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Vehicle Tracking System Based on Image Processing and Azure Cloud

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Abstract— Monitoring and tracking vehicles for law enforcement and other security purposes is difficult problem because of number of automobiles on road today. It is time consuming for officer to physically check license plate of every vehicle. There must be a way for detecting, identifying and tracking vehicle path without constant human intervention. As a solution, we have proposed a system that will extract the licence plate number of a vehicle from given video stream. All the processing of video will be perform on Microsoft Azure cloud. An operator only specifies license plate number. Then video streams are automatically fetched from cloud storage. Framing of that fetched video will be performed on a single virtual machine and then output obtained by framing will be parallely processed on multiple virtual machines for processing purpose. Result will be in the form of licence plate number in text format along with the path travelled by the vehicle by considering respective CCTV ID's.

Keywords— Vertical Edge Detection Algorithm (VEDA), Candidate Region Extraction (CRE), Optical Character Recognition (OCR), Binary Large Object (BLOB) storage, Azure Cloud

I. INTRODUCTION

Vehicles are essential element of Traffic control structure. The population is increasing day-by-day. Thus Traffic monitoring in such crowded area is a challenging task. In the traditional traffic monitoring approaches , a video stream collected from traffic monitoring cameras is viewed in the traffic control rooms or is recorded on the bank of DVR's or computer HDD for later processing. Depending upon the needs, the recorded video is analysed by police or higher authorities. Manual monitoring of the video footage is an expensive task. It is not only time consuming but also requires large number of staff and resources. A human operator loses concentration from video after 20 minutes; making it difficult to pay attention continuously. In a control room, an operator has to juggle between viewing live and recorded video contents while searching for a vehicle of interest.

The main purpose of the proposed system is to build a robust and high throughput cloud computing based solution for automatic processing of videos coming from traffic monitoring cameras. An operator, sitting in a traffic control room, only specifies the license plate number. Then video streams are automatically fetched from cloud storage. Framing of that fetched video will be performed on a single virtual machine and then output obtained by framing will be distributed on multiple virtual machines for processing purpose. Result will be in the form of licence plate number in text format along with the path travelled by vehicle.

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II. RELATED WORK

There are many methods for license plate detection. Some of them are Morphological operations, neural network; Edge detections .The vehicle plate detection is sometimes difficult due to light condition, weather condition, the dust on the plate, etc. In reference [9], Gradient features are used to locate the candidate region. These candidate regions (Region of Interest) are examined by using template of license plate. This method is robust against the noise and tilt but the construction of template is difficult task. When any text block exists other than license plate then this method fails. Hence, the application of this algorithm is restricted.

In reference [10], Sobel operator is used for vertical edge detection. The vertical edges are matched with rectangle. The rectangles which have same aspect ratio like the LP are considered as the possible candidates. Vertical Edge Detection Algorithm (VEDA) is faster than Sobel operator with more accuracy. System of reference [11] is Hough transform based on boundary extraction method. These method is able to detect the straight lines up to 30* inclination. Hough is a time and memory consuming method of detection. The proposed system of reference [12] is used for a Highway Ticketing System. The algorithms are divided into four sections .Vertical edge detection include the linear filtering to smooth the image. The edge density map generation, binarization, Dilation and final license plate location (CCA) are steps of algorithms. But this method fails when the image is blurry. The system of reference [13] has improved the method proposed by enhancing the low-quality input image and then extracting the vertical edges. Then, they used morphological filtering to constitute some regions as plate regions. In this method the license plate specifications and details need to be mentioned to use a morphological filtering.

III. SYSTEM ARCHITECTURE

The following figure depicts the overall working of the proposed system.

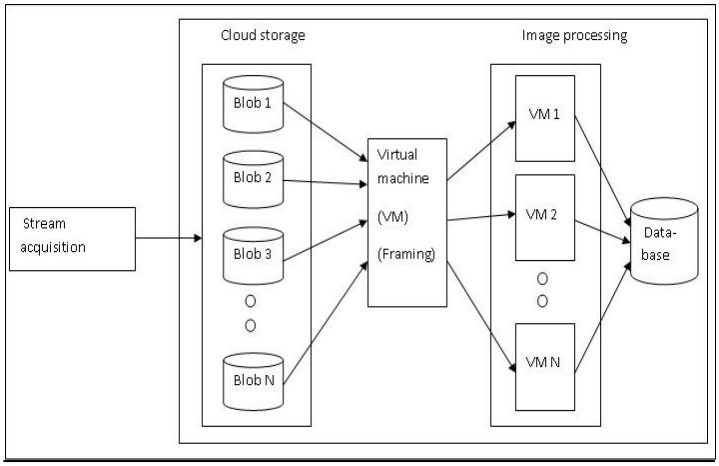

Fig.1 System Architecture

A. Proposed system

1) Video stream acquisition and storage:

The video stream acquisition has been done by using CCTV cameras installed at traffic signals. Later these streams are stored on cloud storage. For storing purpose blob storage facility of Azure cloud has been used as it can store any type of text or binary data, such as media files, documents etc.

2) Parallel processing of video frame data:

The processing server that is virtual machines starts processing on receiving the tracking request from the end-user. It downloads the video from the cloud storage. Then framing of these videos will be performed on single virtual machine. After that video frame data will be given to the multiple virtual machines. Each virtual machine will perform set of video processing algorithms (image processing algorithms) on each frame. As a result we get car licence plate number in text format.

3) Storing the results and informing end-users:

All the resultant text format licence plate number will be stored in database along with their respective CCTV ID's. Then user Query will be matched against the stored result and at the end the end-user gets output which contain tracking result of specified vehicle number on the basis of CCTV ID,s.

B. Algorithms

For processing the image certain algorithms are used in this system. The following figure shows the algorithms used step wise.

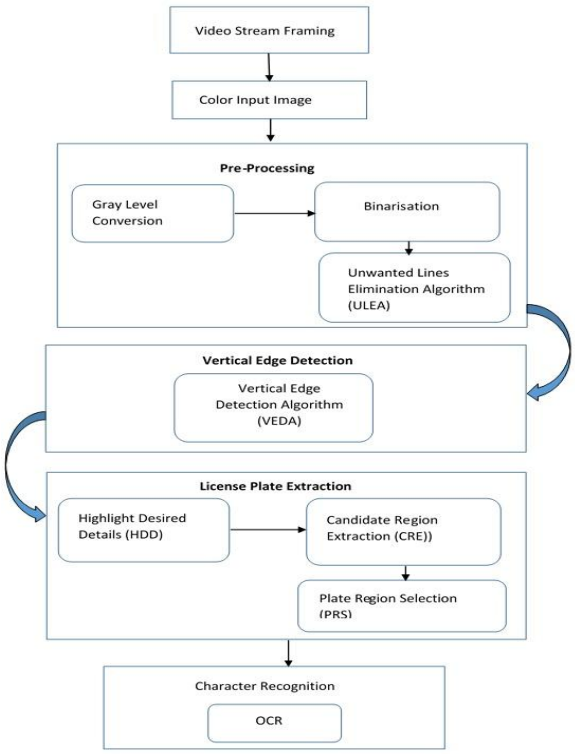

Fig.2 Flow of algorithms

1) Pre-processing:

Pre-processing step is very useful to remove noise from input image.

I) Initially, the RGB image is converted into gray image. For gray scale conversion average method has been used. Formula for gray scale conversion is:

$$gray(i,j) = Red(i,j) + Green(i,j) + Blue(i,j)/3$$

II) Gray scale image is then converted into Binarized image using Bradley's adaptive thresholding algorithm. After binarization image will contain only black and white pixels i.e. 0's and 1's.For binarization this algorithm makes use of integral image which distribute all the neighbourhood pixels evenly distributed in all direction.

III) Unwanted line elimination algorithm (ULEA):

After binarization the unwanted line elimination algorithm is applied to the image. It performs removal of noise and enhances the Binarized image. This algorithm is considered morphological operations and enhancement process.

2) Vertical edge detection algorithm (VEDA):

This algorithm is applied to the ULEA image. It helps to distinguish plate details from the background. Output of VEDA is in special format, starting edge of each character is of 2 pixel widths and ending edge is of 1 pixel width and therefore, character recognition process will be done faster.

3) Vehicle license plate extraction:

I) Highlight desired details (HDD):

This algorithm is used to highlight the desired details of input image such as License plate number. This process depends on VEDA output. It scans all the pixels of VEDA output and when there are 2 black pixels followed by 1 white pixel then it search for 1 width pixel. And draws the black line between that 2 widths and 1 width pixel. For eliminating long and short lines the horizontal distance between two edges has been considered.

II) Candidate Region Extraction (CRE):

This algorithm gives regions which have large darkness ratio. There could be multiple candidate regions. Each candidate region is separated by drawing upper and lower line.

III) Plate region selection(PRS):

This algorithm is used to extract actual region of interest that is licence plate region.

Depending on CRE's output the region having maximum black pixels is selected as a plate region.

IV. CONCLUSION

The Automatic Vehicle Tracking is the system to track the targeted vehicle in the traffic. This system is particularly for Smart Cities. This system can be help for traffic control, traffic monitoring and also to detect malicious activities in traffic. For our system we are using Microsoft Azure Cloud. The videos of the traffic can be taken using CCTV cameras of traffic control and monitoring system. The system is using pre processing, HDD, CRE, PRS, OCR techniques to detect the car license plate. The whole system including car license plate detection and tracking is implemented on Cloud. The proposed system is simple and easy to implement. It is useful for traffic monitoring and control and control the theft of vehicles or other malicious activities in traffic.

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