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License Plate Recognition

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Abstract - *License Plate Recognition has been ingrained in our daily life, and it is expected to continue to evolve and combine with newtransportation technology in the future. The notion of license plate recognition (LPR) offers a variety of solutions to transportation-related issues. It also eliminates human intervention. License platerecognition helps in the problems related to traffic, car theft, crimes, and also it can be used for modernlaw enforcement. It can be installed in areas difficult to reach and in rural areas where technology is scarce. The LPR system is frequently employed in traffic applications such as traffic surveillance and parking lot access management as a basic technology for security. It solves all these problems. The vehicle's license plate is identified using a computer vision algorithm. It uses different algorithms to extract the number plate and uses optical character recognition to read the licenseplate. We have used the canny algorithm for edge detection and sorted algorithm to select the most relevant contour to localize the number plate. Localization of the number plate can greatly enhance the speed and accuracy of the LPR. We have tried to cover the existing methodology in the survey paper and try to come up with a simple output using our knowledge that we gathered during the research of the project.*

Key Words: License Plate Recognition (LPR), OCR (optical character recognition), Edge detection, gray scale, canny Algorithm, noise reduction, contour.

1.INTRODUCTION

Automatic License Plate Recognition (ANPR), also known as License Plate Recognition, has long been a part of our lives and will continue to be in the future as long as it is compatible with future transportation technology. The notion of autonomous vehicles opens up a plethora of possibilities for transforming fundamental transportation networks. By removing the need for human interaction, LPR technology is already assisting in the development of intelligent transportation networks. It's no longer only the roadside or parking-fence cameras. It originally became mobile in automobiles over time, but with the evolution of smartphone technology, many license plate recognition systems have now become portable as well. Because of its inexpensive acquisition costs, LPR is widely employed in the toll and parking businesses. LPR is a frequent choice for toll and parking business.

License plate detection is based on computer vision method or technique to identify the number plate of the cars. In recent years, it has been used widely asa major technology in the field of security or traffic application such as surveillance in parking lot and parking lot access control and information management. Modern LPR cameras not only scan license plates, but can also provide vital extra information such as counting, heading, vehicle groups and speed. Because of its ability to detect and read large numbers of fast-moving cars, technology has entered many elements of today's digital scene. While LPR technology comes in various packages, they all share the same primary purpose: to come up with a errorless mechanism to scan a vehicle number plate without any humanintervention. It is used in a wide variety of applications, including access control, parking management, toll, user billing, delivery tracking, traffic management, policing and security, customer assistance and instructions, red light and laneenforcement, queue length estimation, and others. For many years, license plate recognition techniques have been created. The precision of LPR system has improved much extent as hardware and software have improved. This technology could be improved in the future and used to help solve crimes. With improvements, this license plate recognition system can be built at a reasonable cost and its effectiveness will be available in all areas.

2. LITERATURE REVIEW

Currently, there are many studies in the number plate detection field and the detection of licenseplate is primarily divided into five stages: input image, image preprocessing, locating the numberplate, and then identifying the character.

Grayscale images and Density Transform images are commonly used in the first two segments. The purpose of the first two steps is to aid in a more precise search for the license plate. The search for and detection of the license plate is the first and most important stage in an automobile license plate recognition system. The speed and accuracy of automatic license plate recognition systems can be considerably impacted by this detecting phase. The most common technique in prior research was tip statistics, which was based on the premise that brightness variations in the plate region are more pronounced and frequent than elsewhere. However, because of their sensitivity to undesirable edges, they are rarely used on complicated pictures. In order to eliminate undesired edges from photos that have been processed, S. Wang and H. Lee [2] integrated edge statistics with morphological procedures. Some approaches make use of colorproperties.

Lin Luo [1] designs a new and successful method for finding plates. This proposed algorithm includes three main parts listed below. To begin with, the vertical edges of the image are extracted using Sobel operator. On both yellow and non-yellow plates, the HSV color space and integrated picture are then utilized to discover possibilities. Final step is component analysis that pinpoints the location of the number plate. Similarly, Yao-quan [7] uses a color- based technique, but the color information in the color image is well exploited to significantly reduce the edge points. This procedure also eliminates the area that resembles the number plate, but does not match the actual color of the number plate.

With the two described subsystems: the automobile detection subsystem and the license plate removal subsystem, Hsiao-Chen [6] created an altogether new method to license plate detection. The automobile detection subsystem employs the Minimum Movement Amount Decision Rule and the Nearest Distance Decision Rule for dynamic photos to locate cars on the screen. The license plate extraction subsystem employs license plate characteristics and a license plate search algorithm to extract a license plate. We feel, however, that this technique is inefficient when it comes to detecting license plates. Because the detecting technique contains numerous layers, each level is easily disordered.

Character recognition is another crucial stage in the license plate identification system. This is a more difficult step that needs a great deal of computation. The system accuracy depends on the identification step. Recognizing the l plate was extremely difficultwhen viewing the vehicle's license plate in the dark,in the rain, or in other adverse lighting conditions. As a result, we must define the Character using the technique.

In the H. Ching-Tang [2] article, they calibrate the License Plate first, using the grayscale level value to modulate the light, and then apply the Black top- hat approach for character separation and integralitycorrection to eliminate the shadow and produce an ideal display. In the end, they recognized each character using a back-propagation neural network.

In the license plate character identification section of Q. Xiwen [3], it introduces a method that uses an enhanced BP Neural Network for characteridentification. This proposed design works on three layers: an input layer, a concealed layer, and an output layer. For the system to recognize the English character the output layer neuron number should be 5. This strategy has the potential to improve accuracy and training speed. Another significant advantage is the avoidance of municipal minimum points.

A pattern matching method is described by Y. Chenpu [4]. A single database must exist. For example, the database contains 26 letters and 10 digital letters for English and digital letter recognition. The computation was then used to match the template and determine if it did. It also pioneered a comparable method for identifying Chinese characters. According to Slimani et al. [5] proposed a two-step process for removing plates. Otsu's Threshold Path, an effective technique for adaptive thresholding procedures, is used in the first step to deal with variable lighting conditions. The CCA approach is then used to find rectangular structures in the binaryimage. To ensure that the created image is a plate, the second step is to perform edge detection on the resulting plate, followed by the closed curve method. This method was used to evaluate more than 2,500 Moroccan format photos from video sequences with a 96 percent success rate. 96.6 percent was the successful extraction rate on a low-quality video while using the component analysis technique. In binary images, contour detection algorithms are used to find associated objects. Plate-like geometric elements are selected for further processing. However, if the resulting image is of poor quality, this technique may cause distortion problems.

A license plate detection system for cars in Tamil Nadu (India) was proposed by P. anishiya and prof.S. Mary Joans [8]. This technology uses digital photos and is simple to integrate into commercial parking systems, for recording, parking service access, securing parking homes and preventing automobile theft. The proposed technique for plate localization combinesmorphological processing with field criterion testing.

D. Jiang, T.M. Mekonnen, T.E. Merkebu and AGebrehiwot. [9] The article under discussion is about an automobile license plate recognition system. Explains the design algorithm and its potential application. The system accepts the color image inputs of the cars and gives the registration number of the cars. In order to obtain the necessary information, the system goes through three main processes. The localization of the number plate, the character segmentation written on the license plate and then recognizing the character. The number of plates is first calculated from the original image, followed by the isolation of the characters, and then the recognition of each character. A set of training photos was used to build the algorithms.

Z. Xu, H. Zhu.[10] proposed a solid method for the localization of the number plate. The approach uses plate edge information as well as rich corner information in the plate area. It can handle more challenging location issues such as license plates ona complex background.

3. OBJECTIVE

- To detect the number plate and extract the number form the image.
- To Grey scale the image and reduce the noise so the picture become more evident to read.

- To accurately detect the number plate using different algorithm to detect edges such as the Vertical Edge Detection Technique which is believed to be the most reliable algorithm for detecting edges another method is Canny algorithm which is also used to detect the edges in an easy way.

- Using Contour Detection to detect the polygon or shape inside the image. The geometrical feature having similarities with the number plate is chosen.

- Lastly, we need to render the result that is to recognize the character written on the number plate.

4.PROBLEM STATEMENT

It is common for security forces and authorities to encounter difficulties when pursuing a car or attempting to apprehend a vehicle that has violated traffic laws. On a busy day, authorities find it difficult to manually log car numbers in a parking lot.So, in order to eliminate the human interaction with the system and to make the entire process autonomous, we may installthis system that will automatically recognize

the car that violates traffic laws, snap a picture of it, and save the license plate number in the database in order to fine the owner later. The technique can be used in parking to photograph vehicles and recordtheir license plate numbers in a database (or the cloud, if connected to the internet). This technology eliminates the need for frantic manual labor on each busy day, saves labor costs, and is significantly more efficient than humans. Once retrieved as text,the number of any car can be displayed, saved in the database, or searched for details across the entire database. This project is so adaptable that it may be utilized as a whole application once converted to software or as a component of any larger project. There has also been increase in contemporary national road networks over the past decade. These circumstances has revealed the need for efficacious monitoring and management of road traffic. The aim of this project is to create a model that can properly recognize and identify the license plate from its image.

5.METHODOLOGY

The detection of number plate is mainly dividedinto two parts. The corresponding position of the plate in the test image is found in the first blocks. The characters on the plate must then be removed and entered in the secondary blocks. Each block hasmore specific steps. The application will be presented step by step in the next section.

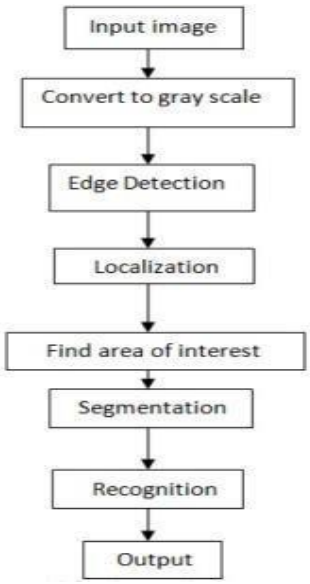

Fig-5.1 Steps for LPR.

The first and foremost step in number platedetection is to find the location of the number plate. This procedure is important as it has a direct impact on the recognition results. If the position of the plate is incorrect, the next steps will be invalid.

5.1 Image Processing

In general, it is very difficult to detect a target froma color image. Image processing often uses atechnique known as grayscale to make it easier torecognize the outline of a target. In most cases, the number plate section area in the image is brighter than the rest of the elements present inside the image. If we try to remove the plate immediately,the contrast between the number plate and thesurrounding items may not always be sharp,limiting the identification accuracy. As a result, the level of the grayscale can be stretched so as to improve the distinction of the output image. In this manner, the problem can be efficiently solved.

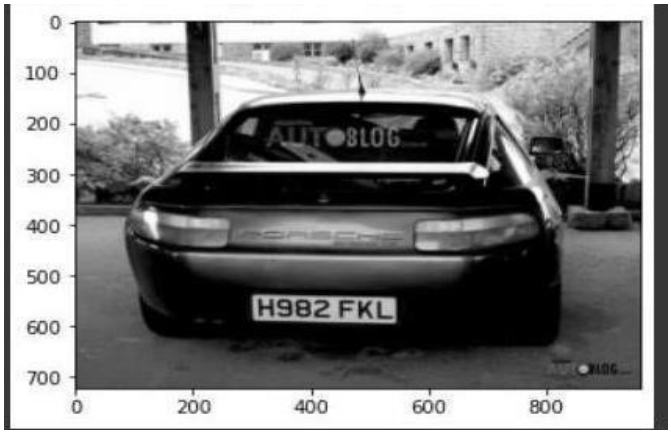

Fig-5.1.1 Gray scaled image

5.2 Binarization Process

It is the conversion of a grayscale image to a black and white image. A grayscale image consists ofseveral grayscale values ranging from 0 to 255. In order to make the image more relevant to read, the image is processed several times to make the binary image more useful. In the binarization process, the grayscale threshold value of an image is critical since it decides whether grayscale pixels are transformed to black or white.

5.3 Apply filter and find edges

After applying the grayscale, we need to apply the edge detection and apply filter. This detecting phasemay have a significant impact on the overall speed and accuracy of LPR system. Vertical Edge Detection Algorithm or Canny Algorithm can be used for detecting the edges which will make the image more evident, easy for us to detect the number plate. Bilateral filter will minimize the noise and make the image more suitable to read. The image will be starting to look like this.

Fig-5.3.1 Noise reduction and edge detection using contour detection.

5.4 Contour Detection

Contour Detection detects the polygon or a shape inside an image. In our case the polygon will have four points and it will resemble the shape of numberplate that is a polygon with four points. In contour detection many contours will be selected after which we will select the most relevant contour using sorted algorithm or any other algorithm.

Then we can render the output, and for the number plate extraction, we may use a mask that covers the entire image except for the license plate or contour that we have picked. We can crop the image after applying the mask, then show the number plate part, and use OCR (optical character recognition) to read the number plate and present the results.

Fig-5.4.1 After applying the mask and cropping the number plate from the image.

6.Output using Python.

We used the python to show the outcome of the research paper. We installed and imported all of the Python dependencies, including easyocr, a python library that allows developer using computer vision method to optically recognize the character with ease. With OpenCV, we used imutils to make fundamental image processing operations like translation, scaling, and displaying images easier. OpenCV is used so we can process image and videoto identify object, face or even written text.

Fig-6.1 Read in image and then grayscale it using cvtColour and displayed it by using matplot.

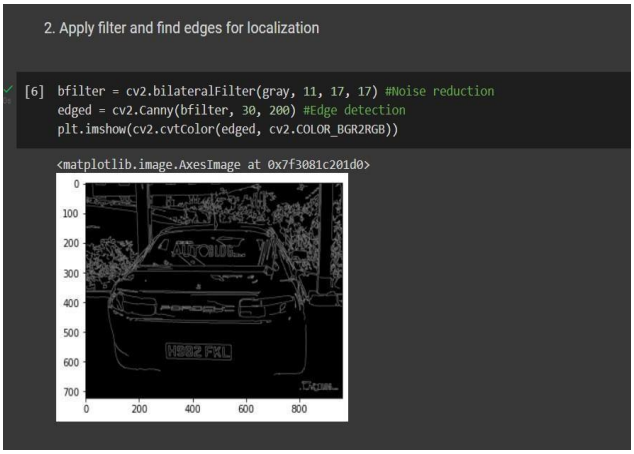

Fig-6.2. Use bilateral filter to reduce the noise and then canny algorithm to detect edges.

Now we used OpenCV for detecting polygon orshape inside the image. In specific we will be looking for contour with four point and then choosing the top 10 contour using sorted. We used the PolyDP to make the selection. Higher the DP value the more shape will be taken. The location of the number plate or the four points of the number plate will be displayed in output and will be used in next step that is to apply mask and then crop the image.

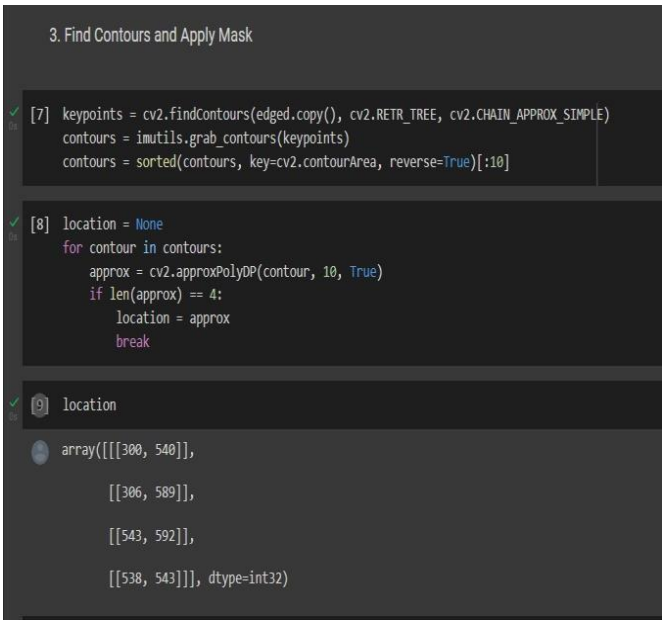

Fig-6.3 Contour detection and selecting most relevant contour.

We were able to determine the image's location in Figure 6.3. Now we'll pass the location so that the mask is applied to the image except for the given points of the contour/number plate. After applying the mask, the entire image will be covered in black except for the number plate, which we easily clipped away, leaving only the number plate. The OCR was then used to interpret the text printed on the image and highlight the number plate with a green box before rendering the result just below the number plate.

Fig-6.4 Applied the mask and cropped thenumber plate

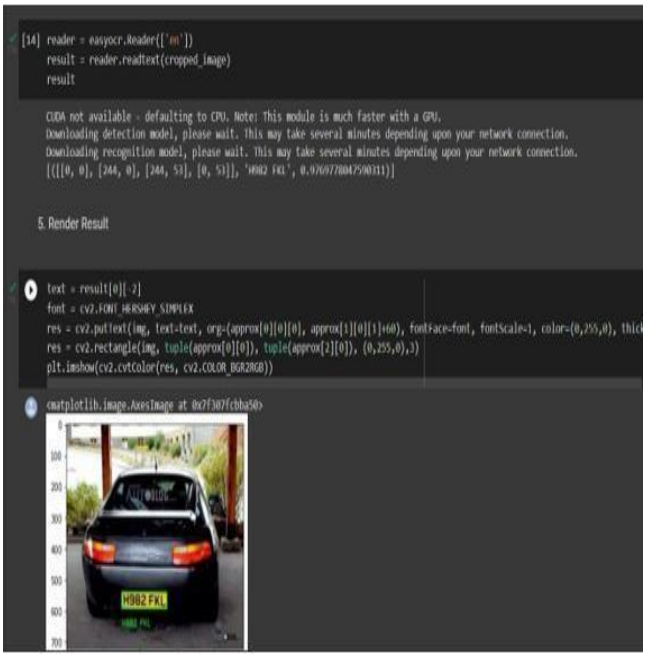

Fig-6.5 Read the text on license plate and rendering the result

7.SUMMARY

In general, an LPR has four phases of processing. The resolution and shutter speed of the camera must be considered at the image acquisition step. Then comes the extraction stage where we need to reduce the noise and hange RGB to gray scale. After this we need to find the edges also known as edge detection. In the segmentation stage we need to localize the plate and extract it.

Finally, in the character recognition process, characters are detected using optical character recognition. LPR is challenging due to the numerousplate forms and varying ambient circumstances. Many LPR approaches have been presented in recent years. There are many sections on kernel processing procedure, experimental database, processing time and recognition rate. However, the authors of [11] noted that it is not appropriate to reach a conclusion because there is no universal technique for evaluating which method produces the most accurate results and best performance.

8.FUTURE WORK

Existing LPR technology has a number of flaws, including erroneous findings where the image does not have smooth texture, such as when the image is blurred or contains curved plates. As a consequence, the existing algorithm may be tweaked to produce more accurate results Furthermore, there are restrictions to identifying the character, such as the number of characters that change by location, which requires the development of a global algorithm.

9.CONCLUSION

According to review of various papers we came to know about various techniques accessible for recognizing car number plates, including the Sobel edge detection, Automatic license plate recognition, Novel method used for detecting edge, different algorithm for contour detection, categorize features in each stage, and identifying & recognizing car license plate. As a result, we are currently using an improved character segmentation method to lower the amount of effort necessary to recognize a vehicle license number plate.

In the end I want to conclude the review with "Cost and imagination are the only constraints on technological advancement. If you can conceive it, you can achieve it."

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