

A Review Paper on Automatic Number Plate Recognition (ANPR) System

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Abstract— Automatic Number Plate Recognition system i.e. ANPR system is an image processing technology. In which we uses number plate of vehicle to recognize the vehicle. The objective is to design an efficient automatic vehicle identification system by using the vehicle number plate, and to implement it for various applications such as automatic toll tax collection, parking system, Border crossings, Traffic control, stolen cars etc. The system has color image inputs of a vehicle and the output has the registration number of that vehicle. The system first senses the vehicle and then gets an image of vehicle from the front or back view of the vehicle. The system has four main steps to get the required information. These are image acquisition, plate localization, character segmentation and character recognition. This system is implemented and simulated in Matlab 2010a.

Keywords— ANPR, localization, segmentation, recognition, OCR

I. INTRODUCTION

The Automatic Number Plate Recognition (ANPR) was invented in 1976 at the Police Scientific Development Branch in the UK. However, it gained much popularity during the last decade along with the improvement of digital camera and the increase in processing speed. ANPR is an image processing technology which enables to extract vehicle license plate number form digital images. It consists of a camera that has the capability to capture an image, finds the location of the number plate in the image and then extracts the characters using character recognition tool that translate the pixels into alphanumerically readable character or string. ANPR can be used in many areas from speed enforcement and tool collection to management of parking lots, etc. [7]. At present, in ANPR there are several techniques used for the recognition plate's number such as pattern matching [8], neural network character recognition [1], and image processing technology [2].which are computationally expensive or use artificial neural network which involves complex mathematics. The block diagram of ANPR system is shown in fig 1.

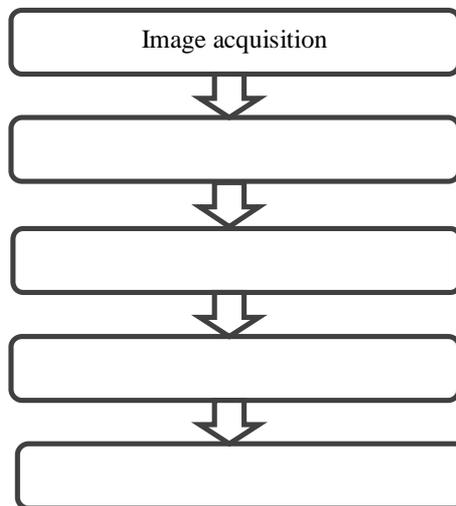


Fig 1:- Block diagram of ANPR system.

The ANPR system works in these steps, the first step is the detection of the vehicle and capturing a vehicle image of front or back view of the vehicle, the second steps is the localization of number plate and then extraction of vehicle number plate in an image. The final step use image segmentation technique, for the segmentation several methods have been proposed neural network [1], mathematical morphology [2], colour analysis [3], and histogram analysis [4].

Segmentation is for individual character recognition. Optical character recognition (OCR) is one of the methods to recognize the each character with the help of database stored for respective alphanumeric character.

II. ANPR SYSTEM MODEL

The decisive portion of ANPR system is the software model. The software model which uses image processing toolbox for chain of image processing techniques which are executed in MATLAB. Typical ANPR System consists of four steps these are image acquisition, license plate extraction, character segmentation, and character recognition. For the efficient and accurate results various approaches have been used for this purpose.

The first step is the acquisition of an image i.e. getting an image using the digital camera connected to the computer. These captured images are in RGB format so it can be further process for the number plate extraction. The database system that contains the personal information of the vehicle owner and several plate vehicle images, abbreviations and acronyms.

III. IMAGE ACQUISITION



Fig 2:-Captured image by digital camera.

a) IMAGE PROCESSING

Captured RGB image is shown in fig 2. The captured image is affected by many factors like: optical system distortion, system noise, lack of exposure or excessive relative motion of camera or vehicle etc. result is the degradation of a captured vehicle image. And the adverse influence to the further image processing Therefore before the main image processing pre-processing of the captured image should be taken out which includes converting RGB to gray shown in fig 3, noise removal, border enhancement for brightness.



Fig: 3 -Converted from color image to gray image.



Fig 4: - Pre-processed image

Filtering can be done in two ways one is spatial filtering and second one is frequency domain. Further the spatial filtering can be done in two ways first is mean filtering and second is median filtering. Pre-processing is carried out on the captured image to improve the quality of the image so that the main processing on the image becomes easier. After the pre-processing, well contrast enhanced and changing the color image in to gray now it is to feed into the main body of ANPR system. Fig 4 shows the filtered image. After this pre-processing ANPR system has three main steps. Those are Localization, character segmentation and character recognition.

IV. PLATE LOCALIZATION

As a second step in ANPR system processing, the ANPR software should locate the possible number plate of vehicle and then extracted from the image for further processing. The initial phase in localization of vehicle number plate is by detection of the number plate size. The challenge is to include an algorithm that is able to detect the rectangle number plate region in the image which is called as Region of interest (ROI). For extraction of the plate region, method based upon combinations of edge statistics and mathematical morphology will be applied to detect that region. In this method gradient magnitude and their local variance in the vehicle number plate image are computed. They are based on the property that the brightness variation in the number plate region is more remarkable and more repeated than elsewhere. Block-based processing is also useful in plate localization [5]. Number plate localization is shown in fig 4.



Fig 4:- Vehicle number plate localization

Another method is using yellow search algorithm. A yellow search algorithm is used to extract the ROI in an image. The image is search for the yellow colour pixels or some which are closer to yellow in value. If the pixel value is of yellow colour or close to the yellow colour the pixel is set to 1, otherwise the pixel value is set to 0. and we can find required ROI.

V. PLATE SEGMENTATION

A precise binary image is got after the license plate localization. In order to recognize the vehicle number plate characters afterwards, each character must be divided respectively. That is task of character segmentation. The individual characters have to be distinguished (segmented) from each other. In this step, the characters & digits of the plate are segmented and each is saved as different image. Number Plate segmentation plays an important role in ANPR system.

To obtain segmented characters in number plate, first plate image is converted into binary image. Then 'Lines' Function is used to divide text on the number plate into lines, which uses "clip" function. "Clip" function crops black letter with white background. After cropping image, resizing is done and same operation is repeated for each and every character on the cropped image. Fig 6 shows the plate segmentation example.

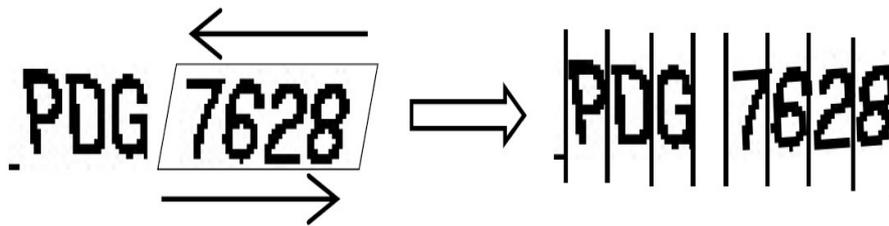


Fig 6:- Example of plate segmentation.

Because the images contain some noise it is further filtered and normalized. To make the final image to match up the standard template uniform that contains only two gray values of black and white.

VI. CHARACTER RECOGNITION

This is the most important and critical stage of the ANPR system. Character recognition step will be identifying the characteristics of the character input image. In this stage, the segmented characters are rescaled to match the characters into a window. For this purpose, each character is normalized to the proper size of binary image and then follows by reshape to standard dimension before further processing. Fitting approach is also necessary for template matching.

Different methods were used for character recognition, letters and characters in the paper. Finish the identification by calculating the similarity of features. For the similar characters, make the second identification with the method of feature point matching. Another approach is that Once the lines in an extracted vehicle number plate are separated, the line separation process is now applied column wise so that individual character can be separated. The separated individual characters are then stored in separate variables. The extracted characters taken from number plate and the characters on database which we have stored are now matched. The next phase is template matching. Template matching is an efficient algorithm for character recognition. The characters image is match up to our given database and the best resembling is considered. Another method for character recognition is the optical character recognition (OCR) is used to compare the each individual character against the complete alphanumeric database. The OCR actually uses correlation method to match individual character and finally the number is identified and stored in string format in a variable. The character is then compared with the database for the vehicle authorization. The resultant signals are given according to the result of comparison. Templates will exist for all the characters i.e. A-Z and 0-9 as shown in fig 7.

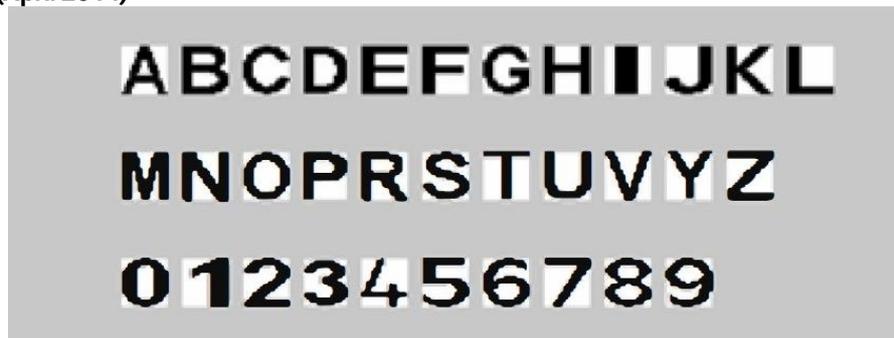


Fig 7:- Database of templates.

In another method of artificial neural network it is very important to expand the training database size for Neural Network if we do Neural Network [6]. By increasing the database size, the accuracy for the network will be increased. Artificial Neural Networks can be used to classify the characters of number plate. However, they do not provide hardware. Therefore statistical feature extraction has been used. In this method, at first the character is separated into twelve identical parts and fourteen features are extracted from each part. The features used are binary edges (2X2) of fourteen types. Finally syntax checking is done to confirm that any wrong character is not recognized as a valid number plate.

CONCLUSION AND FEATURE WORK

In this review paper, the automatic number plate recognition system using vehicle license plate is presented. The system use image processing techniques for identifying the vehicle from the database stored in the computer. The system works satisfactorily for wide variation of conditions and different types of number plates. The system is implemented and executed in Matlab and performance is tested on genuine images.

The system works quite well however, there is still room for improvement. The camera used in the system for this project is sensitive to vibration and fast changing targets due to the long shutter time. The system speed can be increase with high resolution camera. The OCR method is sensitive to misalignment and to different sizes, so the affine transformation can be used to improve the OCR recognition from different size and angles. The statistical analysis can also be used to define the probability of detection and recognition of the vehicle number plate. At present there are certain limits on parameters like speed of the vehicle, script on the vehicle number plate, skew in the image which can be removed by enhancing the algorithms further.

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