International Journal of Research in Engineering, Science and Management
Volume-2, Issue-10, October-2019
www.ijresm.com | ISSN (Online): 2581-5792

Automatic License Plate Recognition Using LabVIEW

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***Abstract*: In this Research, a hybrid solution is presented with combining basic machine vision techniques and neural networks. This system is based on regular PC with camera to acquire images of vehicle which include a vehicle car license plate and store data in database. The proposed system consists of three main parts, License Plate Detection, Character Segmentation and Character Recognition. In plate detection based on edge detection, contrast and connected components labelling, and Segmentation is based on ROI. Recognition phase consist of Block Based ANN and Optical Character Recognition. For Recalling of missing Character our used of Trained Data from database. The proposed system has been implemented using Vision Assistant 2013 & Labview13.0 the recognition of about 97.33% vehicles shows that the system is quite efficient.**

***Keywords*: License Plate, Character Recognition, Edge detection, Contrast and Connected Components Labelling, ROI based Segmentation, Block Based ANN.**

1. Introduction

Automatic License Plate Recognition and Recalling of Missing Character system is an application of computer vision. Computer vision is a process of using a computer to extract high level information from a digital image. A license plate reader works by extracting the characters from an image. Our system will provide a way to detect and identify license plates without constant human intervention. Sizably voluminous magnitude of papers within three last decades for ANPR has been demonstrated which shows the consequentiality and the worth of this subject in literature [1].

This paper presents a Hybrid Methodology of ALPR which has mainly five Stages. Image Acquisition is the first step in an LPR system and there are a number of ways to acquire images, our current image acquisition methods used an image acquisition card that converts video signals to digital images based on some hardware-based image pre-processing [2]-[5]. Secondly License Plate Detection is the most important phase in an LPR system. This step based on Edge Detection, Contrast and Connected Components labelling based techniques [6,]-[8]. Third Step is Character segmentation which segments the license plate number and characters. This phase use ROI based Technique [9]. Second last step is Recognition phase which recognize the characters from the license plate by using Block Based ANN and Optical Character Recognition based techniques [10], [11]. Last Phase is trained database which are trained from the ROI based. It's providing the recalling features of missing values which are hazy and not shown properly [12]. Block diagram of given system is

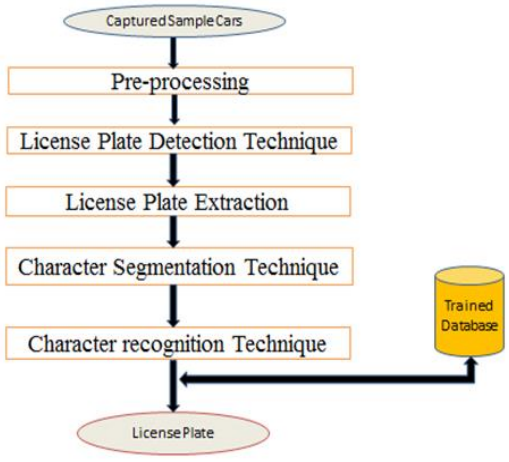

Fig. 1. Block diagram of given methodology

2. Methodology

A. Image Acquisition

The first step is the capturing of an image using electronic devices such as optical (digital/video) camera; webcam etc. can be used to capture the acquired images. For this project, vehicle images will be taken with aCanon Power Shot ELPH 110 HS camera. The images were stored as colour 640*480 dimensions and JPEG format which taken by a camera placed at a distance of 1-2 metres away from the vehicle.

In India the Car number plate containing white background with black foreground colour for private cars and for the commercial vehicle used yellow as background and black as foreground colour. As shown

Fig. 2(a). Private car

Fig. 2(b). Commercial car

B. *Pre-Processing*

When an image is acquired, there may be noises present in an image. These noises affect the recognition rate greatly. So these noises should be removed from the images.

Gray scale conversion: From the 24-bit color value of each pixel *(i,j)* the R, Gand B components are separated and the 8-bit gray valueis calculated using the formula:

*Gray (i, j) = 0.59 *R(i, j) + 0. 30 *G (i, j) + 0 11*B(i, j)*

Median filtering: Median filter is a non-linear filter, which replaces the gray value of a pixel by the median of the gray values of its neighbours. We have used 3 × 3 masks to get eight neighbours of a pixel and their corresponding grey values. This operation removes salt-and-peeper noise from the image. Noise removal is necessary step in License plate recognition system because it greatly affects the recognition rate of the system.

Fig. 3. Gray Scale Image

C. *License Plate Detection Technique*

In this we use a hybrid technique to use edge detection, contrast and connected component based detection which provide the basic hybrid detection techniques.

Edge Detection After enhancement of image we perform extraction of vehicle number plate by localization of number plate region using Sobel edge detection [13] and fuzzy logic as shown in figure. Sobel operator has a 3x3 convolution kernel. One kernel is the other rotated by 90 degree. Masks used by Sobel operator are

$$\begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

The kernels respond to vertical and horizontal edges and the characters in the number plate have vertical edges of uniform nature at regular intervals. These characters are also equally distant to the number plate edge. These features help us to locate the number plate within the image.

Colour contrast has Black and white number plate has high colour contrast. It's not applicable for number plates with colours.

Now we try to find the connected objects. The connected objects are investigated with using 8 and 4-ary connectivity. However, only 8-connected objects contain the desired regions, so we should label these connected objects.

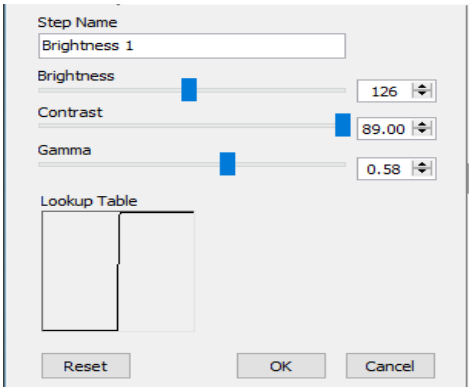

Fig. 4. Step name

Fig. 5(a). Contrast Image

Fig. 5(b). Edge detection Image

D. *License Plate Extraction Technique*

Number plate extraction is the key step in ANPR system, which influences the accuracy of the system significantly. The goal of this phase, given an input image, is to produce a number of candidate regions, with high probability of containing number plate and validate for true number plate. In this step extract vehicle number plate from eroded image. Following fig. show the algorithm of plate region extraction.

Fig. 6(a). Threshold input image

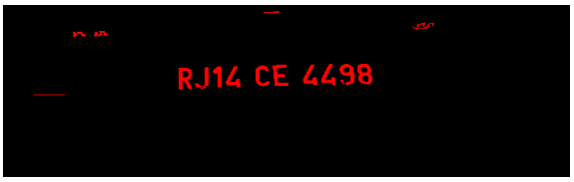

Fig. 6(b). Extracted Image

E. Segmentation Based Technique

Segmentation step is one of the most important and difficult task in License plate recognition. Segmentation is the process of decomposition of different objects by extracting their respective boundaries and the text component is isolated from the background [14, 16 and 17]. In 'Region of Interest' or ROI based Segmentation usually determined on the basis of pixel intensity values or user-determined areas (by drawing and subsequent masking). When the user defines a gray-scale intensity value, above which the object(s) lie and below which encompasses the background, the image is said to be thresholded, and the process is referred to as thresholding. If the objects of interest have a median range of intensity values, defining a slice of possible intensity values between 0 (black) and 255 (white) can segment the image and separate the objects from background. ROI based is given on above Figure 5.a threshold image.

F. OCR Based Techniques

In this field block based ANN and OCR based recognition is done and result shown below.

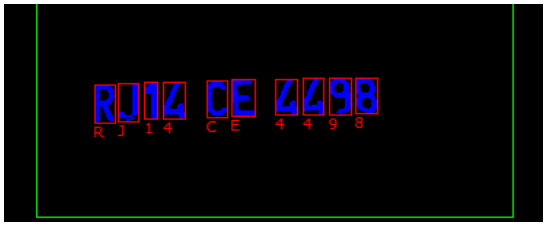

Fig. 7. ANN and OCR based recognition

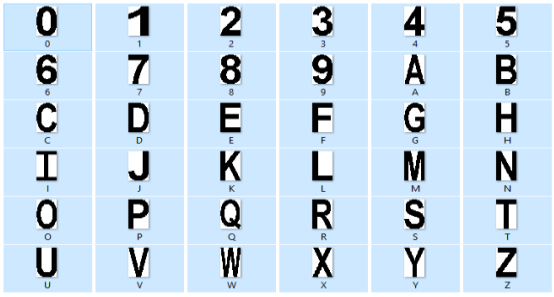

Fig. 8. Trained Database

3. Experiment Results

We implemented experiment with Dell PC Intel(R) Core(TM) i3 CPU M350@2.27GHz, RAM 3.00 GB, Windows 10 Home Basic 64-bit Operating System and Vision Assistant and LabVIEW 2013 Build 20130617025742.

We tested for 150 vehicle images, which obtained from the actual system, these vehicle images are have different background, such as illumination, angles, sizes and types of LP, different distance from camera to vehicles, light conditions in Jaipur India environment. There size of the images in RGB true-colour image was tested (640x480 pixels). The results of our method show in Table 2. The average rate of accuracy is 97.33%.

Table 1
Result

Number of images	Number of extracted images	Number of recognition images	Average
150	149	146	97.33%

4. Conclusion

This paper proposed an improved License Plate Recognition algorithm for Jaipur India. The proposed algorithm consists of three main modules: Pre-processing (convert RGB image to grayscale image, adjust grayscale image intensity, image binarization), Extraction and Segmentation (morphology opening to remove noises & dilation operation, ROI based thresolding), OCR (Block Based and Character based). We tested for 150 Indian vehicle images, which obtained from the actual system, the average rate of accuracy of our Hybrid method is 97.33%, our results are more exactly presented methods. From the result of the experiment, we can see the proposed approach is robust. But there are still some images failed in the experiment, our algorithm still needs further research.

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