Number Plate Recognition using morphological operations

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Abstract — Automatic Number Plate Recognition (ANPR) is a real time embedded system. It is used to track and monitor the moving vehicles by automatically extracting the number plates. Now a day the requirement of ANPR system is increased due to different formats of number plates. In this paper Indian vehicle number plate recognition system is proposed. Proposed method uses simple morphological open and close operations using different structuring elements. By using only captured images this system is used in car parking, in car theft issues and many more. By overcoming the difficulties in existing methods, proposed method gives good results.

Key words — Vehicle number plate localization, morphological operation opening and closing, optical character recognition.

1 INTRODUCTION

The aim of this paper is to build application which recognises number plate at the entrance of a gate. By using camera, the system captures the number plate of a car and processes them. Once the number plate is detected, recognition is done with the help of database. The aim of the project is to avoid traffic issues and similar problems. The algorithm which is used in this project includes following steps:

- Pre-processing.
- Segmentation
- Recognition
- Comparison

2 PROPOSED SYSTEM

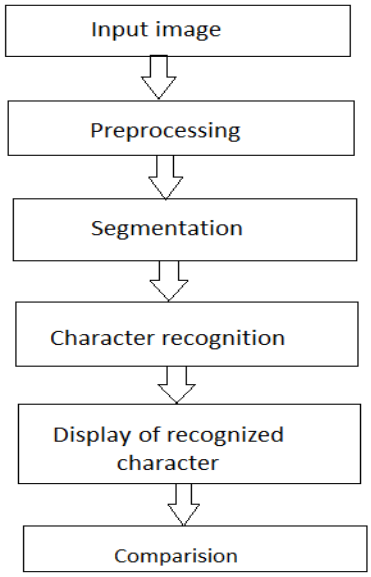


Fig. 1. Proposed ANPR Process.

I INPUT IMAGE

The first stage of image processing for number plate is the image captured by Electronic devices such as optical (digital/video) camera, webcam etc. For this project, vehicle images will be taken with a digital camera. The images will be stored as colour JPEG format on the camera. The distance between image and camera should be 5-6 meters. After that the captured image is converted into gray scale image.

Fig. 2.Original image for recognition.

II Pre-processing

The RGB image is then converted into a gray scale image for easy analysis as it consists of only two colour channels. Median filtering is used to remove salt and pepper noise. The aim of this process is to improve the picture quality of the image. Image enhancement techniques consists process of sharpening the edges of image, contrast manipulation, reducing noise, colour image processing and image segmentation as well. The gray image is then cropped whereby it will extract the smallest rectangle which will contain the edge of the license plate and license plate itself. This cropping process will highly increase the speed of image processing. The figure below shows the binarised image:

Fig. 3.The binarised image.

III CHARACTER SEGMENTATION

Our proposed method applies basic mathematical morphology operations like 'opening' and 'closing' alongwith very simple heuristics for the localization of the license plates and character recognition technology to extract the numbers from the localized license plate. It is a topological and geometrical based approach for image analysis which provides powerful tools for extracting geometrica lstructures and representing shapes in many applications. In mathematical morphology these are represented as matrices. Structuring element is a characteristic of certain structure and features to measure the shape of an image and is used to carry out other image processing operations. The shape and size of the structuring gelement (SE) plays crucial role in image processing and is therefore chosen according to the condition of the image and demand of processing.

Typical structuring elements are shown below:

.

Fig. 4. Segmented number plate using morphological opening.

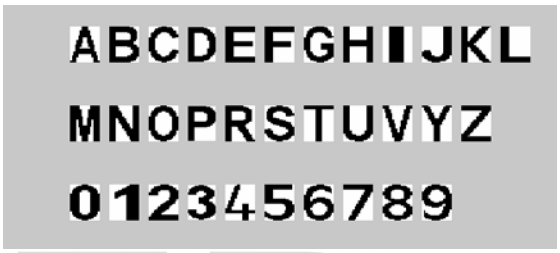
Fig. 5. Segmented numbers

IV CHARACTER RECOGNITION

It is employed for the purpose of conversion of images of text into characters. The process of OC involves several steps including segmentation, feature extraction and classification. Each of these steps is a field onto itself and is described briefly here in the context of a Matlab implementation of Optical Character Recognition (OCR).

Before recognition algorithm normalisation is done. Normalization provides a tremendous reduction in data size of the characters. For perfect match, input images must be equal-sized with the database characters. The extracted characters cut from plate and the characters on database are now equal-sized.

The next step is comparison. In this, character image is compared with the database and the best similarity is measured. To measure the similarity correlation is used. This method measures the correlation coefficient between a number of known images with the same size unknown images or parts of an image with the highest correlation coefficient between the images producing the best match.



The output of OCR on the segmented license plate shown above is:

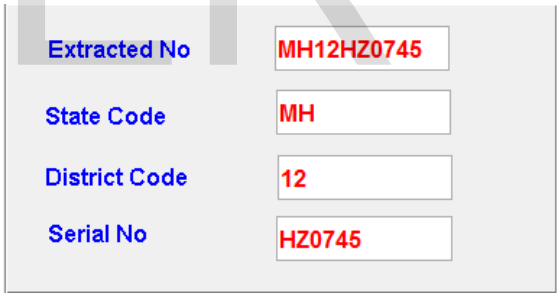


Fig. 6. The output of OCR on the segmented license Plate.

V COMPARISON

Database is a collection of information or data which it is being orderly organized thus it can be accessed easily and updated. Database can be in the form of text, contents and images. Database is needed to make sure that the image space can contain enough characters which have been extracted and the vehicle license plated number stored in the notepad for the purpose of comparison. The database would be enlarged inorder to improve the accuracy and better chances of obtaining the correct result. The class recognition will check if the computed ratio is correct. It will ignore the class if the image thresholding is too low. If the class has match correctly, it will be compare with data set in the database and provide an output if the image is recognized correctly. Characters are compared to determine whether the input image is authenticated

or not. This is done by comparing the recognised license plate with the database. The database contains the list of license plate which are authorised. Comparision is done line by line and by checking every character in each line. If all characters are matched then message will come as "authenticate".

3 RESULTS

The system's accuracy in locating the number plate is more than 98%. The problem encountered in the earlier systems in locating the number plate when vehicle bodies and their number plates have similar colors was overcome. There by achieving higher accuracy in number plate extraction step. As the fonts vary from one number plate to the other, ambiguous situation may arise in recognizing the characters 'G' and 'C', 'I' and '1', '7' and 'T' and alike since OCR template was developed for one particular font. But some of them were overcome by "character categorization" approach.

Table1. Results of the Test

Units of LPR System	Number of Accuracy	Percentage of Accuracy
Extraction of Plate Region	15/15	100
Segmentation	14/15	94
Recognition of Characters	14/15	94

4 CONCLUSION

A morphology based approach for localization of Indian license plates along with the number recognition based on template matching has been proposed. In this approach, number plate located at any corner of image can be recognized. Number plates having variations in background as well as font can be easily localized. Unwanted conditions such as screws and unwanted text on number plate which create problem for localization are treated suitably and taken into consideration. This logarithm has been found to be 90% accurate overall. The major sources of error were due tomisinterpretation of characters in the number plate caused byextreme variation in the dimensions, overlapping and style of the characters and low contrast in images. However these errors can be aptly rectified by using more adaptive thresholding methods and advanced techniques such astrained Neural Networks.

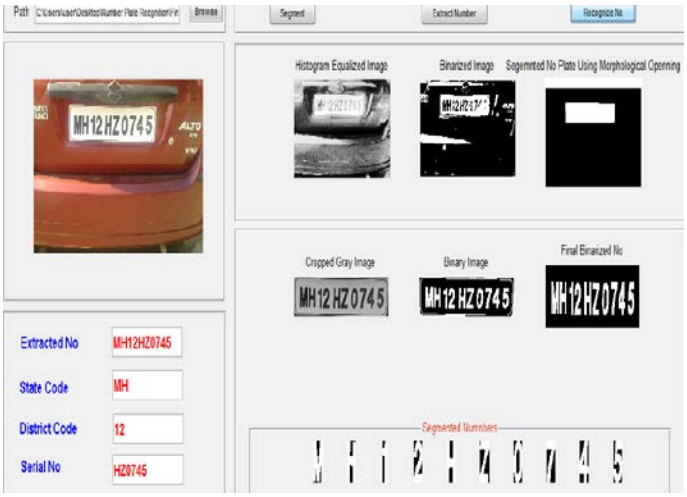


Fig.7. Graphical User Interface for the Demo program

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