International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2019 IJSRCSEIT | Volume 5 | Issue 2 | ISSN : 2456-3307
DOI : https://doi.org/10.32628/CSEIT1952288

Traffic Analysis and Signal Timer Management Using OpenCV

Ravi Patel, Manas Vyas, Abhishek Parmar, Utpal Patel

Department of Computer Science and Engineering, Parul University, Limda, Gujarat, India

ABSTRACT

Traffic has been a major issue at intersections throughout the world, here a technique is proposed to reduce manpower required to handle the traffic and remove static timers from intersections. Proposed system is consisting of simple computer device with CCTV. It works by analyse traffic condition from video input and then count vehicles to manipulate signal timer which avoid traffic collision and maintain traffic flow. Therefor the first step in this process is taking video input from mounted CCTV camera and then detection of cars. The system uses Haar like features, which is mainly made for face detection. Haar feature-based cascade classifier is effective object detection technique. It has data set containing positive and negative image data which help agent to identify target object. Result shows this system is more effective in detection of cars compare to existing systems.

Keywords : Traffic Congestion, Computer Vision, Haar Features, Object Detection

I. INTRODUCTION

In recent years it has been observed that increasing number of vehicles on roads leads to many problems such as accident, traffic congestion and many more. Urban and metros are bearing lot of burden due to the lack of proper infrastructure and poor traffic management system as well. Road authorities has taken steps to get recover from this situation but failed to maintain traffic accurately. An automatic traffic surveillance system using OpenCV [11] library will make difference at higher extent.

The very first step in traffic surveillance is identification of vehicles from the footage of CCTV camera. The proposed system will be capable of detecting target vehicles.

It is challenging task to detect vehicles from live video. But detection of vehicle and count them is very crucial to manage traffic efficiently in order to reduce congestion and maintain traffic flow. Steady CCTV camera mounted at top on crossroad would be more preferable to get accurate result. The research specially focuses on automatically detection of vehicles, counting of vehicles and manipulate signal timer which are main aim of proposed system. Describe system uses Haar features which previously used mainly for face detection. The rest of paper is organized as follows. Section I presents related work of this system such as previously used traffic management techniques. In section II implementation part has covered and finally result and conclusion is described in section III.

Figure 1 - Current traffic scenario

1.1 RELATED WORK

The problem of vehicle detection is bit challenging one, there are many systems are built and also lot of researches has been done in order to manage traffic.
Sun Shujuan et al [1] used Haar features and cascade classifier for detection of vehicle at real time. There algorithm was validated on extremely large database. Used system have lane detection to reduce complexity of searching object on a road which is known as "Region of Interest". Also, implemented system have demonstrated the effectiveness of algorithm to port it into android smart phone.

Xing li et al [2] proposed system which has driver assistance to detect cars in day time. previously used critical feature of shadow underneath of car. Histogram analysis method used to detect vertical and horizontal edge detection of shadow. These candidates are classified using Histogram of Gradient (HOG) and Support Vector Machine (SVM) to identify vehicles in good illumination conditions. The drawback of their system is it can only work in good lighting conditions.

Diqing sun et al. [3] has proposed boosted Histogram of Gradient features to differentiate between vehicles and other objects. This method was also working on shadow underneath car and intensity difference between shadow and background regions. Then used thresholding process to separate two regions and applied Support Vector Machine classifier. That was good technique compare to normal HOG features.

Kai Yang et al [4] had used HOG multi model, embedding neural network concepts and Extreme Learning Machine (ELM) for object detection. The ELM technique used Single layer Feed Forward neural network (SLFN), had improved performance and also learning speed was fast then conventional HOG + SVM method. Despite there are several algorithms available to detect vehicles still there are lot of changes needs to be done.

Meghana B S, [5] had used Radio Frequency Identification (RFID) module. The system proposes use of RFID tags which will be associated with individual vehicles. These tags are highly cost effective and also capable to save more crucial information in it. On that base RFID scanner analyse the vehicle and identify them. It was quite slow to count number of vehicles at once.

1.2 PROPOSED SCHEME

Proposed scheme is highly relying on OpenCV object detection which uses Haar [6] like features to convert image queue from RGB to grey scale images. It helps system by reducing colour complexity of images. It is the initial process then system will analyse Image sequence and differentiate changes from background image via comparing them to each other. This process takes lowest amount of time and identify target object. Finally, counting process take place and change signal timer according to traffic density.

To implement the framework, OpenCV consist of a python wrapped called cv2 is used. Below shown is a step by step visualization of the working of proposed system.

CLASSIFICATION OF OBJECT DETECTION, TRACKING AND COUNTING

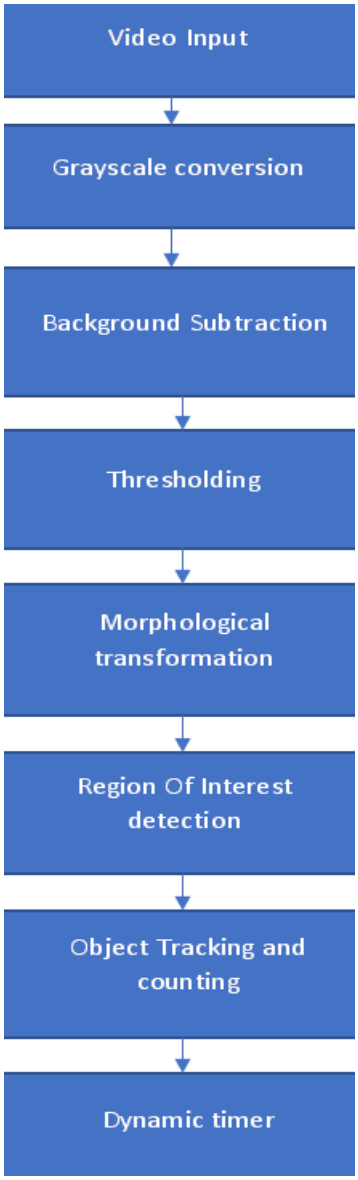


Figure 2 - Flow Chart of Proposed System

1.2.1 Take Live Footage to System: The very first step is to take video input from CCTV camera which mounted on the top of crossroads. The video will be process in real time to get accurate data to manipulate it for further process. It is easy to take live footage from CCTV camera via just one line of code in python.

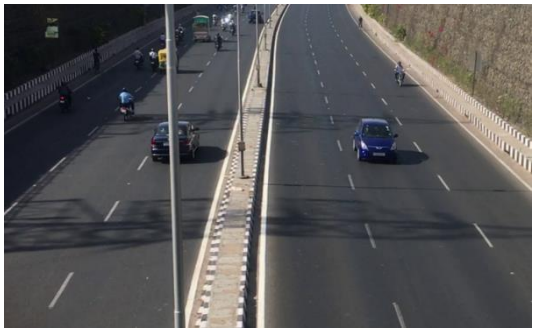


Figure 3 - CCTV Footage

1.2.2 Grayscale conversion: After having real-time video, system will extract it into image sequence and then turn them into grayscale image from RGB. It is because system have to deal with colour complexity while image in RGB form. So, to reduce this problem grayscale transition is necessary part in algorithm.

1.2.3 Background Subtraction: In order to get foreground area system needs to subtract area. So, background subtraction take place here, system compares ideal image with every current frames and mark changes that occur during comparison. Remarkable change extract from the background subtraction and it is called foreground detection.

Figure 5 - After Background Subtraction

1.2.4 Thresholding: After having foreground output data from background subtraction it might be unclear sometimes. Thresholding is used to increase output intensity of input data. It makes image sharper to easily identify foreground.

Figure 6 - Thresholding

1.2.5 Morphological Transformation: It is simple operation based on image shape. It is normally performed on binary images. There is basically two operators Erosion and Dilation. Erosion operation erodes away boundaries of foreground and in Dilation operation increase the foreground part for better detection.

1.2.6 Region of Interest Detection: To detect object efficiently selection of interested region is crucial. So, the system has to make selection in image frame that from where system will get the data. Region of interest is a part of the image of which is used to perform operation on. In this case it will be a portion of road on which the objects are to be detected.

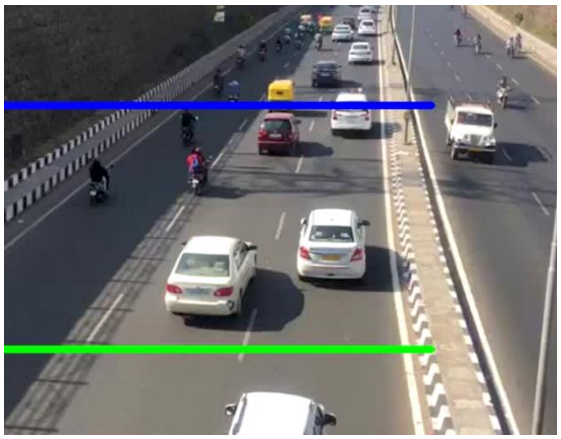


Figure 7 - Region of Interest

1.2.7 Object Tracking and Counting: In object tracking region of interest is decided and every time an object enters in the region of interest an ID ids given to object. This ID help system to track in real-time and number of objects in area at given time can be counted.

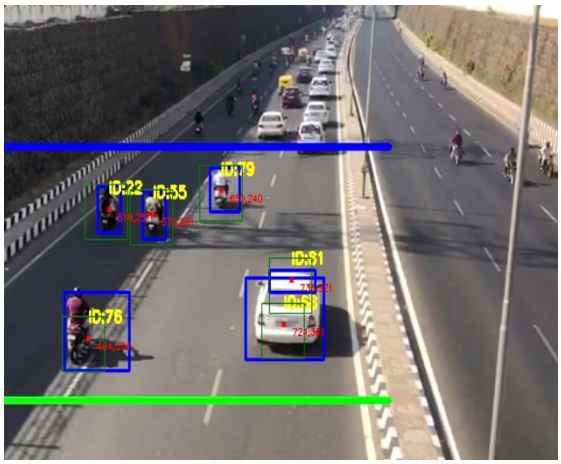


Figure 8 - Object Tracking and Counting

1.2.8 Dynamic Counter: The process runs on each and every frame of the incoming video input, an average of the number of vehicles on each frame is taken into consideration and is multiplied by the average number of objects and a timer is decided. This timer then turns into a countdown and thus while this timer run for a specific road. The same process is done on a either side of road.

II. CLASSIFICATION OF HAAR FEATURE

Haar cascade technique was introduce to detect human face. Afterwards used in various object detection as a method. Haar cascade can be classified in different aspects and it is mentioned below.

2.1 Collection of Image Data-set: The first step towards object detection is to train the agent, for that a set of images is fed to the system. These images are further classified into positive and negative set of images. The image which contain target object is known as positive image. The image which does not contain target object is known as negative image.

2.2 Crop and Mark Positive image: Image data from any website might have other unnecessary objects in frame. So, to get accurate positive image the target

image is to be cropped in a manner that it only contains the target object. Once cropped the image has to be marked them set of positive image data set.

2.3 Arranging Positive and Negative Image: The system needs to differentiate image data into to data set positive and negative in order to help agent to differentiate target object and another object accurately. This will make data set organized.

2.4 Creating a Vector of Positive Image: Now the images that are selected as positive for object detection need to be feed to agent to get accurate result. It is endless process that more data feed agent it will throw the output more accurately.

2.5 Haar Training: Object detection is mainly relied on agent; whose duty is to identify object from the image sequence. It takes the training from positive and negative image data set repetitively to differentiate object and background accurately.

ADVANTAGES OF PROPOSED SYSTEM

1. It can detect and count object accurately.
2. Proposed system can recognize object in different illumination condition.
3. Proposed system is able to manipulate signal lights and timer dynamically at real-time.
4. It can manage traffic flow more efficiently
5. It helps to reduce congestion at inter section of roads.
6. Men-power can be reduced to manage traffic
7. This system is capable to run-on low-end machine.
8. Maintenance cost is low.

III. RESULT

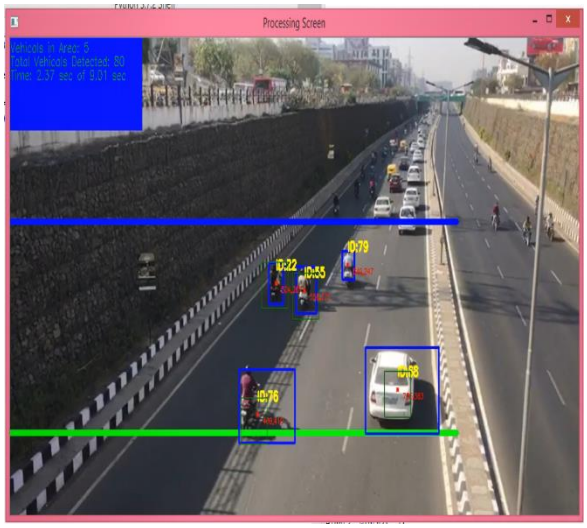


Figure 9 - Result1Object detection and Counting

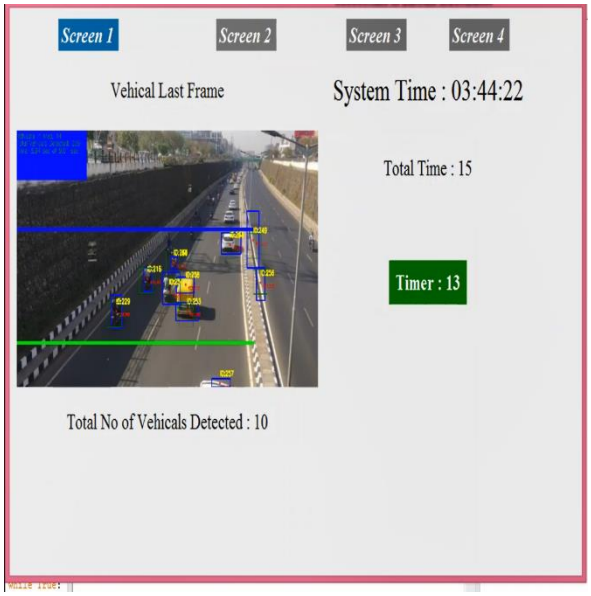


Figure 10 - Result2 GUI

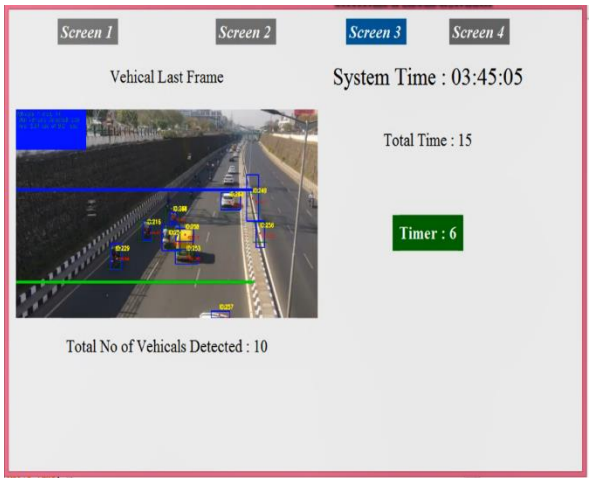
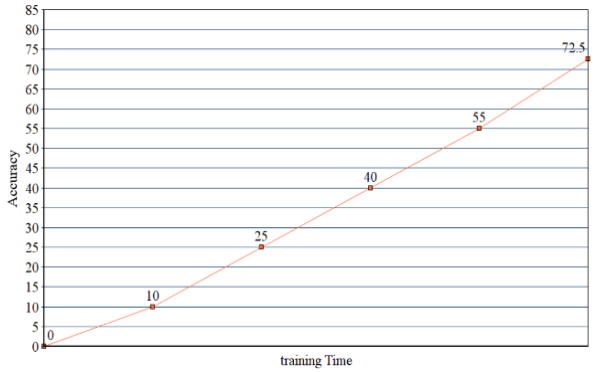


Figure 11 - Result3 GUI



This graph shows accuracy(y-axis) training(x-axis) Iteration of agent.

Overall accuracy of the proposed scheme is 72.33%.

COMPARISON OF OBJECT DETECTION TECHNIQUES

Table 3.1 - Comparison of Various Object Detection Techniques

Ref.	Technique	Accuracy	Installation	Cost
[7]	Inductive Loop	High	Hard	High
[8]	Weight Sensor	Medium	Hard	High
[9]	IR sensor	High	Easy	Medium
[10]	RFID	High	Hard	Low
[2]	SVM	Low	Easy	Low
[3]	HOG + SVM	Medium	Easy	Low
	HAAR	High	Easy	Low

IV. CONCLUSION

The research presents the basic concept of vehicle detection and various scheme as per the properties of vehicle detection scheme. OpenCV is used in a video-based technique for object detection. It can be useful for those who are wishing to carry out research in the direction of image processing used for vehicle detection. This paper can be helpful to know which and how various vehicles detection was being used for analysing vehicle density to avoid traffic congestion and manage them efficiently. There are various vehicle detection schemes described in this paper and comparison has done which may help to extend current research.

V. REFERENCES

[1]. Shujuan, Sun; Zhize, Xu, Xingang, Wang, Guan; Huang; Wenqi, Wu; De, Xu, "Real-time vehicle detection using Haar-SURF mixed features and gentle AdaBoost classifier" in control and design conference (CCDC) 2015, Vol. No. PP. May 2015

[2]. Xing Li; XiaosongGuo, "A HOG feature and SVM based method for Forward Vehicle Detection with Single Camera" in intelligent human machine system and cybernetics (IHMSC). 2017 5th international conference on Vol. 1 No. PP. May 2017

[3]. Diqing Sun, Watada, J., " Detecting vehicles in traffic scene based on boosted HOG features and SVM", in intelligent signal processing(WISP) 2015 IEEE 9th international symposium on, Vol., No., PP. May 2015.

[4]. Kaiy Ung; Du, E. Y.; Delp, E. G.; Pingge jiang, Yaobin Chen; Sherony, R; Takahashi, H., "An extreme learning machine based pedestrian detection method" in intelligent vehicle symposium 2016 IEEE Vol., No., PP. June 2016.

[5]. Golding, Andrew R. "Automobile Navigation with dynamic traffic data" US patent No. 5933100 August 2015.

[6]. Shaif Chaudhary; Soummyo Priyo R., Chattopadhyay; Tapan Kumar Hazra, "Vehicle detection and counting using Haar feature base classifier" 2017 IEEE.

[7]. Rakesh V. S, Shaithya "Traffic Control system using inductive loop detector", Vol.4 issue 5 May 2015.

[8]. Mobile Road Traffic Management System using weighted sensor, Vol.11 2017 IEEE. Technique. IEEE.

[9]. Hussain, Tarik M. et al. "Infrared pyroelectric sensor for detection of vehicle using digital signal processing" Vol. 10 2016 IEEE.

[10]. Meghana B S, Santoshi Kumari, Pushphavathi, "Comprehensive Traffic management system: real time traffic data analysis using RFID" TP 2017 IEEE.

[11]. Da Li; Bodong Liang; Weigang Zhang, "Real-time moving vehicle detection tracking and counting system with OpenCV", 2014 IEEE.

Cite this article as :

Ravi Patel, Manas Vyas, Abhishek Parmar, Utpal Patel, "Traffic Analysis and Signal Timer Management Using OpenCV", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 5, Issue 2, pp.888-894, March-April-2019. Available at doi : https://doi.org/10.32628/CSEIT1952288

Journal URL : http://ijsrcseit.com/CSEIT1952288