Vehicle Number Plate Recognition with Bilinear Interpolation and Plotting Horizontal and Vertical Edge Processing Histogram with Sound Signals

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Abstract:- The Vehicle Number Plate Recognition is a system designed to help in recognition of number plates of vehicles. This type of system is designed for the objective of the security system. Vehicle Number Plate Recognition is based on the Image Processing system. Vehicle Number Plate Recognition helps in the functions like detection of the number plates of the car, processing them and using processed data for further processes like storing. The system is simulated and implemented in MATLAB, and its performance is tested on the real image. It is assumed that images of the vehicle have been captured from Digital Camera or Mobile Phones. Alphanumeric Characters on the plate has been extracted using the Template Images of Alphanumeric characters. Many times it becomes very difficult to identify the owner of the Vehicle who violates the traffic rules and drives the vehicle so fast. Therefore, it is difficult to catch and punish those people because the traffic personal might not be able to retrieve the vehicle number from the moving vehicle because of fast speed of the vehicle. Therefore, there is a need to develop Vehicle Number Plate Recognition (VNPR) system as this is one of the best solution to this problem.

Keywords: *Number Plate Recognition, Morphology, Noise Filtering, Image Scaling, Binary Dilation, Thresholding, Image Segmentation, Bilinear Interpolation*

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1. INTRODUCTION

An Vehicle Number Plate Recognition is an Image Processing technology which is used to identify the vehicles by their number plates using Optical Character Recognition. It involves Low-Level Image Processing Techniques with Higher Level Artificial intelligence techniques. In this system the transformation of the pixels of the digital

image is done into ASCII text. Number plate extraction comes under the field of image processing. We assume that the vehicle is static and the images are captured at a particular distance.

Vehicle Number Plate Recognition is developed using simulation tool MATLAB (Matrix Laboratory) in which the images are captured from the Mobile Phones or Camera and after capturing image the colored image is converted into Gray scale for preprocessing. After conversion of image into Gray Scale Image Dilation process is applied on image. In Dilation Process the unwanted holes if present in the image have been filled effectively. After dilation process, Horizontal as well as Vertical edge processing has been done and then both of these histograms passed through Low pass Filters. These filters (LPF) filter out the unwanted noise from image. When unwanted noise from the image is removed then the image segmentation is done and the region of interest is extracted and at last the image is converted into binary form. The conversion is done in the Binary Images because these type of images are easily processed as compared to colored images. After Binarization, each alphanumeric character on number plate is extracted.

2. LITERATURE REVIEW

Peng H et al. Presented an algorithm which is called "Document Image Recognition". It is one of the most effective approach which is used to find the most similar template for inputting the image in a database.

The preprocessing of image and characters are recognized using edge detection segmentation This technique is implemented using MATLAB. Number Plate Recognition algorithm works in different steps firstly Image Acquisition.

Chittode J S et al. developed an algorithm on the basis of Morphological operations and used for number plate recognition.

Singh M et al. developed an efficient approach which works on strategy of closing and opening of Morphological operations. Primary the localization of plate in image has been done and after that the skew correction is done for segmentation of alphanumeric characters. The final step is of Recognization which is done using the template matching.

Kranti S et al. proposed a methodology in which mainly two methods like edge detection and window filtering method. Both methods give efficient results.

Paunwala C.N et al. recommended a methodology in which the ROI is used using Morphological processing and directional segmentation. ROI is the considered as an area which consists of the number plate from which an Alphanumeric characters are recognized flexibly. We can test this type of method is on different databases which contain images.

Othman K et al. used a methodology in which the texture based approach is used and the work is done on edge information for localization and recognition. Neuron Network and Multi layer perceptron are used for the purpose of segmentation of alphanumeric characters of Vehicle Number Plate.

Ganapathy V et al. developed a methodology for Malaysian vehicles which is mainly based on Hough transform and Morphological analysis and THE extraction of number plate is done with 95% accuracy.

3. IMPLEMENTATION

There are five main algorithms which are used to identify the vehicle license plate which are as under:

1. The Location of the license plate which is responsible for finding and isolating the plate in the image.
2. After Location and Extraction of the Image the Image can be transformed into a standard format for brightness and contrast.
3. Orientation and adjustment of the number plate will be done.
4. Segmentation of the plate will be done.
5. Optical Character Recognition (OCR) will be done and the output of the recognition of each character is processed as ASCII code associated with the image of the character.

The flow chart of license plate recognition system implementation in this work is shown in the following figure.

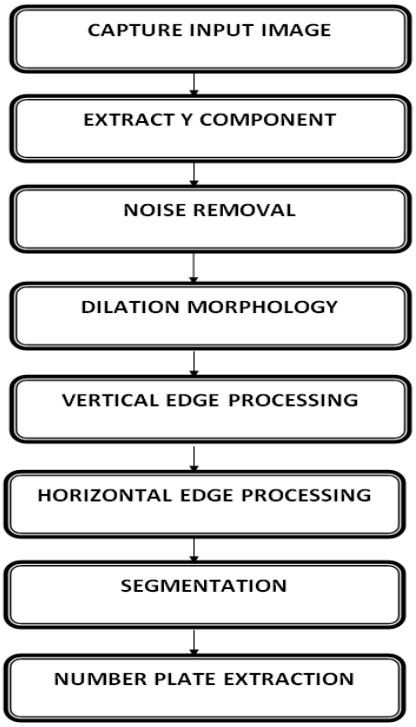

Fig 3.1 The Flowchart of VNPR system

4. MORPHOLOGY IN VNPR

In Morphological image processing the structures of objects within an image are manipulated or modified. To remove noise we can use two algorithms called Dilation and Erosion. Both of these algorithms are also known as Morphological Operators.

4.1 IMAGE SCALING

Image Scaling is process of resizing a digital image. Scaling is a non-trivial process in which the efficiency, smoothness & sharpness of the image is increased. When the image is Bitmap the size of an image is reduced or enlarged.

4.2 NOISE FILTERING

Noise Filtering feature is very interactive as it can remove an unnecessary information from an image and also it can remove many types of Noise present in the image. There are various filters such as low pass, high pass, median, mean etc.

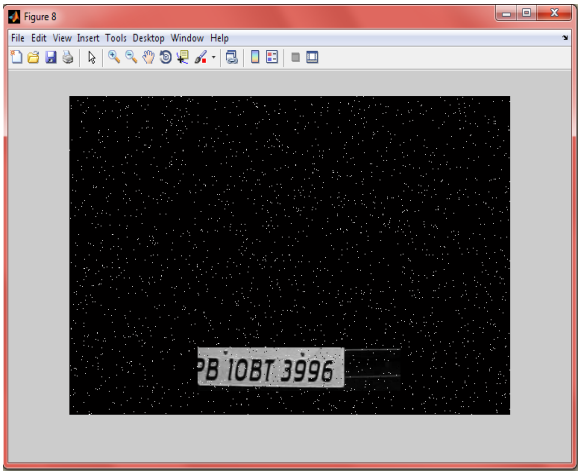

Fig 4.1 Noisy Image(with Salt and Pepper)

Fig 4.2 Removal of noise from image

4.3 BINARY DILATION

When first dilation and then erosion is done with the same mask then that process is called Morphological closing operation and the reverse of this operation is called Morphological opening operation.

A binary image is a set of white and black Pixel. Consideration of only black pixels and the white pixel are

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1177 – 1182

treated as Background. The images are thicker due to dilation operation.

The input image as shown below in Figure

Fig 4.3 Input Image

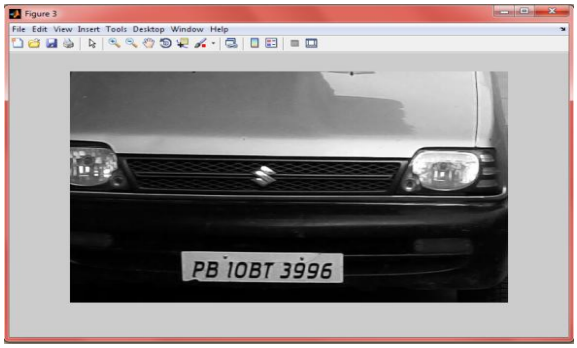

Fig: 4.4 Dilated Image

4.4 IMAGE SEGMENTATION

It is the process in which the subdivision of an image is done into its constituent parts. Segmentation should be stopped when the isolation is done on the objects. For Image Segmentation, Thresholding techniques are used.

4.5 THRESHOLDING

Thresholding is one of the simplest algorithm that is used in the Segmentation. Thresholding consists of filtering the pixels that form the image so that if they exceed. A threshold uses two values 0 and 1. By default the threshold is set to 0. Otherwise , set to 1 or not change.

4.6 BILINEAR INTERPOLATION

We can zoom images by a positive integer factor by using the Bilinear Interpolation method. In this technique we fill the gaps between pixels using the neighbor pixels.

For example, we have an unknown pixel in between four pixels, and let's assume an unknown pixel f(x ,y) which is ringed by four pixels which are:

$Q_{11} = (x_1, y_1)$.

$Q_{12} = (x_1, y_2)$.

$Q_{21} = (x_2, y_1)$.

$Q_{22} = (x_2, y_2)$.

Now by using Bilinear Interpolation(BI) Methodology we can find the values of this unknown pixel.

Now, first of all, we will move in the x direction only.
For x factor, the formula used for BI is:

$$f(x, y_1) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{11}) + \frac{x - x_1}{x_2 - x_1} f(Q_{21})$$

$$f(x, y_2) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{12}) + \frac{x - x_1}{x_2 - x_1} f(Q_{22})$$

Now after calculating these x formulas, now we will move in y direction. Now using these formulas we can quite easily find out an unknown pixel f(x, y) using Bilinear interpolation technique which we will use to make the Vehicle Number Plate Zoom.

5. APPLICATIONS

The various applications are:

- Parking
- Access-control
- Tolling
- Border control
- Vehicle theft prevention
- Journey Time Measurement
- Mainly for monitoring, surveillance and security.

6. RESULT

Whenever the images are captured from the center and the images are captured from the fixed distance then the accuracy of the Vehicle Number Plate detection is better.

Car Number Plate Detection

Step 1: Acquisation of image of Car: Scan image of Car or take it by Digital Camera or by Mobile Phone.

CAR-1 IMAGES

We will View the image by using the code:

```
I = imread ('aarti.jpg');

figure(1);

imshow(I);
```

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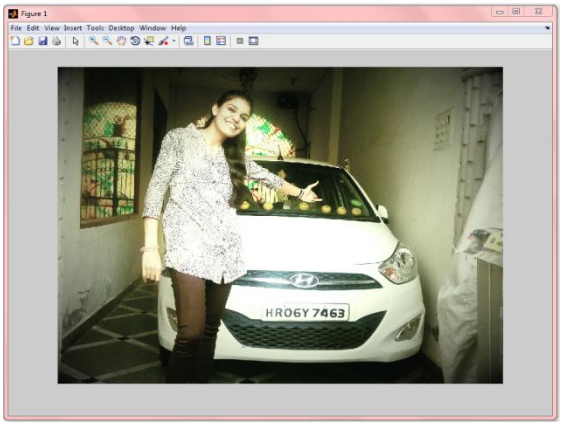

Fig 6.1 Original Image

Step2: Extraction of the Y component will be done. Here we will Convert an Image to Gray.

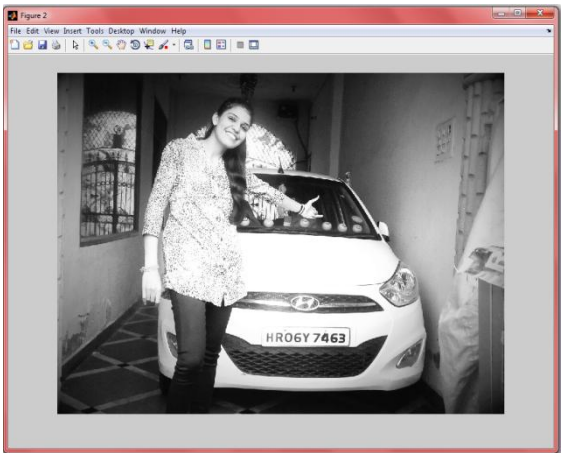

Fig 6.2 Gray image

Step 3: Dilate Image in order to remove the noise

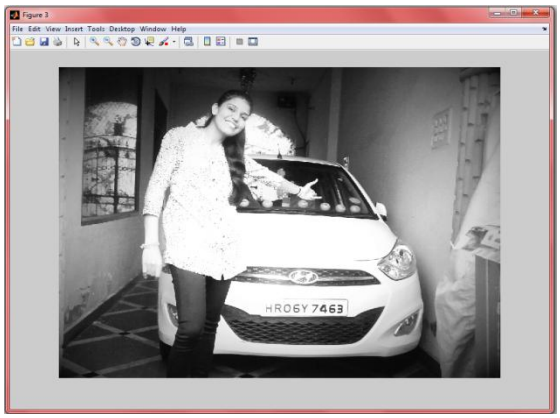

Fig 6.3 Dilate Image

Step 4: Erode Image in order to remove the noise

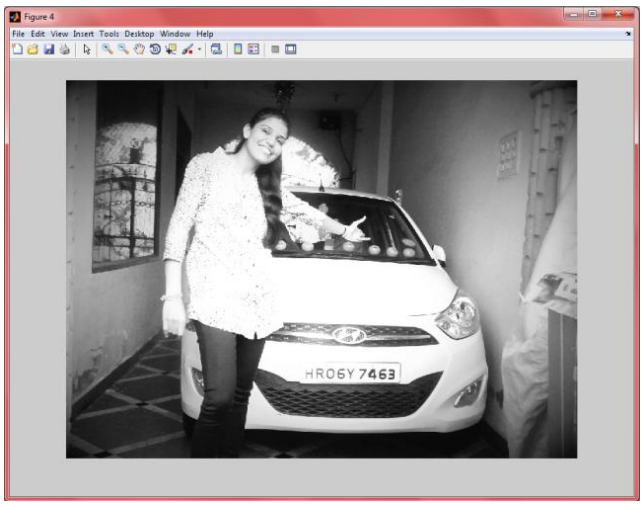

Fig 6.4 Erode Image

Step 5: Process the Edges In The Horizontal Direction

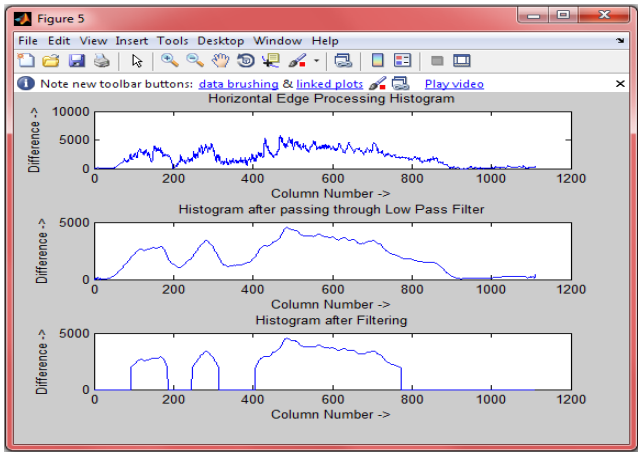

Fig 6.5 Horizontal Edge Processing Histogram

Step 6: Find the Peak Value & Plot the Histogram for analysis & Processing of Edges In Vertical Direction. Also, Find the Peak in Vertical Histogram

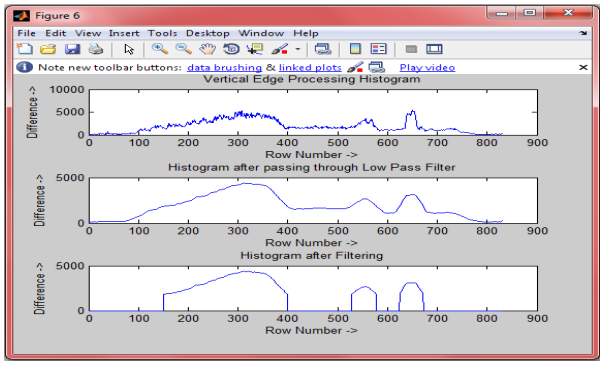

Fig 6.6 Vertical Edge Processing Histogram

Step 7: Smoothen the Horizontal Histogram by applying Low Pass Filter & Filter out Horizontal Histogram Values by applying Dynamic Threshold

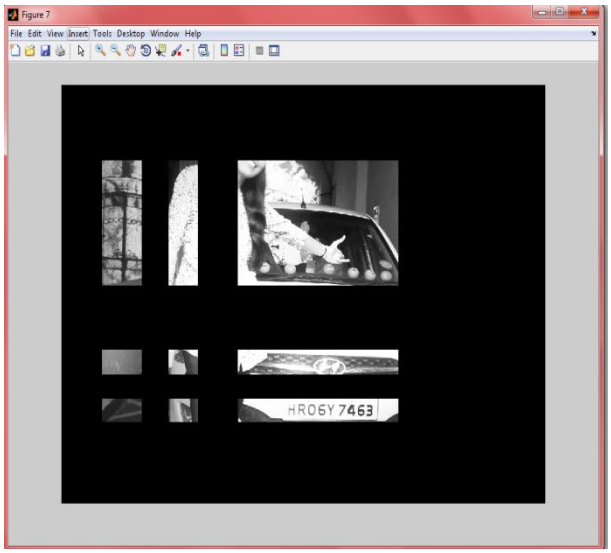

Fig 6.7 Smoothen the Horizontal Histogram

Step 8: Find Probable candidates for Number Plate

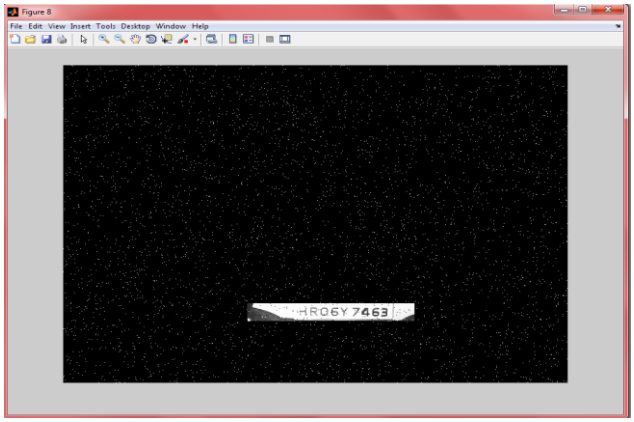

Fig 6.8 Finding of Probable candidates for Number Plate

Step 9 Region of Interest Extraction & Image Zoom & Bilinear Interpolation

Fig 6.9 Interest Extraction & Image Zoom

7. FUTURE SCOPE OF NLP

To fetch the successful result of the program we need to do the small improvements at each and every stage. The image must be centered. Vehicle Number Plate Recognition can be further oppressed for vehicle location tracking, vehicle owner identification, vehicle speed control, vehicle model identification, traffic control. It can also be prolonged as multilingual VNPR to identify the language of characters automatically. It can provide various benefits like security-in case of cautious activity by vehicle, traffic safety enforcement. We do not need to search vehicle owner registration details as with the help of this system we will get the immediate information. If the resolution of the images are low then in that case improvement algorithms will be applied so that the low resolution images will be converted into super resolution images. As we know that most of the Vehicle Number Plate Recognition focus on processing only one vehicle number plate but in real-time there can be more than one vehicle number plates. So, an algorithm must be used which can store the image of multiple vehicle number plate.

8. CONCLUSION

I have implemented the Vehicle Number Plate Recognition. By using Algorithm, Successful detection of the Number Plate region has been done from the image which consists of vehicle number although it has got its own limitation of image processing and other hardware requirements. I have applied an algorithm on many images and I found that it successful recognition of images has been done. The system is implemented in MATLAB and it performance is tested on real images. As there are problems of traffic, stealing cars so there is an immediate need of such kind of Vehicle Automatic Number Plate Recognition system in India. As this system is very economical and eco-friendly. Government should take some interest in developing this system.

SUBCOMPONENTS	ACCURACY	%AGE
EXTRACTION OF PLATE REGION	88/90	97%
CHARACTER RECOGNITION	85/90	94%

Table 6.1: Test Result of License Plate Detection Module

IMAGE QUALITY	AVERAGE EXECUTION TIME
480 X 640	40 SECONDS

Table 6.2: Test Result of Execution Time

9. ACKNOWLEDGMENT

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