Real Time Vehicle Recognition System for Secure Environment

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Abstract. An automatic system based on “Digital Image Processing” technology is developed using MATLAB tool to recognize the vehicle by identifying the license plate. A database is linked to the MATLAB processor, which takes input as the detected number plate. Information about the owner is extracted and electronic format of the challan is generated if the number plate is in wrong format. Also in case of theft or crime, the required number plate is fed to the database system and if it is matched with the detected number plate, an alert is generated. The captured image is in RGB format which is converted into grey scale. Here theories and techniques used to identify the area and Edge detector operators is used to measure threshold values to get the dilated image. After that flood fill operation can be used to stuff the wholes to get a fine binary picture. The fundamental steps to identify the vehicle license plate and plate size, then the partitioned picture is amplified with gray scale only to get the license plate of vehicle. Afterwards the template matching process done to match the image from license plate and template’s picture, thus the number plate detected is then matched with one stored in the database system to get complete information of the vehicle owner. The first section in your paper.

Keywords: Character Segmentation, Image Acquisition, Optical Characters Recognition, SQL database.

1. INTRODUCTION

Automatic license plate recognition is a real time system based on image processing technology to identify the characters from the images of the number plate [2]. It is an advanced machine vision to detect the number plate without human intervention [2]. Identification of vehicle was major issues in all places [1]. Many times it’s become very difficult to recognize the owner of the vehicle who drives fast or violates traffic rules [6]. Therefore, it is not possible to catch and punish those kinds of people because the traffic personal might not be able to retrieve vehicle number from the moving vehicle as the speed of the vehicle is fast [6]. Thus there arises the need to develop the system that detects and keeps the record of the vehicles [1]. ALPR system is an influential technique, used in Smart Transportation System [1][2][8] which brings the information of vehicles that can be passed down for
check out, study and control. Moreover, it is used for many purposes such as adequate traffic control, restricted area control access and tracing of required vehicles, toll collection, detection and prevention of wide range of criminal activities, maintaining law enforcement on public roads [2][4][6][8] [10].

The major steps involved in this system are detection and capture of vehicle picture, plate localization, character recognition, character division, wrong format detection, electronic format for challan generation. The camera placed at the entrance gate will capture the vehicle image of front or back in context of the vehicle and sends it for image processing [10]. The captured RGB image is converted into the grey format [5][7]. The number plate occupies a small portion of the figure. Thus plate localization is used to get a rectangular number plate region in the image having high probability of number plate called the Region of Interest (ROI) [10]. In the character segmentation step, each and every character is segregated and disjointed [11]. These extracted characters from the image are then recognized by template matching process [12].

In case of any theft or crime in which vehicle is involved, the vehicle number can be given in database of the investigation agency. During the recognition process if the number plate matches with the required one (stored in database), an alert is generated [15]. The detected number is also checked whether it is in correct format or not.

The system block diagram of the proposed paper is shown below in fig1.

![System Block Diagram](image)

**Figure: 1 System Block Diagram**

2. **PROPOSED METHODOLOGY**

The blocks of the above proposed system are discussed below

2.1 **Image Acquisition**

This proposed system helps in capturing the image of the vehicle with the help of a camera as shown in fig.2. The image is stored in form of file formats like JPG/JPEG, TIFF, GIF, PNG. In this
system by making use of infrared lightening we allow the camera to capture the image twenty-four hours of the day.

Fig. 2. Captured Image

2.2 Conversion of RGB Image into Gray Image

Color constituents Red, Green & Blue not needed in processing the algorithm of the picture. This Input picture is later converted into a gray scale image (fig.3) of a 2-dimensional array which was earlier illustrated as a 3-dimensional array in MATLAB.

Fig. 3 Grey Image

2.3 Dilation of Image

Dilation process deals with improvement of the input picture via quilting holes now the picture, sharpening a boundary of substances in the picture, merging a disjointed outlines and increasing the illumination of a picture (fig. 4). The enlargement process hence enriches a boundary detection.
2.4 Edge processing by Histogram

Histogram is a display in the form of graph where we can group data into different ranges. In this step both horizontal for column wise & vertical for row wise histogram is used. These graphs constitute the sum total of variations in the gray level of the adjacent pixels. To compute column histogram (fig. 5) algorithm is traversed done every column of the image. The dissimilarity between the second pixel and first pixel is considered and if this variation is more than the threshold value, it is included in the sum total of the variations.

Thus this algorithm moves downward till the column is terminated. The vertical histogram (fig. 6) is calculated by processing the rows instead of columns.
2.5 Smoothening of Histogram Values

The extreme variations in the value of histogram need to be smoothen to forbid the reduction in an information. So that the histogram can proceed using a low-pass filter. Considering the values, we have in the right hand side and in the left hand side we can estimate the average of each histogram values. Thus the smoothening is done for both vertical and horizontal edges.

2.6 Removal of unwanted regions in the Image

An unwanted regions consist of portions in picture having very little dissimilarity among the adjacent pixels that is the rows and columns with less histogram values. It is seen that the number plate contains an ordinary surrounding with dark alphabets and numeric fonts in it, so the distinction in the adjacent pixels particularly at the borders of the characters and the surrounding will be very high. This unwanted region is then eliminated by using a dynamic threshold. Thus the result is a graph representing the areas having maximum possibility of vehicle number plate.

2.7 Character Segmentation

This step deals with locating all the areas in the vehicle image which has the maximum possibility of containing the number plate as shown in fig. 7.

![Fig. 6 Vertical Edge Processing Histogram](image)

![Fig. 7 Segmented Image of Vehicle picture](image)
2.8 Optical Character Recognition

The cropped image is inverted i.e., all white pixels are converted to black and vice versa. Then line separation process is applied in both horizontal and vertical direction. The different isolated characters are then kept in different variables. And then OCR helps in differentiating every single character as shown in fig. 8 and at the end vehicle number is located and kept in a variable in the form of a string.

![Fig. 8 Template for character recognition](image)

2.9 Application of Database system

Now, after the license plate has been detected, we have to send the image file to the database as an input. MATLAB provides us a tool called “Database toolbox”, which detect vehicle number from the captured image and match with prepared SQL database. SQL database is prepared using MATLAB command “ODBC Connection” and vehicle information data collected from RTO regional office.

Information of all registered vehicle owners is stored in the database with all details like name, address, bank details etc. In case any number plate is found to be in wrong format then fine will be deducted automatically from the vehicle owner’s account. Another application of proposed system is in case of theft or crime. If detected vehicle number is lodged in any officials, it will be input to the entire databases at security check points. A query is run to match the plate number with the detected input number plate (involved in crime). As soon as the vehicle is caught, an alert is generated at all the security check points.

3. CONCLUSION

Here in this system, an image processing technology is implemented to recognize the vehicle by detecting the number plate region. In the beginning, plate region is localized by means of morphological process and later number plate characters are isolated one via one using division method. Finally, the extracted number in the string is then compared with database to distinguish the plate characters. An alert is generated if the detected number plate matches with the number plate stored (in case of theft or crime) in the database. The detected number plate can also be checked that weather it is in right or wrong format. An e-challan is generated against the owner is generated if the number plate is in wrong format.

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