AUTOMATIC NUMBER PLATE RECOGNITION SYSTEM

MICRO PROJECT REPORT

Submitted by

VUYYALA KAVYA– 9921004779

in partial fulfilment for the award of the degree of

BACHELOR OF TECHNOLOGY
IN

COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING KALASALINGAM ACADEMY OF RESEARCH AND EDUCATION KRISHNANKOIL 626 126

APRIL 2025

DECLARATION

We affirm that the micro project work titled **"Automatic Number Plate Recognition System"** being submitted in partial fulfilment for the award of the degree of **Bachelor of Technology in Computer Science and Engineering** is the original work carried out by us. It has not formed part of any other project work submitted for the award of any degree or diploma, either in this or any other University.

Vuyyala Kavya

9921004779

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Date:

Signature of the Mentor

Mr.R. Mari Selvan

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KALASALINGAM
ACADEMY OF RESEARCH AND EDUCATION
(DEEMED TO BE UNIVERSITY)
Under sec. 3 of UGC Act 1956. Accredited by NAAC with "A++" Grade

BONAFIDE CERTIFICATE

Certified that this project report **"Automatic Number Plate Recognition System"** is the Bonafide work of "**Vuyyala Kavya(9921004779)"** who carried out the Micro project work under my supervision.

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Submitted for the Micro Project Viva-voice examination held on

Internal Examiner **External Examiner**

ACKNOWLEDGEMENT

First and foremost, we thank the 'Supreme Power' for the immense grace showered on us which enabled us to do this project. We take this opportunity to express sincere thanks to the late,

"Kalvivallal" Thiru T. KALASALINGAM, Chairman, Kalasalingam Group of Institutions, "Illayavallal" Dr. K. SRIDHARAN, Ph.D., Chancellor, Dr. S. SHASI ANAND, Ph.D., Vice President, who is the guiding light for all the activities in our university.

We thank our Vice Chancellor **Dr. S. NARAYANAN, Ph.D.,** for guiding every one of us and infusing us with the strength and enthusiasm to work successfully.

We wish to express our sincere thanks to our respected Head of the Department **Dr. N. SURESH KUMAR,** whose moral support encouraged us to process through our project work successfully.

We offer our sincerest gratitude to our Project Supervisor, **GUIDE NAME,** for his/her patience, motivation, enthusiasm, and immense knowledge.

We are extremely grateful to our Micro Project Coordinator **Dr. P. Anitha**, Faculty In Charges **Dr. M. Rajasekaran, Mrs. B. Lavanya, Ms. P. J. Kiruthiga** for their constant encouragement in the completion of the Project.

Finally, we thank all, our Parents, Faculty, Non-Teaching Faculty, and our friends for their moral support.

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SCHOOL OF COMPUTING COMPUTER SCIENCE AND ENGINEERING

MICRO PROJECT SUMMARY

Micro Project Title	**Automatic Number Plate Recognition System**
Micro Project Team Members (Name with Register No)	Vuyyala Kavya(9921004779)
Guide Name/Designation	Mr.R.Mari Selvan
Program Concentration Area	Artificial Intelligence
Technical Requirements	Python , Google colab

Engineering standards and realistic constraints in these areas

Area	Codes & Standards / Realistic Constraints	Tick ✓
Economic	Reduces manual labor costs for toll coll collection and increases revenue collection	✓
Environmental	Lowers paper usage in traffic violation notices	✓
Social	Improves traffic regulation and road safety,and may also raise privacy concerns related to surveillance and data collection	✓
Ethical	With this surveillance the misuse of collected data	✓
Health and Safety	Helps to reduce the number of road accidents	✓
Manufacturability	Availability of components like high-speed cameras,processors,and storage solutions.	✓
Sustainability	Contribute to smart initiatives for sustainable urban development	✓

ABSTRACT

In the densely populated country of India, where managing traffic effectively is crucial due to the high volume of vehicles on the roads, implementing an advanced vehicle detection system is of paramount importance. This system is designed to employ cutting-edge video processing techniques, combined with Optical Character Recognition (OCR) technology, to capture vehicle number plates from video footage with exceptional accuracy.

Primarily deployed at strategic locations such as college entrances, toll booths, and highsecurity areas, this system utilizes video streams, processing them in real-time to identify vehicles. By transforming these video feeds into individual frames, the system extracts the necessary data, such as the vehicle's number plate, using a range of sophisticated algorithms tailored for this purpose. This process ensures that each frame is thoroughly analyzed, allowing for precise and timely identification of the vehicles as they pass through.

As a vehicle moves through the system's monitoring area, the cameras automatically capture the footage. This footage is then broken down into discrete frames, each of which is analyzed to extract the text data specifically the alphanumeric characters on the vehicle's license plate. The OCR technology applied here plays a pivotal role in ensuring that the characters on the number plates are read and digitized with a high level of accuracy. This allows the system to reliably capture information, even under varying lighting conditions or in the presence of obstructions.

Once the relevant vehicle data is captured, it is securely stored in a database, enabling longterm tracking and analysis. This stored data can be used for a range of purposes, such as monitoring traffic patterns, improving flow, or conducting forensic investigations if necessary. Moreover, the database can facilitate real-time data analysis, enhancing the operational efficiency of traffic management systems.

The broader application of this vehicle detection and tracking system goes beyond just traffic management; it also significantly bolsters security measures in high-stakes environments. With the ability to record every vehicle's movements, the system contributes to enhanced surveillance, providing detailed logs that can be used for identifying vehicles involved in unauthorized or suspicious activities. In this way, it serves as a critical tool for law enforcement and security personnel, helping to prevent breaches and improve the safety and integrity of protected areas.

Through the integration of video processing and OCR technology, this system revolutionizes the way vehicle data is captured, stored, and analyzed, ensuring not only improved traffic flow but also enhanced security and surveillance capabilities.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF NPTEL/COURSE ERA/ UDEMY COURSES

S. NO.	COURSE NAME	COURSE DURATION	COURSE PLATFORM
1.	Extensive Python Fundamentals in 4 Weeks	43.5 Hours	UDEMY

INTRODUCTION

1.1 What is Computer Vision

Software for tasks like text recognition, picture categorization, object and face identification is called computer-vision. Through the use of digital images, videos, and other visual inputs, computers and systems can analyze and comprehend the visual world thanks to the artificial intelligence (AI) area of computer vision. Much how people perceive and comprehend visual information, it involves the creation and use of mathematical models and algorithms to extract meaningful information and insights from visual data. Computer vision applications mimic the functioning of the human visual system by utilizing data from sensor devices, AI, ML and DL. The cloud-based service Azure Computer Vision gives users access to a number of cutting-edge image processing techniques. Azure is a software suite and cloud computing platform provided by Microsoft. It gives businesses the ability to create, implement, and oversee services and applications in a scalable and safe environment. Because of its pre-trained computer vision capabilities, Microsoft Azure Computer Vision Service is a cognitive service that assists with image analysis and provides extensive information about pictures with minimal effort. This aids in developing models that can quickly and accurately assess photos and provide pertinent information.

1.2 Automatic Number Plate Recognition System

One practical method for vehicle monitoring has been license plate recognition, or LPR, also known as ANPR. Future transportation technology will be able to integrate ANPR(Automatic Number Plate Recognition) into our daily lives. The idea of autonomous vehicles presents several opportunities to transform core transportation infrastructure. Intelligent transportation systems are already benefiting from ANPR technology, which also removes the need for human interaction. ANPR is a technique that recognize car registration plates using OCR on photos to provide vehicle location data. The usage of video/CCTV has expanded due to recent developments in computer vision technology and the decline in cost of associated equipment. These advancements have made it feasible to automatically identify cars visually, whether offline or online. Automatic number plate identification and its application to any other areas locals of road traffic monitoring and manage are the subjects of the research.

Because of its capacity to identify and comprehend vast numbers of swiftly moving automobiles, ANPR technology is already present in a wide range of digital environments. Together with the location, date, and time of the car, the system is able to take and save pictures. For security and traffic control needs, ANPR offers useful data.

Automated license plate identification systems consist of hardware and software components that analyze signals and turn them into graphical representations, such as static pictures or sequences, so that the characters on the plate may be recognized. These

systems' fundamental components include a camera, an image processor, memory for an event recorder, a storage unit, and connectivity. Control the access, parking-management, tolling, user-billing, delivery tracking, traffic-management, police and security services, customer assistance and guidance, red light and lane enforcement are just a few of the many different applications that employ it. A system for automatically recognizing license plates using AI neural networks, particularly in congested areas and when cars are passing by on freeways. This system makes use of OpenCV (Open-Source Computer Vision Library), a library of Python programming functions primarily focused and used on real time computer vision.

Fig 1.1: Automatic number plate recognition system

2.1 Objectives

The main goal of a license plate recognition system is to automatically detect, recognize, and interpret license plates on vehicles. It identifies the vehicles involved in criminal activities, track stolen vehicles, and enforce traffic laws by automatically detecting license plates. The system aims to achieve high accuracy in reading and recognizing license plates, reducing errors in data collection. ANPR is to enhance the efficiency of vehicle tracking and monitoring.

Fig 2.1: Detecting the number plates

2.1.1 Existing Work

There are many research, development and implementation projects in the area of Automatic Number Plate Recognition (ANPR) to automate the process of recognizing and collecting number plate information, such as numbers and letters, from photos or videos. The development of computer vision algorithms and methods used to detect identification and license plate recognition is a prominent feature of ANPR's current operations. Convolutional neural network (CNN), a type of deep learning (DL) model, replaces manual image and pattern matching methods used in current technologies to improve recognition and license plate recognition. These CNN techniques use large datasets of labeled license plate images to learn important features and patterns. This works best in real-world situations such as lighting changes, occlusion, and visual distortion.

Another area of focus in ANPR research is the integration of complementary technologies and sensors to enhance system capabilities. For instance, some ANPR systems incorporate infrared cameras or depth sensors to improve performance in low-light conditions or adverse weather conditions. Additionally, the combination of GPS and geographic information systems (GIS) enables ANPR systems to track vehicles across multiple locations and provide valuable insights into traffic flow, congestion patterns, and vehicle movements.

LITERATURE REVIEW

SI.NO	ARTICLE NAME	AUTHOR	YEAR	DESCRIPTION
1.	Automatic number plate recognition using TensorFlow	Dr.Vishwanath Burkpalli , Abhishek Joshi	2022	Our proposed system utilizes cuttingedge technology to detect vehicle number plates, segment characters, and recognize them from images. Enhanced technology that automatically detect vehicle license plates present challenges.
2.	Automatic number plate recognition	Vanshika Rai and Deepali Kamthania	2019	For license plate detection, it employs techniques based on vertical edge detection and high-density area analysis. Character recognition is performed using a K-nearest neighbors (KNN) classifier. Challenges like environmental variability, speed limitations, and nonstandard plates pose areas for improvement, demanding robustness enhancements.
3.	Automatic Number Plate Recognition: A Detailed Survey of Relevant Algorithms	Lubna , Naveed Mufti, and Syed Afaq Ali Shah	2021	The paper surveys ANPR algorithms, categorized by recognition stages, discussing performance and challenges. Lack of a common dataset hampers uniform evaluation. ANPR systems rely on complex capabilities, lacking standardization across regions. OCR engines are tailored to specific countries, and vendor solutions vary in strengths, tailored to regional needs.
4.	Automatic Number Plate Recognition	Gaurav Srivastava, Aashish Sharma, Abhishek Mittal	2020	In this system, number plates are analyzed using application software to identify the owners of vehicles. Identifying broken or fuzzy plates, changes in observable regions, hazy images, and trouble telling apart similar symbols like O and D, 5 and S, 8 and B, or E, O, and 0 are among the difficulties.

MICRO PROJECT IMPLEMENTATION

Implementing Automatic Number Plate Recognition (ANPR) using EasyOCR involves a systematic approach to accurately extract license plate information from images or video streams. Firstly, the process begins with the acquisition of images containing vehicle license plates, obtained either through cameras installed at specific locations or by loading pre-existing images into the system. Subsequently, the images undergo preprocessing steps to enhance their quality and improve the performance of the subsequent processing stages. These preprocessing techniques may include noise reduction, image denoising, contrast enhancement, and resizing, among others.

Once the images are preprocessed, the next step is license plate detection, where object detection algorithms or image processing techniques are employed to locate and isolate the license plate region within the image. This step is crucial for accurately identifying the region of interest before proceeding to character recognition.

EasyOCR, a Python library for OCR (optical character recognition), is then utilized for character recognition on the isolated license plate region. EasyOCR supports multiple languages and can handle various fonts and text sizes, making it a versatile tool for ANPR applications. After performing OCR on the license plate region, the recognized text is extracted from the OCR result.

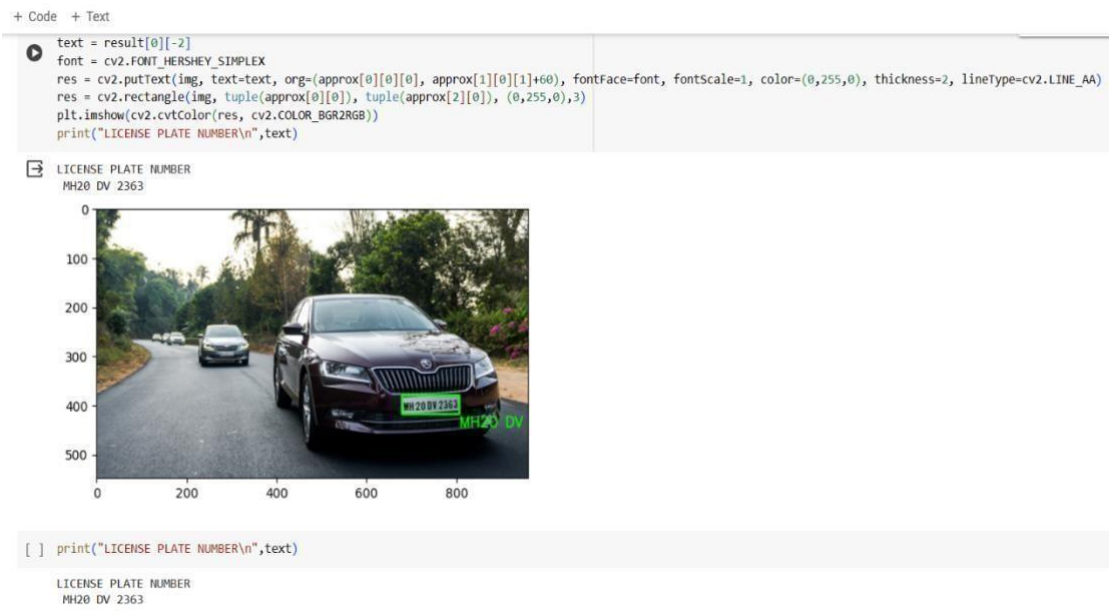


Fig: 2.2: Implementation

2.2.1 Algorithms Used

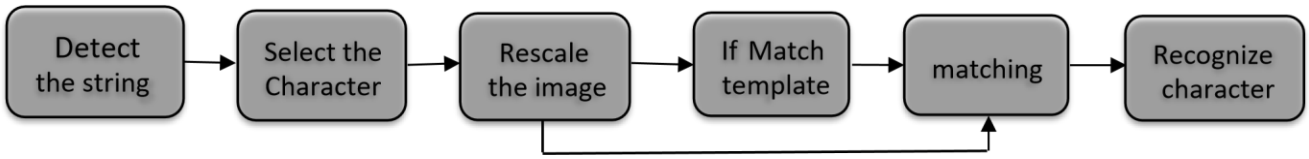
License Plate Recognition systems leverage various algorithms to accurately extract license plate information from images or video streams using EasyOCR, a Python library for optical character recognition. Here's an overview of the algorithms commonly used:

Optical Character Recognition (OCR):

It's a technique that can identify words included in a digital picture. Using OCR software, a hard copy paper document or an image may be transformed into a text-rich, readable electronic counterpart. OCR systems enable accurate textual content extraction and interpretation by analyzing character forms, patterns, and layouts using a variety of methodologies. OCR is a very important computer vision method for extracting characters and numbers from pictures. As a result, license plates can be recognized by this system. License plate images are converted to text by using image processing techniques like Tesseract OCR or Easy-OCR algorithms, which also help identify individual characters and confirm their sequence.

Template Matching:

In image processing and computer vision, template matching is a method for locating a template picture inside a bigger image. Many applications, including object identification, pattern recognition, and facial recognition, use template matching. It's a method of looking for matches between a license plate image and a collection of license plate images. A method for locating a particular pattern in a text string is called template matching. The vehicle number plates are the set of characters in the case of ANPR.



Convolutional Neural Networks (CNNs):

It is used for visual data analysis, including images and videos. CNNs are trained using large datasets through techniques like backpropagation, where the model adjusts its parameters to minimize the difference between predicted and actual outputs. In ANPR CNNs are employed for the initial detection of regions in an image that potentially contain license plates. CNNs are trained to recognize the characteristic features of license plates, such as their shape, color, and texture. A CNNbased opticalcharacter recognition system is applied to recognize the characters which are segmented.

2.3 Methodology

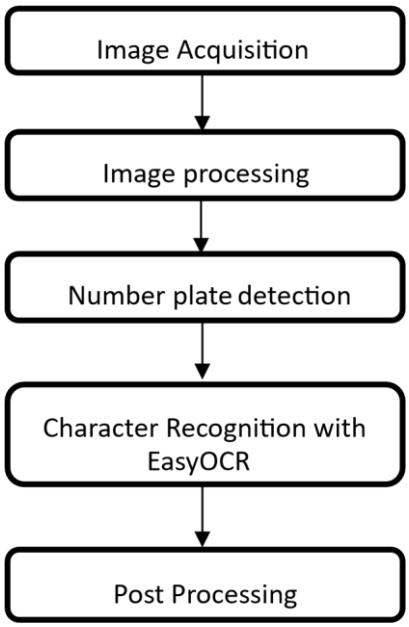


Fig:2.3 Flow chart of ANPR system

The methodology for executing Automatic license Plate Recognition using Easy-OCR involves:
Image Acquisition: The first step in the procedure is obtaining pictures of license plates. Cameras positioned in particular areas, such parking lots, junctions, or toll booths, might be used for this. As an alternative, the system may be used to process already-existing photos. Since these captured photos are in RGB format, number plate extraction may proceed. The database system holds the owner of the vehicle's personal data in addition to a few plate pictures and acronyms.

Fig: 2.4 Image Acquisition

Image Preprocessing: The acquired images undergo preprocessing to increse their quality and increase the performance of subsequent processing stages. Preprocessing techniques may include noise reduction, image denoising, contrast enhancement, resizing, and normalization. These

techniques help remove unwanted artifacts and improve the visibility of license plate regions within the images. In preprocessing the color picture is changed over into a grayscale picture.

Number Plate Detection: Once the photos are preprocessed, license-plate detection algorithms are used to locate and isolate license plate regions within the images. This step is crucial for accurately identifying the regions of interest containing license plates before proceeding to character recognition. License-plate detection algorithms may include traditional image processing techniques such as edge detection, morphology, contour analysis, and template matching.

Character Recognition with Easy-OCR: After the license-plate regions are detected, Easy-OCR, a Python library for optical character recognition, is utilized for character recognition. Easy-OCR supports multiple languages and can handle various fonts and text sizes, making it a versatile tool for ANPR applications. The library employs machine learning-based algorithms trained on large datasets of labeled images to accurately recognize alphanumeric characters from license plates.

Post-processing: Following character recognition, post-processing steps are applied to the extracted text to validate, correct errors, and format the results. Post-processing techniques may include comparing the recognized plate number against a database of valid license plate patterns, performing checksum validation, or applying contextual rules based on the jurisdiction's license plate format. The goal is to refine the OCR results and improve the overall performance of the ANPR system.

Fig.2.5:

RESULTS & DISCUSSION

The result of running the provided code is the recognition of the license plate number from the input image. The recognized license plate number is printed and displayed on the original image along with a bounding box around the detected license plate region.

Additionally, the code visualizes each step of the ANPR process, including image preprocessing, edge detection, contour detection, masking, and character recognition, using matplotlib's it shows function to display the images at various stages of processing.

Finally, the license plate number is printed twice, once as part of the EasyOCR output index, and the text is displayed in its original form using OpenCV's text output function. Overall, the code outputs are a visual representation of the ANPR process and demonstrate how to detect and recognize license plate numbers from input images using EasyOCR and OpenCV.

Fig.3.1:step by step process

CONCLUSION AND FUTURE SCOPE

4.1 Conclusion

An effective method for managing and identifying vehicles is the automated number plate recognition (ANPR) system. Our study has led us to the conclusion that the technology we want to employ can effectively identify the license plate region from the photos, which is made up of the vehicle number followed by character identification and segmentation. This method can be used to correctly detect the numbers from a vehicle's license plate, and we will be using it on a lot more photographs. For security-related considerations, this project is built with the automation of the license plate detection system in mind. Our data may be utilized for a variety of things, like recovering stolen cars, stopping speeding, and much more, which could eventually replace the manual method that is in place now. All things considered, the project emphasizes how useful EasyOCR and OpenCV are for creating ANPR solutions and how important they are for developing automated recognition technologies for real-world applications.

4.2 Future Work

Future work can be integrating ANPR with other emerging technologies like edge computing and 5G networks can enhance real-time processing capabilities, enabling faster and more reliable identification of vehicles. Collaboration with transportation authorities and law enforcement agencies will be essential to develop standardized datasets and protocols for training and testing ANPR systems across different regions and jurisdictions. ANPR is geared towards pushing the boundaries of technology to create more robust, efficient, and socially responsible systems for automated vehicle identification.

COURSE CERTIFICATION


udemy

Certificate no: UC-ddd726ad-9a2f-4c97-8cb8-b2db4eca42b0
Certificate url: ude.my/UC-ddd726ad-9a2f-4c97-8cb8-b2db4eca42b0
Reference Number: 0004

CERTIFICATE OF COMPLETION

Extensive Python Fundamentals in 4 Weeks

Instructors **Ogunleye Olalekan Samuel**

Vuyyalakavya

Date **Feb. 8, 2025**
Length **43.5 total hours**

Figure 6.0: Certification details

REFERENCES

1. Hadavi, S., Rai, H.B., Verlinde, S., Huang, H., Macharis, C., & Guns, T. (2020). Analyzing passenger and freight vehicle movements from automatic number plate recognition camera data. *European Transport Research Review.*

2.Hadavi, S., et al. (2020). Analyzing passenger and freight vehicle movements from automatic number plate recognition camera data. *European Transport Research Review.*

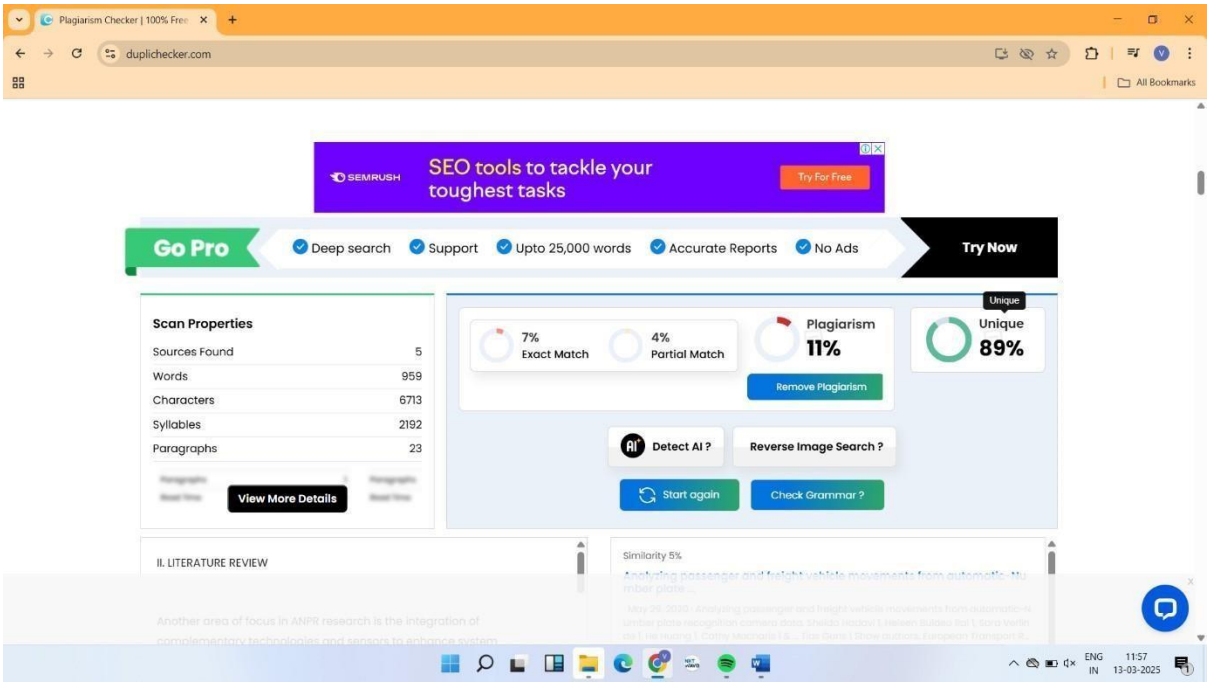
Mufti, N., et al. (2018). Automatic Number Plate Recognition.

3.Li, J., van Zuylen, H., Deng, Y., & Zhou, Y. (2020). Urban travel time data cleaning and analysis for Automatic Number Plate Recognition. *Transportation Research Procedia, 2020.*

4. Luo, X., Ma, D., Jin, S., Gong, Y., & Wang, D. (2019). Queue length estimation for signalized intersections using license plate recognition data.

5.Xu, Z., Yang, W., Meng, A., Lu, N., Huang, H., Ying, C., & Huang, L. (2018). Towards endtoend license plate detection and recognition: A large dataset and baseline. In *Proceedings of the European Conference on Computer Vision (ECCV),* Munich, Germany, 8–14 September 2018 (pp. 255–271).

PLAGIARISM REPORT (Project Report & Paper)



INTERNAL QUALITY ASSURANCE CELL MICRO PROJECT AUDIT REPORT

This is to certify that the micro project work entitled "**Automatic Number Plate Recognition System**" categorized as an internal project done by VUYYALA KAVYA of the Department of Computer Science and Engineering, under the guidance of MR.R.MARI SELVAN during the Even semester of the academic year 2024 - 2025 are as per the quality guidelines specified by IQAC.

Quality Grade

Deputy Dean (IQAC)

Administrative Quality Assurance **Dean (IQAC)**

APPENEDIX