

A VEHICLE LICENSE (NUMBER) PLATE RECOGNITION SYSTEM

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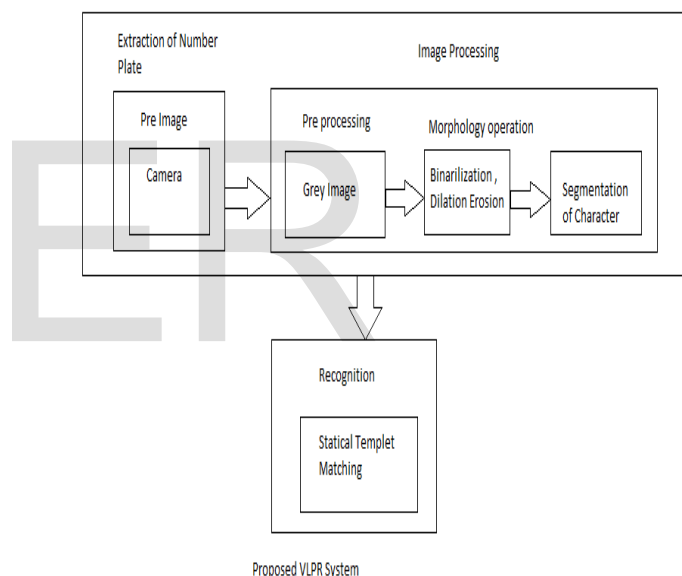
Abstract: Automatic license plate recognition system plays an important role in many applications such as freeway surveillance, law enforcement, electronic toll collection etc. License plate recognition is very difficult because of different environmental condition like fog rain, shadow, and irregular illumination condition, variable in distance, angle of plate and speed of vehicles. If we consider these all effects then VLPR system become very complex. The localization of the number plate of the vehicle images is the basis for any VLPR system. This is the first step in any VLPR system and it is considered as the most crucial step in the VLPR system. The success rate also depends mainly on this stage only. Hence the best localization of the number plate is necessary to get the high recognition rate in any VLPR system. A survey has been made in this paper by considering different methods that have been addressed us to detect the number plate from the vehicle images. All these methods are represent in form of table based on the features that they have used. At the end, we compare the result made in terms of advantages, drawbacks to improve the system techniques

Key Words: VLPR, MSE, PSNR, Morphology

1. INTRODUCTION

VLPR system is important in day today life to improve safety transportation and mobility because of increased in vehicle productivity in changing life style. VLPR systems are generally divided into four steps 1) Vehicle image capture 2) detection of number plate from captured image and extraction of number plate 3) segmentation of characters and finally 4) character recognition. In proposed method as shown in fig (1) first step is image capturing for that we used 8Mps camera. For Image processing we are used MATLAB software.

In preprocessing we first convert RGB image into gray image then applied median filter to remove the noise. Then to extract ROI finding the region that includes most transition points would be adequate for localizing the plate region. Then in Image pre-processing we applied morphological operation to extract the number plate. In this we are checking the continuous rectangular area. Then next step is segmentation of character in number plate. And the last step is Character recognition. In this the characters and numbers were cut into blocks with fixed size These blocks were matching with previous database blocks of characters that is called as templet matching



Proposed VLPR System

Fig -1: VLPR System

2. LITERATURE SURVEY

VLPR system is important in day today life to improve safety transportation and mobility because of increased in vehicle productivity in changing life style. VLPR systems are generally divided into four steps 1) Vehicle image capture 2) detection of number plate from captured image and extraction of number plate 3) segmentation of characters and finally 4) character recognition.[1] There are lot of methods for extraction of number plate form the capture image such as Optical character Recognition (ORC) [2][10][11][7][13] Artificial Neural Network[2],[4],[5],[6],[7],[8],[9], Probabilistic Neural Network(PNN), Sliding concentric window (SCW)[14],Support Vector Machine(SVM)[15],

fuzzy based algorithm, inductive learning [20], region based [21], color segmentation [22], fuzzy based algorithm [23], scale invariant feature transform (SIFT) [24], trichromatic imaging, Least Square Method (LSM).

Sliding Concentric Window [1][14] is the method used to extract the number plate area from captured image then it is a two-step method contains two concentric windows moving from upper left corner of the image. Then statistical measurements in both windows were calculated based on the segmentation rule which says that if the ratio of the mean or median in the two windows exceeds a threshold, which is set by the, then the central pixel of the windows is considered to belong to an ROI (Region of Interest) because number plates contain only two colours black and white or yellow in India. The two windows stop sliding after the whole image is scanned. The threshold value can be decided based on trial and error basis. The connected component analysis is also used to have an overall success rate of 96%. The experiment was carried out on Pentium IV at 3.0 GHz with 512-MB RAM and took 111ms of processing time for number plate segmentation.

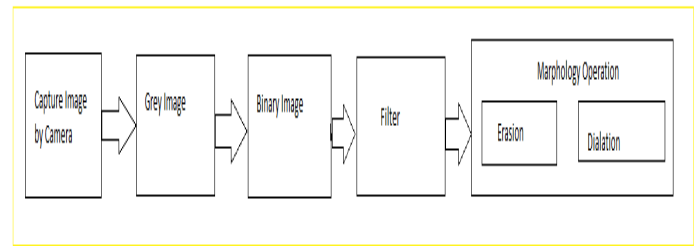
Another SCW based system is presented in [2] for locating Korean number plate. After applying SCW on vehicle image authors used HSI color model for color verification and then tilt was corrected by using least square fitting with perpendicular offsets (LSFPO). The distance between camera and vehicle varies from 3 to 7 meters.

3. PROBLEM DEFINITION

There are a lot of problems in number plate detection like plates may exist in different locations of an image. An image may contain no or many plates. Plates may have different sizes due to the camera distance and the zoom factor. Plates may have various characters and background colours due to different plate types or capturing devices. Plates of different nations may be written in different fonts and language. Plates may be obscured by dirt. Plates may be tilted. In addition to characters, a plate may contain frames and screws

4. PROPOSED METHOD

Pre-processing of Image- The first stage of license plate recognition system is finding the plate location from vehicle image. The plate region consists of white background and black characters normally.



Pre-Processing of Captured Image

Fig -2: Pre-processing of Captured Image

Therefore, the transitions between black and white colors is very intensive in this region. Finding the region that includes most transition points would be adequate for localizing the plate region. So the first step is convert the captured image into grey image and then convert into binary image.



Fig -3: Original Captured Image

- 1) Image processing- By using erosion and dilation morphological operation we can extract the number plate area.
- 2) Extraction of number plate- 1. Rectangle check
Checking that the candidate regions for plate had rectangle shape by compare white pixels count of these regions to their areas with $\square \} 5\%$ tolerance
If count of white pixels = $\square \} 5\%$ area of these region
This region may be a plate Else This region not a plate
2. Plate dimension check
- 3) Segmentation of Characters- Segmentation is one of the most important elements in automated analysis. At this step, the objects or other entities of interest are extracted from an image for recognition processing. In the segmentation of plate characters, license plate is segmented into its constituent parts obtaining the characters individually.

4) Character recognition - After segmentation steps, the characters and numbers were cut into blocks with fixed size These blocks were matching with previous database blocks of characters that is called as templet matching

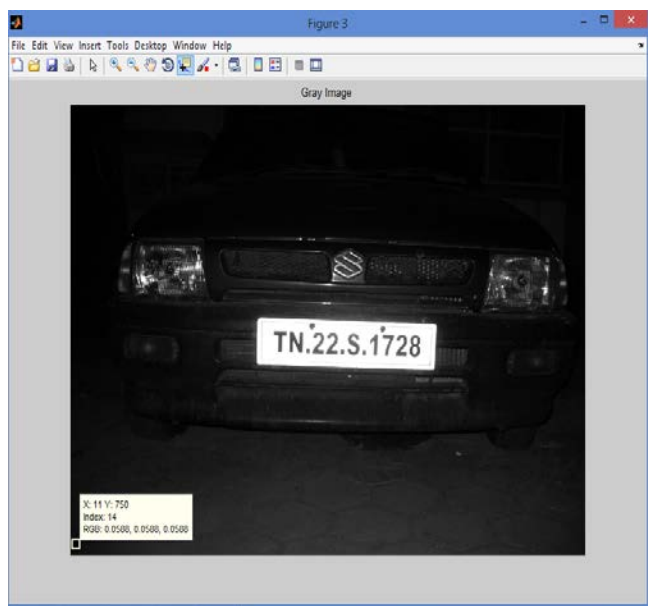


Fig -4: Gray Image

5. EXTRACTION OF PLATE REGION-

In image processing first step is convert RGB image into gray image, it improve the speed of processing and easy to extract area of interest. As there are lot of filters in MATLAB for edge detection like Sobel, canny, Prewitt. To find good method for extraction of number plate following filters are applied

1) Sobel Filter – Sobel filter is also known as sobel operator. It is used for edge detection in an image. Sobel operator is 3×3 matrices. One is Gx which convolves in horizontal direction from right to left. And other Gy which convolves in vertical direction top to bottom.

$$G_x = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix}$$

$$G_y = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ +1 & +2 & +1 \end{bmatrix}$$

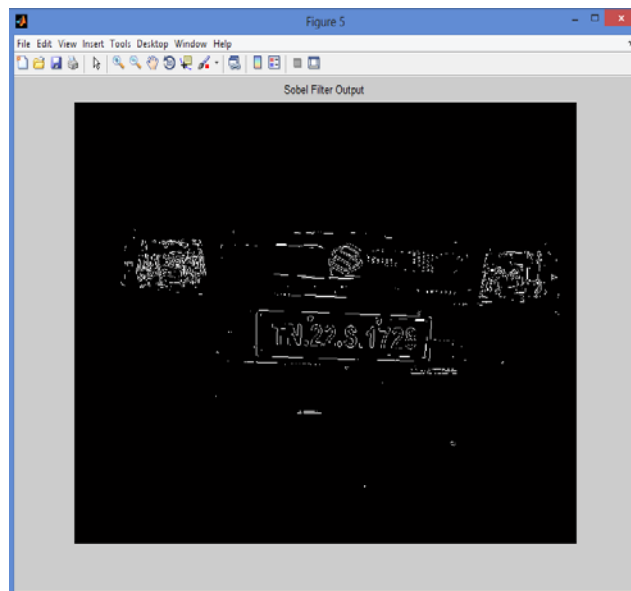


Fig -5: Sobel filter output

2) Canny Filter –In canny filter first Apply Gaussian filter to smooth the image in order to remove the noise. Then to find the intensity gradients of the image we apply non-maximum suppression to get rid of spurious response to edge detection. In this require two thresholds to determine potential edges Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges.

$$B = \frac{1}{159} \begin{bmatrix} 2 & 4 & 5 & 4 & 2 \\ 4 & 9 & 12 & 9 & 4 \\ 5 & 12 & 15 & 12 & 5 \\ 4 & 9 & 12 & 9 & 4 \\ 2 & 4 & 5 & 4 & 2 \end{bmatrix} * A.$$

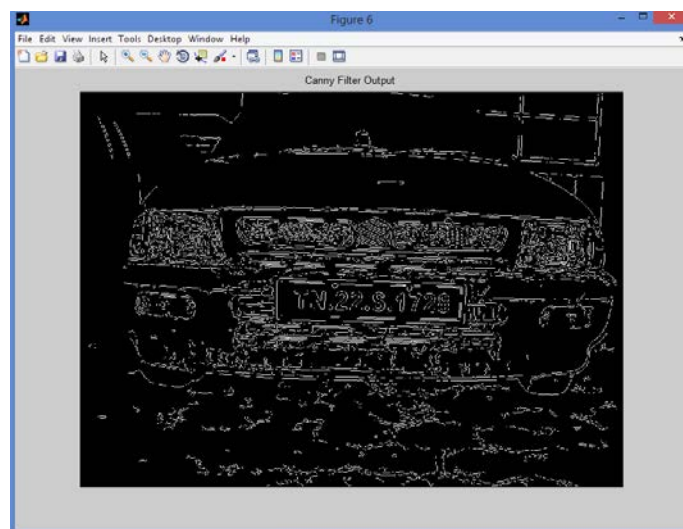


Fig -6: Canny filter output

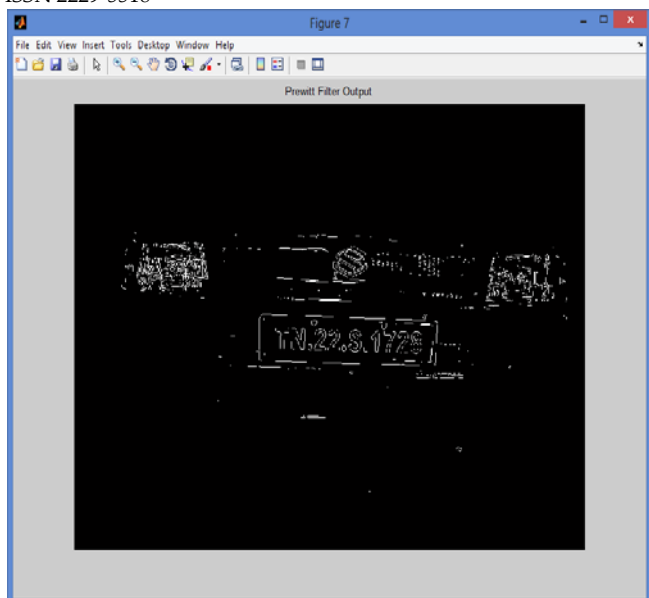


Fig -6: Prewitt filter output

5) Morphology(Dilation & Erosion).-

Morphological operations apply a structuring element to an input image, creating an output image of the same size. In a morphological operation, the value of each pixel in the output image is based on a comparison of the corresponding pixel in the input image with its neighbors. By choosing the size and shape of the neighborhood. The most basic morphological operations are dilation and erosion.

Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the *structuring element* used to process the image. In the morphological dilation and erosion operations, the state of any given pixel in the output image is determined by applying a rule to the corresponding pixel and its neighbors in the input image. The rule used to process the pixels defines the operation as a dilation or an erosion. This table lists the rules for both dilation and erosion.

In this paper to analysis the best method for extraction of number plate here we applied these four filters. And we put the performance of parameter are MSE and PSNR.

Table -1: Analysis of filter in terms of MES and PSNR

Parameters	Sobel Filter	Canny Filter	Prewitt Filter	Morphology Filter
MSE	2.7613417816 16211e+03	2.7595295092 26481e+03	2.7603762677 51058e+03	2.7595934244 79167e+03
PSNR	13.719601966 468112	13.722453182 826442	13.721120759 511733	13.722453182 826442

6. CONCLUSIONS

From above table it is seen that there is no major difference in MSE and PSNR. According to the value of MSE, it should ideally zero. And in results Morphology filter is having less value than other filters. But PSNR value should be more for a good filter. The above table it seen that values of MSE of canny filter and morphology filter are same. So from the observation fig 5. And fig 8 objectively the number plate is more clear in morphology filter output. So Morphology filter is better than other filter for this application.

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