A Mini Project Report on

License Plate Recognition System

T.E. - I.T Engineering

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CERTIFICATE

This to certify that the Mini Project report on License Plate Recognition System has been submitted by **Jemin Bhanushali (20104109)**, **Maaz Mirza (20104124)** and **Hamza Ansari (20104058)** who are a Bonafede students of A. P. Shah Institute of Technology, Thane, Mumbai, as a partial fulfilment of the requirement for the degree in **Information Technology**, during the academic year **2022-2023** in the satisfactory manner as per the curriculum laid down by University of Mumbai.

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ABSTRACT

License Plate Recognition (LPR) is an image processing technology which uses number (license) plate to identify the vehicle. The objective is to design an efficient automatic authorized vehicle identification system by using the vehicle number plate. The system is implemented on the entrance for security control of a highly restricted area like military zones or area around top government offices e.g., Parliament, Supreme Court etc. The developed system first detects the vehicle and then captures the vehicle image. Vehicle number plate region is extracted using the image segmentation in an image. Optical character recognition technique is used for character recognition. The resulting data is then used to compare with the records on a database to come up with specific information like the vehicle's owner, place of registration, address, etc. The system is implemented and its performance is tested on real images. It is observed from the experiment that the developed system successfully detects and recognizes the vehicle number plate on real images.

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CHAPTER 1

INTRODUCTION

License plate recognition (LPR), also known as automatic license plate recognition (ALPR), is a technology that enables the automatic detection and recognition of vehicle license plates. The system uses a combination of cameras, software algorithms, and databases to capture and analyze images of license plates and retrieve relevant information about the vehicle and its owner.

The process of license plate recognition involves several steps. First, cameras capture images of passing vehicles, typically using infrared or visible light cameras. The images are then processed by software algorithms that detect and isolate the license plate within the image. The algorithms use a variety of techniques, such as edge detection, segmentation, and character recognition, to extract the characters on the license plate.

Once the characters are extracted, they are compared to a database of known license plates to determine if the vehicle is registered, and if so, retrieve information about the vehicle and its owner. This information can include the make and model of the vehicle, the registered owner's name and address, and any outstanding warrants or violations associated with the vehicle.

LPR systems have a variety of applications across different industries. In the parking industry, LPR systems can automate the process of monitoring and enforcing parking violations. They are also used in toll collection systems, where they can automatically detect and identify vehicles passing through toll booths without the need for physical toll booths or manual toll collection. In law enforcement, LPR systems can be used to detect stolen vehicles, monitor traffic violations, and assist with investigations by providing a record of vehicle movements.

However, the use of LPR systems has also raised concerns about privacy and data protection. The collection and storage of license plate data can raise questions about who has access to the data and how it is used. In addition, errors in the LPR system can lead to false positives or negatives, which could result in innocent individuals being falsely accused or guilty individuals escaping punishment.

- Problem Identified:

License plate recognition (LPR) systems are designed to identify and solve a variety of problems related to vehicle identification and tracking. Some of the specific problems that LPR systems are designed to address includes Parking violations, Toll evasion, Stolen vehicles, Traffic violations, Border Security, Public Security, etc.

- Solution Proposed:

The solution proposed for the identified problems related to vehicle identification and tracking by license plate recognition (LPR) systems is to use machine learning algorithms and make a system that automatically capture, process, and recognize license plate numbers.

1.1 Purpose :

License Plate Recognition (LPR) systems can be used for a variety of purposes, such as:

- Parking enforcement: LPR systems can identify vehicles that are parked in restricted or unauthorized areas, or that have exceeded the allotted parking time, and automatically issue tickets or alerts to parking enforcement personnel.
- Toll collection: LPR systems can detect vehicles that have passed through toll booths without paying, and automatically issue fines or alerts to toll enforcement personnel.
- Law enforcement: LPR systems can identify stolen vehicles by comparing the license plate number to a database of known stolen vehicles, and alert law enforcement personnel to the location of the vehicle. The system can also detect vehicles that are violating traffic laws, such as speeding, running red lights, or making illegal turns, and automatically issue fines or alerts to law enforcement personnel.
- Border security: LPR systems can detect vehicles that are attempting to cross the border illegally, or that are associated with criminal activity or smuggling, and alert border security personnel to the potential threat.
- Public safety: LPR systems can be used to track the movements of vehicles associated with criminal activity or terrorism, and alert law enforcement personnel to potential threats to public safety.

Overall, the purpose of LPR systems is to improve the efficiency and accuracy of vehicle identification and tracking.

1.2 Problem Statement :

The problem that License Plate Recognition (LPR) systems aim to solve is the challenge of accurately and efficiently identifying and tracking vehicles in real-time. Traditional methods of vehicle identification and tracking, such as manual observation or manual input of license plate numbers, are time-consuming and prone to human error. This can result in parking violations, toll evasion, missed

opportunities to identify stolen vehicles or vehicles associated with criminal activity, and increased workload for law enforcement personnel.

Furthermore, in high-traffic areas, it can be difficult for human operators to keep track of all the vehicles passing by, making it challenging to detect potential security threats. The solution proposed by LPR systems is to use advanced computer vision technology and machine learning algorithms to automatically capture, process, and recognize license plate numbers in real-time, improving the accuracy and efficiency of vehicle identification and tracking for a variety of purposes.

1.3 Objectives:

- Main objective is to automate the process of reading license plates, which can be time-consuming and error-prone when done manually.
- The objective of license plate recognition (LPR) is to accurately and efficiently identify and read license plates on vehicles.
- To improve the speed and accuracy of tasks such as identifying stolen vehicles, locating suspects or wanted individuals, enforcing parking regulations, and collecting tolls.
- To provide valuable data for traffic analysis, vehicle tracking, and crime prevention.

1.4 Scope:

- Can be used in parking management to monitor vehicles to keep the track of vehicles coming in and out of parking lot.
- Can be used in traffic management systems.
- Can be used in many toll collection systems to automatically identify and charge drivers who use toll roads or bridges.
- Can be used to help the authorities get information about the owner of a vehicle that has broken a rule.

CHAPTER 2

Literature Review

Sr.no	Title	Author(s)	Year	Algorithms	Result
1	Automatic Number Plate Recognition	Vanshika Rai, Deepali Kamthania	2021	Traditional Methods, Deep Learning	Achieved an accuracy of 92.7% and Robustness
2	Automatic Number Plate Recognition	Gaurav Srivastav	2020	Multi-modal deep learning model using text and image features	Accuracy, Speed and Robustness
3	Vehicle Number Plate	Chinmayi Gurav, Vedika Kamble	2019	Traditional Methods, Deep Learning	Achieved an accuracy of 91.14% , speed and Robustness

CHAPTER 3

PROPOSED SYSTEM

3.1 Features and Functionality

1. Text analysis: The system may analyze the text of news articles or social media posts to detect patterns and characteristics that are commonly found in fake news.
2. Source verification: The system may verify the source of the news article or social media post to determine if it is from a credible source or if it has been created by a known fake news source.
3. User feedback: The system may allow users to send feedback regarding any mistakes, which can help improve the system's accuracy over time.
4. Real-time analysis: The system may be able to analyze news articles or social media posts in real-time, allowing it to quickly identify and flag fake news as it is published.

3.2 Algorithm Working flowchart

Here is a general flowchart for the working of an OCR algorithm:

1. Image acquisition: The first step is to acquire an image of the text to be recognized. This can be done using a scanner, camera, or other image capture device.

2. Preprocessing: The acquired image is preprocessed to enhance its quality and improve the accuracy of character recognition. This may include techniques such as noise reduction, image normalization, and contrast enhancement.

3. Text segmentation: The image is divided into individual characters or words, which are then analyzed separately.

4. Feature extraction: Features of each character, such as shape, size, and texture, are extracted and converted into a numerical representation.

5. Character recognition: The extracted features are compared to a database of known characters using pattern recognition algorithms. The character with the closest match is then identified as the recognized character.

6. Postprocessing: The recognized characters are subjected to postprocessing techniques such as error correction and context analysis to improve their accuracy and reliability.

7. Output: The recognized text is output in a format that can be used by other applications or stored in a database for further processing.

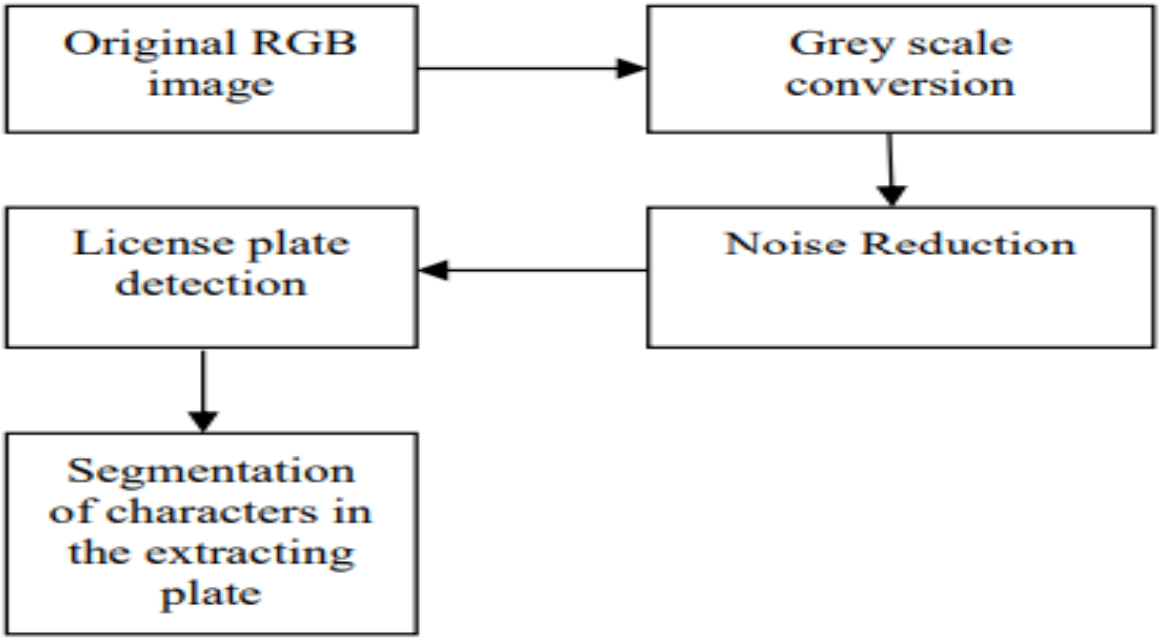

Fig. 1: Algorithm Working Flowchart

CHAPTER 4

REQUIREMENT ANALYSIS

Importance of Requirements Gathering:

Requirements gathering is the process of identifying and documenting the needs, goals, and expectations of stakeholders for a particular system. This process is essential for the development of any software system, including a license plate recognition system, because it ensures that the system is designed to meet the specific needs and requirements of its users.

Functional Requirements:

Some of the functional requirements for a licence plate recognition system are:

- License plate recognition: The system should be able to capture license plate images and recognize the characters on the plate using OCR algorithm.
- Real-time processing: The system should process the license plate images in real-time to allow for immediate identification and tracking of vehicles.
- Database integration: The system should be able to integrate with databases containing vehicle registration and owner information for automated identification of vehicles.
- Alerts and notifications: The system should send alerts and notifications when specific license plates are detected, such as for stolen vehicles or vehicles associated with criminal activity.
- Analytics and reporting: The system should provide analytics and reporting on vehicle traffic patterns and other metrics, which can be useful for planning and resource allocation.

Non-functional requirements:

Some of the non-functional requirements for a licence plate recognition system are:

- Accuracy: The system should be highly accurate in recognizing license plate characters to minimize errors and false positives.
- Speed: The system should be able to process license plate images quickly to provide real-time identification and tracking of vehicles.
- Reliability: The system should be reliable and robust, able to handle varying lighting conditions, weather, and other environmental factors.
- Scalability: The system should be scalable, able to handle large volumes of traffic without compromising on accuracy or speed.
- Security: The system should be secure and protect the data and privacy of vehicle owners.

CHAPTER 5

PROJECT DESIGN

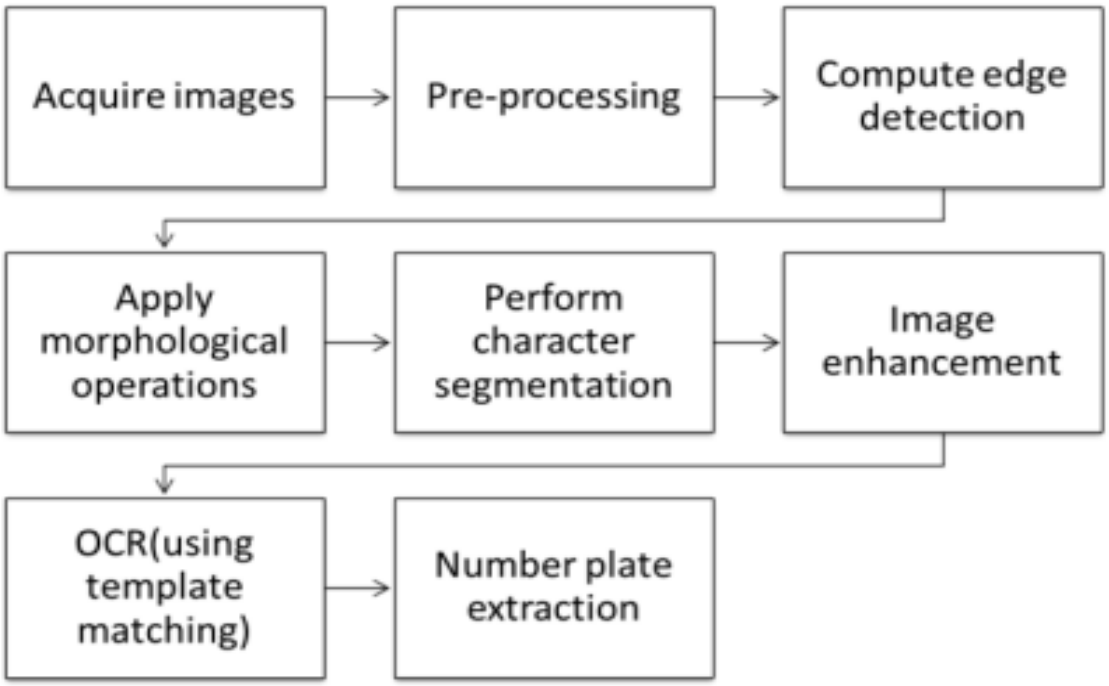

Fig. 2: System Design Flow Diagram

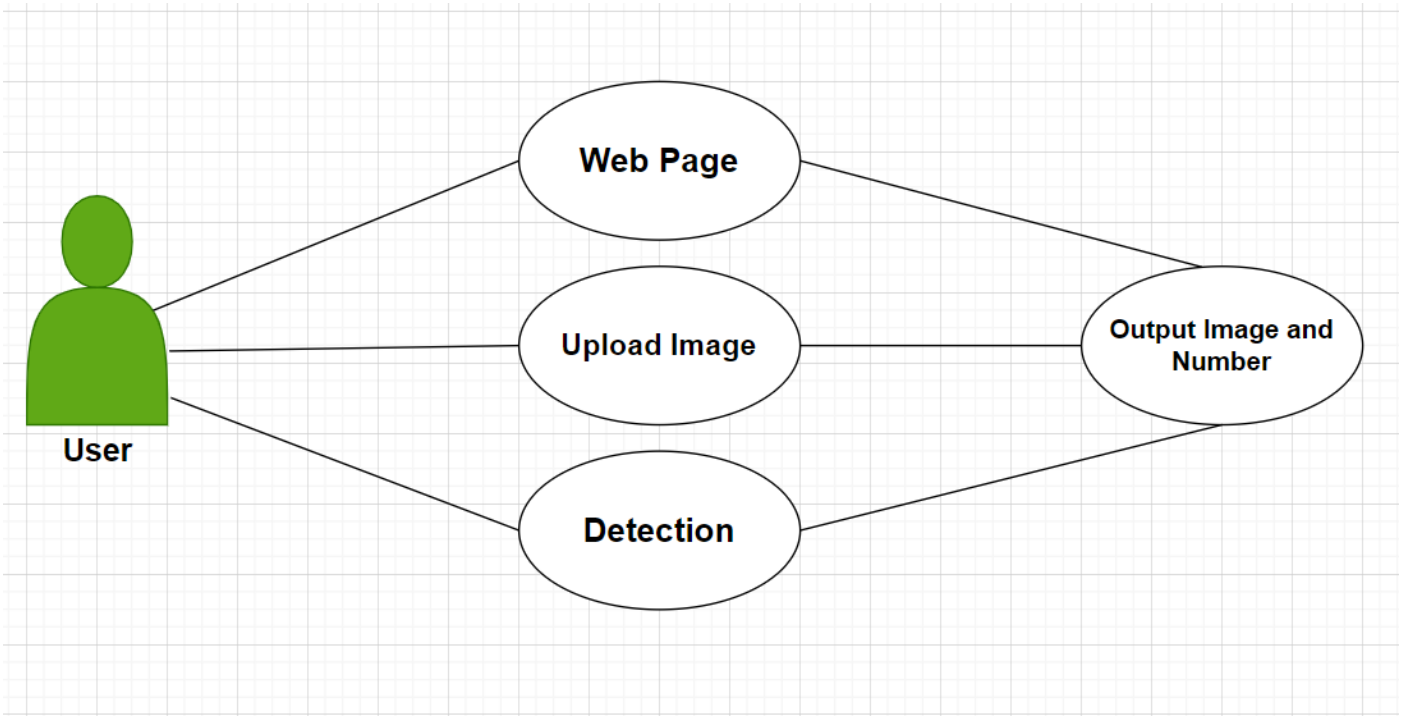

Fig. 3: Use Case Diagram

CHAPTER 6

TECHNICAL SPECIFICATION

Development: VS Code

VS Code also known as Visual Studio Code is a source code editor made by Microsoft for Windows, Linux, MacOS. It has various features such as Debugging, Syntax highlighting, extension, intelligent code completion.

Frontend: Streamlit

Streamlit is a free and open-source Python library that makes it easy to build and deploy interactive data science web applications. With Streamlit, data scientists and developers can quickly create and share interactive web apps without having to deal with the complexities of web development.

Streamlit provides a simple and intuitive API for building web apps that can be updated in real-time with just a few lines of code.

Backend: Jupyter Notebook

Project Jupyter is a project to develop open-source software, open standards, and services for interactive computing across multiple programming languages. It was spun off from IPython in 2014 by Fernando Pérez and Brian Granger.

OS : Windows

Windows is a **graphical operating system** developed by Microsoft. It allows users to view and store files, run the software, play games, watch videos, and provides a way to connect to the internet. It was released for both home computing and professional works.

CHAPTER 7

PROJECT SCHEDULING

Sr.no	Group Members	Time Duration	Work to be done
1	**Jemin Bhanushali** **Maaz Mirza** **Hamza Ansari**	1St week of January 2nd week of January	Work on the project ideas & GUI framework Implemented the GUI
2	**Jemin Bhanushali** **Maaz Mirza** **Hamza Ansari**	3rd week of January	Implemented the GUI integrated with Jupyter Notebook
3	**Jemin Bhanushali** **Maaz Mirza** **Hamza Ansari**	By the end of February month	Learned Optical Character Recognition Algorithm and implemented it in the project

CHAPTER 8

IMPLEMENTATION

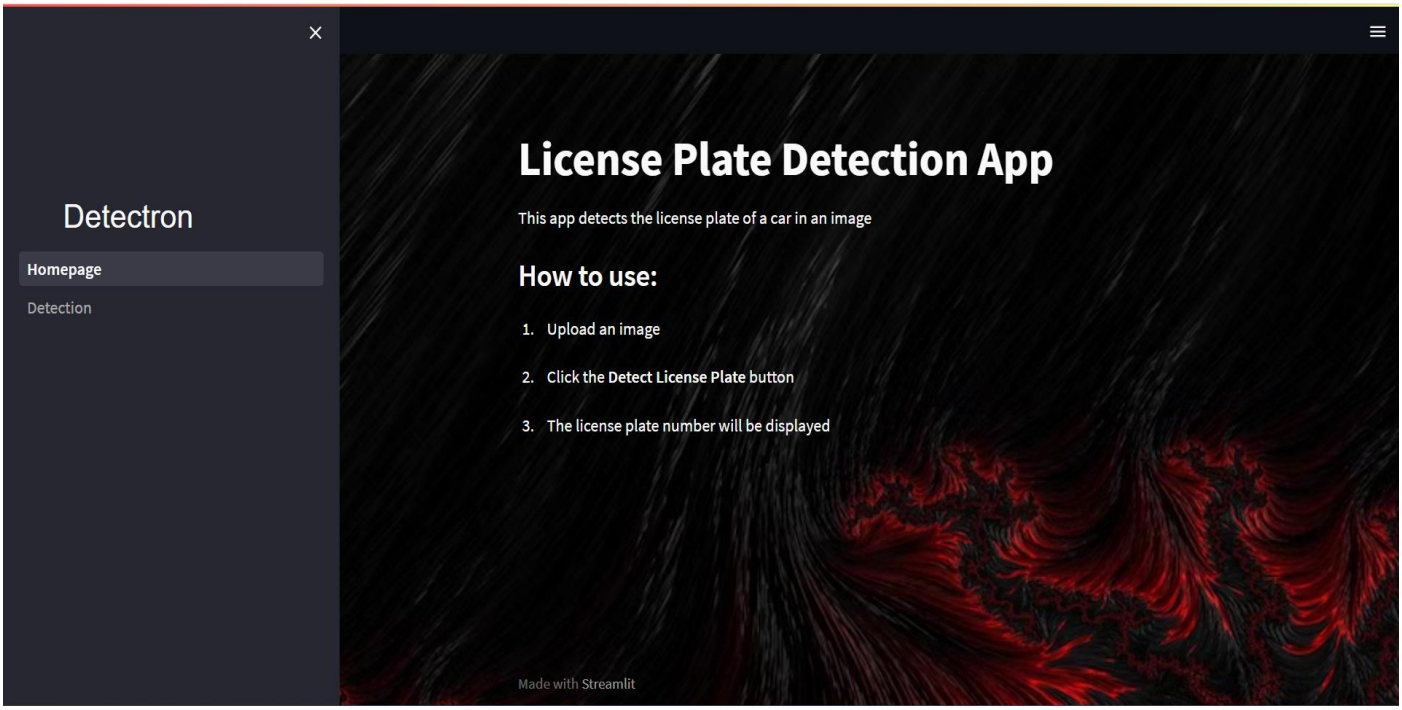

Fig.4 : Home Page

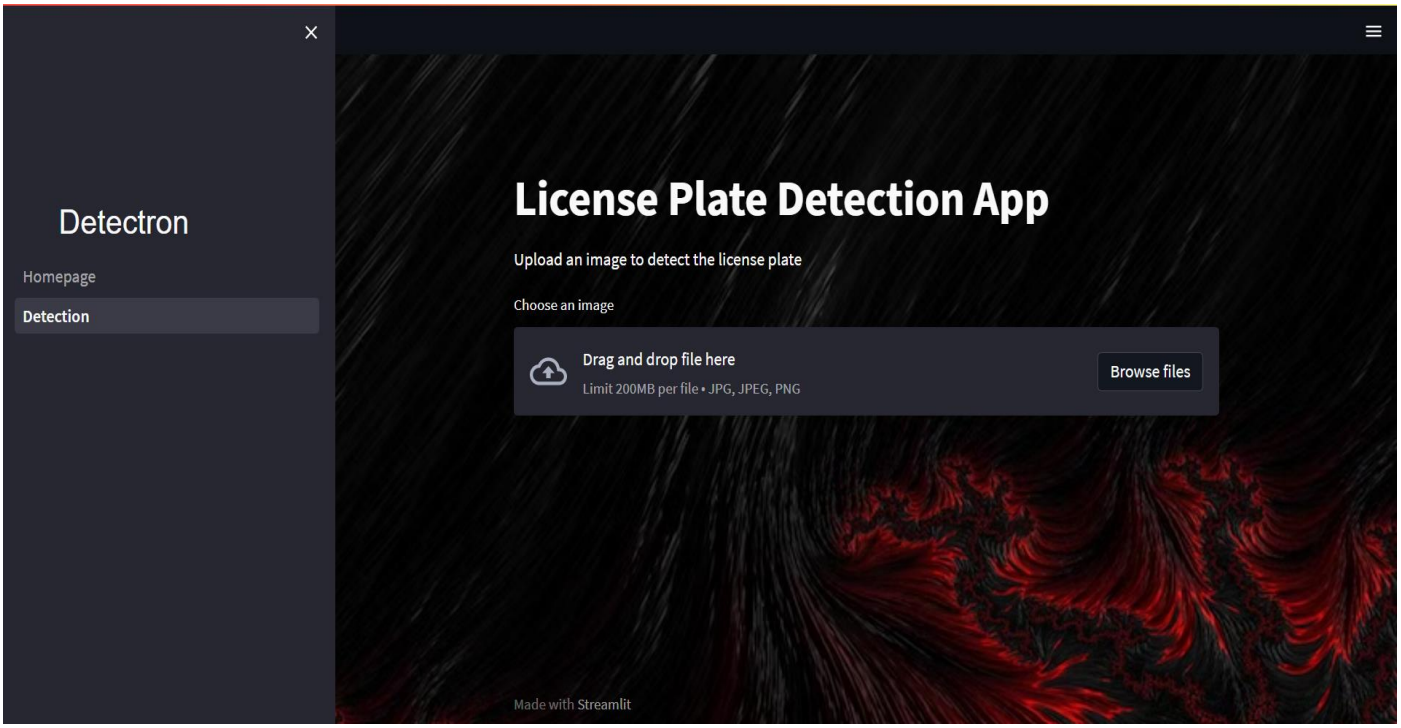

Fig.5 : Detection Page

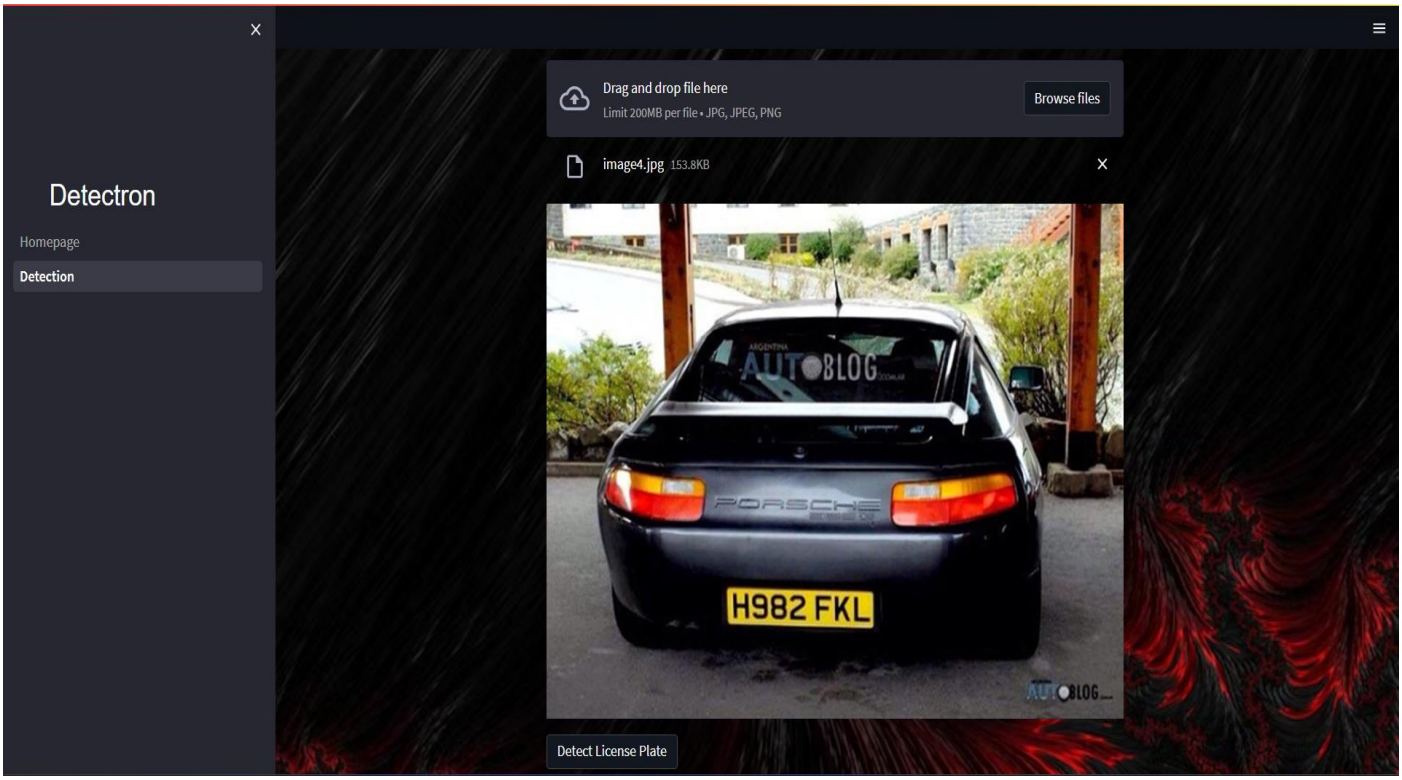

Fig.6 : Inputting Image

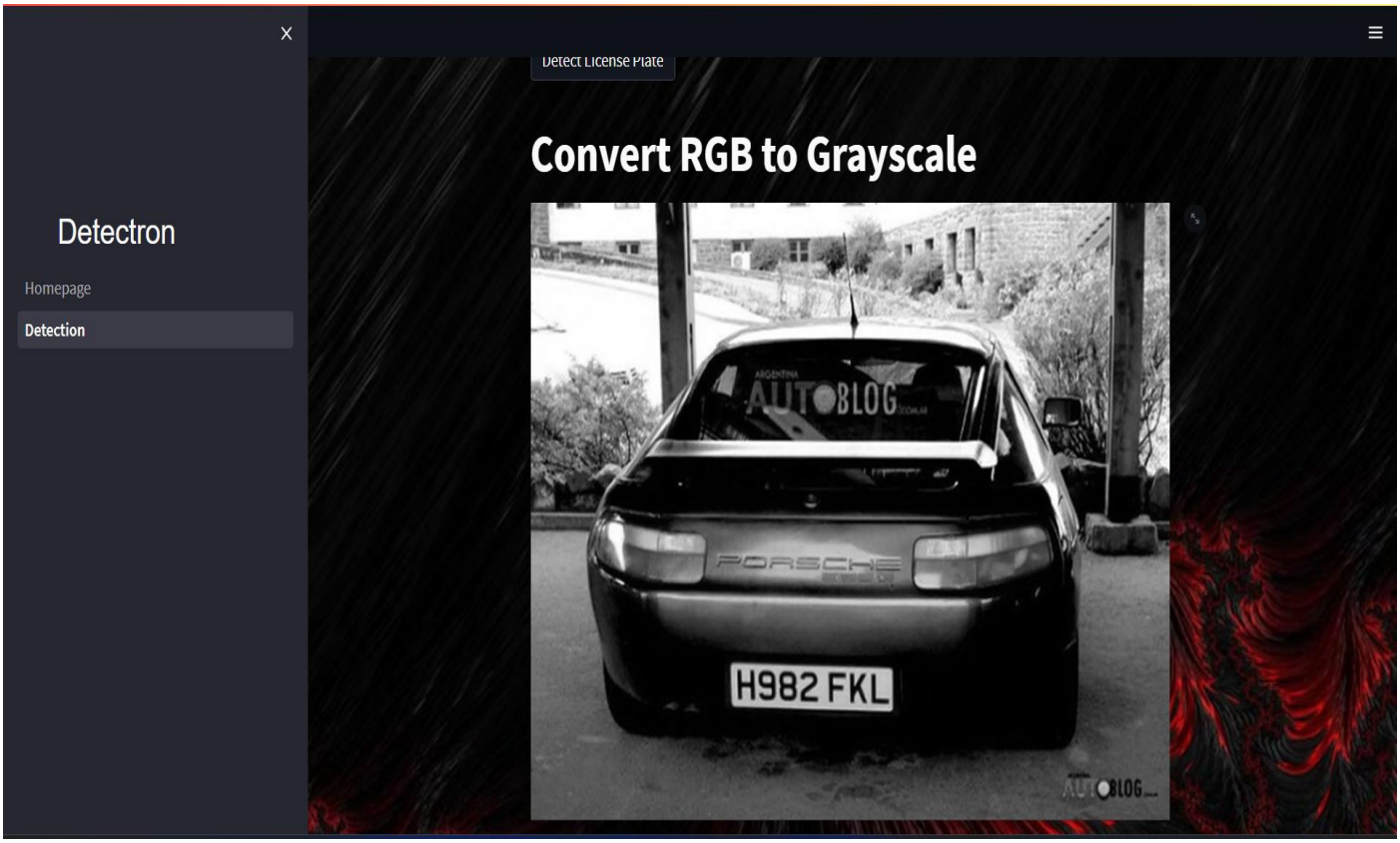

Fig.7 : Converting Image from RGB to Grayscale

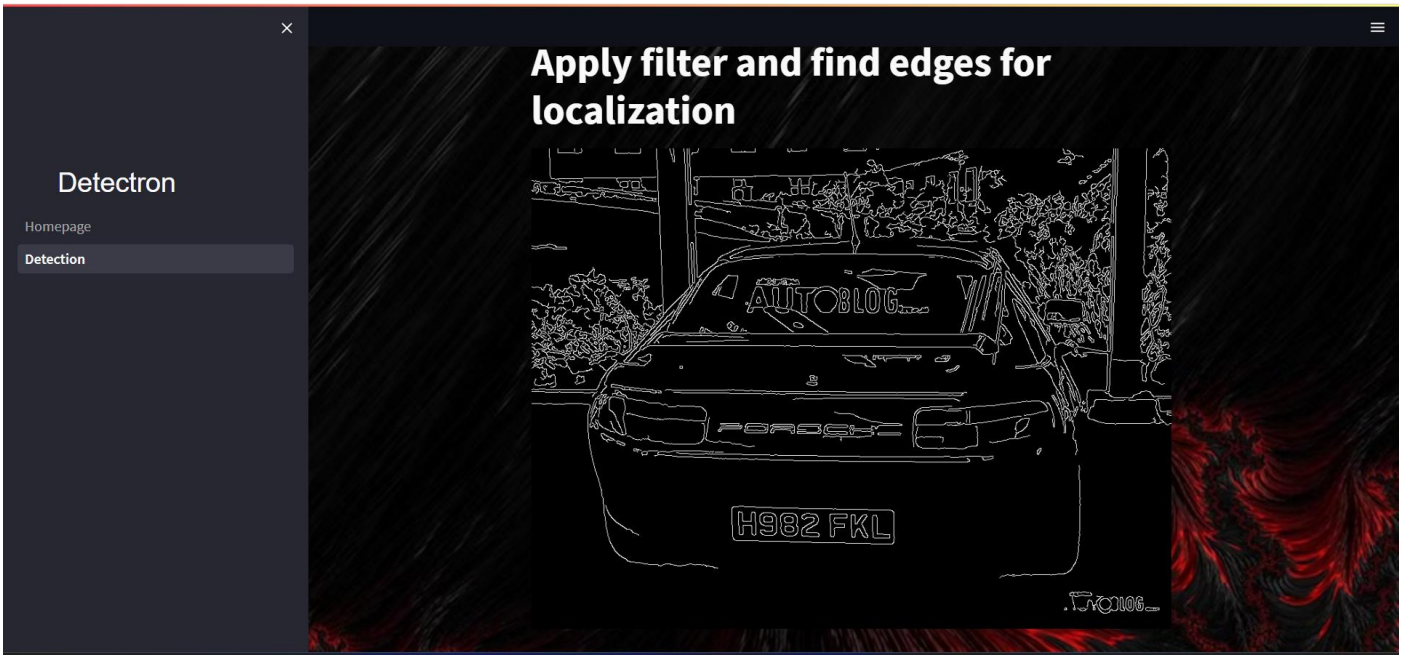

Fig.8 : Applying filter to image and finding Edges

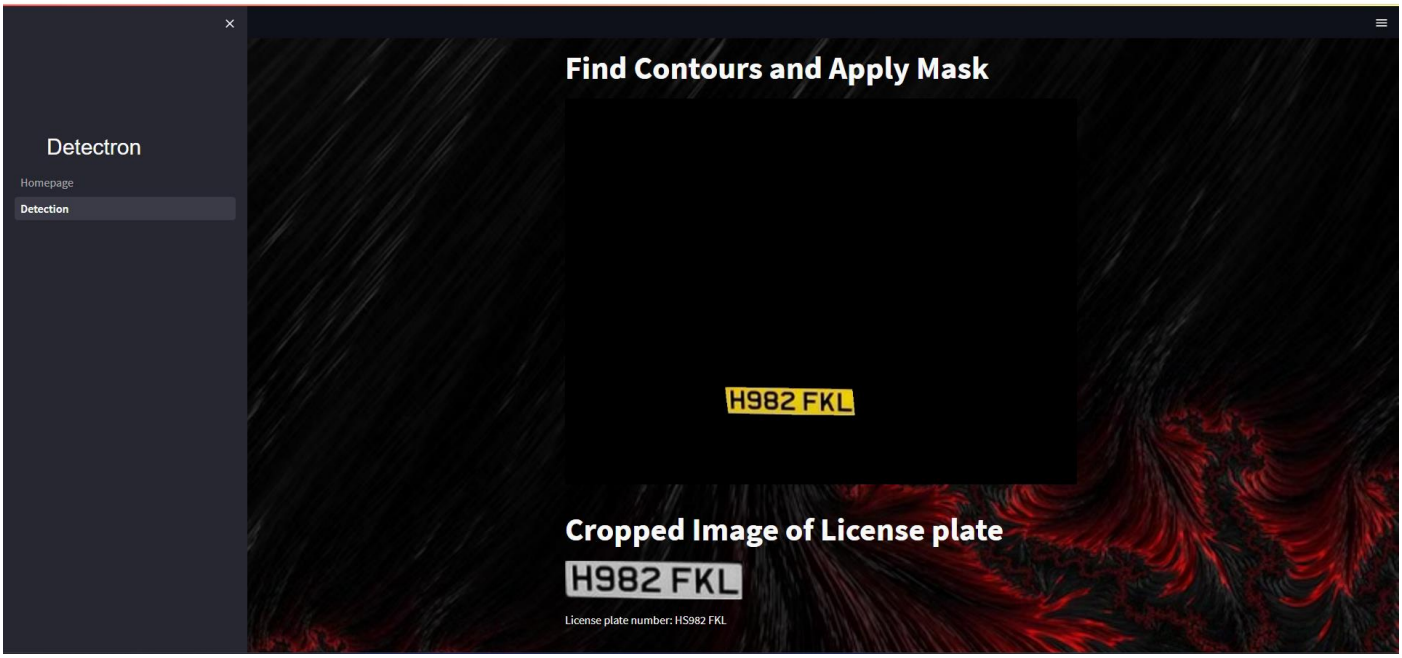

Fig.9 : Finding Contours and Applying Masks and Finally displaying the Detected Number

CHAPTER 9

RESULT AND DISCUSSION

Here are some possible results and discussions for an LPR system:

Accuracy: The accuracy of an LPR system can be evaluated based on its ability to correctly identify license plates in different lighting conditions, weather conditions, and vehicle speeds. The accuracy can be measured in terms of the percentage of correctly recognized license plates compared to the total number of license plates processed by the system.

Speed: The speed of an LPR system is crucial in applications where real-time recognition is required, such as toll collection or traffic monitoring. The speed can be evaluated based on the time taken to process a single license plate or the number of license plates processed per unit time.

Robustness: The robustness of an LPR system is its ability to handle different types of license plates, such as those with different fonts, sizes, and colors. A robust system can handle these variations and still recognize the license plates accurately.

CHAPTER 10

CONCLUSION AND FUTURE SCOPE

Conclusion:

In conclusion, License Plate Recognition (LPR) systems have become increasingly important in various industries for vehicle identification and tracking. LPR systems use advanced technologies such as OCR algorithms and machine learning to accurately recognize and capture license plate information in real-time.

LPR systems can help address a wide range of issues related to vehicle identification and tracking, including parking violations, toll evasion, stolen vehicles, traffic violations, border security, and public security. By automating the process of vehicle identification and tracking.

However, the implementation of an LPR system requires careful consideration of various factors such as accuracy, speed, reliability, scalability, security, and integration with databases. Furthermore, privacy concerns must also be taken into account, and appropriate measures must be taken to protect the privacy of vehicle owners. Despite these challenges, LPR systems hold great promise for improving vehicle identification and tracking, and their use is expected to continue to grow in the future.

Future Scope:

The future scope of License Plate Recognition (LPR) systems is quite promising, with the potential for significant advancements in technology and applications. Here are some areas where LPR systems are likely to have a major impact in the coming years:

- Integration with smart cities: LPR systems will be an integral part of smart city infrastructure, helping to optimize traffic flow, reduce congestion, and improve overall transportation efficiency.
- Increased use in law enforcement: LPR systems will continue to be used by law enforcement agencies to track stolen vehicles, identify suspects, and investigate criminal activity.
- Advancements in machine learning: LPR systems will continue to benefit from advancements in machine learning and artificial intelligence, which will improve their accuracy and speed.
- Use in autonomous vehicles: LPR systems will play a key role in enabling autonomous vehicles to navigate roads and highways safely and efficiently.

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