

An Algorithm For Automatic License Plate Recognition Applied To Parking Section

Karishma. K .Jage¹

¹Department of Computer
Engineering,
Padmabhooshan Vasantdada
Patil Institute of Technology,
Pune, Maharashtra, India

Gauri . D. Joshi²

²Department of Computer
Engineering,
Padmabhooshan Vasantdada
Patil Institute of Technology,
Pune, Maharashtra, India

Shradhadevi . S. Nair³

³Department of Computer
Engineering,
Padmabhooshan Vasantdada
Patil Institute of Technology,
Pune, Maharashtra, India

Shweta . A. Patil⁴

⁴Department of Computer
Engineering,
Padmabhooshan Vasantdada
Patil Institute of Technology,
Pune, Maharashtra, India

Under the guidance of

Prof S. U. Kadam

Department of Computer Engineering,
Padmabhooshan Vasantdada Patil Institute of Technology,
Pune, Maharashtra, India

Abstract

To design a real time application this will recognize the license plates automatically of vehicles at a gate. The proposed ALPR system for vehicle parking at shopping malls. A License plate recognition (LPR) system is one kind of an intelligent transport system and is of considerable interest because of its potential applications in highway electronic toll collection and traffic monitoring systems. The purpose of this paper is to develop a real time application which recognizes license plates from vehicles at a gate, for example at the entrance of a parking area. The image is given as input once the license plate is detected; its digits are recognized, displayed on the user interface by checking with a database. In this system the Database of the vehicle registration will be stored on the Remote Server for the security Purpose; Rules of RTO are considered to check if vehicle is registered or not. Then parking area will be allocated to different types of vehicles and simultaneously parking charges would be calculated using electronic payment system.

Keywords : *Automatic License Plate Recognition (ALPR), Grayscale Conversion, Edge Detection, Segmentation, Character Recognition, Template Matching, Remote Server, Regional Transport Office (RTO), Electronic Payment System*

1. Introduction

Automatic license plate recognition (ALPR) is to extract vehicle license plate information from an image or a sequence of images. The extracted information can be used with or without a database in many applications such as electronic payment systems (toll payment, parking fee payment), freeway and arterial monitoring systems for traffic surveillance. The main goal of our project is to provide parking spaces for the vehicles based on license plate recognition in shopping malls. This will help in maintaining a systematic way of allocating and de-allocating of parking spaces for cars, bikes without manual intervention. [1]

Databases of each vehicle entering at the gate of shopping mall (name of owner, no. , etc) are maintained on a remote server accessed from RTO. Then using a web-cam, image of license plate is taken and the number written on it is matched with the database stored on the remote server. After matching with the database if such a number exist then parking space is allocated. Similarly while leaving from the mall; car parking space is freed by de-allocating.

Parking charges would be calculated using electronic payment system as soon as vehicle exit from parking area. The data of person is saved in order to track the culprit in case of bomb blasts or any other crimes. This paper application will be applicable for more than 15 countries.[1][2]

1.1 WORKING OF THE SYSTEM

We use different stages for recognizing the license plate which is as follows: [2][3]

1. Image Acquisition / Input Image module
2. Edge Detection Module
3. Character Segmentation
4. Character Recognition

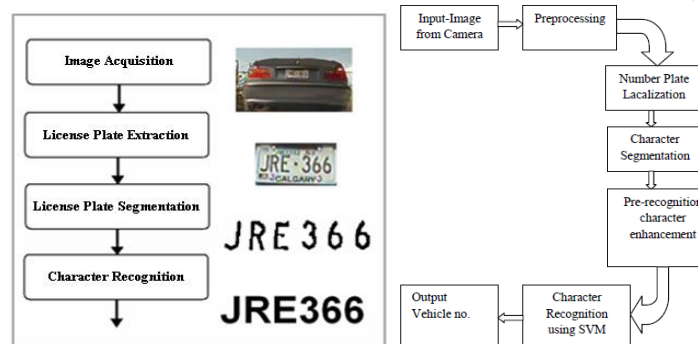


Fig 1: Processing of License Plate image

Finally the character recognized will be stored in the Database and will be used for further processing.

License plate recognition (LPR) is an image-processing technology used to identify vehicles by their license plates.

1.1.1 IMAGE ACQUISITION /INPUT IMAGE MODULE

In this stage, we give input as image of License plate of the vehicle. This image is in RGB format; We hence convert it into grayscale.



Fig 2: Input Image

Fig 3: grayscale

Input image now converted into grayscale. The Red, Green, Blue Components are separated from 24-bit color value to of each pixel (i, j) to calculate 8bit gray value. [2]

Using formula $gray(i,j) = 0.30 * R(i,j) + 0.59 * G(i,j) + 0.11 * B(i,j)$

1.1.2 EDGE DETECTION MODULE

a. Vertical Edge Detection

The anticipated methodology employs Sobel edge detector as it offers additional precise outcome.[4] The Sobel edge detector utilizes a 3x3 mask, which is applied on the input image to identify half of the vertical edges, four corners of the license plate can then be traced.

b. Filtering

The intention behind filtering operation is to select the regions that can give out as possible license plate boundaries and eliminate the others by filling black colors in their place.[3][4]

c. Vertical Edge Matching

In this phase the width to height ratio of license plate is exploited to match the vertical edges for locating the region of where there is a possibility of license plate. [3][4]

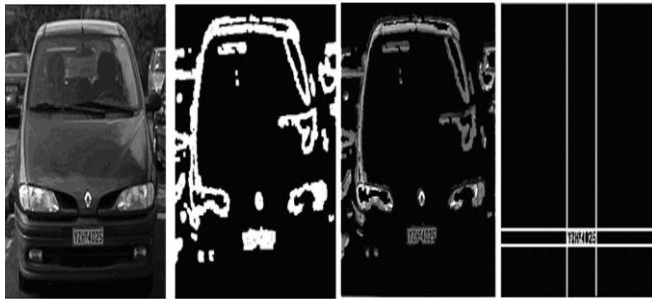


Fig 4: view of the edge detection

1.1.3 CHARACTER SEGMENTATION

Character segmentation is the procedure of extracting the characters and numbers from the license plate image. These are of two types - [5]

a. Vertical Scanning

Vertical scanning method is employed to dig out each character from the image found on first and last column pixel. It looks into the image by pixel vertically from [0, 0] until [width, height] which is executed in column by column scanning. At last, every character or number will be slice to split it from the plate background. Each element will be stored in array separately for next horizontal scanning process.

b. Horizontal Scanning

Once every element is saved separately in preceding step horizontal scanning will identify the first and last rows of the image. The intention is to eradicate extra upper and lower region from the image.

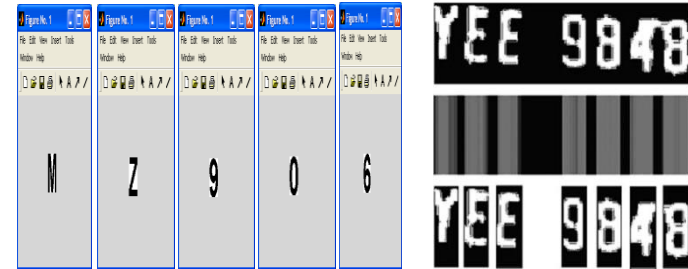


Fig 5: Number plate after segmentation

1.1.4 Character Recognition

After the segmentation of elements (characters and numbers), the final module in the recognition process is character recognition. In the last module, character recognition is done by utilizing template matching technique.[5]

a. Template matching -

In the final module, each segmented character from the previous module will be matched with the stored templates of the character. These stored templates consist of pixels. These pixels are termed as test point. There are two types of test point. One test point is called white test point and the other is termed as black test point. The white area of the character image from segmentation stage is tested by the white test point. Black test point is used to test the black area of the character image. The result of the test point is given by:

Result= $\frac{\text{Matched point}}{\text{Test point}} \times 100\%$

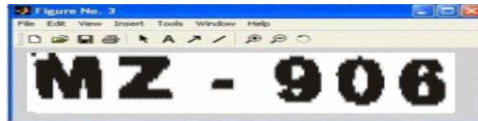


Fig 6: Template matching

1.2 USER CLASSES AND CHARACTERISTICS

a. Remote Server –

The registered information of the vehicle will be stored in the Remote Server. It will contain the name of the vehicle owner, type of the vehicle, information of the owner of the vehicle. Databases of each vehicle entering at the gate of shopping mall (name of owner, no. , etc) are maintained on a remote server accessed from RTO.

b. Computerized allocate free space -

After recognition the license plate image the system will check for the free space and automatically allocate the space for the vehicle. And after leaving the system will automatically free that space.

c. Features of the system

1. Indian number plates can have single row or double row; system is able to detect double line or row number plate.
2. Perfection Ratio 80 to 100 percent for single line and double line LPR.
3. The system is developed for more than 15 countries.
4. In this system, the license plate of the vehicle which is being parked will be saved.
5. There is no need for human surveillance.

2. GUI FOR THE PARKING SECTION

This way the space will be allocated to vehicles automatically. The space allocated will turn to brown. And the space which is free will be green. The space which is reserved for regular members will be in blue. [6]

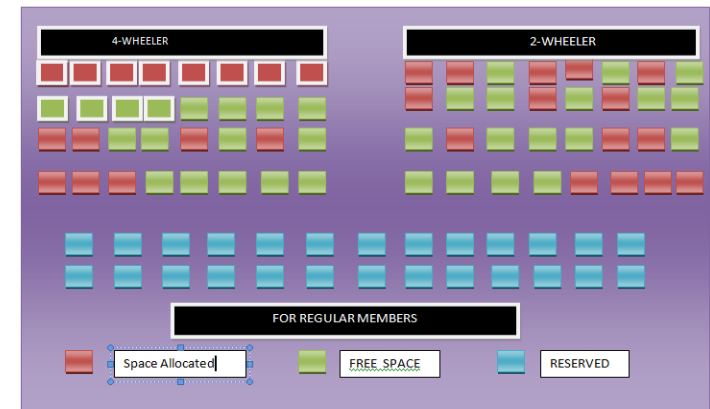


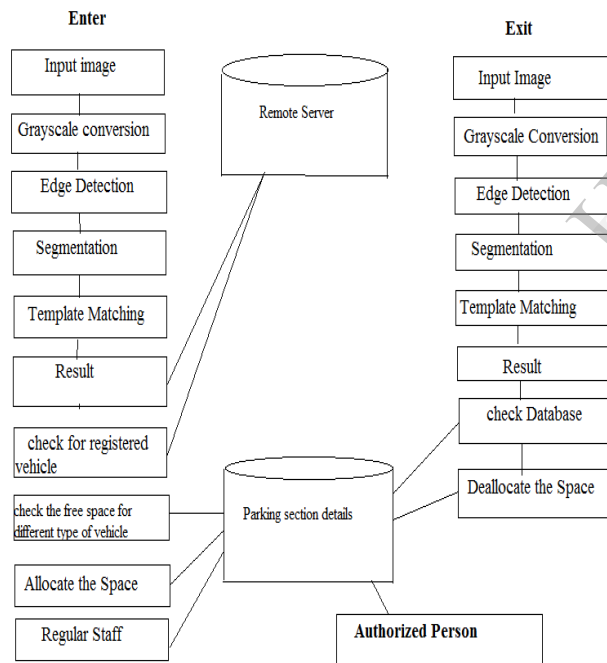
Fig 7: GUI of the parking section

2.1 System Implementation Plan

1. Input license plate image.
2. License plate extraction.
3. check whether the number plate is register in remote server.
4. if number plate is register then allocate the Space check which type of vehicle is present
5. Else does not allocate the space.
6. Check whether the free space is present for the particular type of vehicle.
7. If present then allocate the space.

8. Else print message search another space. Store the information in database.
9. Again while leaving the parking section recognizes the image and searches that number plate in the database.
10. De-allocate the space.
11. The Parking space will be Allocated Automatically.
12. Charges for parking are calculated by determining entry and exit time of the vehicle.

2.2 SPECIFIED ARCHITECTURE OF THE SYSTEM



3. Electronics Payment System

This composite system will provide the number plate recognition and electron parking bill The captured picture together with the recognized number and entry record (entry date & time) will be stored for parking fee calculation later. Once this is completed, the entry barrier will open to allow the vehicle to enter and park. When the leaving vehicle reach the exit booth, its presence is detected by a loop sensor. This sensor will initiate a picture to be taken and the license plate to be read by the LPR module. The LPR module will match the recognized vehicle number with its own file for the entry time for this particular vehicle. Once the exit and entry record are matched, the system will calculate and display the parking fee is due. When the transaction is complete, the exit barrier will open and the vehicle will leave. The information of the vehicle which is entering will be saved in the database. So in case of any bomb blasts we can find out the information related to the particular vehicle.[7][8]

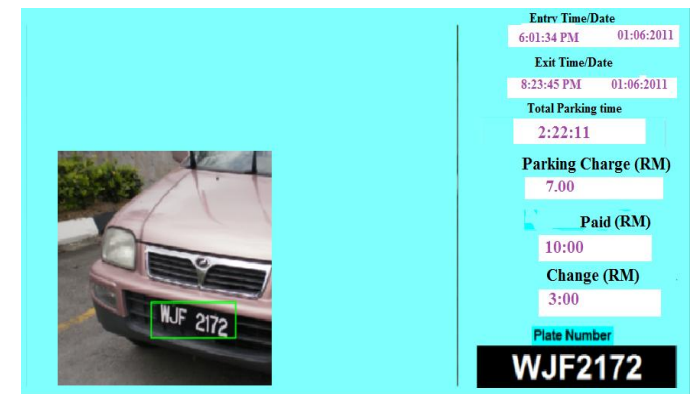


Fig 8: GUI based car parking electronic billing window

4. Technical Specifications

4.1 Advantages

1. High level of security.
2. The license plate will be recognized automatically.

3. No need for human surveillance.
4. GUI of the system helps to find the free space.
5. Maintenance of database of each vehicle.

4.2 Limitations

1. The system is unable to solve the Theft issues.
2. The language of the plate can be different.
3. License plate cannot be recognized if it is dirty.
4. The owner of the vehicle and the person who is driving can be different.

4.3 Application

1. The system will be used in Toll Plaza
2. It will be used in Any Parking Section.
3. Monitoring the traffic.
4. It will be used in Defense Areas.

5. CONCLUSION

The proposed algorithm is fast enough; the recognition unit of a LPR system can be implemented only in software so that the cost of the system can be reduced. Compared to most previous work that in some way restricted their working conditions, the techniques presented in this paper are much less restrictive. The proposed LPR algorithm consists of two modules, one for locating license plates and one for identifying license numbers.. Although the proposed algorithm is concerned with the license plates of more than 15 countries, many parts in the algorithm are readily extended to use with license plates of other countries. This paper can be used for any parking section.

6. FUTURE WORK

In Mall, the parking section consists of theft issues. So to reduce the theft issues we can use the Biometrics that is Finger Print Detection for security purpose that is matching the finger prints of the person who enters the parking section with the person who leaves the parking section according to the license plate stored in database.

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