Automatic License Plate Detector

Ms. C. Lekha, Ananya Tamuli Saikia. , P. Geeta, Priyanka Nath

Abstract: ***The increasing number of automobiles is gradually resulting in a high number of off-road accidents. Accidents are most likely to occur only when traffic regulations are violated. These kinds of activities generally require patrolling by police for speeding vehicles. We thus reduce human effort in this system by bringing in automated license plate detectors. These detectors can read the license plate of the vehicles and store it for future use. Given that a vehicle is found speeding, the plate number is noted by the detector and the culprits can be caught easily. It can also be used to check upon air pollution levels and fine vehicles causing pollution more than the level as specified by the pollution board. We can also use it to identify vehicle owners and check whether they have registered license plates or a fake number plate. It also can be used for collecting tolls on highways by automatic systems or for theft control. The license plate detector in this paper can also read license numbers written in foreign dialects or in other formats, such as Arabic, Hindi, Urdu etc. The tools used are Open source programming language of Python and its Open Computer Vision library (OpenCV).***

Index Terms: Computer Vision, License Plate , Open Source, Python

I. INTRODUCTION

With the increase in the number of automobiles by the day, the rate of road accidents along with a high percentage of air pollution is taking a toll on the people staying in such suburbs. Traffic regulation has become a lot more difficult to deal with since the past few decades. Road accidents occur almost every day causing fatalities and much havoc. Amidst all these also arises the issues of air pollution and the list goes on. Today most of the things have become automated and one such new trend is the automated license plate detector. It reduces human efforts and aids us in all forms from security checks to traffic regulation. We can also use it in automatic toll collectors or for distinguishing fake number plates from real ones. In India, there are majorly two kinds of license plates- yellow or white background with the black foreground. The equipment can also be useful in minimizing air pollution caused by traffic in the cities. Vehicles causing pollution more than a certain limit can be fined by the pollution board. It is also useful to catch culprits of speeding vehicles. Most of the times such number plates cannot be recorded by human eyes due to high speed, deformation or from lack of illumination. The automated detector in our system uses the open source programming language Python and uses its Open Computer Vision Library. The OpenCV library consists of pre-programmed functions mainly directed at real-time computer vision. The previous automatic detectors used proprietary tools like MATLAB which are pricey and also do not support portable programs. Another beneficial factor is the speed of execution. OpenCV codes run faster than MATLAB codes and thus are more preferred these days.

II. RELATED WORK

A lot of techniques have been doing rounds over the years to achieve accuracy in Number plate extraction. This directly influences the successive steps of Character Segmentation and Recognition of the system. The different techniques can be overviewed as: Hao Chen et al [1], in his paper, came up with a method comprising of two steps. Firstly, the eligible plates are selected on the basis of similarity of texture information. The next step employs auto-correlation based binary image and projection algorithm. These techniques are used to detect the true candidate plate. GisuHeo [2], used a method where a number of lines would form a rectangle at the plate boundary. This step would be followed by calculation of plate area by vertical edge density algorithm. Ozby et al [3], in his paper, had created a smearing algorithm to locate the number plate. Also, in a Korean license plate extraction process, Mei Yu et al [4] came up with vertical edge detection which was followed by size, shape filter for edge area and edge matching. This technique would be implemented by plate model. Farhad Faradji et al [5], in his paper, employed the technique of Sobel vertical edge detection on the image captured. This was used to calculate the area of the plate. Fake plates were eliminated using a compact factor. The compact factor evaluates the densest vertical edge area thus determining the valid number plate. Segmentation is the process after number plate extraction and it has also undergone a varied number of processes for achieving the same. There have been Segmentation techniques based upon projection analysis, Hough transform, region growing etc.In his paper" Segmentation of characters on car license plates", Xinagjian He et al [6] ,used horizontal and vertical projection analysis for segmentation of the characters.Yuangang Zhang et al [7], in his paper, "A new Algorithm for character segmentation of license plate", used the technique of Hough Transform for character segmentation. In this method, the horizontal edges of the plate have to be pre-decided, using Hough transform. It helps to segment the characters with a large rotation. Having prior knowledge of the plate model helped in segmentation of characters by vertical projection analysis. Feng Yang et al [8], on the other hand developed a region growing algorithm for character segmentation. Shen Zheng et al [9], brought upon connected component analysis for the same.

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II. EXISTING SYSTEM

In conventional ways, automobiles were handled only manually by traffic regulators or by other Inspecting departments. To summarize, a lot of human efforts went into such tasks and with increasing automobiles, it has become tougher to maintain discipline on roads. The next step was to bring in automated license plate detectors. But these detectors used tools like MATLAB which were proprietary and high priced. Using MATLAB had disadvantages of its own. For instance, it does not support portable programs. Also, it's slow to execute its code. This led programmers to prefer open source Python and OpenCV more than MATLAB.

III. PROPOSED SYSTEM

Figure 1: Architecture Diagram

The automatic license plate detector suggested in our paper uses open source language Python and its OpenCV library to make execution of code faster and more reliable. There are precisely six major steps through which the license plate undergoes to finally get scanned and be declared as a valid number plate or an invalid one. These steps are - Capture, Preprocess, Localize, Connected Component Analysis, Segmentation, and Character Recognition.

A. Capture

The first step involves capturing of the image of the vehicle license plate using a high- resolution photographic camera. The use of an Infrared camera is mostly a better option to capture the image as it can be pitched and rolled in accordance with the license plate. Character Recognition becomes tough when the angles are oblique and thus it turns out to be the most sensitive section. Sometimes, the readable characters become obscure or deformed due to lighting issues or obliqueness of the photographic camera. The success ratio of the system increases with the higher resolution of the camera.

B. Preprocess

The quality of the image can be improved by

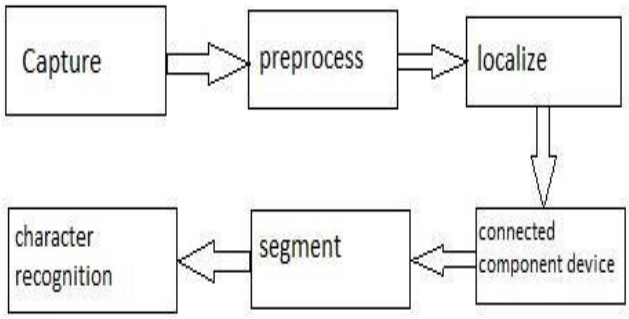

Figure 2: Captured image by the Camera.

employing a set of algorithms. It is the most integral phase of any computer vision system. The preprocessing majorly involves two processes: Resize and Convert Color Space. Resize: The size of the image from the camera might be of a larger size and can thus turn the system slow. Thus, the image can be adjusted as per any probable aspect ratio. Convert Color Space: The images captured are mostly in their raw form or encoded into some multimedia forms. The images are usually captured by IR or photographic cameras. These images are in the RGB modes with three channels (i.e. Red, Green & Blue). The color information of the image is depicted by the number of channels present. The image is later converted to grayscale.

C. Localize

The main part of the vehicle image is only the rear view. When the image is captured a lot of other unnecessary parts of the vehicles and their surroundings are captured along with it. These parts are totally useless for the working system. The other useless areas are sheer noise and need to be removed. This is called localization.Localization is defined as binarizing the image to black and white. There are 2 ways to do this- Highlighting characters and suppressing background.Localization employs the techniques of image processing called Thresholding. The image pixels are truncated to two values based on the value of the threshold. Pre-image analysis is done for identifying the apt threshold value. The problem arising from non-uniform lighting can be taken care of by employing Adaptive thresholding. Adaptive Thresholding determines a local optimal value of the threshold.

D. Connected component analysis

To get rid of the undesired areas of the captured image, a connected component algorithm is applied to the binarized plate. This analysis helps in the recognition of characters in the image.

The central idea of this process is to traverse through the image and discover the connected pixels of the image. Each blob of the image is marked and extracted.

Figure 4: Connected Components (Blobs)

E. Segmentation

In this process, the required portion alone is cropped out. The blobs form the endpoints of the required part of the image. We thus employ the method of Image Scissoring. The license plate is scanned in a vertical fashion and scissored on the rows where there aren't any white pixels. The scissored area is then copied into a new matrix.

F. Character recognition

The selected blobs are in the end send to the Optical Character Recognition Engine (OCR) Engine. This returns the ASCII form of the license number.

Most of the old License plate detectors could not recognize number plates written in languages of countries other than India. But this system can detect many such foreign dialects such as Arabic, Urdu or Hindi etc. Also, in some countries, the format for license plates are different from that of India such as California or Mexico etc. In most cases, the format of license plates alters with the change in a continent, ie: Asian number plates would have a different format from that of American number plates. They may also vary among the countries of the continent. Thus the license plate detector comes in as very handy.

IV. CONCLUSION

To summarize, the automatic license plate detector is a great technological advancement and minimizes manual work to a large extent. It is used in many fields such as security from car thefts, automatic toll collection system or for fining speeding vehicles. It can make the process of traffic regulation a lot simpler than the situation at present. Lastly, it can also be implemented by pollution controllers to check upon the level of pollution created by each vehicle and thus necessary actions can be taken against it. The system presented in the paper also employs the techniques of image processing and uses open source tools like Python and its Open Computer Vision library. The use of these tools make the execution of the system faster than the conventional techniques and also brings down the expenses by a considerable amount.

As of the future scope of the project, the system must inculcate higher accuracy levels for text localization. Also evaluation must be done using images with higher noise content. It must be functional in cases of high speeding vehicles too.

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