart Cameras

Introduction: IntelliVision's License Plate Recognizer™ stands as a pivotal deep learning-based license plate recognition software solution for ALPR/ANPR. It boasts industry-leading accuracy and seamlessly integrates with various camera types for both live streams and archived footage.[3]



Fig. 3. Intellivision- AI and Video Analytics for Smart Cameras

Working: The system automatically matches against watch lists, providing real-time alerts. It detects and recognizes license plates on both moving and stationary vehicles, logging all plates for forensic analysis. Support is provided for most countries with Western characters, accommodating various plate styles. The system enables tracking of vehicles across multiple cameras or locations, boasting up to 99% accuracy in customer usage.

4. Adaptive recognition

Introduction: The Serbian Public Enterprise “Putevi Srbije” initiated a ground-breaking project to establish advanced Multi Lane Free Flow on state roads. The project’s primary goal was to identify vehicles transporting hazardous materials, recognize vehicle license plates, and provide detailed information about the vehicle’s color, type, and model, with a specific focus on ADR compliance. The cornerstone of this innovative project is the deployment of Adaptive Recognition’s Vidar cameras, encompassing vehicle counting, vehicle categorization, and precise traffic data collection. These functionalities set the foundation for a future free flow automatic road toll concept in the country.[4]

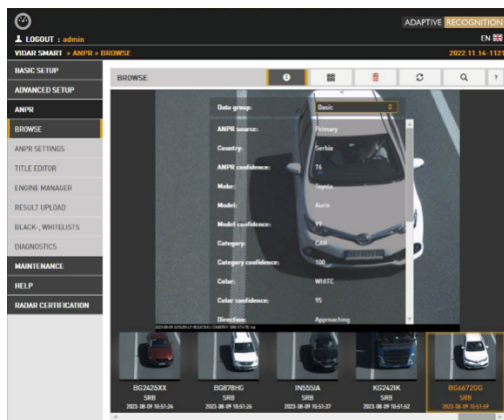


Fig. 4. Adaptive recognition

Working: Vidar cameras offer image-based axle counting, accurately monitoring vehicle traffic on roads by analysing captured images to count passing axles. Additionally, these cameras categorize passing vehicles based on make, model, and color, enhancing road safety and enabling authorities to tailor safety measures accordingly. Data management is streamlined through the Globosely Data Server (GDS), which efficiently handles the vast amount of collected data, facilitating seamless integration and analysis. Vidar cameras utilize integrated intelligence, employing high-resolution IP cameras and laser technology for vehicle detection, ensuring reliable performance in various

conditions. Their decentralized architecture guarantees uninterrupted Automatic Number Plate Recognition (ANPR) and Make, Model, and Recognition (MMR) functionality, minimizing system downtime and providing continuous monitoring capabilities.

5. Axis communication

Introduction: License Plate Recognition (LPR) solutions have evolved significantly, offering purpose-built cameras equipped with advanced analytics from Axis or their partners. By harnessing real-time analytics, these systems automatically capture license plate information, enabling swift comparisons or additions to predefined lists. Subsequently, they trigger appropriate actions tailored to specific use cases, such as gate access control, fee calculations, or alert generation.[5]



Fig. 5. . Axis communication

Working: The LPR system includes a special camera equipped with Axis or similar analytics. This system can run directly on the camera, on a computer nearby, or on a server. The analytics automatically captures license plate numbers in real time. It then compares them to a list and takes actions like opening a gate, charging a fee, or sending an alert. Depending on lighting conditions, the system may use cameras with built-in IR lights or other light sources for best performance.

Software Required:

1. PyCharm: PyCharm is a popular intertwined development terrain (IDE) used for software development, It’s developed by Jet Brains and offers features similar to law editing, debugging, testing, and interpretation contral. PyCharm supports a wide range of programming languages, including python, Java, C, and JavaScript. The IDE has a stonerfriendly interface.

2. Browser: A browser is a software application used to access, view, and interact with websites on the internet. It allows users to enter web addresses, view web pages, search for information, and interact with other websites by clicking on links, filling in forms, and more. There are many popular browsers available today, including Google Chrome, Mozilla Firefox, Microsoft Edge, Safari, and Opera.

Frontend:

1. HTML: HTML stands for Hyper Text Markup Language. It's used with a markup language to construct web pages.. HTML is an abbreviation of Hypertext and Markup language. Hypertext defines the link between the web pages. The markup language is used to define the text document within the tag which defines the structure of web pages. The fifth and most recent version of HTML is called HTML 5. Along with introducing the Document Object Model (DOM) and Application Programming Interfaces (API), it has enhanced the markup accessible for documents.

2. CSS: CSS, or Cascading Style Sheets version 3, is the latest version of the standard language used for describing the presentation of a document written in a markup language. It allows for more flexible and precise control over layout, colors, fonts, and other style-related aspects of a webpage. Some of the key features of CSS3 include transitions, animations, and responsive design. These features make it easier to create visually appealing and dynamic websites that adapt to the user's screen size and device type.

3. JavaScript: JavaScript is an object-oriented, high-level, interpreted programming language that makes it possible to create interactive websites and mobile apps. Originating from Netscape in 1995, it has attained widespread popularity and adoption globally. JavaScript facilitates the integration of dynamic and interactive components within web pages, including dropdown menus, animations, and forms. Its versatility extends beyond client-side scripting, allowing for the creation of standalone applications, server-side scripting, and seamless integration with other programming languages. As a cornerstone of modern web development, JavaScript empowers developers to craft engaging and responsive user interfaces, enhancing the overall interactivity and functionality of digital experiences.

Backend:

1. Python: Python stands as a favored option for constructing backend systems due to its simplicity, resilience, and scalability. The backend, tasked with user request processing, database management, and core functionalities, benefits from Python's capabilities. Leveraging Python's rich library ecosystem and numerous frameworks streamlines backend development, freeing developers from infrastructure concerns. This allows them to concentrate on implementing features and functionality, enhancing productivity and efficiency in application development.

Database:

1. MySQL: MySQL is a widely used open-source relational database management system. Data management, organization, and storage are its uses. It is an incredibly versatile system that can be used for a wide range of applications, from small personal websites to large

enterprise-level systems. It is renowned for being scalable, secure, and stable.. MySQL uses a structured query language called SQL to interact with the database and manage data.

3. PROPOSED WORK

In automatic plate recognition, our first task is to spot a vehicle in a live video. Once we've identified a vehicle, we move on to pinpointing where its number plate is located.. This whole process relies on special algorithms that help us find rectangular areas in the video that might contain the vehicle and its number plate. Detecting the number plate area involves using mathematical operations called convolutions. Altogether, there are four main steps involved: Localization, Pre-processing, Segmentation, Recognition. Finally, we use techniques like optical character recognition (OCR) to analyze the cropped number plate area and extract the alphanumeric characters. This step allows us to recognize and understand the number plate information.

Implementation

The implementation presented here showcases a sophisticated system tailored for real-time detection and identification of vehicle number plates using Optical Character Recognition (OCR). This system is an amalgamation of cutting-edge computer vision techniques and advanced deep learning models, offering robust functionality suitable for various surveillance, lost vehicle detection, traffic monitoring, and security applications. By leveraging the power of live camera feeds and state-of-the-art object detection models like YOLOv8, this system operates seamlessly to continuously analyze video frames in real-time. Its primary objective is to detect number plates of moving vehicles accurately and efficiently. Upon detecting a vehicle within the video frame, the system promptly initiates a series of steps to pinpoint and extract the number plate region. Once isolated, OCR algorithms meticulously decipher the alphanumeric characters imprinted on the plate. This process occurs swiftly, allowing the system to maintain pace with the dynamic nature of moving vehicles. A crucial aspect of the system's functionality lies in its ability to validate the detected number plates against the Indian number plate format. This validation ensures that only legitimate number plates are processed further, enhancing the system's reliability and accuracy.

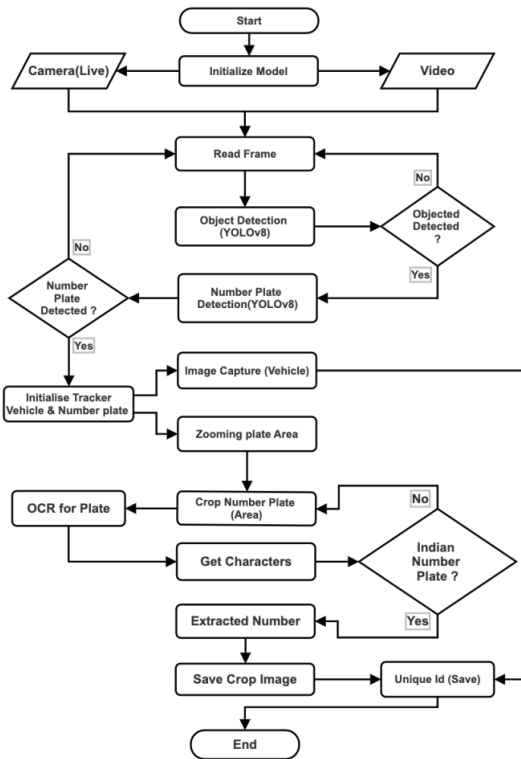


Fig.6. Flow chart diagram

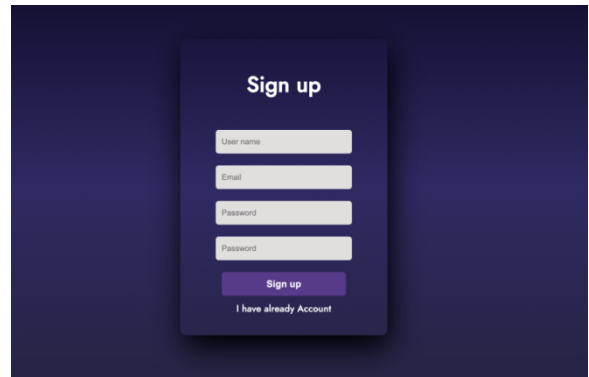


Fig.8. Register Page

Vehicle #	Model #	Confidence #	License Image #	License Plate #	Confidence #	Timestamp #	Camera #	Actions
Search 2013 months	Search 2013 months	Search 2013 months	Search 2013 months	Search 2013 months	Search 2013 months	Search 2013 months	Search 2013 months	
	Hyundai i10 gen-2014-2021	28 %		9199 KND6	92 %	2023-09-08,19:52:22	Camera-Dv-Adm-1	
	Hyundai i10 gen-2013-2020	100 %		22796D	8 %	2023-09-08,19:54:10	Camera-Dv-Adm-1	
	Hyundai i10 gen-2020	82 %		4002JL0	84 %	2023-09-08,19:54:08	Camera-Dv-Adm-1	
	Hyundai i10 gen-2009-2020	84 %		2220098	42 %	2023-09-08,19:53:56	Camera-Dv-Adm-1	
	Hyundai i10 gen-2012-2017	100 %		8802090	6 %	2023-09-08,19:53:50	Camera-Dv-Adm-1	
	Hyundai i10 gen-2012-2017	100 %		8802090	20 %	2023-09-08,19:53:50	Camera-Dv-Adm-1	
	Hyundai i10 gen-2013-2020	100 %		88091V	18 %	2023-09-08,19:53:43	Camera-Dv-Adm-1	

Fig.9. Stored Information

4. OUTPUT

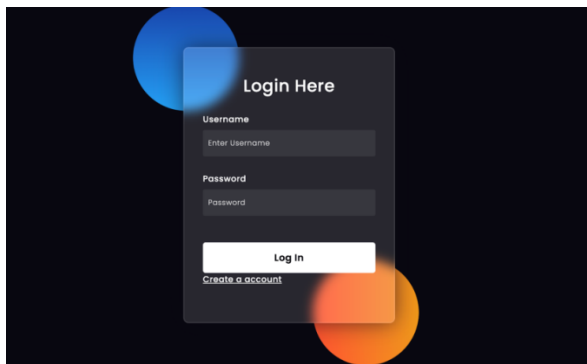


Fig.7. Login Page



Fig.10. Vehicle Detection

Vehicle Details

Enter License Plate:

Status: null
Registered: 2011-12-07
Owner: JAVEID ALI KHAN
Father's Name: COLONEL UMMED ALI KHAN
Current Address: E - 701 DARA ENCLAVE PLOT NO 6, SECTOR 09 NERUL, NAVI MUMBAI, , Maharashtra, 400706
Permanent Address: E - 701 DARA ENCLAVE PLOT NO 6, SECTOR 09 NERUL, NAVI MUMBAI, , Maharashtra, 400706
Category: LMV - Motor Car
Chassis Number: MA3FHEB1S00160065
Engine Number: D13A1724719
Maker: MARUTI SUZUKI INDIA LTD
Model: SWIFT ZDI
Body Type: SALOON
Fuel Type: DIESEL
Color: PMA WHITE
RTO: VASHI (NEW MUMBAI)
Manufactured: 11/2011
Gross Weight: 1505
Unladen Weight: 1080
Cylinders: 4
Seating Capacity: 5
Cubic Capacity: 1248
NOC Details: null

Fig.11. Vehicle Details

5. CONCLUSION

In conclusion, the system has provided a comprehensive overview of the development of a Moving Vehicle Registration Plate Detection System using Optical Character Recognition (OCR). The study has delved into the challenges associated with license plate recognition, including dynamic environmental conditions, high-speed vehicle movement, and diverse license plate variations. Integrating state-of-the-art OCR technologies, deep learning models, and comprehensive font style databases for versatile recognition. The system architecture has been detailed, emphasizing the multi-step process of Automatic Plate Recognition (APR) and the integration of advanced algorithms for character recognition from vehicle plates. Furthermore, the paper has highlighted the significance of security measures and optimization techniques in ensuring the system's efficiency and robustness. The integration of end-to-end encryption, access control mechanisms, anti-tampering measures, and optimization for resource efficiency has been thoroughly discussed. Additionally, the research has reviewed innovative methods and approaches proposed by various researchers, contributing to the advancement of the field of license plate recognition. Overall, the study has provided valuable insights into the complexities and considerations associated with license

plate recognition, offering a comprehensive framework for the development of an effective and efficient moving vehicle registration plate detection system. The proposed system holds promise for practical applications in traffic monitoring, automatic toll payment, parking lot access control, and other related domains, thereby contributing to advancements in the field of computer science and engineering.

6. REFERENCES

- [1]. Feinberg, Alec. "DTK SOFTWARE License Plate Recognition Solution." 5 Sept. 2024, <https://www.dtksoft.com/lprsolution>.
- [2]. Parwani, Sparsh. "Automatic Number Plate Recognition System (Vehant Technologies VehiScan@).. 9 May. 2023, <https://www.vehant.com/products-solutions/traffic-management-solutions/>
- [3]. Dr. Fahmy H. Finkelstein, Dr. Michael Rothschild, and Dr. Eric A. Stevens. "Intellivision - AI and Video Analytics for Smart Cameras." July 2020, <https://www.intelli-vision.com/license-plate-recognition/>.
- [4]. Kis László. "Adaptive Recognition Transforming Serbian Road Monitoring with Adaptive Recognition's Vidar Cameras." Jun. 2020, <https://adaptiverecognition.com/>.
- [5]. Ho Addy. "Axis Communications AB License plate recognition." 29 Aug. 2019. <https://www.axis.com/solutions/license-plate-recognition>.