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Licence Plate Recognition Using Feature Extraction and Principle Component Analysis

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Abstract--- There are many techniques available for recognizing license plates but due to the Indians not using the standardized number plates we often face a problem of not recognizing the number and the characters on the number plate properly. The different ways in which the number plates are present often creates a problem for the present techniques to not recognize the number plates properly. To overcome this issue, we are implementing a new number plate recognition technique in which we are going to use feature extraction to catch the number plate present on the vehicle automatically and then by segmentation we will detect the characters and digits present on the number plate and check it in the Artificial Neural Network(ANN) as the standard technique often fails to do so for us. This technique will not only be able to recognize the license plates written in English but also those which are written in Hindi and then store them in a database with a timestamp of when it was captured.

Keywords--- Number plate recognition, Principal component analysis, Feature Selection, Artificial Neural Network

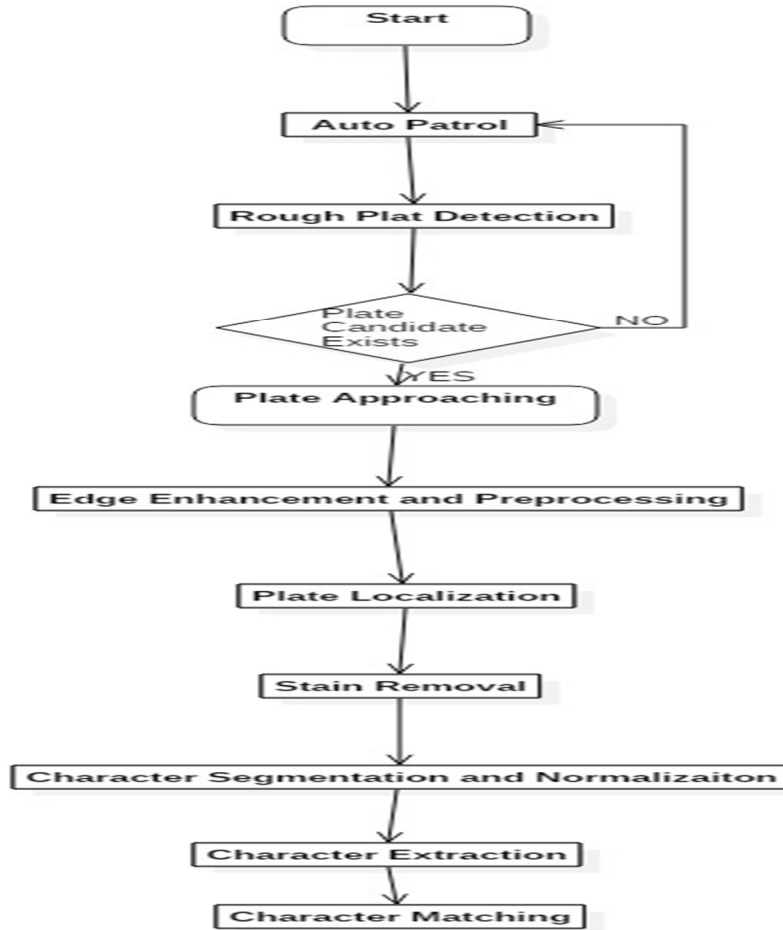
I. INTRODUCTION

License plate recognition has been used all around the world, but it is not used much in India because we Indians are not used to following proper standards when it comes to number plate. We often find number plate in different shapes and characters written in fancy fonts which creates problem in recognising the number plate by the existing systems as they are designed to capture only a certain type of number plate and recognize only certain type of characters which are clearly understandable. To overcome the situation, we will be designing a system which will be using plate segmentation for segmentation of characters and then by applying PCA for skew detection and rotation of the characters for image processing.

II. EXISTING SYSTEM

There are a number of algorithms proposed for number plate localization such as multiple interlacing and transform domain filtering. In case of multiple interlacing algorithm horizontal edge detection and vertical edge detection is performed separately on input vehicle image. Since the Indian number plates do not have any bordering and are many times found decorated with stickers alongside it becomes difficult for the present methods to locate the number plate. Even after localizing the number plate the next challenges that we face is the character recognition, since the characters may be fancy so we need to upgrade our ANN in order to read the characters. One problem that we face with the ANPR system is that in indian according to the rules 1st the state code comes then the area code and then a code which is helps knowing when the vehicle was bought and then the final number but many times we see the 1st and 3rd swapped or the 1st and 3rd elements placed side by side and the 2nd element placed 2nd which often generates error for the present systems.

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III. PROPOSED SYSTEM

The system is intended to be simple to use and to provide a consistent user interface. The implementation part of the system depends on the algorithms selected for each operation. There are variety of algorithms, which could be applied for the operations to be performed. The optimal algorithms for each operation have been chosen. The algorithms been used in the system and the detailed information for modules are as follows:

The proposed system consists of 2 self-developed novel methods namely

Plate extraction(using feature selection) and segmentation

Character recognition using PCA

The proposed application will be implemented in the following way.

The 1st job will be of a camera which may be a smart phone camera or a CCTV camera which will capture the image of the vehicle. The captured image will depend on the position of the camera. Now we will divide the captured image into horizontal and vertical histograms. The division of the image into histograms plays an important role and is described below:

The process is divided into 3 sub processes namely: Pre-processing, Determination of the kind of plate and object enhancement. Here pre-processing will perform character segmentation in order to convert them into standard normalized form. The Determination of the kind of plate will determine if the plate belongs to a public or a private vehicle. In the end we perform object enhancement, here the object is the characters and digits on the number plate that are being enhanced for easier and accurate recognition.

It can be explained as follows:

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A. Plate Extraction And Segmentation

Plate Extraction and Segmentation is the heart of our proposed system. This process of plate extraction and segmentation decides the actual result and the output is dependent on its result. In Plate extraction and Segmentation the 2 main histograms used are Horizontal histogram and vertical histogram.

These 2 play a very important role in the process of extraction and segmentation. It can be explained as follows:

This process is divided into three sub-processes namely

Pre-processing

Determination of plate kind

Object enhancement

It can be explained in detail as follows:

1) *Pre-Processing*: Pre-processing is very important for the good performance of character segmentation. The size of the plate images is an important factor for the accuracy of character segmentation. All the license plate images are normalized to 160*40 in pixel. It is called as size normalization. The experiments show that this scale is fit for character segmentation. This reduction of a scale is done using the down sampling matrix.

2) *Determination Of A Plate Kind*: There are three kinds of Indian license plates: black characters on a yellow background, white characters on a blue background and white characters on a black background. The gray scale images are of two kinds: black characters on a white background and white characters on a black background. The ratios of number of white pixels to that of black pixels are quite different in these two kinds of gray scale images. So the kind of a plate image can be determined by histogram analysis. For that when the image is taken we know that the image is in 2D matrix in RGB colour. Our aim is to convert this RGB into Grey scale image that is to reduce 2D matrix into 1D, because we need to know the plate kind of our license plate. And to know this we note down the intensities of the colours and from that we come know the plate kind. For grey scale the intensity of a black colour is 0 and that of white is 255.

3) *Object Enhancement*: The quality of plate images varies much in different capture conditions. Illumination variance and noise make it difficult character segmentation. Then some image enhancement should be adopted to improve the quality of images. As we all know, the image enhancement methods of histogram equalization and gray level scaling have some side effects. They may have the noise enhanced as well. For character segmentation, only the character pixels need to be enhanced and the background pixels should be weakened at the same time. In fact, a license plate image contains about 20% character pixels. So these 20% character pixels need to be enhanced and the rest pixels need to be weakened. It is called object enhancement. The object enhancement algorithm consists of two steps. Firstly, gray level of all pixels is scaled into the range of 0 to 100 and compared with the original range 0 to 255, the character pixels and the background pixels are both weakened. Secondly, sorting all pixels by gray level in descending order and multiply the gray level of the top 20% pixels by 2.55. Then most characters pixels are enhanced while background pixels keep weakened. Fig. shows the result of object enhancement. It can be seen from Fig. that after object enhancement the contrast of peaks and valleys of the projection is more significant than the original.

Since we know that PCA makes use of pattern recognition from its Artificial Neural Network (ANN), we will first built an ANN will contain all the characters and digits in both the English and the Hindi language. After finding the pattern PCA will check it on the 3 slopes i.e. x, y and z axis. If at least 2 slopes matches with a pattern which is already present we will consider that to be the final character.

The importance of this technique is that it can give more accuracy in identifying the license plate and will reduce the man power when applied to practical use at traffic signals or in parking lots.

Principal component analysis (PCA) [24] is a way to identify patterns in data of high dimensions and highlight the similarities and/or differences in the data. PCA have been applied successfully in the fields of face recognition and image compression. For vehicle license plate images, which are two-dimensional data, the principal component analysis can be used to determine the skew (inclination/slope) of the license plate. After removal of clusters (shown in Fig. 4), PCA analysis is applied on such image (which shows only the corners points).

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IV. CONCLUSIONS

In the proposed method the feature extraction of the license plate is done using PCA algorithm which provides better localization of number plates and thus solving our problems with the present methods and then by upgrading ANN we can have a better understanding of characters.

V. ACKNOWLEDGMENT

It gives us great pleasure in presenting the preliminary project report on 'License Plate Recognition using Feature Selection and Principal Component Analysis'. We would like to take this opportunity to thank our internal guide Prof. Nitin Hambir for giving us all the help and guidance We needed. We are really grateful to him for his kind support. His valuable suggestions were very helpful. We are also grateful to Prof. S. S. Das, Head of Computer Engineering Department, DYPSOE, Lohegaon, Pune and to our Project Co-ordinator Prof. J. L. Chaudhari for their indispensable support, suggestions and motivation during the entire course of the project. In the end special thanks to our Director Dr. S. S. Sonawane who encouraged us and created a healthy environment for all of us to learn in best possible way. We also thank all the staff members of our college and technicians for their help in making this project a successful one.

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