An Approach towards Detection of Indian Number Plate from Vehicle

Sourav Roy, Amitava Choudhury, Joydeep Mukherjee

Abstract*—Vehicle number plate recognition is the most interesting and challenging research topic from past few years. It is shown that the number plates are different shape and size and also have different color in different countries. In India the most common vehicle number plate used yellow or while as background and black used as foreground color. In this paper we proposed a system to localization of number plate mainly for the vehicles in West Bengal (India) and segmented the numbers as to identify each number separately. This paper presents an approach based on simple and efficient morphological operation and sobel edge detection method. We also presents a simple approach to segmented all the letters and numbers used in the number plate. After reducing noise from the input image we try to enhance the contrast of the binarized image using histogram equalization. We mainly concentrate on two steps; one is to locate the number plate and second is to segment all the number and letters to identify each number separately. The project develops by using MATLAB7.4.0.

Keywords*—Number plate localization, Morphological operation, Character segmentation, Thresholding, Edge detection.

I. INTRODUCTION

Vehicle number plate Identification (VNPI) is a part of digital image processing which broadly used in vehicle transportation system to identify the vehicle. Number plate recognition systems have wide range of application such as traffic maintenances, tracing stolen cars, automatic electronic Toll collection system and many more. But the main aim is to control the traffic management system. In State like West Bengal (India) the traffic management system developing day by day. In India the number plate containing white background with black foreground color for private cars and for the commercial vehicle used yellow as background and black as foreground color. The number plate start with two digit letter "state code" followed by two digit numeral followed by single letter after those four consecutive digits as the below figure1.1.

Figure 1.1-sample of number plate

From the figure 1.1, 1 indicates the Country code, 2 indicate the state code, and 3 indicate the district code, 4 indicate the type of vehicle and 5 indicates the actual registration number. Locating the number plate is very challenging work in the field of image processing. The whole system mainly consists of two steps. First to identify the position of the number plate from the particular vehicle and then segmentation of all the numbers and letters of the number plate. The identification task is challenging because of the nature of the light. The location error will increasing if the color of the number plate is very similar to the background. Noise on the number plates some time cause of error and low acuracy. There are some limitation that led to failure in most practical appliction due to the diversity of the number plate characteristics and the complexity of the natural environment like rain, snow, for etc.

In this paper, we proposed a method mainly based on edge detection and morphological operation and reduce the noise using mid-filtering noiseremoval method.

II. RELATED WORK

Many plate detection, segmentation algorithm have been proposed to implement VNPI system. Number plate detection algorithm can mainly classify into three classes: edge-based, color base and texture based.

The most popular method used for license plate identification is described by Dening Jiang, Tulu Muluneh, Tiruneh Embiale, Ashenafi Gebrehiwot in "Car Plate Recognition System" [1].

Hulli Hsan and Runping Han proposed a method to extract number plate to location based on the edge detection and color information [2].

Ch. Jaya Lakshmi, Dr. A. Jhansi Rani, Dr K.Sri Ramakrishna, M. kanti Kiran and V.R Siddhartha proposed a novel approach for Indian license plate recognition system. [3].

License plate location algorithm based on edge Detection and morphology are describe in [4] [5] [6] [7].

To locate the number plate its first to identify whether any noise added to the plate. This noise may be the part of outside environment. Seyed Hamidreza Mohades Kasaei and Sayed mohammadreza Mohades Kasaei proposed a method

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to extracting and recognize the vehicle number plate for passing under outside environment [8].

An efficient method of locating vehicle license plate is proposed by Zhigang Xu and Honglei Zhu [9].

Several segmentation and recognition method are used to number plate segmentation [10]. More correct and efficient segmentation [11] of number plate will produce good and more efficient recognition.

Based on the above mentioned method, many number plate localization algorithms have been developed. In this paper, an improved and efficient approach is identified with high detection rate based on sobel edge detection and morphological operation.

III. PROPOSED METHOD

Number plate is a pattern with very high variations of contrast. If the number plate is very similar to background it's difficult to identify the location. Brightness and contrast is changes as light fall changes to it. In this paper the morphological operations are used to extract the contrast feature within the plate.

The work is divided into several parts:

A. Input raw image
B. Image binarization
C. Reduce noise using mid-filtering method
D. Enhance contrast using histogram equalizer.
E. Plate localization
F. Character segmentation

Figure2.1 shows the basic step diagram of our proposed method.

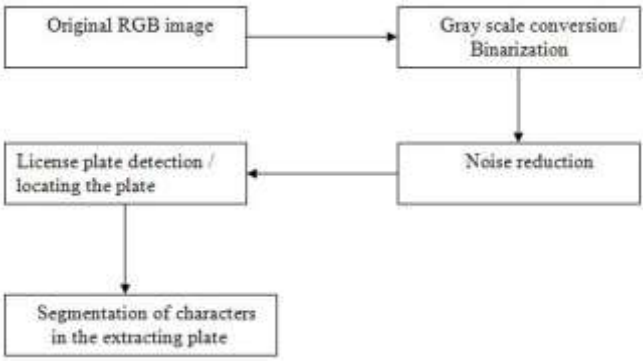

Figure 2.1- Block diagram of proposed approach.

A. *Input raw image*

Input the image that is taken from the car [Figure 2.2].

Figure: 2.2- input car image

B. *Gray scale conversion*

From the input RGB image it has to be convert to gray scale and the 8-bit gray value is calculated.

C. *Noise reduction*

We used median filtering technique to reduce the paper and salt noise. We have used 3x 3 masks to get eight neighbors of a pixel and their corresponding gray value.

D. *Contrast enhancement using histogram equalization.*

Using histogram equalization technique the contrast of each image is being enhanced. The function used to enhancement that is

J=histeq(k); histeq enhances the contrast of the images by transforming the values in an intensity image.

When image pixel intensity of 8-neibourgh connectivity, we supply a desired histogram, histeq chooses the grayscale transformation T to minimize

$| c_1 (T (k))-c_0 (k) |$

In below we state the change of histogram from original image (Figure 2.3) and after applying the contrast enhancement using histogram equalization (Figure 2.4).

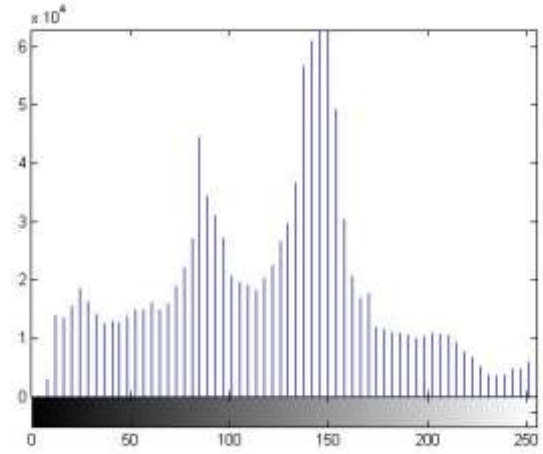

Figure2.3- Before contrast enhancement

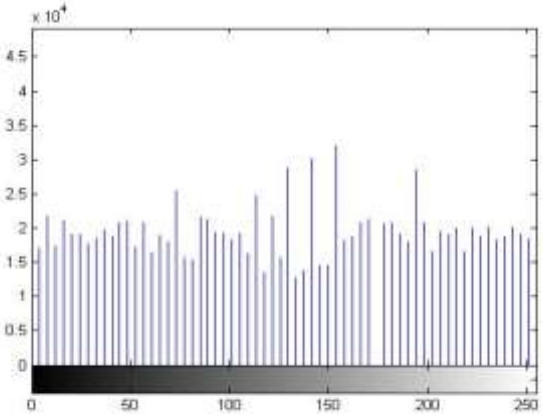

Figure2.4- After contrast enhancement.

E. *Plate localization*

The basic step in recognition of vehicle number plate is to detect the plate size. In general number plates are rectangular in shape. Hence we have to detect the edges of the rectangular plate. Mathematical morphology will be used to detect that region.

Using Sobel edge detector we used to high light regions with a high edge magnitude and high edge variance are identified. Depending upon the threshold value edge will be detected from the input image. Figure 2.5 shows the input image before applying Sobel edge detection algorithm and figure 2.6 shows after applying the Sobel edge detection method.

Figure: 2.5- Grayscale image after image enhancing.

Figure: 2.6- After applying 'Sobel' edge detection method

After edge detection removes all connected components that have lower than p(eight pixel in our method) pixels. Thus it will produce another binary image [2.7]

Algorithm:

1. Determine the connected components.

```
L= bwlabeln(BW,conn);
```

2. Compute the area of each component.

```
S= regionprops(L,'Area');
```

3. Remove small objects

```
Bw2 = ismember(L,find([S.Area] >= p));
```

Figure 2.5 shows the shows the input image after removing the connected component fewer than 8 pixels.

Figure: 2.7-After removing lower pixels.

Matlab toolbox function provide a function imfill(BW,'holes') that fills holes in the binarized image called BW. The set of background pixels are known as hole that cannot be reached by filling the background from the edge of the image. Figure 2.8 shows after remove lower pixels connected components fills the holes

Figure: 2.8- After filling the 'holes'

Using flood fill algorithm we fill the hole to locate the plate region. Now omitting the lower pixel components to gets the actual plate.

Algorithm:

```
        for m=2:p-1
  for n=2:q-1
    if(In(m,n)>0)
      c=Connectivity(H3,m,n);
      if(c>2)
        In(m,n)=1;
      else
        In(m,n)=0;
      end
    end
  end
end
```

Connecting edges will be removes in figure2.9

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Figure: 2.9- image after removing components with connectivity less than 1000 pixel

Using Matlab toolbox function bwareaopen() that specifies the desired connectivity. All components connectivity lower than 1000 pixel are removed to get the actual location of the number plate [Figure 2.10].

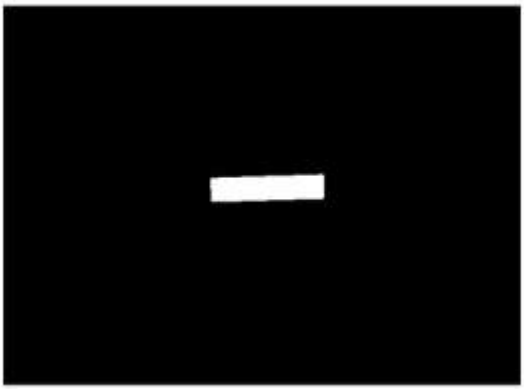

Figure: 2.10- Locate the number plate after morphological filtering.

We output the four vertexes coordinates of the last selected region after morphological filtering and extract the number plate [Figure: 2.11].

Figure: 2.11- License plate before crop

The final positioning of the number plate after cropping [Figure2.12].

Figure: 2.12- The final number plate after the positioning.

F. Character Segmentation

Matlab toolbox function provides a function called regionprops(). It measures a set of properties for each labeled region in the label matrix. We use boundingbox to measure the properties of the image region. After labeling the connecting components, the region will be extracting from the input image [Figure: 2.13].

Figure 2.13- Segmentation of characters

IV. EXPERIMENTAL RESULTS

We have run our proposed method on desktop computer with Core2 due processor 2.26 MHz with 1 GB of RAM under MATLAB R2007a environment. Several vehicle images are captured using 1.3 mega pixel camera as well as 12 mega pixel cameras. In the experiments, we test our proposed method on the different type car image to identify the location accurately.

Fig: 3.1-Proper light on cropping.

Fig 3.2-Successful number plate.

Figure: 3.3 More lights on background than the number plate

Figure: 3.4-Problem in distinguishing the actual plate position due to light.

V. CONCLUSION AND FUTURE WORKS

In this paper, an efficient less time consuming vehicle number plate detection method is proposed which performed on complex image. By using, Sobel edge detection method here detects edges and fills the holes less than 8 pixels only. To extracting the license plate we remove connected components less than 1000 pixels. Our proposed algorithm is mainly based on Indian automobile number plate system. Extraction of number plate accuracy may be increased for low ambient light image.

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