RECOGNITION OF MOVING VEHICLE NUMBER PLATE USING MATLAB

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Abstract

In this paper a system is developed for detection and character recognition of moving vehicle number plate. The detection of Indian vehicle number plate is a challenging task from many years. Since, various countries design the number plates with different size, shape and color for detection. This approach is based on efficient morphological operation like erosion and dilation. Sobel edge detection is used to perform spatial gradient measurements on a image and segmentation of all letters and numbers in the number plate are done by using bounding box method. Template matching technique is used for recognition of characters in the vehicle number plate. Video surveillance system helps in security purpose like Home security, banking security and also in traffic and military application.

Index Terms: Number plate recognition, Segmentation, Bounding box, Template matching

I. INTRODUCTION

The purpose of this paper is to build a real time application which recognizes moving vehicle number plates on the road segment. The system based on regular PC with video camera, catches video frames which include a visible vehicle number plate and processes them. Once a vehicle number plate is detected then segmentation of all letters and numbers in the number plate are done by using bounding box technique and characters are recognized using template matching method. The system is based on MATLAB program and a digital camera, which help to capture the images of the vehicle number plate. A system was developed which is able to extract the vehicle number plate. Video surveillance system helps in security purpose like Home security, banking security and also in traffic and military applications. Number Plate Recognition is a real time system which identifies the characters directly from the image of the vehicle number plate. The detection of vehicle number plate is a most interesting and challenging research topic from past few years. Because a wide variations are found in the vehicle number plates in terms of font type, character size and location of the number plate. Also, in certain cases, many unwanted characters are present on the number plate. The localization is used to recognize the vehicle number plate area and also it is used to eliminate all the background and preserve only the number plate area from the input image [1]. From this number plate area, the individual characters are then segmented out and characters are recognized. The study of Number plate recognition system is a field of research in artificial intelligence, machine vision, pattern recognition and neural networks. Number plate location algorithm consist of steps like as Edge Detection, Morphological operation like dilation and erosion, Smoothing, segmentation of characters and recognition of plate characters are described in [2] [3].

The rest of this paper is organized as follows. Section II represents over view of the related work. Section III presents detailed block diagram of the system and the last section describes the conclusion of the paper.

II. RELATED WORK

The early approaches were based on characteristics of boundary lines. The input image being first processed to enrich and enhance boundary line-information by using algorithms such as gradient filter. The image thus processed was converted to its binary counterpart and then processed by certain algorithms, such as Hough transform, to detect lines. Eventually, couples of 2-parallel lines were considered as a plate-designate. Another approach was based on statistical properties of text. In this approach, text regions were discovered using statistical properties of text like the variance of gray level, number of edges, edge densities in the region, etc. This approach was commonly used in finding text in images, and could well be used for discovering number plate areas as they include alphabets and numerals. In addition, there are other methods relating to this problem focusing on detecting vehicle number plate using artificial intelligence algorithms. These systems use edge detection and edge statistics to detect the location of the number plate area. All of these systems discussed above have some kind of limitations for example they are plate size dependent, color dependent, Work only in certain conditions or environment like indoor images etc. A method was proposed which is independent of color, size, location and angle of the number plate of the vehicle.

III. GENERAL BLOCK DIAGRAM OF NUMBER PLATE RECOGNITION SYSTEM

The input image is captured by different methods either by analog camera or by digital cameras, but nowadays digital technology has their advantages so better digital cameras are used. The RGB image is then converted into a gray scale image for easy analysis. Median filtering is then implemented for the effective removal of noise. The aim of this process is to increase and improve the visibility of the image. Image Enhancement techniques consists of sharpening the image edges, Morphological operations like erosion and dilation , reducing noise, color image processing and image segmentation as well. For recognition, segmented image is multiplied with gray scale image therefore the number plate of the vehicle is obtained.

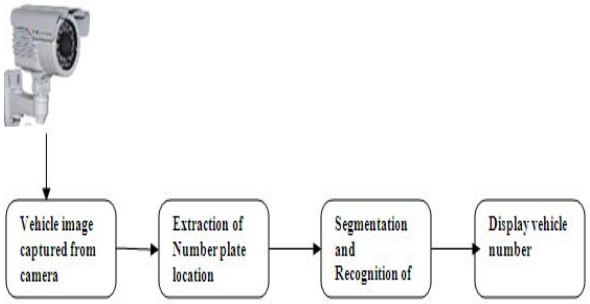

Figure 1.Block diagram of number plate recognition system

A. *Input image*

The Vehicle number Plate is captured using Electronic devices such as camera, webcam etc. The image is taken with the resolution of 1920x1080 pixels.

Figure 2.Input image of the vehicle

B. *Extraction of number plate location*

In this method, RGB to gray-scale conversion is adopted, in order to facilitate the plate extraction, and increase the processing speed. Color image (RGB) acquired by a digital camera is converted to gray-scale image based on the RGB to gray-scale conversion technique. The basic idea of this conversion is performed by eliminating the hue and saturation information while retaining the luminance. The following equation shows an optimal method for RGB to gray-scale conversion, as follows:

$$Gray = 0.299 * R + 0.587 * G + 0.114 * B \quad (1)$$

The gray-scale image resulted by the previous stage is converted to binary image (Black & White). This conversion is the most important stage in all phases of the NPR system, and more specifically for plate extraction phase. As known, the foreground and background colors of vehicle number plates are quite distinct. However, images of the vehicle number plate system often contain unevenly distributed gray intensities, or all the intensity values could lie within a small range, such as the images with

poor contrast, or poor illumination. Therefore, the crucial point is to use an effective technique for binarization; otherwise, the method would fail to extract the license plate region from the vehicle image correctly. In order to overcome the illumination problems, our method performs this task. As a result, the plate characters are appearing clearly after binarization. The next step removes any object contiguous to the border of the image. Thus, unnecessary objects are removed, while the plate characters will not be affected because they are surrounded by a black background. After removing the unwanted objects, a specific filter is used for illuminating the very small objects based on the size of each one.The binary gradient mask shows lines of high contrast in the image. These lines do not quite delineate the outline of the object of interest. Compared to the original image, gaps in the lines are observed that surrounds the object in the gradient mask. This linear gap disappears if the Sobel image [4] is dilated using linear structuring elements. The binary gradient mask is dilated using the vertical structuring element followed by the horizontal structuring element. The sobel operator performs spatial gradient measurement on an image and thus it emphasizes regions of high spatial frequency that corresponds to edges. Typically it is used to find the approximate absolute gradient magnitude at each point in an input gray scale image.

The region of interest has been successfully segmented, but it is not the only object that has been found. Any objects that are connected to the border of the image can be removed using the imclear border MATLAB function.

To get the only number plate area in a vehicle image with characters and numbers present on it, the segmented image is multiplied with gray scale image.

Figure 3.Grayscale image

Figure 4.Sobel edge detector image

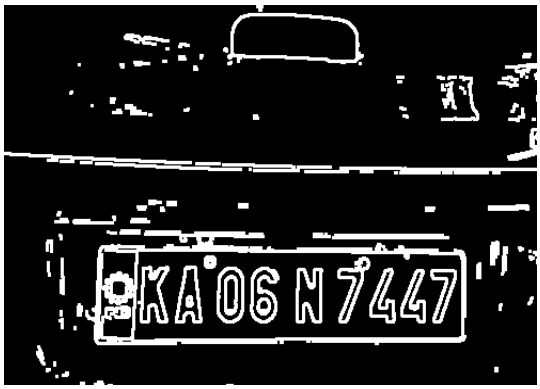

Figure 5.Dilated image

Figure 6.Image with filled holes

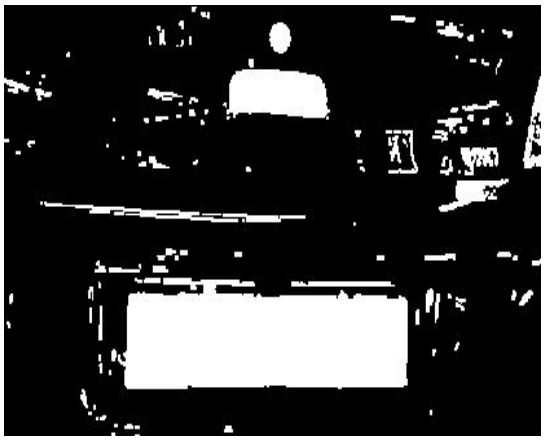

Figure 7.Removed connected object image

Figure 8.Number plate of vehicle image

C. Character segmentation

Segmentation is one of the most important processes in the number plate recognition, because all further steps rely on it. If the segmentation fails, a character can be improperly divided into two pieces, or two characters. The ultimate solution on this problem is to use bounding box technique. The minimum or the smallest bounding or the enclosing box for any point set in N dimensions is the box with the smallest measure within which all points lie. The bounding box [5] is used to measure the properties of the image region .The minimum bounding box of a point set is the same as the minimum bounding box of its convex hull, a fact which may be used to speed up computation. The term "box"comes from its usage in the Cartesian coordinate system, where it is indeed visualized as a rectangle.

Figure 9.Number plate with bounding box image

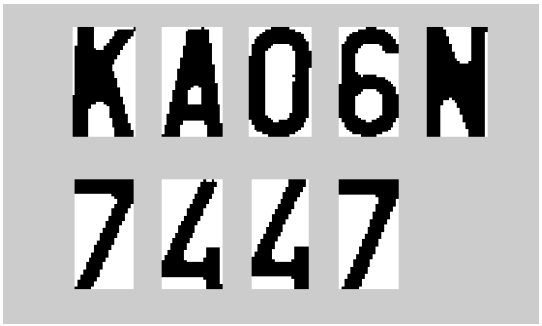

Figure 10.Image of each character

D. Character recognition

In proposed model character recognition is done by template matching which is a classical pattern recognition method. The outcome of the NPR module in terms of foreground segments is to be recognized using template matching. In this method, pixel values of template characters (A-Z, 0-9) are stored in vector such that vector location 1 stores value for character A, location 2 for B and so on. Firstly, the sample is classified and then the recognized characters are normalized by the template size in the character database. It will match with all templates and calculate their similarity. Template matching techniques compare portions of images against one another. Each data segment corresponding to each character is matched with all the 36 data templates in the library. Finally the best match will be chosen as the result.

Figure 11.Templates used for Template matching

The number plate as text file is displayed as shown below

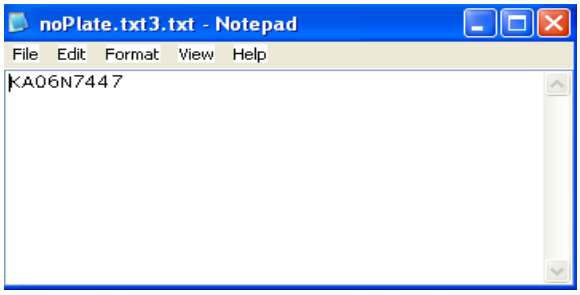

Figure 12.Image of result

IV. CONCLUSION

In this paper, a convenient and practical method for vehicle number plate localization and recognition of vehicle number plate based on morphological edge detection and template matching is presented. Our proposed system is able to recognize number Plates on moving vehicle. The performance of the system is robust

in its toleration of variation of illumination conditions. Therefore a proposed method is mainly designed for real time recognition of moving vehicle number plate.

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