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Indian Number Plate Recognition using MATLAB

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***Abstract:*— The Indian vehicles number plates detection is the most interesting and challenging research topic from past few years. It is observed that the number plates of vehicles are in different shape and size and also have different color in various countries. This paper presents an approach based on simple but efficient morphological operation with edge detection method. This approach is simplified to segmented all the letters and numbers used in the number plate by using bounding box method. After segmentation of numbers and characters present on number plate, template matching approach is used to recognition 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.**

***Keyword:*-- Vehicle Image, Extraction of Number Plate. Morphological Operation, Edge Detection, Character Segmentation & Recognition of Number Plate.**

I. INTRODUCTION

Number plates are used for identification of vehicles all over the nations. Vehicles are identifying either manually or automatically. Automatic vehicle identification is an image processing technique of identify vehicles by their number plates. Automatic vehicle identification systems are used for the purpose of effective traffic control and security applications such as access control to restricted areas and tracking of wanted vehicles. Number plate recognition (NPR) is easier method for Vehicle identification.

NPR is also called in different references as:

- ♣ Automatic Vehicle Identification (AVI).
- ♣ Car Plate Recognition (CPR).
- ♣ Automatic Number Plate Recognition (ANPR).
- ♣ Optical Character Recognition (OCR).

II. PROPOSED SYSTEM DIAGRAM

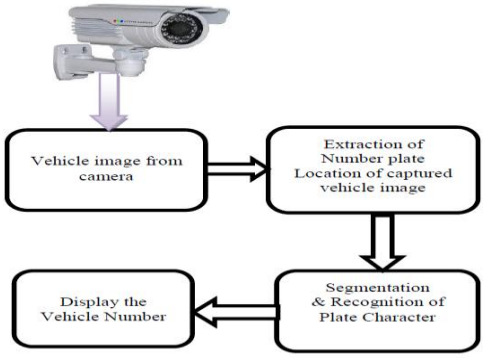

Fig.1. Block Diagram Of proposed system

Input Image :

Camera is been set at required area. And capture the vehicle image .

Figure 2 : Sample of Vehicle Images

Extraction of number plate.

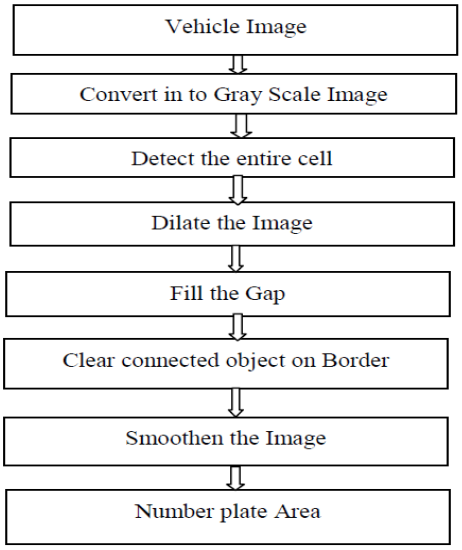

Fig.3. Flow Chart of extraction technique

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1) Vehicle Image & Gray Scale Conversion

Fig.4.Oiriginal image

The inputs to the system were the images of vehicles captured by a camera. Image captured from the camera is first converted to the gray scale image using

I gray=0.114*R+0.587*G+0.299*B……(1)

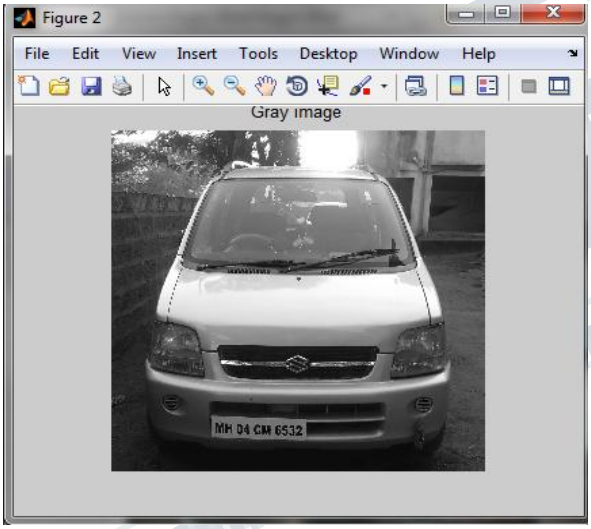

Fig.5. Gray Scale image

2) Detect entire cell:

Two cells are present in this image, but only one cell can be seen in its entirety. We will detect this cell. Another word for object detection is segmentation. The object to be segmented differs greatly in contrast from the background image. Changes in contrast can be detected by operators that calculate the gradient of an image. The gradient image can be calculated and a threshold can be applied to create a binary mask containing the segmented cell. Edge detection is performed on the given image, which aims at identifying points at which image brightness changes sharply or, more formally, has discontinuities. There mainly exists several edge detection methods (Sobel, Prewitt, Roberts, Canny).We use here Sobel operator to calculate the threshold value. Convolution matrices of Sobel edge detector shown as

$$Gx=\begin{pmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{pmatrix} \qquad Gy=\begin{pmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{pmatrix}$$

We then tune the threshold value and use edge again to obtain a binary mask that contains the segmented cell.

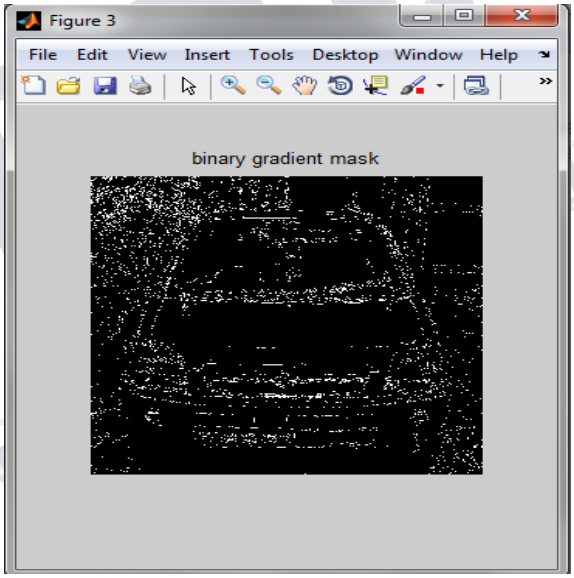

Fig.6. Binary gradient image

3) Dilate the Image:

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, you can see gaps in the lines surrounding the object in the gradient mask. These linear gaps will disappear if the Sobel image is dilated using linear structuring elements. Structuring element is represented as matrices. Structuring element is a characteristic of certain structure and features to measure the shape of an image and is used to carry out other image processing operations, which we can create with the strel function in Matlab. The binary gradient mask is dilated using the vertical structuring element followed by the horizontal structuring element

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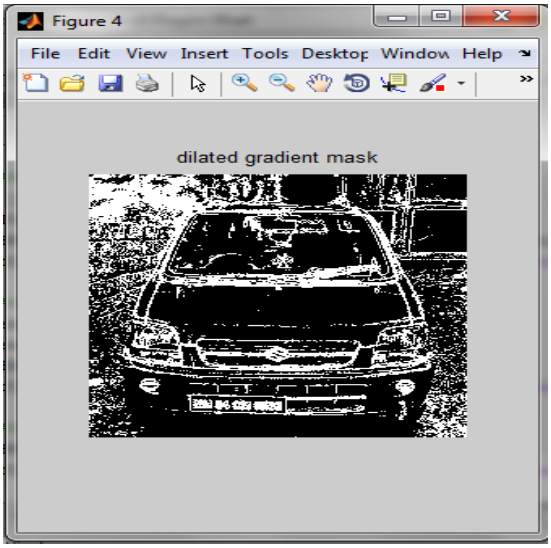

Fig.7.Dilated image

4) ***Fill Interior Gaps*:**

The dilated gradient mask shows the outline of the cell quite nicely, but there are still holes in the interior of the cell.

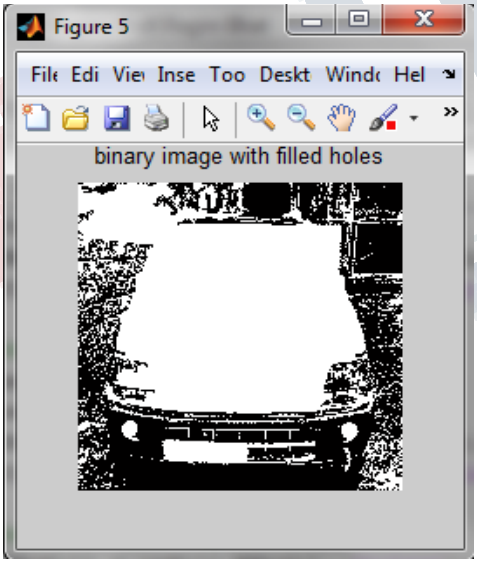

Fig.8. Binary Image with filled holes.

5) ***Remove Connected Objects on Border:***

The cell 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 MATLAB function. The connectivity in the function was set to 4 to remove diagonal connections.

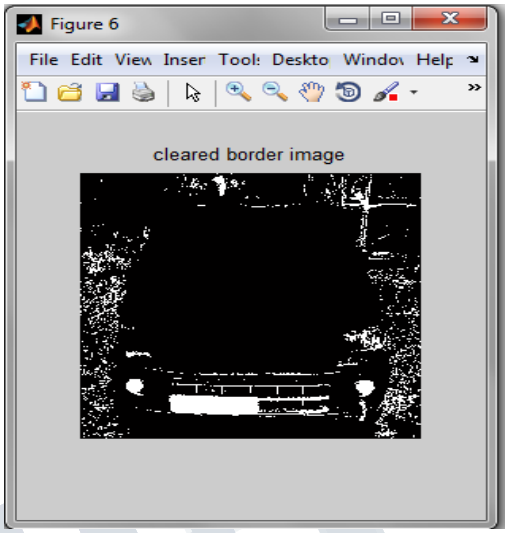

Fig.9. Removed connected object image

6) ***Smoothen the Object is segmented Image:***

Finally, in order to make the segmented object look natural, we smoothen the object by eroding the image twice with a structuring element of diamond, disk, line etc. We create the disk structuring element using the MATLAB function.

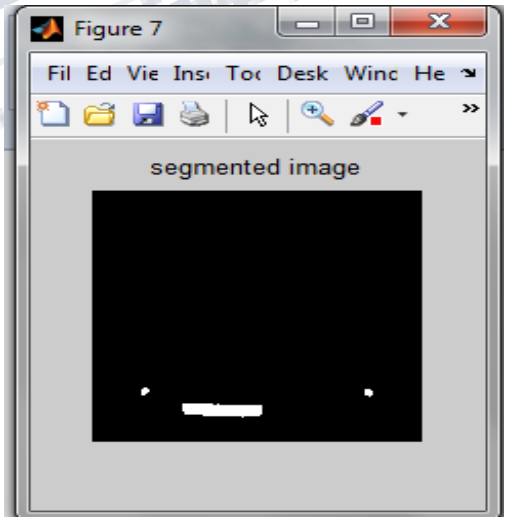

Fig.10. Extraction of number plate area

7) ***Number plate Area:***

Multiply the Segmented Image with gray scale image, we get the only number plate area in an vehicle image.

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Fig.11..Number plate of Vehicle image.

8) Segmentation of Characters on number plate

Segmentation is one of the most important processes in the automatic 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 can be improperly merged together. We can use a horizontal projection of a number plate for the segmentation, or one of the more sophisticated methods, such as segmentation using the Bounding box

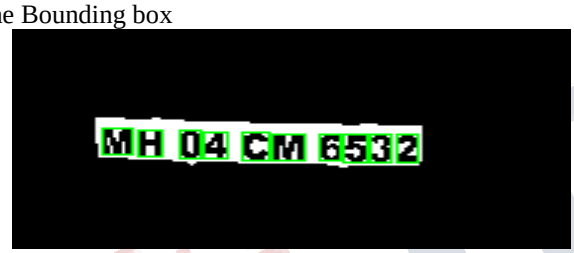

Fig.12. NP with bounding box image

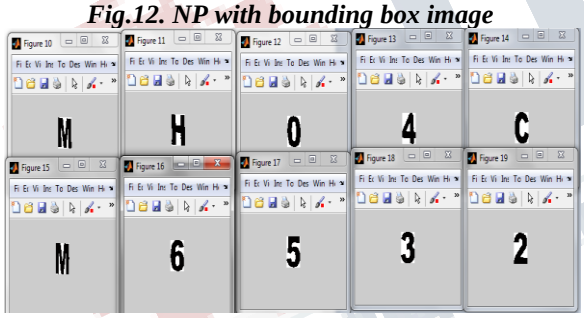

Fig.13. Image of each character.

9) Recognition of number plate:

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. Template matching is one of the Optical Character Recognition techniques [8]. The image is converted into 42x24 bitmap. The character image is compared with the ones in the database and the best similarity is measured. The character recognition actually uses correlation method to match individual character.

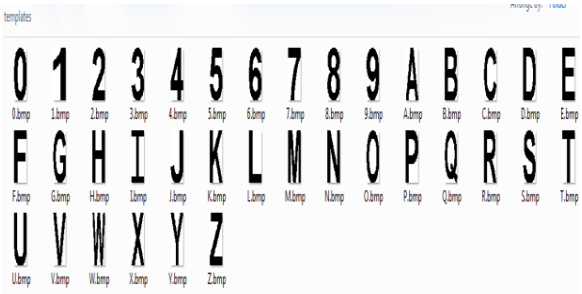

Fig.14. Database of Characters & Numbers

This process involves the use of a database of characters or templates. There exists a template for all possible input characters. For recognition to occur, the current input character is compared to each template to find either an exact match, or the template with the closest representation of the input character

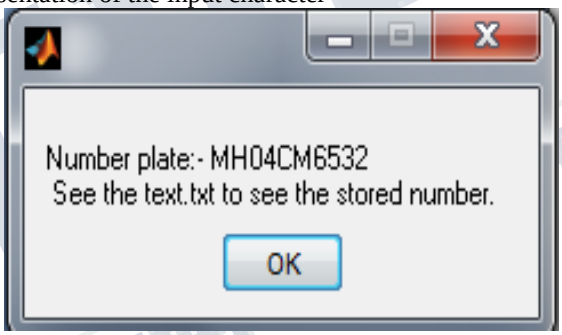

Fig.15. Image of Result

10) Display the Result:

At last when whole number is recognized, output of text file is created & save the information in the following format.

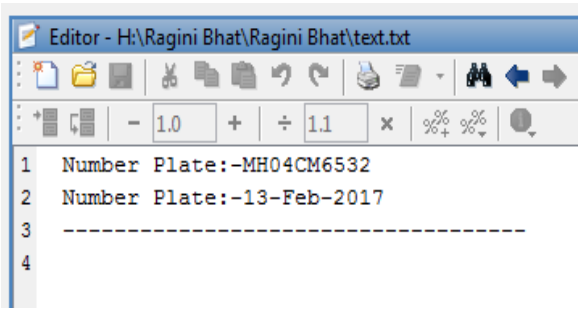

Fig.16. Image of result stored at text file.

III. SOME OF POSSIBLE DIFFICULTIES:

- Broken number plate.
- Plate partially visible or dirt on the plate.
- Blurry images.

- Number plate not within the legal specification.
- Low resolution of the characters.
- Poor illumination and contrast usually because the plate is too far away but sometimes resulting from the use of a low-quality camera.
- Poor lighting and low contrast due to overexposure, reflection or shadows.
- Poor maintenance of the vehicle plate. similarity between certain characters, namely, O and D, 5 and S, 8 and B

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