A MINI-PROJECT REPORT

ON

"REAL-TIME NUMBER PLATE RECOGNITION SYSTEM"

Submitted to

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

in partial fulfilment of the requirement for the degree of
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in

Computer Science & Engineering

Submitted By

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Certificate

This is to certify that the mini-project entitled

"Real-Time Number Plate Recognition System"

Is a bonafide work, and it is submitted to the
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur.

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For the partial fulfilment of the requirement for the degree of
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ABSTRACT

Real-Time Number Plate Recognition System is a mass surveillance system and image processing technology that uses a number license plate to identify the vehicle. To design an efficient automatic authorized vehicle identification system by using the vehicle number plate is the objective of this project.

Various fields where the Number plate recognition system can be used are automatic payment of tolls on highways or bridges, surveillance systems, traffic monitoring, tolls collection points, parking management systems and vehicle tracking.

The developed system is used for detecting the vehicle and then capturing the vehicle image. Image segmentation is done on the image. Character extraction from the plate is done using the character recognition technique. The resulting data, along with details of the owner, is then stored in a database. If the owner's data is already stored in the database, entry is permitted to them. The system is implemented and simulated in python.

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1. INTRODUCTION

Most of the number plate localization algorithms merge several procedures, which result in long computational and accordingly considerable execution time. This may be reduced by using simpler algorithms. Since the reliability of the procedures severely degrades in the case of complex, noisy pictures that contain many details, their results highly depend on the quality of the image. Unfortunately, the only solution offered by various available procedures is camera adjustment. This means that the image of the car must be captured in a way that the environment is excluded as much as possible and the size of the number plate is as large as possible. Since the optimum moment of exposure can hardly be guaranteed, adjusting the size is especially difficult in fast cars. Number Plate Localization based on Edge Finding: The algorithms rely on observing that number plates usually appear as high contrast areas in the image (black-and-white or black-and-yellow). First, the original car image in colour is converted to a black and white image grayscale image, as shown in figure 1.1.

Fig 1.1(a): Original Image   **Fig 1.1(b): Filtered Image**

2. LITERATURE SURVEY

The critical contributions and techniques developed recently for accurate identification of vehicle license plates and further implementation are included in this technique.

Utkarsha Gurjar utilized a system to identify the stolen vehicles and is used at police checkpoints and toll squares. In addition to the above, some fundamental subtle elements of enlisted clients can be recovered. This framework comprises three modules: character acknowledgement, tag confinement and character division. Using the camera, the proposed project captures the vehicle's image and utilizes the ideas of advanced picture handling concentrates the tag number. It compares the tag number against the Database containing the elements of substantial tag numbers. If it is found in the legitimate tag database, it will check in the stolen auto database, and if a match is found, a ready message will appear.

P.Anishiya, prof. S. Mary Joans focused on a number plate localization and recognition system for vehicles in Tamilnadu, India. This system is developed based on digital images. This system can be easily applied to commercial car parking complexes to secure the usage of parking houses, document access to parking services, and prevent car theft issues. The proposed algorithm is a combination of morphological operation with area criteria tests for number plate localization.

3. ANALYSIS

This project aims to describe how the Real-Time Number Plate Recognition System will be constructed. Business complexes and residential society administrations will benefit in many ways, like fast processing of entry/exit and parking management systems. If the system is integrated with GPS, it will help in traffic monitoring, local surveillance for tracing stolen vehicles in complexes.

The problem with the existing system is that the existing system is time-consuming and labour consuming. It also lacks accuracy and needs maintenance. The existing system does not provide the required amount of security. It does not have a fast response facility. The response time of the existing system is very high.

Our system detects the number plate of a vehicle at the entrances of offices/flat schemes. Then it identifies whether it belongs to the given flat scheme or not. If it belongs there, then it is permitted entry. If it is not, the visitor is asked to register, and details are recorded in the Database.

Our system aims to reduce the time and labour consumption which was high in the existing system. It increases the security of the residents of that particular complex and guarantees a smooth entry exit for all visitors and residents in the complex.

We have created a model that detects the license number plate of the vehicle and extracts the license number characters from the image. Data is collected from various data sources and is pre-processed using various

image processing techniques. We created and used our Database, which stores the details of the vehicle owners and gives results based on the previously stored data and the timestamp.

4. SYSTEM DESIGN

4.1. Hardware and Software Detailed Design
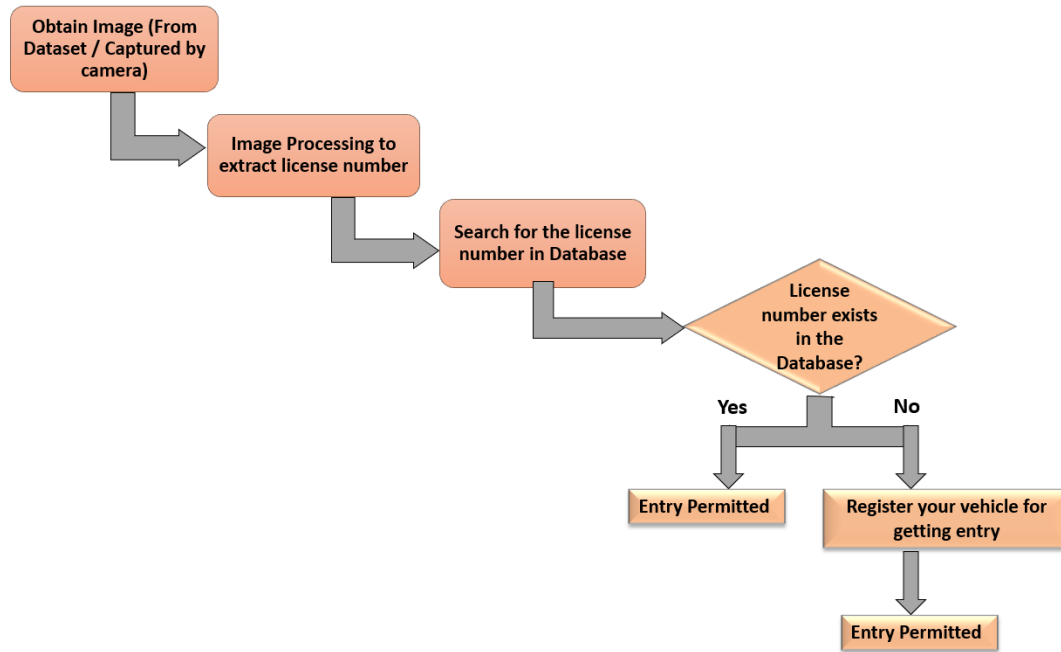
Fig 4.1: System Overview

1. Firstly, read an image (from Dataset / captured by camera) using OpenCV.
2. Apply filtering, edge detection, use contour search to detect the license plate.
3. Extract license number in the text format using OCR with Easy OCR.
4. Search for the license number in the Database.
5. If the license number exists in the Database, permit entry. Else, register that vehicle and permit entry.

4.2. Database Design
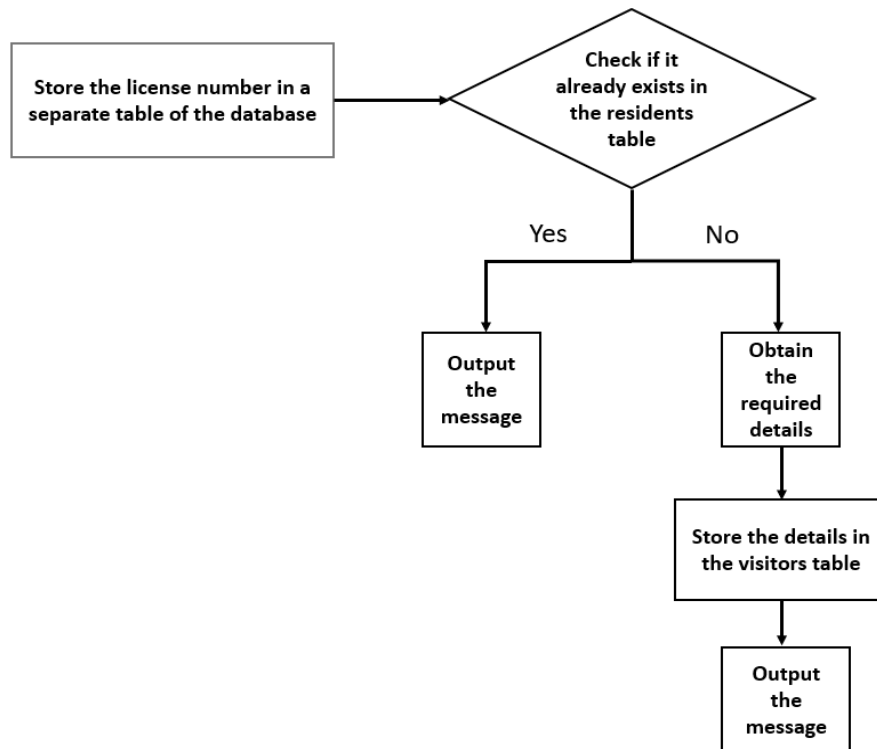
Fig 4.2: Database Design

1. The Database created for this project consists of two tables.

2. The first table is for keeping a record of the residents of the premises. It contains the details of residents like vehicle number, owner's name, phone number, wing number and flat number.

3. The second table is for keeping the record of visitors. It contains the visitor's vehicle number, name, phone number, and vehicle entry time on the premises.

5. SYSTEM REQUIREMENTS

5.1. Hardware Requirements

1. Server
2. Surveillance Camera
3. Storage Device

5.2. Software Requirements

1. Python 3.7
2. Library: Open CV
3. Package: Easy OCR
4. Languages: HTML, CSS, MySQL, PHP

5.3. Functional Requirements

1. Capabilities for automatic recognition of vehicles, number plates localization and have extraction feature.
2. Store the features extracted from the number plate.
3. If there is a need for evidence in disputes or crime situations, then retrieve and modify the information accordingly.

5.4. Non-Functional Requirements

1. Secure access to confidential data.
2. 24 X 7 availability and high working efficiency.
3. Better component design to urge for better performance at peak time.
4. The flexible service-based architecture of the system will be desirable for future expansion.
5. In case of any failure preventing system breakdown, the system must display necessary information.

6. IMPLEMENTATION

6.1. Image to Text

6.1.1. Grayscale and Blur
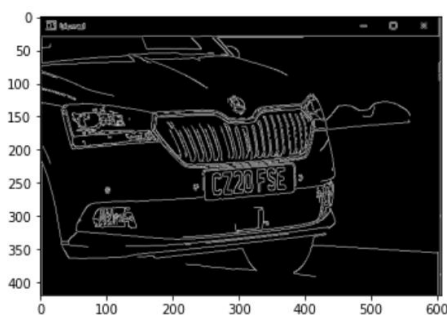
Grayscale is a range of monochromatic shades from black to white. Therefore, a grayscale image contains only shades of grey and no colour.

Fig 6.1: Grayscale image

6.1.2. Edge detection

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness.
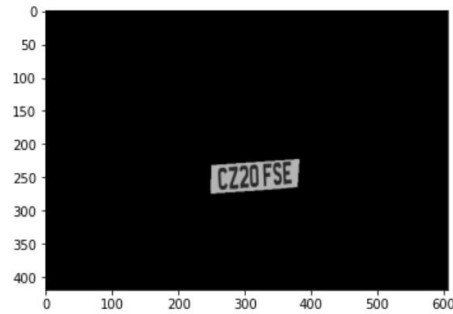

Fig 6.2: Filtered image

6.1.3. Contour Detection and apply the mask

Contours detection is a process that can be explained simply as a curve joining all the straight points (along with the boundary), having the same colour or intensity.

Fig 6.3: Masked image

6.1.4. Extract License Plate

The following is the image obtained on performing contour detection on the image.

Fig 6.4: License plate image

6.1.5. Character Segmentation

Character segmentation is an operation that seeks to decompose an image of a sequence of characters into sub-images of individual symbols.

```
[([[1, 0], [128, 0], [128, 52], [1, 52]], 'CZ20FSE', 0.37965821219717155)]
```

Fig 6.5: Character Segmentation image
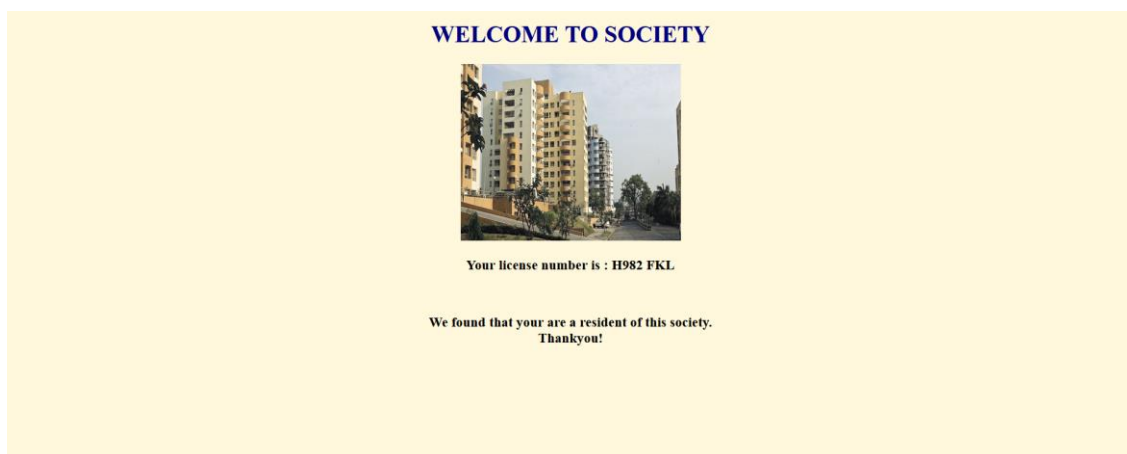
6.1.6. End Output

The following is the image obtained on performing character segmentation on the extracted license plate.

Fig 6.6: End Output image

6.2. Rendering Final Result

If the extracted license number matches with any of the existing license numbers in the Database, the following message is displayed.

Fig 6.7(a): Main Web Page

If the extracted license number does not match with any of the existing license numbers in the Database, a message directing to register is displayed.
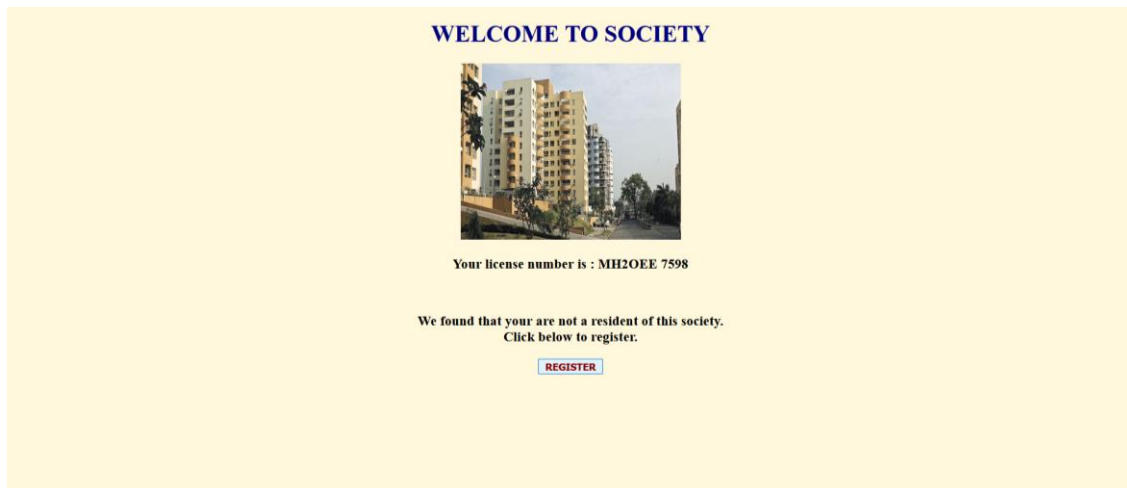
Fig 6.7(b): Main Web Page

By clicking on the "REGISTER" button, we are directed to the Registration form page, where we have to enter the required details and get registered.

Fig 6.8: Registration form

When the "Register" button is clicked, the details get inserted into the visitors' table along with an entry timestamp. After successful registration, the following message is displayed.

Fig 6.9: Final message

7. SOFTWARE TESTING

After gathering all the requirements and designing the model, the development proceeds; in every development phase, a small prototype of the system is developed and analyzed by the user. In our system, a small prototype is made that detects the vehicle. The system can be developed further to localize the number plate, segment the number plate and extract the character sequentially.

The evolved prototype is checked whether or not it satisfies the requirement as targeted formerly withinside the requirement analysis. Here, time and again, the system is checked whether or not the detected automobile is accurate or not. Also, the system is validated if it offers accurate capabilities from a wide variety plate. Additionally, there may be any blunders withinside the system process.

8. RESULT DISCUSSION

At the end of the iteration, a working product is displayed to the customer and critical stakeholders. The system then localizes the number plate from the moving vehicle and extracts the features after segmenting the number plate characters.

After completing the project, our system can localize the number plate and extract the characters from the plate in real-time. The accuracy of plate localization was 92%, and the accuracy of predicting the characters from segmented characters was 96%.
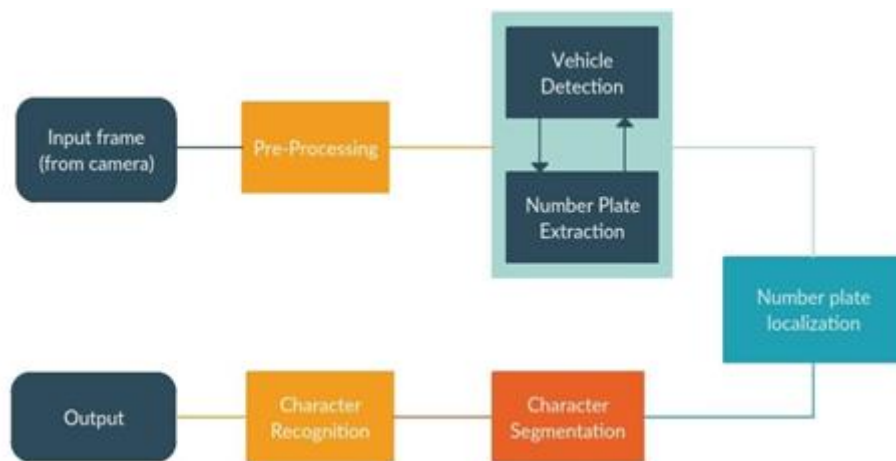
Fig 8.1: Flow chart of the image to text

9. ADVANTAGES

9.1. Reduce time and labour consumption

Using RTNP, we can quickly discontinue the human factors on vehicle entry due to considerable benefits. This system will quickly scan and process images and deny or permit entry.

9.2. Ensure security of residents

Undesired operators often force working personnel for using threats, intimidation, violence, or bribes to allow their cars to enter the premises. This project can reduce this to a very great extent.

9.3. Smooth entry of desired members on the premises

This system can be used to control the entering and exiting of vehicles to and from the complexes. This system helps personnel recognize vehicle number plates and determine whether the cars can be permitted entry/exit in/from the premises.

9.4. 24/7 operation

In times of crimes and fraud, it is very beneficial and is a very reliable system.

9.5. Good accuracy

Reliable performance and good accuracy for different types of license plates are provided using this system. It transmits real-time stamps of entry of the vehicle to the Database and supports the capture of license plates and the vehicle image.

10. DISADVANTAGES

10.1. Extreme Weather Conditions

Lousy weather and hindrances can affect the accuracy of results rendered by automatic license plate recognition systems. When such conditions occur, the security measures might have to be turned off, and manned surveillance will be needed.

10.2. Privacy Concerns

Due to the storage of images and records, some privacy concerns may be raised. Usually, people are afraid that the records of someone's whereabouts in all these records might be misused. It can become a subject of data thefts or people with all kinds of criminal intentions.

Although experts claim that LPR is not an infringement on anyone's privacy, the police have always been able to run registration plates, as they are issued to be used on public roadways. This system automatically checks every plate, and no discrimination could be involved.

The responsible agencies consider these privacy concerns to make sure that people feel safer instead of at more significant risk.

11. APPLICATIONS

11.1. Monitoring and Surveillance

Automatic license plate recognition eliminates the tedious process of manually recording numbers. It is almost impossible for a person to spot the exact registration number, especially when a car speed. The automatic number plate recognition systems record the numbers in real-time, giving a clear view of traffic insights.

11.2. Still and Video Footage

Many automatic license plate recognition systems have both still and video footage. Some of these systems are specially designed to take snapshots when a vehicle speeds, pass on a red light or take a wrong turn. The recording is stable under different camera positions and angles as well as different weather conditions.

11.3. Improved Security

License plate recognition is a deterrent for serial traffic offenders. The system helps with reactive security also. This includes investigations, forensics, inspections, and legal proceedings. There is a possibility of taking the driver's picture for an improved security system. Automatic license plate recognition seems a necessity in every perspective.

11.4. Less Manned Surveillance

The reduced importance of manned surveillance may be a disadvantage for some people. However, that is not entirely correct. The traffic personnel can be way more efficient now with all the information provided by the

Automatic license plate recognition software. The accuracy that this system provides is very high.

11.5. Smooth arrival/departure

The number plate of a vehicle is detected at the entrances of offices and identified whether it belongs to the given office complex or not.
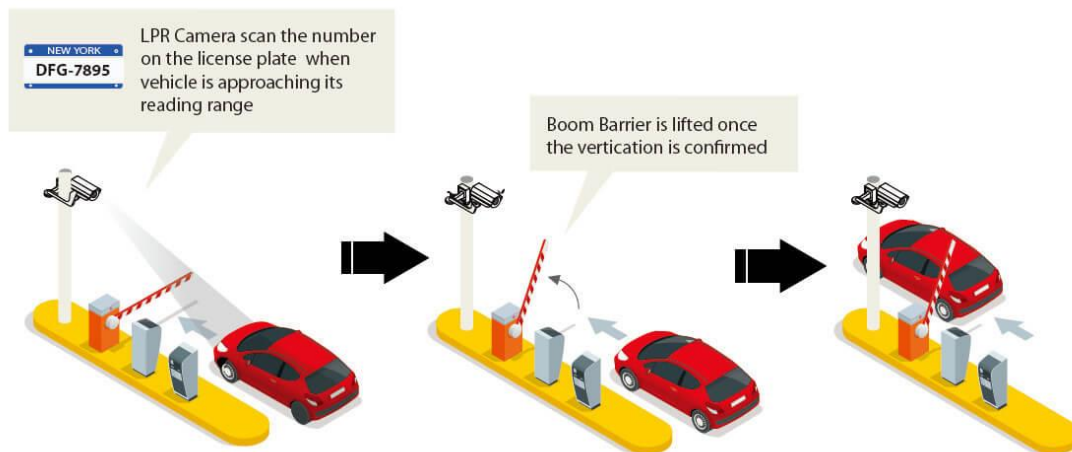
Fig 11.1: Smooth arrival/departure

11.6. Admission Tickets for authorized vehicles

Defining and issuing temporary permissions for admission or parking tickets for authorized vehicles to enter the area/premises.

12. CONCLUSION

We have created a model that detects the license number plate of the vehicle and extracts the license number characters from the image. Data is collected from various data sources and is pre-processed using various image processing techniques. We created and used our Database, which stores the details of the vehicle owners and gives results based on the previously stored data and the timestamp.

The Database created for this project consists of two tables. The first table is for keeping a record of the residents of the premises. It contains the details of residents like vehicle number, owner's name, phone number, wing number and flat number. The second table is for keeping the record of visitors. It contains the visitor's vehicle number, name, phone number, and vehicle entry time on the premises.

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APPENDICES

Contour: An outline, especially of a curving or irregular figure

Deterrent: Something that should stop you from doing something

Insights: A deep understanding of what something is like

Intimidation: To frighten

Prototype: The first model or design of something from which other forms will be developed

Rendering: To cause something to be in a particular condition

RTNP: Real-time number plate

Segmentation: The act of dividing something into different parts

Surveillance: The careful watching