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Name Plate Recognition for Real Time Application

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***Abstract*—the era of automation brings comfort and ease in the life style. The security, safety and information management issues are the most vulnerable issues which need to be resolved at every possible level. The traffic monitoring is one of the important issues in this world of growing population and vehicle density. It is very essential to monitor, record the traffic movement for smooth management. The manual ways to keep on watching is impossible due to exponential growth in the number of vehicles running on the road all the time. Obviously the security, monitoring of vehicles & name plate reading automata ion becomes necessary for vehicle management system. This ensures continuous reading, recording of vehicle & person details. In this paper, we present the analysis of various techniques used in name plate recognition system and presents a real time algorithm of name plate reading system that promises better and accurate results.**

***Keywords:* -- Template Matching, Morphological, Segmentation, and Real Time**

I. INTRODUCTION

The name plate reading system has a great demand in the security, safety and management of smart city. This system can be used in applications such as safety in traffic, e-toll collection, smart car parking, and intelligent parking applications [4][5][6]. It has become a popular area of research because it is difficult to achieve complete accuracy in the name plate recognition system. The major problem that restrict the accuracy are environment oriented issues like illumination and shadow; the other factors are the in consistency in size of the name plate and font type.

The use of preprocessing is also dependent on the way of capturing image. If a tilted name plate is captured then the orientation of the name plate should be made proper such that the character recognition and identification is accurate. A name Plate can be extracted by using image segmentation methods. The previous work presents numerous segmentation techniques amongst which theimagebinariza method is more popular used to transform the RGB image to binary image. A threshold is selected depending by trial and error, method so that at the output, the image created should have visibly distinguishable pattern or design.

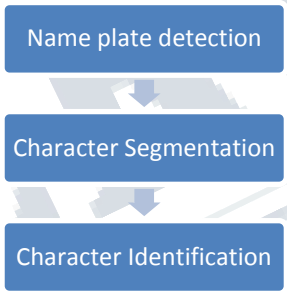

Figure 1: General process of name plate recognition

The selection of the threshold can be automated within the system by choosing adaptive threshold determination technique; the other segmentation technique includes use of the features to perform image segmentation. The edge feature of an image can be used for this purpose. The edge detection algorithm is applied to the image and the edge information is obtained. As the edges of the name plate are available, it becomes easy to segment the image. But in a complex image with many edges other than that of the name plate, this method may fail. Various popular edge detection filters like Canny edge detector, Sobel operator and Laplacian operator are used for edge detection; the more reliable technique to extract feature is the Hough Transform. It is used to detect the line features in the image frame captured by the system. Further it can also be used to localize other shapes like square or round shape. [12]; Blob detection is also used for segmentation in an image by differentiating the color blobs in the frame [1]. It helps to mark a complementary regions in the image frame. Couples of popular blog detection algorithms are Laplacian of Gaussian (LoG) and Difference of Gaussians (DoG) used in number plate detection and identification. Connected Component Analysis uses D-connectivity principle to find

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the region with similar color or pixel intensities. The figure 1 shows the general process of name plate segmentation and detection.

In section II we present a review and in section III, we describe our proposed technique for name plate reading with implementation. In section IV the results are presented. Finally conclusions are in section V.

II. LITERATURE REVIEW

A survey paper by Patel and Shah[1] presents a detailed survey of the techniques used at different stages in the name plate detection system. The methodologies: Otsu thresholding for segmentation, mathematical morphology, blob extraction, character segmentation. Median filter, blob colouring, and peak to peak value methods. The popular methods for character identification are template matching, artificial neural network[1][7] ,Optical Character Recognition(OCR)[8][9] ,Region Based(RB) and Colour Segmentation(CS)[10] and Scale Invariant Feature Transform(SIFT)[11] . The paper also states that there is wide scope for this application in India but the research for name plate recognition is less compared to other countries [1]. The accuracy of most of the implementation is limited by the surrounding adverse conditions.

Yang proposed a pre-processing algorithm to enhance image after capturing through image acquisition device [2]. The localization of the name plate is based on color and shape information of the image. The analysis present that the color and shape based segmentation produces better and accurate results. Also the speed of the algorithm is faster than the name plate positioning algorithms based on the gray scale segmentation methodology. The image captured is converted to gray scale in the pre-processing stage, followed image binarization using the thresholding technique. The binary image is then used to locate the position of the name plate using the color information in the image [2].

A name plate recognition system is presented by Balmurugan which uses a super-resolution algorithm. The image from camera is enhanced to a higher quality and the segmentation is performed. The optical character recognition method is used to extract the text on the name plate. The number is compared with the regional transport office (RTO) database and the complete information of the vehicle is made available. The algorithm includes interpolation, generation of set of candidate image, combining them to get single image and then perform image processing to extract information [3]

The work by Zunino and Rovetta presents the vehicle license plate recognition system based on Vector Quantization (VQ) technique [13]. This method generate good results and also provide some information about the regions of the image frame. This additional information helps to increase the performance of the system. The method of vector quantization is easy to train and the process of training is very adaptive and can be done on-field.

The name plate reading in the real time traffic motoring system have a lot of noise and hence it is important to remove this noise in pre-processing stage to avoid misinterpretation of the characters. For such applications, Sarfraz et. Al have proposed an approach for real time name plate localization and character recognition [15]. The use of special features help system to adapt as per the distance from camera and varying environmental conditions.

Some of the work discuss the implementation of two point license plate recognition system. The most common approach of template matching in name plate recognition face a problem of misreading the characters. The work by Jeong, Han, et. al. have presented a methodology to compensate this problem of misreading the templates by the use of probability model with weighted function to match the results of both the observations in two point system [14]. The other problem of reversal errors is addressed by defining the depending upon the string length. This help to improve the accuracy of the matching process. One a new approach to use Support Vector Machine (SVM) for the purpose of character recognition [16]. The entire character string is considered as a single object whereas most of the work have segmented each character and then identification process is carried out. This work also focuses on shadow removal using improved Bernsen algorithm along with Gaussian filter and image tilt correction and efficient image pre-processing that helps to make system robust to illumination problem.

In our work here presents an efficient image pre-processing approach for name plate read system and using the revised version of earlier developed algorithm for name plate reading.

III. METHODOLOGY

The name plate reading system uses a standard name plates from the sources available on web. The survey

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above shows that the image pre-processing stage is important one to get accurate result. The USB camera provides a RGB or colour image which is further converted to grey scale image. A median filter is used to eliminate the noise from the image frame. This helps to remove small noise like salt and pepper noise from the image. Median filter is widely accepted at pre-processing stage in the image processing. We considered a median filter of size 3x3 i.e. the mask size. The mask shifts pixel by pixel over the complete image and assigns median of the nine elements to the centre pixel. The image pixel intensity values are scaled such that the higher intensity values are expanded and lower intensity values are compressed. As there is high contrast between the intensity values of the character and the background, it helps for further processing.

The median filter brings discontinuities in the structures like thin straight line or small rounds in the image frame and hence to bring structures in proper order, we have applied the morphological operations like opening, closing, erosion and dilation. This helps to increase the accuracy in the detection system. Closing operation equation is

$$A \bullet B = (A \oplus B) \ominus B$$

Where,

A – Image Frame

B – Structuring element

$\oplus$ – Morphological Dilation

$\ominus$ – Morphological Erosion

The morphological operations make the letters and the numbers more thick and hence making it easy to detect and identify. The image pixel values are then normalized between 0 to 1 and then binary image is generated. Since binary image is a logical image values 0 and 1.

$$BinaryImg(i,j) = \{ 255, \quad Img(i,j) > Threshold$$

$$\{0, \quad Img(i,j) \leq Threshold$$

Now, the character is detected by blob extraction method or the connected pixel methodology. This generates a binary image in which the characters are distinguishable. The last stage is to identify the characters. The template matching algorithm is used to identify the letters and numbers which used predefined template. The pseudo-code of the algorithm implementation is described below.

```
Initialization parameters;
Load Image ;
for i 1 to row
   for j 1 to columns
   Image2(i, j) = Value* (Input Image(i,j)/value ).^ factr
    end
end
Image3 = gray(Image2)
Image3 = Spatial Median Filtering(Image3)
Image4 = Morphological Closing(Image3)
BinaryImage=Conver Image To Binary(Image4)
Blobs = Get Blobs in Binary Image
Character array
=Get Character Template Matching(parameters)
End
```

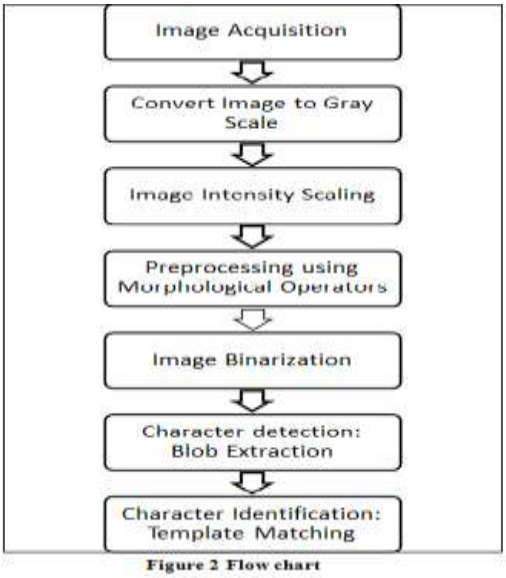

Figure 2 Flow chart

Figure 2 Flow chart

IV.RESULTS

In Figure 3, 4 and Fig. 5 shows the results of the algorithm described above. Fig.3a is the input image whereas Fig.3b shows the extracted characters from the image. The output image is a binary image with the letters in white. After matching the templates with the image shown in fig.3b, the letters are identified. Similarly, the fig.4a shows the input image and the Fig.4b shows the output after processing and character detection. The algorithm required 0.8 sec to execute on the image of 480x640. The algorithm

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is implemented on MATLAB R2012a which provides good results.

Figure 3: (a) Input Image (b) Processed Image

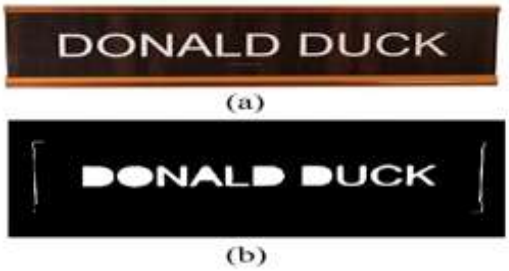

Figure 4: (a) Input Image (b) Processed Image

Figure 5: (a) Input Image (b) Processed Image

V.CONCLUSION

The paper shows the implementation of an algorithm for name plate recognition system. The preprocessing stage using pixel intensity scaling and morphological operators helps to efficiently detect the character with in further stage and hence our algorithm is more efficient. The morphological operation increases the thickness of the character and also removes discontinuities. Amongst the character identification technique, the template matching technique is most time efficient and also generates good results. If the difference in size of the template and character in the captured image is much larger then it may not detect identify the character correctly and hence supervised character reading technique will help to decrease the false detection rate of the system.

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