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VIDEO SURVEILLANCE SYSTEMS FOR VEHICLE PLATE RECOGNITION

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Abstract - **This project aims on Vehicle Number Plate Recognition (VNPR), used as basis for security system. There are issues in detection of frame which containing clear license plate from a video. To speed up the system, the number of frames is reduced using Keyframe extraction. From the frame the vehicle plate is localized with the algorithm of Vertical and Horizontal histogram. Plate image is preprocessed with morphological operations and adaptive thresholding method is used. Binarization of characters are identified in the obtained image. Each characters is segmented by using Connected Component Analysis (CCA) method and recognition of characters are done by template matching method. Similarity measures are done to find whether it is authorized or unauthorized vehicle. If it is unauthorized, the security system alerts for manual authentication, otherwise the system gives security clearance to that particular vehicle.**

Key terms- Vehicle Number Plate Recognition (VNPR), plate detection, template matching

I Introduction

Vehicle Number Plate Recognition (VNPR) appears in variety of applications, including authentication of car for security purposes, toll tax collection, recovery of stolen cars, traffic violations detection, and surveillance applications. This paper focusses on simulation of VNPR in an apartment areas. VNPR process divided into three main parts: Plate detection, Character Segmentation and Character Recognition. Each of these parts plays vital role in recognition of number in accurately. There have been, many algorithms for each part.

For plate detection, numerous algorithms have been proposed. Some of these algorithms are based on finding horizontal and vertical edges by using Canny, Sobel operators which have advantages of smoothening the image noise, reducing the computational complexity [3]. In addition to this, wavelet and high frequency coefficients are used which corresponds to the edges, which also suffer from disadvantages of edge detection algorithm. In some other algorithms, plate detection is performed by finding the borders of a plate using the Hough transform which is a memory and time consuming process.

Some algorithm is implanted by using color as an important feature [2] in detection. These algorithms fail on low color disparity. Some detection algorithms are based on a combination of Mathematical Morphology and Connected Component analysis. Most of the algorithms are applicable in still images that are in good illumination conditions, non-blurred, good quality. But, recognizing the Number plate from a video is complicated, as frames are not clear as still images.

For character segmentation, there are many algorithms based so far like Connected Component Analysis (CCA) and Morphological operations. In these methods, it is important to apply a proper thresholding method to obtain a binary image of the vehicle number plate. Thresholding methods like Niblack, SAUVOLA, Wolf and Jolion, and OTSU are good way for plate binarization. But it relies on proper setting of the involved parameters.

For character recognition, many different classification tools and techniques have been proposed so far, such as Template matching, Artificial Neural Networks (ANN) [1] [7], Support Vector Machines (SVM) and so on.

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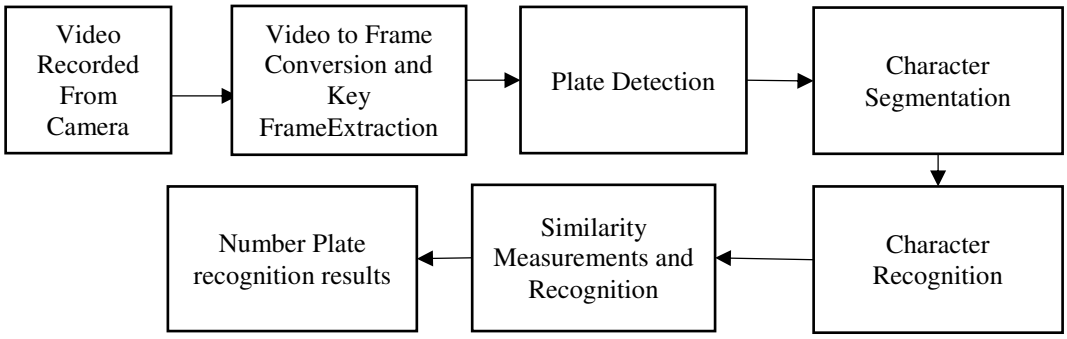

Figure 1: Block diagram of VNPR system

VNPR block diagram describes the flow of paper. Each block diagram is explained in following sections.

Data Base	Duration (seconds)	Frames per second	Key frame extracted
Video_Data_1	19	24	476
Video_Data_2	51	24	1233
Video_Data_3	4	24	97
Video_Data_4	4	23	98

Table 1 Video data sets

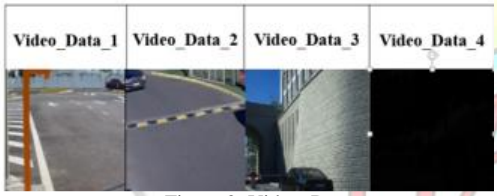

Figure 2: Video_Data sets

This paper is organized as follows: in Section II, Video to frame conversion and key frame extraction is elaborated. In Section III, the vehicle number plate detection algorithm is explained. In Section IV, the character segmentation is discussed. The character recognition and similarity measurements are described in Section V and Section VI respectively.

II. VIDEO TO FRAME CONVERSION AND KEY FRAME EXTRACTION

The aim of this section is converting the video into frames, which is obtained from the camera, mounted on fixed position at the entrance of gate. Camera's line of sight should be adjusted to get appropriate location of the number plate, thus it minimizes the complexity of processing. The obtained video is read and calculates number of frames which has been write as image (.jpg,.png) in the specified directory folder. Those frames are stored in a matrix as 4 dimensional function for further proceedings. For key frame tracing there have been algorithms like Lucas Kanade, Shi Thomasi algorithm, Background subtraction. In this project, it is the best to use Background subtraction method as having camera in fixed position. Key points are detected from moving object in continuous frames and those key points are stored as an individual image which should have vehicle number plate. [6] discussed about Automatic Number Plate Recognition (ANPR), Automatic Number Plate Recognition (ANPR) is a real time embedded system which automatically recognizes the license number of vehicles.

Figure 2: Results of Video to Frame conversion

III. VEHICLE NUMBER PLATE DETECTION

The objective of this section is to trace the location of the vehicle number plate from the image obtained in Section II. We have used the method of finding horizontal and vertical edge [5] variations because there is significant variations in number plate region. After finding these edge variations in both directions, it is

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passed through the low pass filter to eliminate unwanted, noisy variations. Finally, we have plot the maximum variation region to find the exact location of the vehicle number plate. At the end of the process, the unwanted regions are projected as black pixels with region of interest (Vehicle number plate).

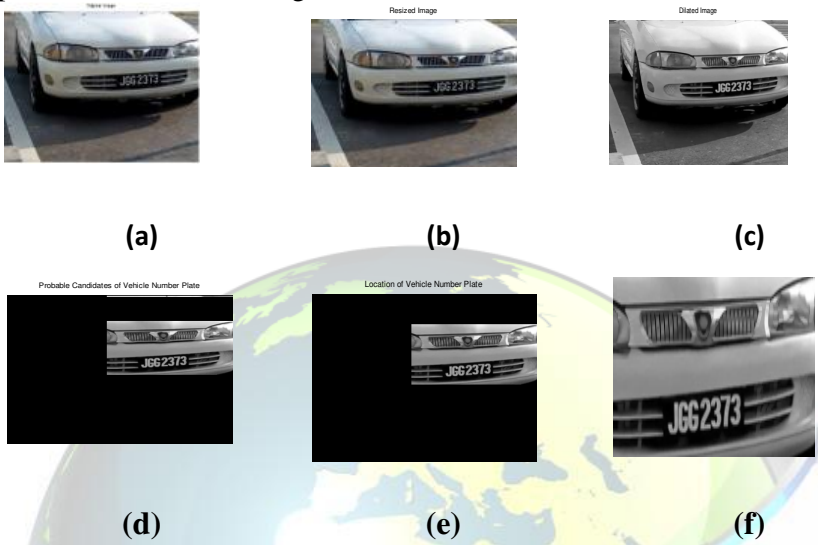

Figure 4: (a) Original image, (b) Resized image, (c) Dilated image, (d) Probable candidates for vehicle number plate, (e) Location of vehicle number plate, (f) Cropped image of number plate

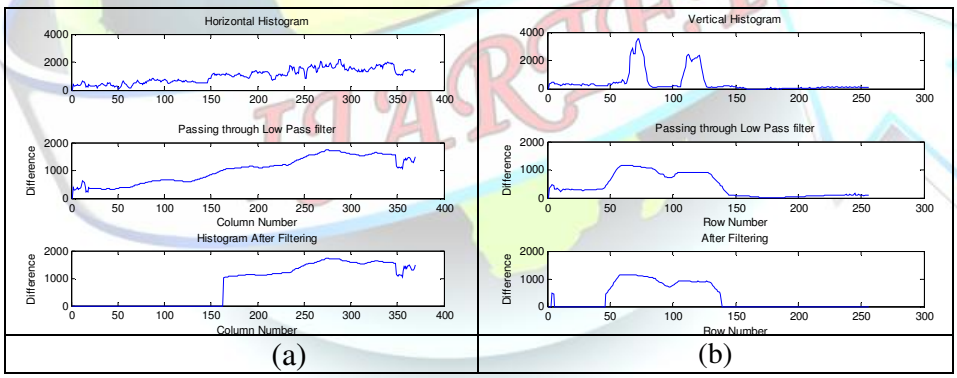

Figure 5: (a) Horizontal histogram results, (b) Vertical histogram results

IV CHARACTER SEGMENTATION

The image which obtained from the Section III is pre-processed with the steps like conversion from RGB to Grayscale image, Noise removing, Erosion and Dilation. Adaptive Thresholding is used to obtain binarization form of vehicle number plate. Each character is segmented and extracted by applying connected component analysis with the use of Boundary box method. Labelling the connected component and eliminating small regions of unwanted component is done to reduce the computational time.

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Figure 6: Segmentation results

V CHARACTER RECOGNITION

The extracted characters from the Section IV is recognized with the Alpha-Numeric characters which are available as template. This template matching technique uses standard and specific font for recognizing the characters. Unspecified font characters leads to failure in recognition.

Figure 7: Template matching characters

VI SIMILARITY MEASUREMENTS

This section is to compare the recognition results with the pre-defined data sets of Vehicle number. If the result is mismatched with the data sets, the system will alert for manual verification and checking. Otherwise, the system will approve security clearance to that Vehicle.

VII CONCLUSION

Most of the Recognition system are applicable for still images of exact vehicle number plate which are in good illumination conditions, but it fails to detect from the video data. Our system are capable of detecting the number plate location from the video data and gives the better recognition results. With this, it can be used for traffic monitoring, highways violations detection, toll tax collection. In future, with the enhancement in detection of logo, structure, color of the cars, dummy cases for authentications purposes will be reduced.

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