IARJSET

ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 8, August 2021

DOI: 10.17148/IARJSET.2021.8805

AUTOMATIC LICENSE PLATE DETECTION AND RECOGNITION

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Abstract: The aim of this project is to detect the license plate of the vehicle and extracting the characters in detected license plate of the over speeding vehicle. License Plate Recognition has been widely used in many traffic applications, such as smart parking system, traffic toll system, and security system. In recent years, LPR has played a crucial role in the development of smart cities as a surveillance system for vehicle management, investigation of stolen vehicles and traffic monitoring. There is three phases in License Plate Recognition phase, license Plate Localization, license plate and Optical Character Recognition.

Keywords: Bilateral Filter, Gray Scale, Canny Edge Detection, Optical Character Recognition, License Plate detection.

I. INTRODUCTION

This project involves a novel computer vision-based automated system for multi-vehicle detection, tracking, and determining the license plate number. License Plate Recognition has been widely used in many traffic applications, such as smart parking system, traffic toll system, and security system. License Plate Recognition has two steps, first step is to detect and localize a license plate in an input image/frame and next step is to extract the characters from the license plate and the final phase is to apply OCR to recognize the extracted characters. Vehicle Number Plate Detection aims at detection of the License Plate present on a vehicle and then extracting the contents of that License Plate. A vehicle's license plate is commonly known as a number plate. It is a metal plate that is attached to a vehicle and has the official registration number of a vehicle embossed on it. Number plates are placed at the front and back of the vehicle and help anyone to identify a vehicle. Motor vehicle registration is the registration of a motor vehicle with a government authority, either compulsory or otherwise. The purpose of motor vehicle registration is to establish a link between a vehicle and an owner or user of the vehicle. Motor vehicle registration is the registration of a motor vehicle with a government authority, either compulsory or otherwise. The purpose of motor vehicle registration is to establish a link between a vehicle and an owner or user of the vehicle. This link might be used for taxation or crime detection purposes Contents of Number Plates.

II. LITERATURE SURVEY

Priyanka et al., [2] proposes that the input image consists of many colours and therefore the image is processed initially to enhance the standard and prepares it to next phases. Since the image has different colours the system will convert the RGB pictures to grayscale pictures exploitation NTSC standard technique.

Cheng-Hung et al., [3] uses SVM to detect vehicle's license plates. SVM is a supervised learning method used for classification and regression analysis. This project uses the SVM OAR (one against rest) architecture with the HOG values of an image as features to train a classifier. In order to identify license plates correctly, there is a need to train a classifier that can classify license plates and non-license plates. Moving objects are detected by background subtraction. Positive and negative samples need to be prepared during the training phase.

Sarthak et al., [3] used various supervised machine learning techniques to recognize the characters on the number plates. All the techniques are first trained to know how the various characters look like. We have used 20 images of different looking images for each alphabet and number. We first convert the images into a one-dimensional array containing all the pixels. Each of those pixels is used as a different feature for training the model.

III. SYSTEM DESIGN

The developed system first detects the vehicle and then captures the vehicle image. Vehicle number plate region is extracted using the image segmentation in an image. Optical character recognition technique is used for the character recognition. The resulting data is then used to compare with the records on a database so as to come up with the specific information like the owner, place of registration, address. Gradient edge detection algorithm which detects each vehicle edges by taking the maximum and minimum values in the first derivative of the image frame. Background subtraction is used to extract foreground image based on background model for each frame.

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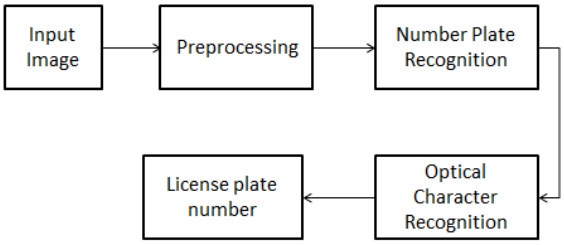

Frame by frame tracking of object which has been detected is very difficult task but at the same time it is important. In order to identify license plates correctly, we need to train a classifier that can classify license plates and non-license plates. We have to prepare positive and negative samples during the training phase. The positive samples are the license plates and the negative samples are the vehicle's regions without license plates. Due to the reduced complexity of the negative samples, the recognition rate of license plates is increased. OCR algorithms allow us to prepare text data into editable formats for computers to efficiently process them.

IV. IMPLEMENTATION

A. PREPROCESSING

Preprocessing is an initial step to image processing improving the data image quality for more suitable for visual perception or computational processing. Preprocessing remove unwanted data and enhance the image by removing background noise, normalizing the intensity of individual image particles, image deblur and remove image reflections. Preprocessing for vehicle license plate number uses some common subprocesses, which are grayscaling process and filtering process like bilateral filtering. Gray scaling is a process to produce a gray scale image from a multicolor image. In this process, the threshold of an image is calculated. Preprocessing takes image dataset as input and produces filtered image.

Step 1: Resize the input image by changing the width to 500.

Step 2: Convert the coloured image to grayscale image.

GrayScale = ((0.3 * R) + (0.59 * G) + (0.11 * B))

Step 3: Perform bilateral filtering to remove noise and sharpness.

$g(x) = (fGs)(x) = Rf(y)\, Gs(xy)dy$

Step 4: Canny edge detection is used to detect the edges of garyScale image.

B. NUMBER PLATE RECOGNITION

The first step is to detect the License plate from the car. We will use the contour option in OpenCV to detect for rectangular objects to find the number plate. The accuracy can be improved if we know the exact size, color and approximate location of the number plate. Normally the detection algorithm is trained based on the position of camera and type of number plate used in that particular country. A horizontal first order difference is carried on coarse location image to achieve the horizontal accurate positioning image. Number plate recognition takes preprocessed image and produces localized license plate as output.

Step 1: Detect contours to find different continuous shapes of the image.

Step 2: drawContours function shows the exact contours.

Step 3: Find the area of each contours.

Step 4: Top 30 countours is selected based on the maximum area.

Step 5: Select and crop the Number plate contour.

$r(i,j) = |\, f(i,j) - f(i,j-1)|, i = 1,2,3,...,m,\ j = 2,3,4,...,n$

Step 6: Find the coordinates of the license plate and store in new img.

new img = gray[y:y+h,x:x+w]

C. OPTICAL CHARACTER RECOGNITION

The Final step in this License Plate Recognition is to actually read the number plate information from the segmented image. We will use the pytesseract package to read characters from image. Pytesseract is an optical character recognition (OCR) tool for python. That is, it'll recognize and "read" the text embedded in images. Python tesseract is a wrapper for Google's Tesseract-OCR Engine. Optical Character Recognition takes localized license plate image as input and extracts characters in the license plate.

Step 1: Optical Character Recognition is used to convert image into string of character.

Step 2: Using pytesseract image to string function, the input image is converted to text.

Step 3: Python replace() method replaces a specified phrase with another specified phrase.

text = "".join (text1.split()) . replace (":", "). replace("-", "). replace(")", "). replace(".", ").replace(",", "")

Step 4: Remove if any special characters have been identified from the text using replace function.

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V.EXPERIMENTAL RESULT

A. PRE PROCESSING

Image preprocessing is crucial in many applications of image processing because color information does not help in identifying the important edges or other features. So image is converted to grayscale to remove noise from the image. A bilateral filter is a non-linear, edge-preserving, and noise-reducing smoothing filter for images. The preprocessing result is shown in the Table 5.1.

Table 5.1: Preprocessing of the input image

Name	Input	Canny image
input1		
input2		
input3		
input4		

B. NUMBER PLATE RECOGNITION

Number plate localization is responsible for finding and isolating the plate on the input. License Plate Recognition is an image-processing technology used to identify vehicles by their license plates. First the license plate has been localized and using the coordinates license plate have been extracted. The contour image and located license plate is shown in Table 5.2.

Table 5.2: Number Plate Recognition

Name	Contour	Number plate located
input1		
input2		
input3		
input4		

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C. OPTICAL CHARACTER RECOGNITION

The automatic number plate recognition with OCR works by using the technology to capture the images and retrieving the license numbers on the plate. It works by simply highlighting the numbers on the image and separating them from the other objects on the screen. Figure displays the characters in the license plate have been extracted using OCR.

Figure 5.1: License plate segmentation of input 1

Figure 5.2: License plate segmentation of input 2

Figure 5.3: License plate segmentation of input 3

Figure 5.4: License plate segmentation of input 4

The image acquisition technology determines the average image quality the license plate recognition algorithm has to work on. Figure shows the characters segmented from the license plate.

```
Detected License Plate Number is : MH20CN7475
-1
```

Figure 5.5: Optical Character Recognition for input 1

```
Detected License Plate Number is : HR26BP3543
-1
```

Figure 5.6: Optical Character Recognition for input 2

```
Detected License Plate Number is : MH01AV8866
-1
```

Figure 5.7: Optical Character Recognition for input 3

```
Detected License Plate Number is : MH20EE7598
-1
```

Figure 5.8: Optical Character Recognition for input 4

To evaluate the model, performance metrics like accuracy score, recall score, precision score, f1 score and roc auc score are used. Model is generated using logistic regression algorithm. Table 5.5 shows the True Positive (TP), True Negative (TN), False Positive (FP), False Negative (FN) of dataset and compare with SVM model accuracy.

Table 5.2: Performance Evaluation

Values	SVM	Proposed Model
TP	4	19
TN	0	3
FP	2	0
FN	0	0
Accuracy Score	66.67	86.36
Precision Score	66.67	86.36
F1 Score	80	92.68

VI.CONCLUSION

The objective of the project is to detect the license plate of the vehicle and extracting the characters in detected license plate of the over speeding vehicle. It includes Vehicle Speed Estimation and License Plate Detection. There are three steps in License Plate Recognition phase.

The first step is License Plate Localization. The next step is the license plate Segmentation used to segment the license plate and the final step was Optical Character Recognition. In the next phase vehicle speed estimation will be implemented.

IARJSET

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