# Vehicle Speed Detection

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***Abstract* -Speed detection of vehicle and its tracking plays an important role for safety of civilian lives, thus preventing many mishaps. This module plays a very significant role in the monitoring of traffic where efficient management and safety of citizens is the main concern. In this paper, we discuss about potential methods for detecting vehicle and its speed. Various research has already been conducted and various papers have also been published in this area. The proposed method consists of mainly three steps background subtraction, feature extraction and vehicle tracking. The speed is determined using distance travelled by vehicle over number of frames and frame rate. For vehicle detection, we use various techniques and algorithms like Background Subtraction Method, Feature Based Method, Frame Differencing and motion-based method, Gaussian mixture model and Blob Detection algorithm.**

***Keywords — pH, Wireless Communication, Arduino UNO, Wi-Fi.***

## I. INTRODUCTION

Detection of vehicle and tracking of speed if the crucial part of town planning. In the last decade, vision-based traffic monitoring system has received considerable attention. This can be done with the help of vehicle detection and speed monitoring. The monitoring system gives various information about, vehicle count, traffic congestion and speed of the vehicle. One of the root cause of road accidents is speed. Extracting frames from the video and comparing the speed between two given points can be used to determine whether the car is moving above the permissible limit or not. There are many algorithms available for extraction of vehicles from the background. Traditionally radar systems were used for such applications but had some limitations. So to overcome the limitations in existing methods, various techniques have been developed for vehicle speed determination using image processing.[7] But the main factors that would affect these image processing algorithms is, waving of tree branches, camera noise, illuminations. The goal of this current research is to develop an automatic vehicle counting system along with the detection of speed, which can process videos recorded from stationary cameras over roads e.g. CCTV cameras installed near traffic intersections / junctions and counting the number of vehicles passing a spot in a particular time for further collection of vehicle / traffic data. The paper deals with vehicle detection and speed tracking which is explained further.

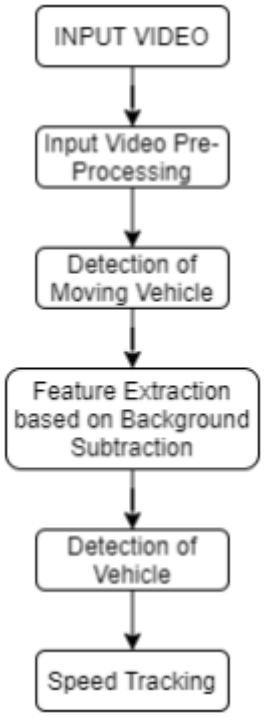
## II. LITERATURE REVIEW

There are following research papers that have been published in the recent past: [1] In this research paper the object is detected using the Caffe model for DNN while simultaneously the distance of obstacle is measured with the help of ultrasonic sensor and according to the distance of obstacle the motor movements are controlled with the help of PWM controller. Caffe is a deep learning framework developed by BAIR. If any obstacle is detected in that frame then the sensor will calculate the distance of the vehicle from the obstacle. The corresponding frames are converted into blob which is compared with the pre-trained model. If the distance calculated is less than or equals to 30cm then a low signal is sent and the vehicle is stopped. [2] In this research paper the moving objects are detected using Gaussian Mixture Model, DBSCAN clustering and bounded in a box to keep track till the time it is visible in the camera. Then the object is tracked by applying Kalman Filter and Optical Flow method. Both these methods communicating with each other give rise to the Euclidean Manager concept applied in the paper. Then the speed of the car is calculating by calculating the moments of its pixels. The video is also converted to gray scale image as it is being mentioned as a noise in the research paper while detecting them. The algorithm is tested on cars with the speed of 15km/hr and 20 km/hr.

## III. METHODOLOGY

### A. *Materials/Components/Flowchart/Block*

The presented methodology is used for determining the speed of a moving vehicle towards the camera situated at a considerable distance by tracking the motion of vehicle through series of images. The proposed methodology consists of steps as shown in the figure below




### B. *Steps performed in Jupyter Notebook*

- We are using Haarcascade classifier to identify vehicles.
- Vehicle Tracking - ( assigning IDs to vehicles
- We have used correlation tracker from dlib library.
- Speed Calculation
- We are calculating the distance moved by the tracked vehicle in a second, in terms of pixels, so we need pixel per meter to calculate the distance travelled in meters.
- With distance travelled per second in meters, we will get the speed of the vehicle.

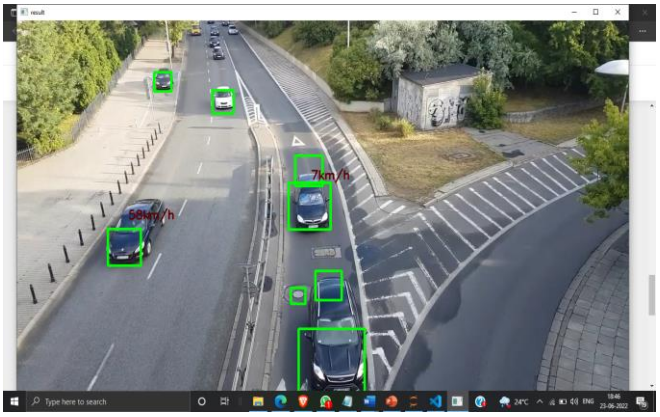
### C. *Characterization*

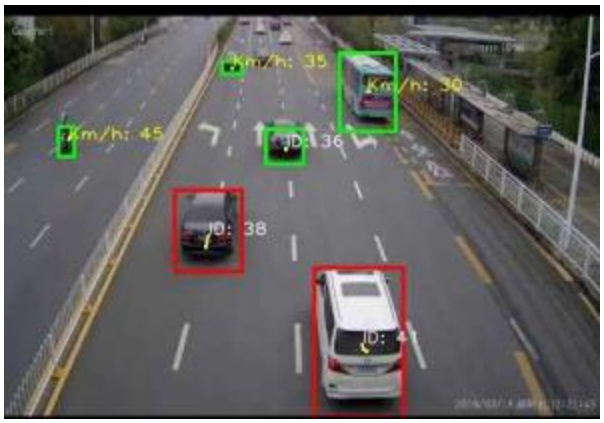
Primarily, the video is converted into small frames. Background Subtraction algorithm is used which subtracts the background from the primary feature/image. A average of all frames is obtained consisting of only the main feature/image hence subtracting the background. Later, the output obtained is applied for Thresholding and Morphological Operation. Detection of the object and centroid is done with the help of Connected Component Method. Centroid is obtained for all frames. Velocity of the vehicle is calculated using the distance travelled by vehicle and frame rate of the input video. The various parameters such as number of frames, frame rate, color format, frame size are extracted.

## IV. RESULTS AND DISCUSSIONS

The vehicles with a particular Id is observed for a series of sequential frames. The number of frames in which the car appears is noted. Total Frames Covered= frame n – frame 0 Where, frame 0 is the first frame when object is entered in Region of interest and frame n is last frame when object passed away from Region of interest and the real-world distance is mapped on the image. The count of total number of frames is then multiplied with duration of one frame which is calculated from frame rate of video. Similarly, total time taken by vehicle to travel and distance is fixed and is mapped from real-world into image. Speed=Distance/ (TF*Frame rate) Thus, from distance and travelled time of detected vehicle, speed of that vehicle is determined from above formulae

The features in feature extraction are nothing else but independent characteristics of vehicle such as speed, color ,shape ,centroid, edges etc. The result of connected component analysis is used and a bounding box has been drawn around vehicle






## V. Conclusion

Road safety and reducing accidents is a very crucial issue and must be considered at utmost priority. One must abide the rules of maintaining appropriate speed guidelines. Technological tools and tracking devices which help in monitoring the motion and speed of vehicles can help reduce the number of accidents on roads as well as trace the origins of the mishap. In this paper, we have discussed the challenges and obstacles faced while implementing a system which detects a vehicle and monitors its speed and motion. The separation of foreground and background objects and commonly preferred approaches to solve this issue. In addition, to this we have also suggested a possible formulation which can be used to detect the motion of vehicle. Furthermore, the paper also talks about the speed tracking algorithm and tried to elucidate the working of these algorithm and mathematics involved behind it. To support our thesis, we have also mentioned snippets from the system we designed for vehicle detection. Several nations are already using such systems to detect the speed and direction of vehicle. We have used opencv and haar cascade classifiers for object detection. Haar cascade is a approach based on machine learning where a cascade function is trained from a series of images which includes positive and negative. After the training it is used to detect objects in other images/videos. We have thus analyzed various methods for speed tracking and vehicle detection and implemented a optimum solution.

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