RECOGNITION OF VEHICLE NUMBER PLATE USING MATLAB

Pooja R. Sarode[1], Snehal A. Jadhav[2], Prof. Milind Rane[3]
[1,2,3]Vishwakarma Institute of Technology , Pune
Department of Electronics Engineering

Abstract

In this work, we propose a framework that uses a camera installed at roadside to detect the vehicle number plate. A typical video component requires several adjustments after image has been stored such as enhancement of image, localization of number plate, separating each character and recognition of each character. In this work we extract the vehicle number plate from our image and then recognize it based on the characteristics of number plates in different countries. We use Sobel edge detection for plate localization, template matching and fuzzy logic for recognition. We make use of the characteristics of the vehicle number sequences to further enhance performance. Vehicle number plate recognition can be used to decrease human effort by making systems automatic.

Index Terms: Number plate (NPR), Sobel Algorithm.

INTRODUCTION

Number plate recognition is a technology based on computer vision which involves image processing, fuzzy logic and many other techniques.

Applications of Vehicle Number Plate Recognition(VNPR) can vary from automatic parking facilities, automatic fuel pumping for registered vehicles, restricted areas reserved for VIP members, automatic toll sensors, vehicles involved in theft and other imaginative forms as shown in Figure 1 [5]. Unfortunately there exist various factors which restrict us from recognizing a license plate such as weather, lighting, visual occlusion, placement of number plate, speed of vehicle, damaged plates, angles of camera, color of number plate and different fonts used for the characters.[2]

These factors can be overcome in some ways so that our results are more accurate. With correct evaluation and analysis of the results of recognition of number plate it is possible to improve the accuracy of the number plate recognition system. In India there has been a lot of work done on number plate recognition. It is possible to recognize the characters of Indian number plate based on the specifications of Indian number plates.

MH 01 BY 5628

Considering the standard specifications of Indian Number Plates: Here 'MH' that is the first 2 characters stands for the state code, '01' that is a two digit number code which stands for the regional transport office where the car has been registered. 'B' stands for car and similarly 'y' for scooter and 'P' for public transport vehicles. Finally there comes a four digit car number ('5628').

After the 4 digit car number reaches '9999' the next vehicle number becomes

MH 01 B A 9999 ➔ MH 01 B D 0001 ➔ MH 01 B Y 5628

I. LITERATURE

In this detection process there are many used literature survey which posses the techniques referred for the different modes of detection. In an NPR System, it investigates an input image to identify some local patches containing license plates. Since a plate can exist anywhere in an image with various sizes, it is infeasible to check every pixel of the image to locate it[7]. In this step the number plate is extracted by firstly converting RGB Image i.e., the captured image to Gray Scale Image. Here mathematical morphology is used to detect the region and Sobel operator are used to calculate the threshold value .After this we get a dilated image. Then imfill function is used to fill the holes so that we get a clear binary image.

II. THE GENERAL NPR SYSTEM

General Block diagram of NPR System is shown in Figure1.
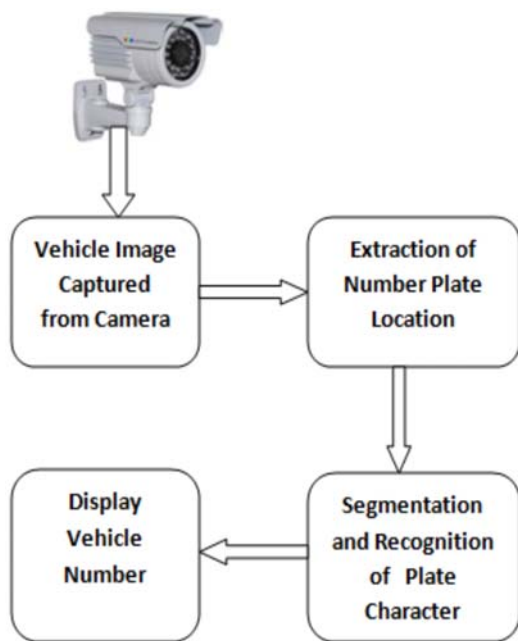
III. PROPOSED TECHNIQUE

Vehicle number plate recognition follows a structural pattern for the recognition of characters. Figure 2 gives a schematic diagram of the of the VNPR system.
First of all we improve the quality of image by using familiar image processing techniques such as the following

1. Conversion to gray scale:
The RGB 24 bit color pixels are converted into 8 bit gray value as shown in figure2.

2. Median Filtering:
The non-linear filter changes the gray value of the pixels to the median of the gray value of surrounding pixels as seen in figure 3(c). We use a 3x3 mask and get the corresponding gray value of each pixel using the 8 neighbouring pixels which results in removal of noise with benefits [5]. Median filtering gives advantages such as no reduction in contrast since output values are its neighbourhood values, it does not shift the boundaries which is a contrast dependent problem and less sensitive than the mean values.
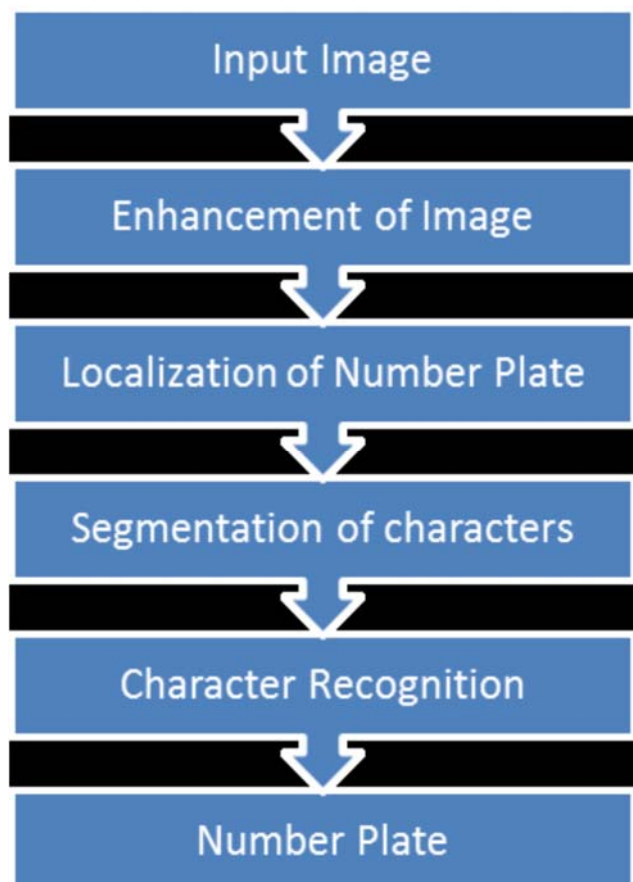
3. Histogram Equalization:

Histogram Equalization is used to enhance the contrast of the image for better functioning.[3]

4. Edge Detection:

After improvement of image we perform removal of vehicle number plate by locating the number plate region using Sobel edge detection and fuzzy logic as shown in figure 3(b) . Sobel operator[3] has a 3x3 convolution kernel. One kernel is the other rotated by 90 degree. It respond to vertical and horizontal edges and the characters in the number plate have vertical edges of uniform nature at regular intervals. These characters are also equally distant to the number plate edge. These features help us to locate the number plate within the image.

5. Characteristic Analysis:

This system is designed on the basis of number plate specified at national level and hence has characteristic features which can be taken into analysis [1,4]:

-The background colour of the plate is white or yellow and the characters are written in black.[4]

-Characters 'E', 'F', 'I', 'O', 'Q', 'V', 'X' and 'Z' are not used in the first 2 characters in a number plate considering only national numbers and not the few exceptions such as numbers of diplomats, etc.

-The 5th character is mostly 'C', 'S' or 'P'.

-The last 4 characters are always numbers. Hence alphabets need not be taken into account. This helps in differentiating matches between characters like 'Z' and '2', 'B' and '8', etc.

-The number plates in common have 10-12 characters at present.

Finally to calculate the efficiency of our number plate, we use the following parameters.

(a)Original   (b)Gray scale (c)Median Filtering

(d)Edge Detection (e)Smoothing(f)Extraction
Figure 3. Proposed Technique

$$\text{Recognition Rate} = \frac{\text{Correct characters}}{\text{Total characters.}}$$

$$\text{Rejection Rate} = \frac{\text{Rejected characters}}{\text{Total characters}}$$

$$\text{Error Rate} = \frac{\text{Incorrect Characters}}{\text{Total characters}}$$

These characteristics of vehicle number plates helps us recognizes the no. plates with more accuracy. Hence, the proposed system faster to recognize number plates using fuzzy logic. We tested the proposed system for 100 images of license plates. The system could not recognize 10 of these images due to bad camera angles, bad illumination and blurred images. These misconceptions during character recognition are mentioned in Table 1 and the they have been eliminated through our characteristic analysis are shown in Table 2. As a result, the images showed recognition rate of 95.1, error rate of 1.3%, and rejection rate of 3.6.

Character on the number plate	Character Recognized as
D	O
M	H
6	8
8	0

Table 1: Common misconceptions that exist.

IV. RESULTS OF CORRECT OUTPUT

Characters on number plate	Correct output found with no confusion with characters below
B	8
O	0
Z	2
S	5
Z	7

Table 2: Misconceptions removed through characteristic analysis and table holds true vice versa.

V. APPLICATIONS OF NPR SYSTEM

1. Parking :- The NPR is used to automatically enter prepaid members and calculate parking fee for non-members.

2. Access control :- A gate automatically opens for authorized members in a secured area, thus replacing or assisting the security guard.

3. Tolling :- The car number is used to calculate the travel fee in a toll-road or used to double check the ticket.

4. Border Security :- The car number is registered in the entry or exits to the country and used to monitor the border   crossings.

5. Traffic Control :- The vehicles can be directed to different lanes according to their entry permits. The system reduces the traffic congestions and number of
attendants.

VI. CONCLUSION

In this proposed project, an application software is designed for the detection of number plate of vehicles using their number plate. At first plate location is extracted using morphological operation then separated the plate characters individually by segmentation. Finally template matching is applied with the use of correlation for recognition of plate characters. Some of possible difficulties:
1. Broken number plate.
2. Blurry images.
3. Number plate not within the legal specification.
4. Low resolution of the characters.
5. Poor maintenance of the vehicle plate.

VII. REFERENCES

1. JUNG, K., K.I. KIM, A.K. JAIN, MAY 2004. TEXT INFORMATION EXTRACTION IN IMAGES AND VIDEO: A SURVEY JOURNAL ON PATTERN RECOGNITION. VOL. 37, NO. 5. PP: 977-997.

2. Kwasnicka, H., B. Wawrzyniak, 2002. Symposium on Methods of Artificial Intelligence (AI-METH 2002) Gliwice, Poland. License Plate Localization and Recognition in Camera Pictures.

3. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Pearson Education Asia, 2002.

4. Lee, S.W., D.J. Lee, H.S. Park, 1996. IEEE Transactions on Pattern Recognition and Machine Intelligence, pp: 1045-1050. A New Methodology for Grayscale Character Segmentation and Recognition.

5. Digital Image Processing,2/e By Gonzalez pg 263.

6. V. S. L. Nathan, Ramkumar. J, Kamakshi. P. S, "New approaches for license plate recognition system," ICISIP 2004, p.p. 149-152.

7. INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING Vol. 2, Issue 8, August 2014.