

Recognition of Vehicle Number Plate Using Image Processing Technique

Faizal Patel, Jaimini Solanki, Vivek Rajguru, Ankit Saxena
Medicaps Institute of Technology and Management Indore, MP, India

Abstract: The video surveillance system is preferred for security monitoring, however, the detection of moving object is a challenging part. In areas where parking space is allotted to a particular vehicle, the wrongly parked vehicle can be recognized. It is noted that the number plates of the vehicle are found in different shape, size and also they are different in color. This makes the detection of the vehicle by their number plates, the most interesting and challenging research topic. Number plate detection is helpful in finding stolen cars, car parking management system and identification of the vehicle in traffic. This paper presents an approach for Number Plate Recognition (NPR) using morphological operation and Sobel edge detection method. In this approach, all the letters and numbers used in the number plate are segmented by using bounding box method. After segmentation, template matching approach is used to recognize numbers and characters. The number plate decoded can be used further for identification, matching and documentation purpose of vehicle details.

Keywords: Number Plate Recognition (NPR), Region Of interest (ROI), Character Segmentation (CS), Optical Character Recognition (OCR), Number Plate Localization (NPL)

1. Introduction

Number plates are utilized as distinguishing proof of vehicles everywhere throughout the countries. The number plate recognition system uses a picture handling technique for perceiving automobiles by their number plates. Number plate recognition systems are utilized with the point of viable movement control and security applications like access control to limited regions and pursue wanted vehicles. Experimentation of number plate recognition has been led for quite a long while; it's as yet a troublesome task. Number plate identification system investigates a data picture to distinguish some nearby fixes containing number plate. Since a plate can exist anyplace in a photo with fluctuated sizes, it's difficult to inspect every pixel of the picture to discover it.

At the point when a vehicle enters an input gate, the number plate can naturally be detected at the entrance point and put away in the database. The Number Plate Recognition (NPR) system for Indian number plate is troublesomely contrasted with the foreign number plate as there's no standard tool after for the proportion or ratio of the number plate size. The recognition task is difficult because of the nature of the light, which causes the image acquisition difficult. In NPR system photo-detection approach is used that includes acquiring a photo of the vehicle, extracting the region of interest, and character segmentation and extraction.

It is troublesome to locate the bounding area or edge of the number plate from the input vehicle image in the open-air scene because of the shades of characters of the number plate and background of the same. The gradients of the original picture are modified to discover applicant number plate region. There are calculations that depend on a combo of morphological activity, division, segmentation, and canny edge identifier. Number plate location detection comprises of steps like as Edge Detection, a Morphological task like expansion and disintegration, smoothing, and division of characters and recognition of plate number.

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Literature Review

In^[1] authors implemented the Automated Number Plate Recognition System (ANPR) whose accuracy was found to be roughly 80%. The implementation of ANPR showed great traffic control and helped in vehicle identification. In^[2] authors developed an efficient technique for extracting the number plate, used to find the missing cars, distinguishing the vehicle in traffic and conjointly for the parking arrangement systems. The vehicle ought to be stationary and therefore the image is captured from fixed angle parallel to horizon. Alphanumeric Characters are used for recognition of characters on number plates.

In^[3] authors proposed a quick technique for car-license detection (CLPD) and presents three primary advances to be specific, Character division, optical character recognition (OCR) and format coordinating. In^[4] creators proposed ANPR (Automatic Number Plate Recognition) framework to identify the vehicle number plate. The framework initially would catch the vehicle's picture as it reaches the checking area. The caught pictures are then extracted by utilizing the division procedure. To recognize the characters, Optical character acknowledgment is used. This is widely utilized as a part of the security system.

In^[5] authors built up a proficient approach to open wellbeing, intelligent transport system (ITS) and for productive administration of movement. They have proposed two strategies for extraction of permit number plates and contrasting it and other existing techniques. The Extracted number plate sections are divided into partitioned characters separately by utilizing a region-based technique. The acknowledgment scheme joins versatile iterative limit with a template matching approach. In^[6] authors proposed the thesis to recognize the stolen autos. Separation and finding associated components for localizing the number plates is done by utilizing simple yet effective morphological operations. It was tried on 20 tests with a precision of 90% for four wheeler number plates.

In^[7] authors introduce a system which uses ANPR technology. It is very helpful for traffic police to find the details of a car breaking the traffic rules. ANPR is been utilized to store the pictures caught by the cameras and the content from the number plate. Infrared lighting is used in capturing systems to enable it to take the photo throughout the day any time. An intense flash can likewise be incorporated into cameras, to enlighten the photo. In^[8] authors display a viable approach in light of the morphological operations along with edge detection (Sobel) strategy. This approach is improved to section and segment every letter and number as a part of the number plate by utilizing bouncing box technique. Further, after segmenting of numbers and characters, template matching methodology is utilized to perceive the numbers and characters.

Outline

In section II, we discussed the general system for recognition of the number plate. The NPR system implementation is explained in section III using the flowchart. Section IV shows result analysis, followed by section V, which describes conclusion and future scope of the NPR system.

Tools used

We used MATLAB R2010a as our platform to work on our project. And various image processing tools are used for our project. MATLAB allows manipulations of matrix and functions, plotting of data into graphical form, implementation of different algorithms. It is also utilized to generate graphical user interfaces, and working with programs that are coded in different languages, including Java, C, C++, Python, and FORTRAN.

Recognition Of Number Plate

Figure 1 shows the block diagram for a general system for recognition of the number plate

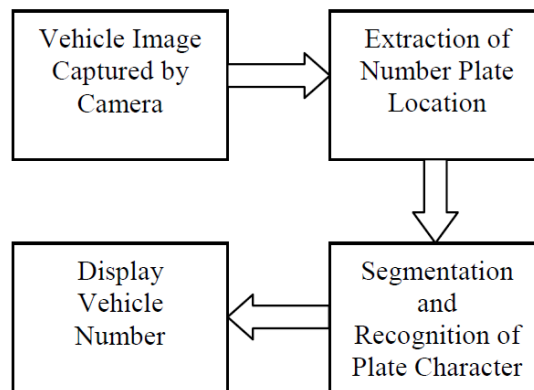


Figure 1; General System Block Diagram

Vehicle Image Captured by Camera

The picture of the vehicle whose number plate shown in image given below as **Figure 2** is to be recognized is caught utilizing an advanced camera of 13 megapixels



Figure 2; Vehicle input Image

Extraction of Number Plate

In this progression, the color image which contains a number plate of a vehicle is transformed into Gray-Scale. Here scientific morphology is used to detect the area along with Sobel edge operations that are utilized to calculate the edge boundary. After this, we obtain a dilated picture. At that point, infill function is utilized to fill the gaps with the goal that we get a reasonable binary image.

Segmentation and Extraction of Plate Character

For segmentation of the characters, the bounding box approach is utilized. It is used to gauge properties of the Image at the region of interest. The essential step in acknowledgment of the number plate is by recognizing the plate features and size. Here the extracted image is multiplied by the grayscale picture with the goal that we only obtain the number plate area in the picture of the vehicle.

D. Final Output

After performing the above every steps the number plate which is segmented and extracted is converted into the text from and displayed in MATLAB window.

Implementation Of NPR System

The flowchart for the implementation of NPR system is shown below in **Figure 3**.

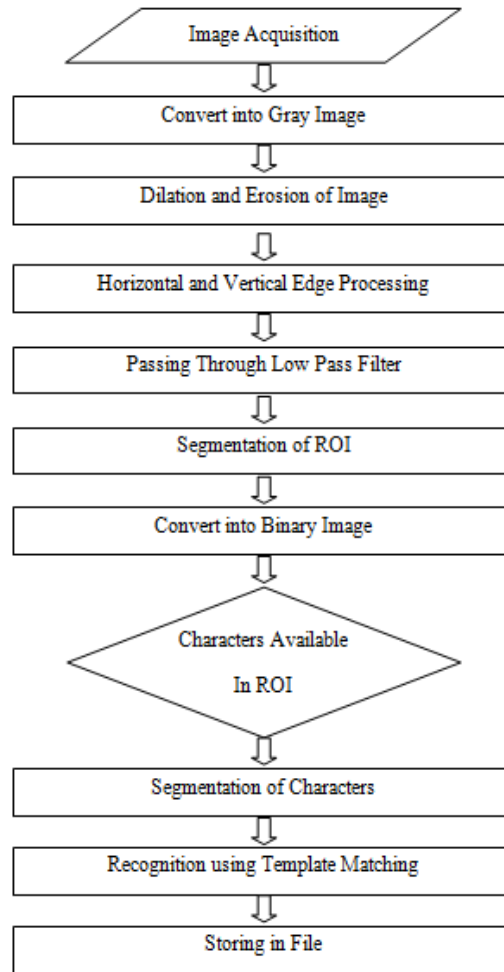


Figure 3; Flowchart of the Process

Input Image

This is the initial phase of acquiring a picture. In the given system, use of the advanced camera of the 16-megapixel camera is made. **Figure 4** shows the original image.



Figure 4; Original Image

B. Extraction of Number Plate Location

The system is fed with the original image of the vehicle taken by the camera. Color image to grayscale conversion is embraced, with a specific end goal to enhance the plate extraction efficiency, and increment in the processing speed. The essential step in acknowledgment of the number plate is by identifying the plate features and size. All in all number plates are fit as a fiddle; henceforth it is important to recognize the edges of the rectangular plate. Numerical morphology is used to recognize the area of intrigue and Sobel edge operations are made to compute the threshold that identifies high light areas with high edge extent and high edge variance.

The binary gradient mask indicates lines of high difference and contrast in the picture. These lines don't exactly portray the outline of the region of intrigue. Contrasted with the first picture, holes in the lines are observed that encompasses the protest in the gradient mask. These linear holes vanish when the dilation of the Sobel image is made utilizing linear structuring components. Structuring components are in form of matrices, which is a characteristic of a specific structure and highlights to gauge the state of a picture which is used to do another image processing operation. **Figure 5** demonstrates the handled picture in which the number plate is very much removed.

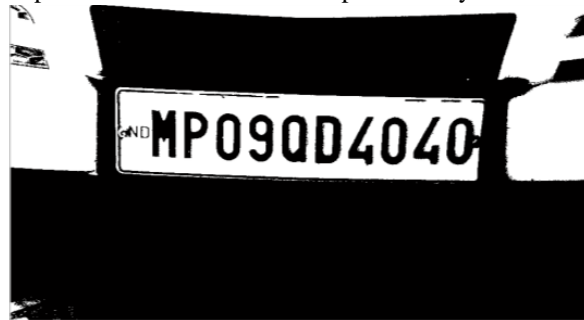


Figure 5; After Dilation, Erosion and converting it into Binary Image

The dilation of the binary mask is made by utilizing the vertical structural component and after which, by the horizontal structural component. The dilated mask draws the outline of the closed area or cells pleasantly, yet there are still gaps inside the cell. The arrangement of background pixels is known as a hole that has not expelled by filling the background from the edge of the image.

C. Remove Connected Objects on Border

The region of intrigue has been effectively segmented, yet it isn't the only object that has been segmented. The network in the function was set to expel corner to corner associations and fill the gap to find the plate area. Subsequent to expelling the lower pixel segments real plate area is distinguished finally, keeping in mind the end goal to influence the segmented object look regular, the picture is disintegrated twice with one of these structural components (line, disc or diamond). These aides in the extraction of number plate area of the vehicle. To get the number plate region only in a vehicle picture with characters and numbers display on it, the segmented picture is multiplied with a grayscale image.

D. Character Segmentation

Segmentation is a standout amongst the most critical procedures in the number plate recognition since every single further step depends on it. On the off chance that the segmentation falls flat, the improper partition of a character can take place into two pieces or two characters. A definitive answer to this issue is to utilize bounding box method. The bounding box is used to gauge the properties of the image area. The bounding box is made over on every character introduced on the number plate, due to which every character and number is extracted out for identification. **Figure 6** demonstrates the use of bounding box method over characters of the number plate.



Figure 6; Building Boxes over Characters and numbers by bounding box method

E. Character Recognition & Display the Result

This step is utilized with the end goal of change of images of text into characters. Number plate recognition system is now used to check the match of every character with the total alphanumeric database individually using an approach of template matching. The matching procedure moves the layout picture to every conceivable position in a bigger

source picture and processes a numerical file that shows how well the format coordinates the picture in that position. Matching is done on a pixel by pixel premise.

The **Figure 7** shows the sectioned characters of the number plate, and **Figure 8** demonstrates the final yield in a text frame.

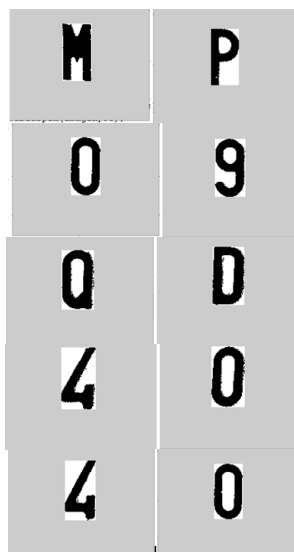


Figure 7; Segmented Characters and Numbers

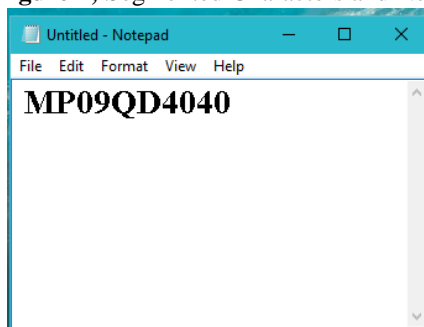


Figure 8; Output stored in Notepad file

Result Analysis

The vehicle ought to stay stationary while taking the picture and the picture is caught from settled point parallel to the earth. We confronted some improper identification either because of the system, that was not able to extract the number plate from grayscale of the image taken improperly or because of luminance conditions and blurry background. Number plate extraction needs a great degree of high exactness when taking a shot at the images of busy streets or parking areas.

Conclusion and Future Scope

In NPR system, the picture of vehicle number plate is taken with the image capturing system and the license number of the vehicle is perceived with the goal that the data and information of the vehicle owner can be obtained. In our paper, we have performed a technique in which the picture of the vehicle plate is taken. At that point, the noise diminishment is performed on it to show signs of enhancement come about. After this, segmentation and identification of characters are done using the template matching technique. In any case, the system can be utilized just for binary pictures and not for RGB pictures. Because of shifting attributes of the number plate, additional research is as yet required in this area. Distinctive filtering procedures can be acquainted with the reducing of noise to a more noteworthy degree, so the image processing can be more productive. In future, the recognition of number plate should be possible from the video processing as well.

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