

Automatic Number Plate Recognition From Surveillance Videos

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Abstract- Automatic number plate recognition is a technology that uses optical character recognition on images to read vehicle registration plate. It is widely used by police forces around the world for law enforcement purposes which includes running the registration numbers of vehicles and also electronic toll collection and as a method of cataloging the moments of traffic on highways and mainly in crowded city areas. This paper presents an approach, based on simple but efficient morphological operation and Sobel edge detection method which is a popular edge detection method. This approach is simplified to segmented all the letters and numbers used in the number plate by using bounding box method. It also uses infrared lighting to allow the camera to take the picture at any time of the day. After segmentation of numbers and characters present on number plate, template matching approach is used to reorganization of numbers and characters.

The concentrate is given to locate the number plate region properly to segment all the number and letters to identify each number separately.

Keywords- Automatic Number Plate Recognition (ANPR), Sobel edge detection method, Support Vector Machine (SVM).

I. INTRODUCTION

ANPR uses optical character recognition (OCR) on images taken by cameras. Automatic vehicle identification is an image processing technique of identifying vehicles by their number plates. Automatic vehicle identification systems are used for effective traffic control such as access control to restricted area and tracking of wanted vehicles. Automatic number plate recognition makes thing easy for the authorities. ANPR can be implemented in India to reduce the crime rate and bring order. NPR system for Indian license plate is Difficult compared to the foreign license plate as no standard followed for the aspect ratio of license plate. The identification task challenging because of the nature of the light. To overcome this we use infrared light. Research on number plate detection has been conducted from many years, it is still a challenging task. Number plate detection system 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 impractical to check every pixel of the image to locate it. In parking, number plates are used to calculate the time a vehicle has been parked for. When a vehicle enters an input gate, number plate is automatically detected and stored in database.

In ANPR system spectral analysis approach is used to capture the image, extract the region of interest, character segmentation using SVM (Support Vector Machine) extraction techniques.

The advantage of this approach is success full recognition of a moving vehicle. It is difficult to detect the boundary of the Number plate from the input car images in outdoors scene due to color of characters of the number plate and Background of the Number plate the gradients of the original image is adopted to detect candidate number plate regions.

There are also algorithms which are based on a combination of morphological operation, segmentation and canny edge detector.

License plate location algorithm consist of steps like as Edge Detection, Morphological operation like dilation and erosion, Smoothing, segmentation of characters and recognition of plate characters are described in

II. THE GENERAL ANPR SYSTEM

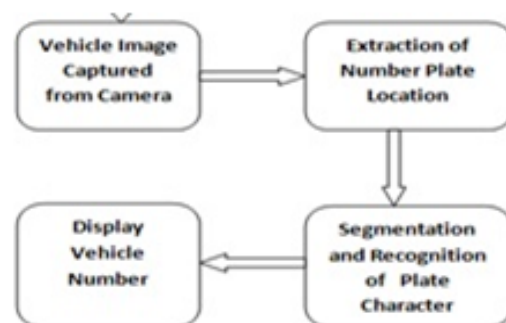


Fig 1. Block Diagram of ANPR

A. Vehicle Image Captured By Camera

The number plate of the vehicle is identified and the image is taken

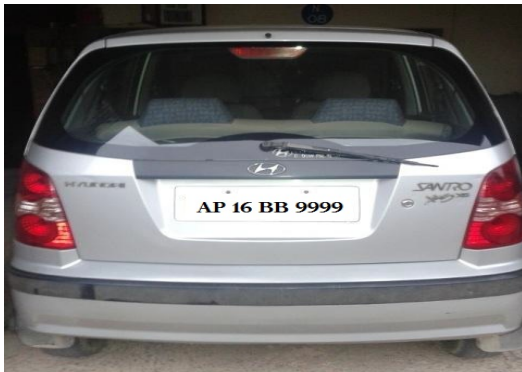


Fig. 2. Captured Image of the vehicle

B. Knowing the Number Plate Location

The number plate is Converted to RGB Image in this step i.e., image is converted Gray Scale Image. Mathematical morphology is used to detect region and Sobel operators calculates the threshold value after this we get a dilated image. With the help of in we get a clear binary image.

C. Recognition and Segmentation of Plate Character

For segmentation bounding box technique is used.

This technique is used to measure the properties of the image region. The first step is to detect the plate size in recognition of vehicle number plate. The image is multiplied with gray 0scale image so that get the number plate of the vehicle but nothing else.

D. Vehicle Number Display

The number plate is displayed in MATLAB window

III. IMPLEMENTATION ANPR USING MATLAB

ANPR implementation using MATLAB is given below:

A. INPUT IMAGE

This is the first phase deals with acquiring an image. In the proposed system, digital camera of 3.2 megapixel camera is used. The input image is 120 x160 or 1200 x 1600 pixels.



Fig.3. Original Image

B. EXTRACTION OF NUMBER PLATE LOCATION

The inputs to the system were the images of vehicles Captured by a camera. RGB to gray-scale Conversion is adopted, in order to facilitate the plate Extraction, and increase the processing speed. Color Image (RGB) acquired by a digital camera is converted to Gray- scale image using

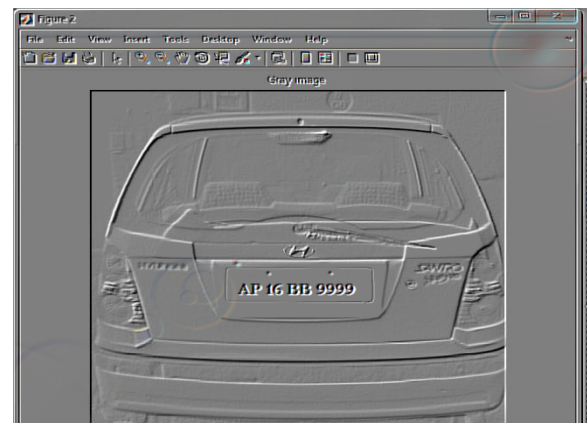
$$\text{Gray}=0.114*\text{R}+0.587*\text{G}+0.299*\text{B}.....(1)$$


Fig5.Binary gradient sobel edge detector

The binary gradient mask shows lines of high contrast in the image. These lines do not quite delineate the outline of the object of interest. Compared to the original image, gaps in the lines are observed that surrounds the object in the gradient mask. This linear gap disappears if the Sobel image is dilated using linear structuring elements. Structuring element is represented as matrices, which is a characteristic of certain structure and features to measure the shape of an image which is used to carry out other image processing operations. The binary gradient mask is dilated using the vertical structuring element followed by the horizontal structuring element.

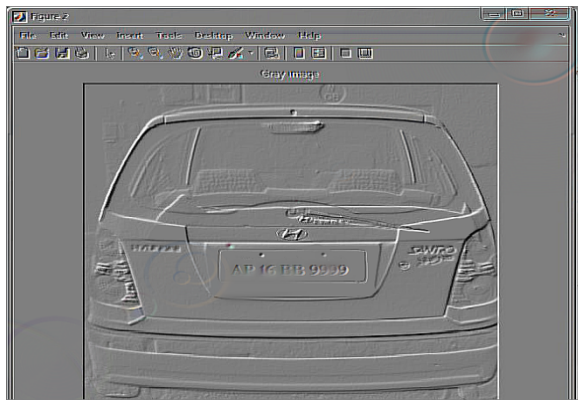


Fig.6. Dilated image

MATLAB toolbox provides a function `imfill` (BW, “holes”) that fills holes in the binarized image. The dilated gradient mask shows the outline of the cell quite nicely, but there are still holes in the interior of the cell. The set of background pixels are known as hole that have not removed by filling the background from the edge of the image. Figure 7 shows after removal of lower than 100 connected pixels. The dilated gradient mask shows the outline of the region quite nicely, but there are still holes in the interior of the region, to fill these holes `imfill` function in MATLAB is used. By filling holes the image of the captured vehicle is shown in Fig. 7

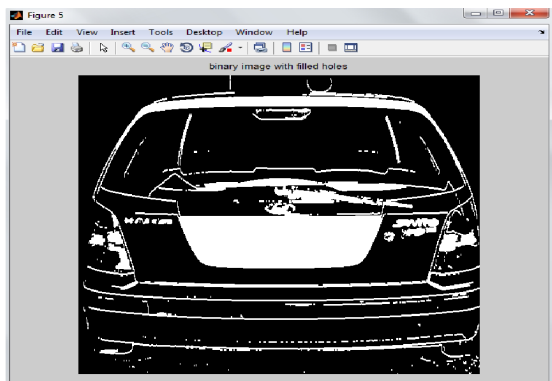


Fig.7. Binary Image with filled holes

C. REMOVE CONNECTED OBJECTS ON BORDER

The region of interest has been successfully segmented, but it is not the only object that has been found. Any objects that are connected to the border of the image can be removed using the `imclear border` MATLAB function. The connectivity in the function was set to 4 or 8 to remove diagonal connections and fill the hole to locate the plate region. After removing the lower pixel components actual plate region is detected.

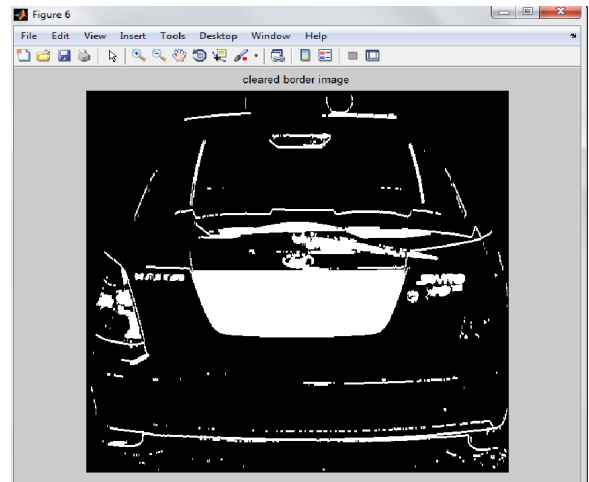


Fig.8. Removed connected object image

Finally, in order to make the segmented object look natural, the image is eroded twice with one of the diamond, disk and line structuring element. This helps in extraction of number plate area of the vehicle.

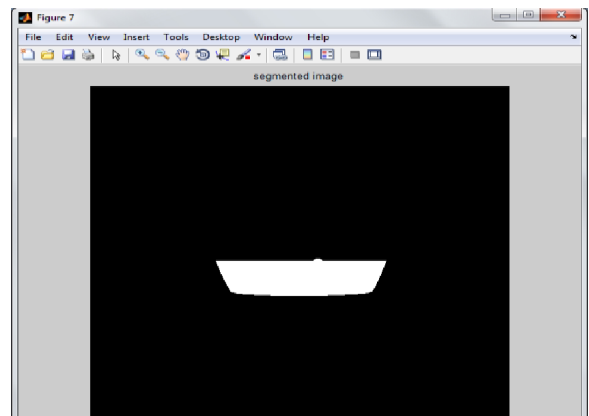


Fig.9. Extraction of number plate area

To get the only number plate area in a vehicle image with characters and numbers present on it, the segmented image is multiplied with gray scale image.

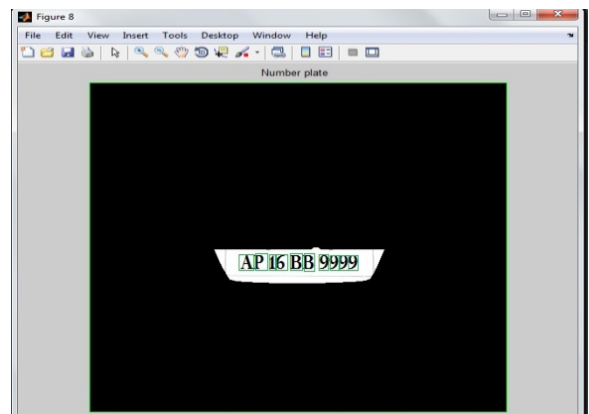


Fig.10. Number plate of Vehicle image

D.CHARACTER SEGMENTATION

Segmentation is one of the most important processes in the number plate recognition, because all further steps rely on it. If the segmentation fails, a character can be improperly divided into two pieces, or two characters. The ultimate solution on this problem is to use bounding box technique. The bounding box is used to measure the properties of the image region. Once a bounding box created over each character and numbers presented on number plate, each character & number is separate out for recognition of number plate the result of operation is shown in Fig. 11

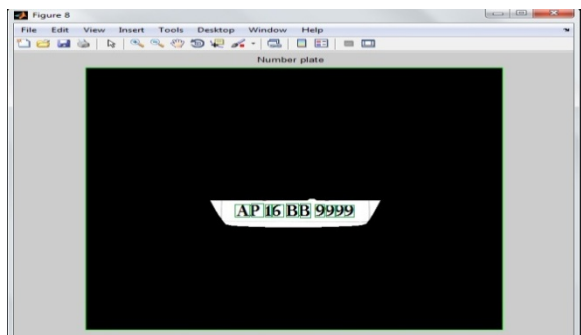


Fig. 11. Number Plate with bounding box image

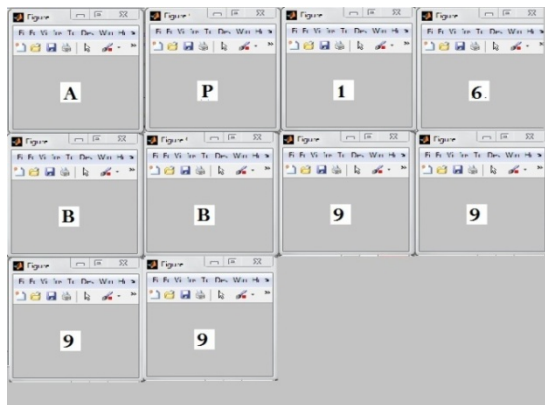


Fig. 12

The above figure shows the image of each character that is present in the number plate of the vehicle sequentially.

E. CHARACTER RECOGNITION & DISPLAY THE RESULT

It is employed for the purpose of conversion of images of text into characters. Number plate recognition is now used to compare the each individual character against the complete alphanumeric database using template matching. The matching process moves the template image to all possible positions in a larger source image and computes a numerical index that indicates how well the template matches the image in that position. Matching is done on a pixel by pixel basis.

The template is of size 42 x 24 as shown in Fig.13.Since the template size is fixed, it leads to accurate recognition.



Fig.13. Templates Used for Template Matching

IV. MATLAB RESULTS

The final result of ANPR system is shown in Fig. 14 below:

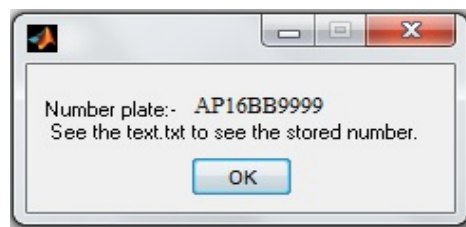


Fig.14. Image of Result

It displays number plate of the desired vehicle.

The number plate as text file is displayed as shown below in Fig. 15:

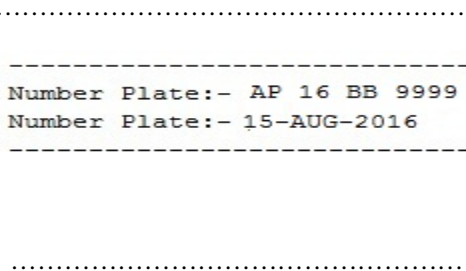


Fig. 15. Image of result stored at text file

The above Fig. 15 shows the number plate of the vehicle and also the date on which the image of the vehicle is captured.

V. APPLICATIONS OF ANPR SYSTEM

- 1. Parking:-** The ANPR is used to automatically enter prepaid members and calculate parking fee for nonmembers.
- 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.

6. Airport Parking:- In order to reduce ticket frauds or mistakes, the NPR unit is used to capture the number plate and image of the car.

VI. CONCLUSIONS

In this system, 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.

Similarity between certain characters, namely, O and D; 5 and S; 8 and B, E; O and 0, etc. and

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 . which can be properly removed by enhancing this approach further. Thus a new framework will be generated to implement this system fully in India.

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