[Volume 1 issue 3 April 2013]
Page No.99-102 ISSN :2320-7167

[INTERNATIONAL JOURNAL OF MATHEMATICS AND COMPUTER RESEARCH]

The Automatic Number Plate Recognition System (Anpr)

Harish D. Kendre,Gaurav V. Talokar, Mohan Girhe, Tejas Pidkalwar

Guided By: Prof. D.P. Rathod

Veermata Jijabai Technoligical Institute

Abstract-

In this paper a method for vehicle number plate identification is implemented and analyzed, on the basis of a novel adaptive image segmentation technique conjunction with character recognition. A novel method for number plate localization based on texture and edge information is proposed. The whole process is divided into two part candidate excretion and candidate verification in the first part the number plate being extracted from complex environment, several candidate areas instead of one with candidates. Adaptive median filter is applied to remove the noise from the image. Image processing technique such as edge detection, thresholding, resampling and filtering have been used to locate and isolate the number plate and the characters. The system can recognize single line number plates under widely varying illumination conditions with a success rate of about 80%.

I. INTRODUCTION

ANPR is a mas s su rve ille nce system that captures the image of vehicles and recognizes their license number. Some applications of an ANPR system are, automated traffic surveillance and tracking system, automated high-way/parking toll collection systems, automation of petrol stations, journey time monitoring. Such systems automate the process of recognizing the license number of vehicles, making it fast, time efficient and cost-effective. Number plate standards vary from country to country. Therefore, current ANPR systems being employed are country specific [1-3], in that they use specific features found on their number plates such as, background and foreground color, boundary of number plate, number plate size, etc. for localizing the number plates.

In India, number plate standards, though they exist [4], are rarely practiced. As a result, wide variations are found in the number plates in terms of font type, character size and location of the number plate. Also, in certain cases, many unwanted characters are present on the number plate. In order to recognize the license number, the number plate area has to be first located in the image. The goal of localization is to eliminate all the background and preserve only the number plate area from the input image. From this number plate area, the individual characters are then segmented out and recognized.

II. PROPOSED SYSTEM

The algorithm of Automatic Number Plate Recognition consists of following steps: Capturing the cars image, extracting the image of number plate, Extracting characters from number plate image, Recognize the Number plate character and Retrieving the vehicle number. The typical scenario of capturing the image is shown in the Figure 1.

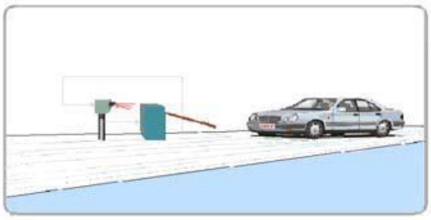
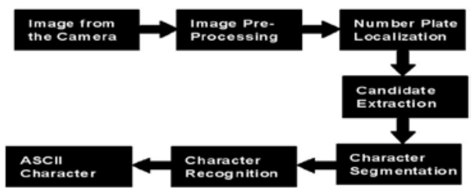


Figure 1: Capturing Vehicle Number Plate

A rear image of a vehicle is captured and processed using various algorithms. Initially, the number plate area is localized using a novel 'feature-based number plate localization' method which consists of many algorithms. This algorithm satisfactorily eliminates all the background noise and preserves only the number plate area in the image. This area is then segmented into individual characters using 'Image Scissoring' algorithm.

After this step, the characters are extracted from the gray-sale image and each character is enhanced using some character enhancement techniques. These characters are given to the character recognition module, which uses statistical feature extraction to recognize the characters. And the System Flow Chart is given in the Figure 2.



III. Preprocessing and Number Plate Localization

The input image is initially processed to improve its quality and prepare it to next stages of the system. First, the system will convert RGB images into gray level images using the NTSC standard method:

Gray = 0.299*Red + 0.587*Green + 0.114*Blue

In the second step, a median filter (5X5) is applied to the gray-level image in order to remove the noise, while preserving the sharpness of the image. The median filter is a non-linear filter, which replaces each pixel with a value obtained by computing the median of values of pixels-in this case in a 5X5 neighborhood of the original pixel.

Figure 3 Original RGB Image

A number of algorithms are suggested for number plate localization such as: multiple interlacing algorithm [5], Fourier domain filtering, and color image processing. These algorithms however do not satisfactorily work for Indian number plates since they assume features like: border for the plate, color of plate and color of characters to be present on the number plate. Hence, we designed and implemented 'Feature-based number plate localization' method well suited for Indian conditions. This approach consists of number of algorithms developed on the basis of general features of both, characters and number plate.

Figure 4 Input Gray Scale Image

For pre-processing, the input RGB image (fig. 3) is converted into gray-scale image (fig.4) and it is adaptively converted into binary image (fig. 5) using Ostu's method [8].
Initialize,

$$q_1(1) = P(1)\ ;\quad \mu_1(0) = 0$$

Do the following recursively,

$$q_1(t+1) = q_1(t) + P(t+1)$$

$$\mu_1(t+1) = \frac{q_1(t)\,\mu_1(t) + (t+1)P(t+1)}{q_1(t+1)}$$

$$\mu_2(t+1) = \frac{\mu - q_1(t+1)\,\mu_1(t+1)}{1 - q_1(t+1)}$$

IV. Character Segmentation

To ease 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. Those methods are: static bounds [6], vertical projection [7] and Connected-Components. The first two methods cannot be used to segment number plates since they do not have a fixed number of characters for each plate. In this paper the following steps are used to segment the characters of the number plate:

1. Stretch the contrast of the image over the entire range of gray levels available (0-255).
2. Threshold the plate image suing Otsu method [8].
3. 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 as shown in Fig.6.
4. Resize each character from the previous step to the standard height and width in order to be used in the recognition process.

Figure 6 Identified Character Components

V. Character Recognition

This is the most critical stage of the ANPR system. Direct template matching can be used to identify characters [9]. However, this method yields a very low success rate for font variations which are commonly found in Indian number plates. Artificial Neural Networks like BPNNs [1] can be used to classify the characters. However, they do not provide hardware and time optimization. Therefore statistical feature extraction has been used.

In this method, initially the character is divided into twelve equal parts and fourteen features are extracted from every part. The features used are binary edges (2X2) of fourteen types. The feature vector is thus formed is compared with feature vectors of all the stored templates (fig. 7) and the maximum value of correlation is calculated to give the right character. Lastly syntax checking is done to ensure that any false characters are not recognized as a valid license number.

Figure 7 Template Samples Used

Due to limited time that they possess and dealing with image vision software, it is not advisable to include all of the possible cases. Thus, they have to set a list of constraints to make the project more systematic and manageable. The constraint is listed as below:

- Image taken only when vehicle is stationary
- Captured image of vehicle at fixed distance.
- Captured image of vehicle at fixed angle
- There will be no motion capture image
- The vehicle number plate position should be captured centered
- The image should be taken with the height of 50cm to 70 cm above the ground level.
- Take only the back view image of the car.
- Captured images on location where light is proportional
- Deal with only Indian Standard Car Number Plate (shown in Figure 1)

VI. Experimental and Results

The system was developed using IDL 6.3. The system was tested with a set of images not used during testing, having wide variations in illumination conditions. The complete recognition process takes an average of 2 seconds. This can be further improved by optimizing the code. Due to the natural condition during the capturing the image some noise was added, it disturb the edge detail of the character in the number plate. So applied a edge detail preserving filter to restore the image. Afterwards converted the filtered image to a binary form to apply histogram localization to segment the characters by horizontal projection. The segmented characters was stored in the folder temp and during the comparison each characters image in binary form with images present in the training set by means of neural network. To correlate the two images of temp and training author made a manipulation to calculate number of zero's and one's in both the images. And compare only the number of zero's of them, as a result author recognized the character of all the segmented characters and display the words in IDL window editor by means of displaying the image file name of the training set.

Following table list the method to recognize the characters.

	Character Position in Temp	Number of O's	Number of 1's
Comparing the number of 0's in first image of temp with all the images in the training set			
Temp character1	0	**773**	822
Training set character1	0	345	279
Training set character2	1	346	278
Training set character3	2	528	576
Training set character4	3	489	663
Training set character5	4	488	616
Training set character6	5	543	535
Training set character7	6	704	423
Training set character8	7	604	523
Training set character9	8	688	439
Training set character10	9	**768**	310

The Final Output window is shown below figure.9

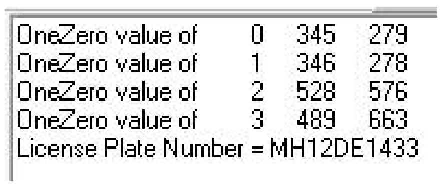


Figure 9 Final Output of Number Plate

If cases where the number plate script is non-English or the number plate is badly distorted are excluded then, 80% of the plates were recognized correctly. The performance of individual sections is: 85% for number plate localization, 95% for character segmentation and 82% for character recognition.

VII. Conclusion and Feature Work

In this paper, an approach for localization of Indian number plates is presented. In this approach, number plate located at any corner of image can be localized. Given an input image, it should be able to first extract the number plate, then isolate the characters contained in the plate, and finally identify the characters in the number plate. The proposed system will search the image for high density edge regions which may contain a number plate. After that a cleaning and a verification process will be performed on the extracted regions to filter out those regions that are not containing a number plate. After that the plate will be passed to the segmentation phase where it will be divided into a number of sub-images equal to the number of the characters contained in the plate. Finally the character in the each sub-image is recognized.

Number plates having variation such as white background black script, black background white script and yellow background black script can be easily localized. Unwanted conditions such as screws and unwanted text on number plate which create problem for localization are suitably taken into consideration. As per the Indian conditions, the major sources of error were the tilt of the number plate, the non-English script, fancy stickers, and extreme variation in the dimensions of the characters (fig.10), which can be properly removed by enhancing this approach further. Thus a new framework will be generated to implement this system fully in India.

Figure 10 Variations in Number Plate Style

REFERENCES

[1] Leonard G. C. Hamey, Colin Priest, "*Automatic Number Plate Recognition for Australian Conditions*", Proceedings of the Digital Imaging Computing: Techniques and Applications (DICTA), pp. 14- 21, December 2005.

[2] M. Yu and Y. D. Kim, *"An approach to Korean number plate recognition basedon vertical edge matching"*, IEEE International Conference on Systems, Man, and Cybernetics, vol. 4, pp. 2975.2980, 2000.

[3] M. Sarfraz, M. J. Ahmed and S. A. Ghazi, *"Saudi Arabian number plate recognition system"*, International Conference on Geometric Modeling and Graphics, pp. 36.41, 16-18 July 2003.

[4] *Indian Central Motor Vehicle Act*, Bear Act, Rule no.49, 50.

[5] Mohamed El-Adawi, Hesham Abd el Moneim Keshk, Mona Mahmoud Haragi, "*Automatic Number Plate Recognition",* IEEE Transactions on Intelligent Transport Systems, vol. 5, pp. 42- 53, March 2004.

[6] http://en.wikipedia.org/wiki/Automatic_number_plate_recognition, Retrieved, August 2005

[7] Lu Y., "Machine Printed Character Segmentation", Pattern Recognition, vol.28, no.1, pp. 67-80, Elsevier Science Ltd, UK, 1995

[8] Otsu N., "A Threshold Selection Method for Gray Level Histograms", *IEEE Transactions on System, Man and Cybernetics*, vol. 9, no. 1, pp. 62-66, January 1979

[9] Yo-Ping Huang, Shi-Yong Lai,Wei-Po Chuang, *"A Template-Based Model for Number Plate Recognition"*, IEEE International Conference on Networking, Sensing & Control, March 21-23, 2004.

[10] [10] Othman Khalifa, Sheroz Khan, Rafiqul Isam, Ahmad Suleiman, "*Malaysian Vehicle Number Plate*

[11] *Recognition*",

[12] International Arab Journal of Information Technology, Vol.4, No.4, October 2007.