

Automatic license plate recognition using optical character recognition and template matching on yellow color license plate

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Abstract: Automatic license plate recognition is used to recognize the characters from license plate image. It is widely used in various areas such as traffic control, robbery, and surveillance. The proposed method applied on yellow color license plate. It has two main stages. Firstly, exact location of the license plate is detected from an input image by using image acquisition and optical character recognition and Sobel edge is used for character segmentation. Secondly, template matching is used to test the recognized characters with templates. This paper also proposes vehicle authorization by checking the license plate number from database and electronic mail is send to administrator if authorization fails.

Keywords: Automatic License Plate Recognition (ALPR), Optical Character Recognition (OCR), Sobel Edge, Template Matching, Road Transport Office (RTO).

I. INTRODUCTION

The ALPR is key part of traffic management system. The number of vehicles has been increased drastically as compared to the infrastructure growth. ALPR technology is persistently growing popularity, especially in security and traffic control. It plays essential role in other numerous applications also, such as traffic law enforcement [1], toll enforcement by police and military force for electronic toll collection [2], and parking [3]. In 1976 ALPR was invented in the UK at Police Scientific Development Branch. The goal of ALPR is to extract and recognize the license plate without any human involvement. The variations in license plate and environment causes problem in detection of vehicle license plate such as size, font style, color, location of plate on vehicle and plates may have different intensity due to headlight or due to environment.

The ALPR uses image processing software to examine the images of vehicle and extract the license plate number. The main benefit is to recognize the license plate in an image which can be a static image or real time image. The most difficult job is to identify the license plate in an image. The basic steps in ALPR are license plate extraction, license character segmentation, license character recognition. License plate extraction is very significant step because it directly affects the further levels. It is used to localize the license plate. The input will be an image that contain vehicle with license plate. The Image Acquisition and Optical Character Recognition is applied to detect the license plate from input image. Character segmentation is used to segment the characters from license plate. The input will be the output from license plate extraction. Sobel Edge is used to separate the characters from extracted license plate. Character recognition is used to recognize the characters from each segmented characters. Template Matching is used to test the characters with Templates.

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The Road Transport Office (RTO) has database of registered license plate. The license plate can be checked from a database which contains complete information about the vehicle. It helps police and military forces in finding stolen vehicles and solving cases. In this paper recognized characters are checked for vehicle authentication. If registered license number is not authenticating, electronic mail is send to the administrator.

II. RELATED WORK

There are lot of techniques have developed for extraction of license plate. The shape of license plate is rectangular. The Edge Detection methods are used to locate the rectangles from an image [4] [5]. This is very simple and fast technique. Morphology [9] [10] [11] is used to extract the license plate from the original image. It helps to remove unwanted small parts from license plate. In [7] hybrid approach is proposed by combining Edge Statistics and Morphology. The accuracy of finding license plate is 99.6%. In [6] Hough transform is used to find the straight lines in an image. The straight lines locate the license plate. It is boundary based extraction. It requires lot of computational time. To reduce the computational time Contour transform [16] is used with Hough transform. Sobel filters [4] [6] are used to find the edges due to the color change between license plate and car body. In [15] Horizontal and Vertical Projection is use for segmentation. Vertical Projection determines the starting and ending location of characters and then Horizontal Projection is applied to segment the characters. Images are made up of pixels. Pixels are connected in the binary license plate. Then it is analyzed and similar sizes are considered as candidates for license plate region [14]. In [13] Adaptive binarization is used to convert the intensity from evening to noon. In [17] fixed background color is used and it reduces the edge points and removes the fake regions. In [8] Optical Character Recognition is technique in image processing. It is used to classify/ scan alphanumeric text into computer – readable text to recognize the license plate. It requires preprocessing stage to remove the boundaries which helps in recognizing the characters. It process information more quickly, accurately and efficiently and also minimizes the errors. Template Matching [12] is used to test the characters with templates which are designed. It is useful for recognizing fixed size characters and non-broken. It finds small blocks of an image and match with template image. Template design is vital part of template matching. Template design must match templates to it corresponding image also have some amount of mismatch to other templates.

Paper is organized as follows. Section III contains scope of research followed by the proposed methodology and discussion in section IV of this paper. Experimental Results is presented in section V. Finally section VI represents conclusion.

III. SCOPE OF RESEARCH

ALPR has a wide scope in Forensic Research Department and Road Transport Office (RTO). The proposed methodology is easy and fast to identify the area of license plate and recognize the text written on the extracted license plate. The recognized characters are compared with the database for verification of vehicle. It helps police authorities and other crime investigation departments to find whether the number plate is authorized or not.

IV. PROPOSED METHODOLOGY & DISCUSSION

The proposed framework is used to recognize the characters from an image of a license plate. Also it authenticates and sends electronic mail to administrator if license number is not registered in the database. In fig 5.1 the yellow background plates are binarized then pre-processing is done to remove unwanted regions from license plate. Optical characters recognition is used to help in segmentation. The characters are segmented on the basis of Sobel edge

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detection. The characters are segmented. Finally, template matching is applied to recognize the characters. After recognition license plate authentication is checked. If authorization fails electronic mail will be send.

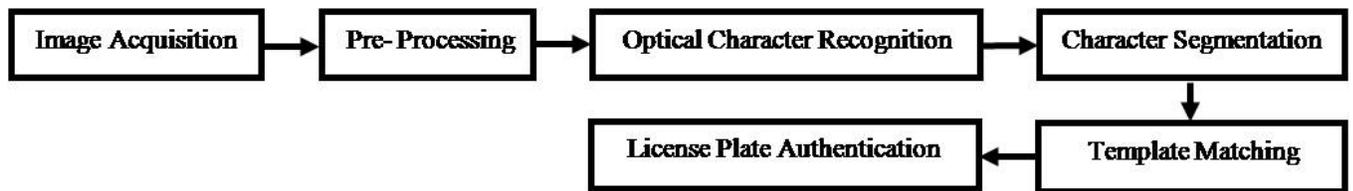


Fig. 1 Steps for the License Plate Recognition

The proposed methodology consists of two main stages:

1. Extraction and Segmentation
2. Template Matching And Authentication

Stage 1 consists of Extraction and Segmentation of images. Extraction locates the area of license plate from an image. Segmentation segments the each character from the license plate. Detailed explanations of the stages are as below:

- *Image Acquisition*

The license plate has background of yellow color. So it is required to find the regions in the image which contain the intensity of three index i.e. R (Red) G (Green) B (Blue) corresponding to the yellow color. Then nearest values of the arena is calculated, considering arena as black. License plate is binarized on the basis of RGB index.

- *Preprocessing*

Getting prop of image area and extreme points by tracing the exterior boundaries of objects and find the properties for each region of objects. Calculate the maximum area where license plate exits by using coordinate based approach. Filters and morphology is applied to fill the gaps in image.

- *Optical Character Recognition*

If any RGB image left in cropped image then convert cropped image to grayscale. Based on threshold value gray image is converted in to binary image. Black pixels are converted in to white pixels and white pixels into black pixels. Now the text color is white and background color is black.

- *Character Segmentation*

The characters are segmented in form of blocks by finding maximum area of each block using Sobel edge detection.

Stage 2 consists of Template Matching and Authentication of extracted license plate. Template Matching recognize the characters from the license plate and verify the license plate. Detailed explanations of the stages are as below:

- *Template Matching*

Database of templates are created of alphanumeric text. Then load the database and compute the correlation between template and segmented blocks. If they match resize the letter of size of template. The output will be the number of license plate.

- *License Plate Authentication*

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 5, May 2014

The number of license plate are matched from database if vehicle number is not found registered the electronic mail is send to the administrator with the image of license plate. The output will be the image of license plate and vehicle and with message license plate is not found.

V. EXPERIMENTAL RESULTS

This method is tested on images having maximum size of 603*399. The images are drawn from web. The images are randomly loaded in to the MATLAB. Color of license plate is yellow as shown in fig. 2 (a). Images are binarized on the basis of RGB index as shown in fig. 2 (b). In fig. 2 (c) Pre-processing is done to find prop of image area and its properties. Coordinate approach is used to find the maximum area where license plate lies on basis of pixels values as shown in fig. 2 (d). It also corrects the position of license plate. The holes and broken part of license plate is filled by using the morphology. Filters are applied to remove the noise. This makes license plate smoother as shown in fig. 2(e). Then inversion of image is done on the basis of threshold values. The color of characters on plate becomes white and background color becomes black as shown in fig. 2 (f). This technique helps in segmentation stage. For character segmentation Sobel edge detection is used. It detects the blocks that contain the characters. Block is separated on the basis of pixel change. When pixel changes from white to black in extracted image then required block is found. When pixel changes from black to white pixel then again new block is found. To recognize the characters from segmented characters is done by using technique known as template matching. It is used to test the characters with templates which are designed as shown in fig. 2 (g). When characters are recognized it is cross matched with the database. If vehicle number is not registered then message is send to the administrator through Electronic mail as shown in fig. 2 (h).



(a)

(b)

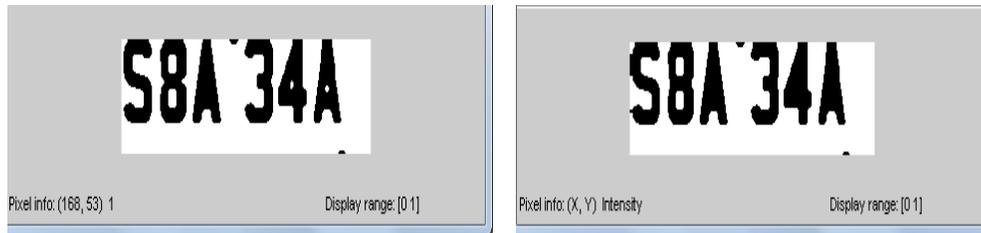


(c)

International Journal of Innovative Research in Science, Engineering and Technology

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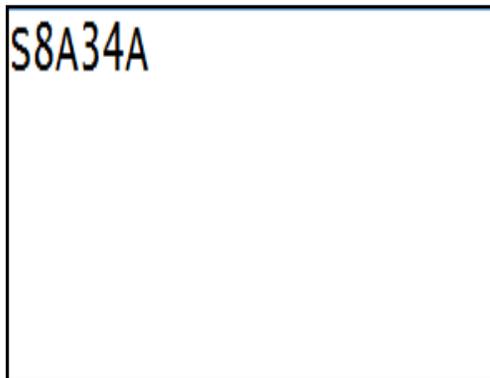


(d)

(e)



(f)



(g)



(h)

Fig. 2. License Plate Extraction and Recognition (a) original image (b) binarized image (c) preprocessing (d) preprocessing (e) morphology is applied to fill the gaps (f) OCR is applied followed by sobel edge detection (g) character is recognized by using template matching (h) electronic mail is send to the administrator because vehicle number is not authenticcate.

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Vol. 3, Issue 5, May 2014

VI. CONCLUSION

The focus of this paper is on recognition of license plate number and authentication of the vehicle number. It helps police and military forces to locate whether license plate number is registered or not. This work proposes license plate extraction technique using optical character recognition preceded by preprocessing and followed by Sobel edge detection in character segmentation. This increased the efficiency to recognize the license plate number. The proposed framework has some limitations also. It is implemented on static images of yellow color single line license plate. In future this methodology can be implemented on real time applications and multiline license plate.

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Vol. 3, Issue 5, May 2014

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BIOGRAPHY

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