 

# Automatic Vehicle Number Plate Recognition for Vehicle Parking Management System

Ganesh R. Jadhav, Electronics and Telecommunication Engineering Department, SKN Sinhgad college of engineering, Pandharpur , India, gjadhav997@gmail.com , +91 9921804338
Kailash J. Karande , Electronics and Telecommunication Engineering Department, SKN Sinhgad college of engineering, Pandharpur, India, kailashkarande@yahoo.co.in

**Abstract**
A license plate recognition (LPR) system is one type of intelligent transportation system (ITS). It is a type of technology in which the software enables computer system to read automatically the license number plate of vehicle from digital pictures. Reading automatically the number plate means converting the pixel information of digital image into the ASCII text of the number plate. This paper discuses a method for the vehicle number plate recognition from the image using mathematical morphological operations. The main objective is to use different morphological operations in such a way that the number plate of vehicle can be identified accurately. This is based on various operation such as image enhancement, morphological transformation, edge detection and extraction of number plate from vehicle image. After this segmentation is applied to recognize the characters present on number plate using template matching. This algorithm can recognize number plate quickly and accurately from the vehicles image.
**Keywords**: ANPR, ITS, Image Enhancement, Edge Detection, Morphological Operation, Number Plate Extraction, Template Matching.

## 1. INTRODUCTION

Automatic number plate recognition (ANPR) system has been a practical technique in the past decades. One type of intelligent transportation system (ITS) technology is the automatic number plate recognition (ANPR) which can distinguish each vehicle as unique by recognizing the characters of the number plates. Automatic number plate recognition system finds wide varieties of applications to fit itself beyond just controlling access to a toll collection point or parking lot. In ANPR, a camera captures the vehicle images and a computer processes them and recognizes the information on the number plate by applying various image processing and optical character recognition techniques. Prior to the character recognition, the number plates must be separated from the background vehicle images. This task is considered as the most crucial step in the ANPR system, which influences the overall accuracy and processing speed of the whole system significantly. Since there are problems such as poor image quality, image perspective distortion, other disturbance characters or reflection on vehicle surface, and the color similarity between the number plate and the background vehicle body, the number plate is often difficult to be located accurately and efficiently.
Generally vehicle number plate recognition is divided into several steps including number plate extraction, image region which contains a number plate, character segmentation, and character recognition. Generally, in order to recognize a vehicle number plate, the region of the number plate should be extracted from a vehicle image. Accurate detection of the plate region is essential process to go over to the step of character recognition. There are two major methods to extract number plate region,

- Edge Detection
- Finding Rectangles in a Vehicle Image .

## 2. RELATED WORK

There are several common algorithms to locate the license plate. Widely used procedures that are solely based on image processing are as Hough transform, Top-Hat and Bottom-Hat filtering (highlights the black-white transitions), Binary morphology algorithm, Edge finding methods, Procedures based on the color of the background and characters [13].
Ankur kr Aggarwal, Aman Kr Aggarwal [2] presented paper on “Vehicle Registration Plate Recognition System Based on Edge Transition by Row and Column Profile on Still Images”. The system is developed based on digital images and can be easily applied to commercial areas based on a smart and simple algorithm for vehicles registration plate recognition system. The percentage of accuracy of the recognition is 97%.
M. M. Rashid, A Musa, M. Ataur Rahman, N. Farahana and A. Farahana [3] discussed paper on “Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition”. It also discussed on parking guidance system that can show and guide user towards parking area space.
Humayun Karim Sulehria, Ye Zhang, [5] “Extraction of Vehicle’s Number Plates Using Mathematical Morphological Techniques”, this paper discus the method for extraction of the vehicle number plates from the

 

image using hybrid mathematical morphology. They had obtained the high accuracy and rate of recognition is above 96%.

Christos Nikolaos E. Anagnostopoulos, Ioannis E. Anagnostopoulos, Vassili Loumos, and EleftheriosKayafas, [6] describes "A Number Plate-Recognition Algorithm for Intelligent Transportation System Applications". This paper gives an algorithm for vehicle number plate identification on the basis of a novel adaptive image segmentation technique (sliding concentric windows) and connected component analysis with a character recognition using neural network.

Shyang-Lih Chang, Li-Shien Chen, Yun-Chung Chung, and Sei-Wan Chen, [8] "Automatic Number Plate Recognition". They have proposed two main modules for this system which are a number plate locating module and a number identification module.

Choudhury A. Rahman, Ahmad Radmanesh [10], describes "A Real Time Vehicle's License Plate Recognition System" in 2003. In this paper they have used the C++ for developing the project. The system is based on finding the number plate as well as the characters on the number plate by using horizontal and vertical projection and color concentration.

Hakob Sarukhanyan, Souren Alaverdyan, Grigor Petrosyan, [11] presented a paper on "Automatic Number Plate recognition system". For extracting number plate they have used the Hough transform. Hough transform work on only gray scale images so image is first converted to the gray scale image for further processing.

## 3. STRUCTURE OF TYPICAL ANPR SYSTEM

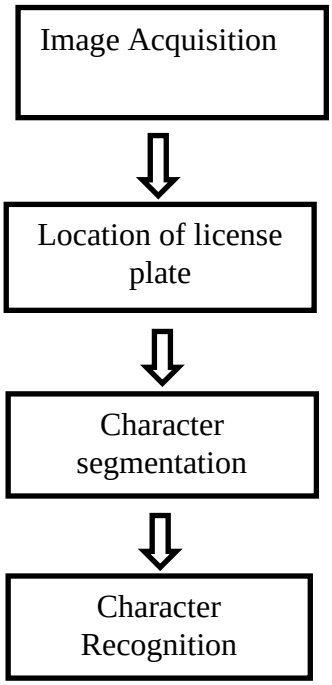


Fig .1 System Architecture

The typical LPR system consists of four major parts: Image capture, license plate location, character segmentation and character recognition. As shown in Figure 1.

### *3.1 Image Acquisition*

The first step is the capturing of an image using the camera. The images are captured in RGB format so it can be further process for the number plate extraction. Pre-processing of the captured image is performed such as RGB to gray scale conversion, noise filtering, binarization process.

### *3.2 Location of License Plate*

This plate localization algorithm is based on combining textural characteristics of license plate and morphological operation sensitive to specific shapes in the input image with a good threshold value by which the license plate is located. A fine percentage of localization of License plates is achieved by this algorithm. License Plate consists of many vertical edges because it consists of Borders, Characters, and Digits. Sobel mask is used to detect vertical edges in the input image.

 

*3.3 Character segmentation*

The process of identifying the characters, it is preferable to divide the extracted plate into different images, each containing one isolated character. There are some widely used methods for character isolation which are used in almost all available LPR systems.

Following steps are used to segment the characters of the number plate:

- Stretch the contrast of the image over the entire range of gray levels available (0-255).
- Threshold the plate image.
- Search for connected components in the image, each connected component will be assigned a special label in order to distinguish between different connected components in the image.
- Resize each character from the previous step to the standard height and width in order to be used in the recognition process.

*3.4 Character Recognition*

Low-resolution template matching method is adopted, namely the using a lower pixel resolution to represent the images and templates to be recognized. Each matrix element corresponds to a sub-matrix in a high-resolution matrix. The element's value is the average of the pixel gray value in the corresponding high-resolution sub-matrix. Compared with the high-resolution matching algorithm, correct identification rate of the letters and numbers is greatly enhanced. The reason is that if the resolution rate goes through a moderate reduction, the error generated by the image distortion and the noise will be decreased. The recognition errors of letters and numbers mainly occur in some of the characters with the very similar main structures but some detailed differences, such as B and 8, O and 0, S and 5.

## 4. CONCLUSION

The basic elements of an ANPR system including plate location, character separation and recognition are presented in this paper. The goal of the research is to investigate the possibility to create a comprehensive system for Indian vehicle identification based on the license plate recognition. In that case no additional hardware, such as e.g. transmitters, mounted on a vehicle, and responders will be required. The system performs well on various types of vehicle license plate images, even on scratched, scaled plate images etc.

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