Implementing Real Time Vehicle Speed Estimation Techniques

Aditya Singh[#1], Bhavya Pandey[#2], Devashish Dana[#3], Harsh Vikram Singh[#4], Dr. Sandhya N.[#5]

[#]Department of Computer Science and Engineering, Dayananda Sagar Academy of Technology and Management, Bangalore, Karnataka, India

A B S T R A C T

This paper is an implementation on real time vehicle speed estimation techniques Video and picture handling has been utilized for traffic observation, investigation and checking of traffic conditions in numerous urban areas and metropolitan territories. This paper focuses on present another way to deal with gauge the vehicles speed. In this examination, the caught traffic films are gathered with a fixed camera which is mounted on an expressway. The camera is aligned dependent on mathematical conditions that were upheld straightforwardly by utilizing references. Item following methods are then utilized on the live video that is being caught by the camera and the movement of the vehicle is being followed and shown on the screen. Utilizing this video and article following procedures, important information is being separated from the video and the qualities are then placed into the condition from which the speed is determined.

Keyword: *Vehicle detection, Traffic Observation, Mathematical conditions*

1 Introduction

Individuals in their everyday lives experiences more issues as the populace is consistently expanding and street traffic turns out to be more blocked due to popularity and less degree of street limit and foundation. It is imperative to look for proficient answers for lessen these issues as they are a lot of common in the reality. Vehicle speed recognition is significant for noticing speed impediment law and it likewise shows traffic conditions. Customarily, vehicle speed discovery or reconnaissance was acquired utilizing radar innovation, especially, radar indicator and radar firearm. This strategy, with spatial conditions and supplies, gets the speed of a moving vehicle. Notwithstanding, this strategy actually has a few weaknesses, for example, the cosine blunder which occurs if the radar weapon isn't pointing towards the course of the approaching vehicle. Likewise, the expense of hardware is one of the significant reasons, and furthermore radio obstruction are two other powerful factors that cause blunders for speed location lastly, the way that radar sensor can follow just a single vehicle whenever is another impediment of this technique. In this paper, we are preparing a survey report through researching on our project topics by reading through various IEEE paper and research papers that have implemented the related technique. This survey paper will compare those research papers on the basis of their techniques used, advantages, feasibility, accuracy and number of disadvantages. This survey report will give a basic idea about the techniques that have been used till now on the respective project and also about the advancement made till date in the domain..

2 Problem statement

Video and image processing has been used for traffic surveillance, analysis and monitoring of traffic conditions in many cities and urban areas. The major problem is manual intervention and accuracy in monitoring such videos. The aim is to build an automatic alert system that can accurately localize and track the speed of any vehicles that appear in aerial video frames, using automated Speed Detection Camera System (SDCS) that alerts the concerned when a vehicle crosses the speed limits.

3. Materials and Methodology

The implementation of this system is done by splitty the system into various modules. The system mainly consists of six basic modules, the first one is Image Acquisition**,** It is achieved by using any high resolution camera, like CCTV, etc. the next module is, Vehicle Detection and classification have been developed using TensorFlow. Our third module is, Speed Calculation **which has been** developed using OpenCV via image pixel manipulation and calculation. The fourth module, Vehicle Color Prediction**,** has been developed using OpenCV via K-Nearest Neighbors Machine Learning Classification Algorithm is Trained Color Histogram Features. Fifth module, Object Counting**,** the TensorFlow is used as a base for object counting on this project. Finally, Alert System is triggered when the vehicle crosses a certain threshold value.

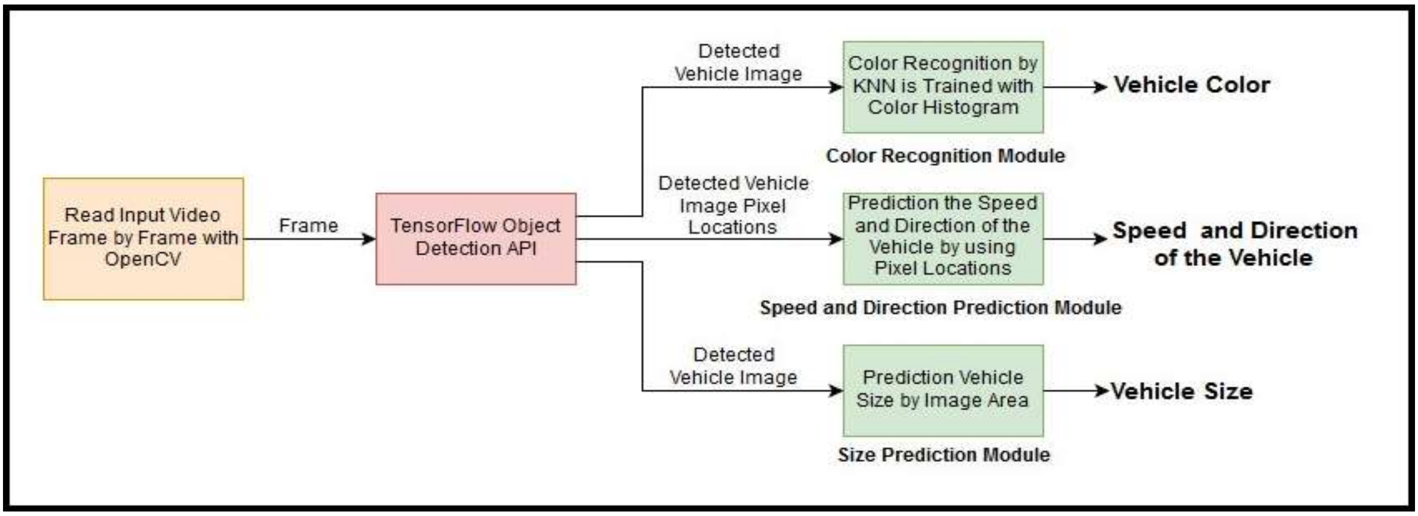

Figure 1, System Architecture

3.1 Image Acquisition Module

Image Acquisition is done by the video capture devices like cameras, then it is stored in convenient formats like mp4,mkv etc.. OpenCV is the library used for accessing the video which is been captured by the camera. Cv2 library of OpenCV is used to capture the video and pass it frame by frame for further processing.

3.2 Vehicle Detection Module

The TensorFlow is the framework for creating a deep learning network that solves object detection problems. There are models in their framework which are available in the refer to as Model Zoo. This includes a collection of pretrained models trained on the COCO dataset, the KITTI dataset, and the Open Images Dataset Here we are using the COCO dataset.

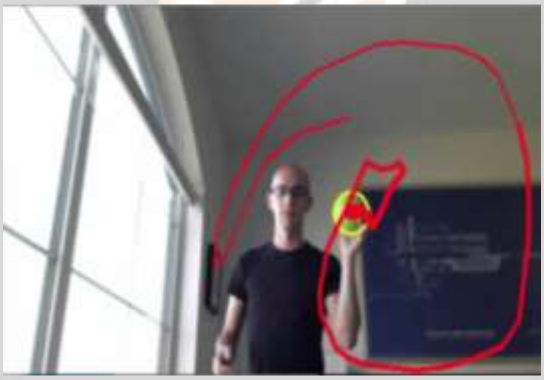

Figure 2, object detection

3.3 Vehicle speed prediction

Vehicle speed prediction has been developed using OpenCV via image pixel manipulation and calculation The object is tracked by plotting a rectangular bounding box around it in each frame. The velocity of the vehicle is determined by calculating the distance in the form of pixel that the object moved in a sequence of frames with respect to the frame rate and the total time of video is recorded

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$$Speed(i) = \frac{Distance}{total\_frames / fps}$$

Figure 3, speed calculation formula.

3.4 Object Counting

To count the number of vehicles, we have used TensorFlow Object Counting. We use the “Cumulative Counting Mode” to count the number of vehicles. In “Cumulative Counting Mode” the speed of vehicle is only calculated when the object crosses the ROI (Region If Interest) line, irrespective if the vehicle is been detected by the system.

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3.5 Vehicle Color Detection Module

K-nearest neighbors is a supervised classification algorithm that needs labelled data to train on. With the given data, KNN can classify new, unlabeled data by analysis of the ‘k’ number of the nearest data points. The training data consist of saved frames and the test data are obtained from the video camera in real-time. The video consists of consecutive frames.

3.6 Alert Module

After overspeeding is detected, the system will record the alert in a databse that has been created in the form of excel sheet.

Vehicle Type/Size	Vehicle Color	Vehicle Movement Direction	Vehicle Speed (km/h)	Exceeding Speed limit
car	white	down	45.8896086	No
car	blue	down	64.08913083	Yes

figure 4, overspeeding alert recorded in database

4. Results

The system was successfully able to detect the moving vehicle. It was also successful in predicting the color as well as direction of the moving vehicle. Moreover, it calculated an accurate speed at a particular instant.

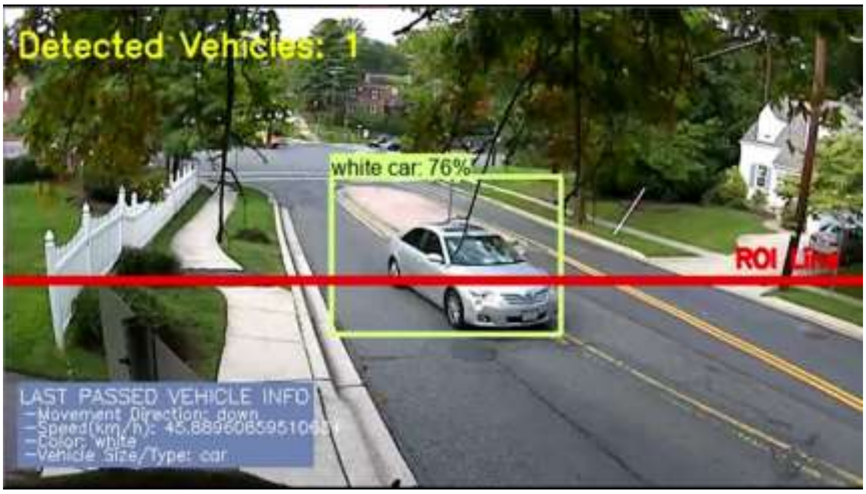

figure 5, screenshot from the working system

5. Conclusion

The vehicle speed detection system that takes live images from the continuous video feed to detect the speed of the moving vehicle has been successfully implemented. In addition to that vehicle color prediction is also implemented. To detect over speeding, the instantaneous speed of the vehicle is checked for a threshold condition, if the vehicle speed is more than the threshold condition then an alert is recorder in the database. The system can give inaccurate results in certain situations due to the effect of light, the position of the camera. With future improvements, the system can be made more robust so that these three things may not be a hindrance to captivity accurate results. The system can be set to read automatically to set the limit values for continuous improvement. In addition to this, in turn, can be read from one or more of the data like number plate, vehicle make and model etc.

5.1 FUTURE SCOPE

The future of this project includes the addition of vehicle number plate recognition module. This module will require the use of Natural Language Processing (NLP) that will automatically detect the number plate of a moving vehicle and store it in a database. This module can further be linked with other opensource databases which would help in efficient tracing of a vehicle in case of a mishap.

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