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VEHICLE SPEED DETECTION SYSTEM IN HIGHWAY

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ABSTRACT

This research planned to build the vehicle speed detection system using video-based approach. Video based vehicle speed detection system is effective application for intelligent traffic monitoring due to low cost and great capabilities. This system uses camera output for video processing and to draw out required information for speed detection. This research paper shows a new way to detect speed of vehicle through video based technique rather than radar. The vehicle speed observation from a video frame system contains six components: First we have to deal with capturing the real-time video of the vehicles. Each moving object is detected using haar cascade when it enters in the frame. Then detected vehicle is provided with a unique ID. After that, movement among consecutive frame are calculated for final speed measurement. The output of the system is displayed in the streaming web application and store the speed and detection time of the vehicle in the csv file. The project aims to reduce the chance of accident. Vehicle speed computation is one of the major key components of traffic inspection system. The presented data can also be used for traffic controlling and law enforcement. It provide the speed of passing vehicle with high accuracy.

Keywords: Vehicle Speed Detection, Computer Vision, Traffic Monitoring, Intelligent Transportation System (ITS).

I. INTRODUCTION

In our day-to-day life transportation play an important role. As the time passed many problems occur like air pollution, vehicle accident, traffic jam and other challenging issue [1]. Therefore, it is required to update the transportation system according to the requirement of the society by keeping in the mind about available transportation sources. This modernization in the transportation system is known as Intelligent Transportation Systems [2]. This system helps to enhance safety on roads and traffic enforcement. Vehicle speed measurement is of two type intrusive and non-intrusive system. Intrusive method inductive loop detectors are installed on the highway to detect the average speed of the vehicle moving on the road [3]. It is hard to fix inductive loop detectors on highways and also hard to maintain inductive loop detectors on road. The non-intrusive method uses radar and video-based speed measurement [4]. The objective of using video camera is to find the speed of the vehicle is suggested to upgrade the current vehicle speed measurement technique which is mostly based on radar technique [5]. Radar technique is costlier than video camera technique [6]. This project aims at designing a system that analyses the real-time video of vehicle passing on highways to estimate the speed of the vehicles passed and maintain a file of the speed of vehicle tracked at a particular timestamp [7]. A web application is built to stream the live video of speed estimation of tracked vehicles. The main cause of road accident all the world is rash driving and over speeding more than five lack traffic accident were reported in the last decades in India [8]. In India the population of vehicles increased significantly and there is no proper system to observe or manage the speed of vehicles moving on road. One of the major cause of accidents on roads is due to over-speeding of the vehicles. To overcome this critical situation there is a need to develop a system which can catch the speedy vehicles [9].

Vehicle speed detection system finds the speed of the vehicle accurately and helps to discover, if any vehicle is moving with the speed greater than the speed limit in real time [10]. It can also be used to generate e-challan. It is cost effective and can be used 24*7. The main concern of the authority dedicated to the road safety is vehicle speed control. This is the important reason to control speed of the vehicles to save the lives of people [11]. There are various application areas of this system like public road safety agencies, private road safety department, government. The first priority of most of the government all over the world is road safety. To overcome this problem and to decrease the death rate due to road accident the development of new traffic enforcement is required. This system captured the image of the vehicle and find the speed of the vehicle [12].

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II. LITERATURE REVIEW

According to our knowledge their exist only limited surveys and research paper related to detect the speed of the vehicle. They use different techniques to detect the speed of the vehicle. Some researchers use ramp-metering technique and harmonization algorithm to detect speed. Vehicle speed detection is a major cause to research in the field of Intelligent Transportation System (ITS) [13].

Many researchers applied various technique to detect the vehicle and to measure the speed of the vehicle. Mostly all the technique are based on computer software and the hardware equipment. As the number of vehicles are increasing day by day it is becoming difficult to manually control and monitor traffic. Moreover, it is costly, time consuming and sometimes it is impossible to control the traffic [14]. To overcome all this problem camera are install on highway, road, for monitoring the vehicle passing on the roads. Several parameters like fog, dust, rainfall, snowfall, light density or blur scenario can influence the quality of captured images. The speed of the vehicle is measured using the frames of an input video. This method proposes a real time application based on real time response [15]. The thought of using video camera technique to find the speed of the vehicle is suggested to enhance the current method of speed detection which is mostly based on radar hardware. The radar technique is having various disadvantages like the cost of equipment is very high. So, there is a need to shift form this method to reduce the cost of investment [16]. Video camera technique can be used as an alternative of radar system. This video camera technique does not require specific hardware. It is mostly based on software components. We require a camera to capture a video and a computer to detect a speed. As the population is increasing continuously people encounters many problems. One of the main problems is traffic accident [17]. Since this problem is affecting adversely in daily life, so there is a need to find the solution of this problem or to reduce the effects of this problem. For traffic enforcement observation of vehicles speed is important. Traditionally, speed of the vehicles is calculated through radar gun or radar detector [18]. In intelligent transportation system, vehicle detection and speed recognition play an important role. There are various approaches to detect the speed of the vehicle. Technologies like helicopter mobile radar, artificial vision or license plate recognition technology. It helps to increase the road safety and to reduce the number of over-speeding vehicles [19]. There is no regulatory system to find the unpredictability or exact speed estimation. Sensors are less accurate so that their use is reduced to detect the speed. We can also use Internet-of-Things (IoT) devices to detect the speed.

To overcome the problem of road accidents various automobile companies, try to give a speed control technique to keep vehicle safe. IoT technology can send an alert about over-speeding of the vehicle and also helps in drunk and drive case too [20]. It also provides solution for rash driving. IoT devices uses sensor to detect the speed and have a great accuracy. Some researchers also use doppler effect to detect the vehicle speed if over-speeding found then uses digital image processing to mark the license number [21]. This system is having a great accuracy and better performance to find the speed of the vehicle. Some researchers use Arduino, Infrared (IR) sensors and jumper wires to find the vehicle speed. We have heard slogans like drive-slowly, over-speeding kills etc. on road. It is a threat to the life of people and can put various lives in danger [22].

III. METHODOLOGY

In this methodology, we are using different type of function and method. Each function defines different method to detect the speed of vehicle. We will compute the speed of vehicle from the video scene system and the description of each component in the project is shown in this methodology [23].

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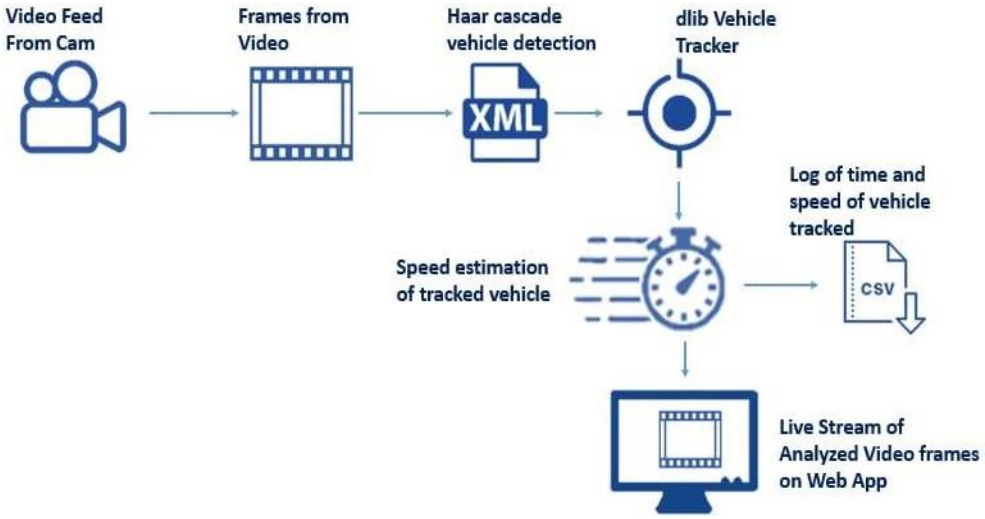

Fig 1: Flow Chart of the system

3.1 Vehicle Tracking and Detection

This activity includes various steps:

- Use the Haar cascade agreement to identify vehicles.
- Vehicle Tracking - (assigning IDs to vehicles).
- Use a correlation tracker from the dlib library.
- Define a function to detect and track the vehicle.
- initialize the color of the bounding box which around the detected vehicle.
- Initialize the frame count as 0.
- Initialize frames per second as 0.
- Create a "car Tracker" dictionary which stores the data of the vehicle tracked.
- Create "car Numbers" dictionary.
- Create two dictionaries to store the location of tracked cars.
- Create a variable named out to which the output video frames are stored in MP4 format and AVI format.
- A Comma Separated Values (CSV) file is created to store the speed of vehicles with respect to timestamp.
- Using date-time library grab the present time and date.
- Grab year, month, and time from the read date and time.
- Read the frames from video.
- Check whether there is an image in the reading frame to perform vehicle tracking analysis, if not present real the loop.

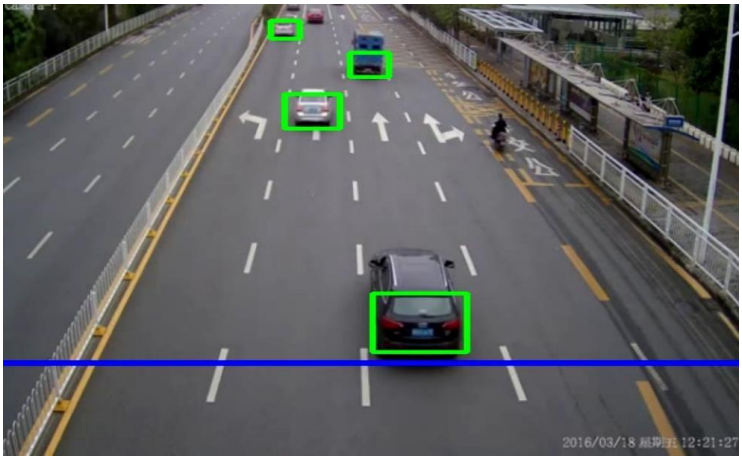

Fig 2: Vehicle tracking and detection

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3.2 Assign Car ID

If the Car ID is Not matched then we have to track the detected car again. Using dlib tracker track the car detected by using coordinates of the detected car.

- Assign a New Car id to Detected Car.
- Now get the positions of the tracked images and find the exact location at which the car is present.

Fig 3: Assign car IDs to the detect vehicles

3.3 Speed Estimation

In this technique, we are calculating the speed of the vehicles moving on the roads. We will measure the distance covered by the tracked vehicle in second in word of pixels [24]. So, we require pixel/meter to measure the distance covered in mt. Here we have estimated the pixels per meter manually. The value of ppm would change from one roadway to another roadway and to be modify to use on different video [25].

- To calculate ppm in meters.
- We required to find the real range in meters of the road (We could search on google to know the estimated range of the roads in our country).
- We take the video figure and measure the range in pixels automatically.
- Now we are having the pixels from our video figure and the range of the roadway in meter of the real world. Now we will calculate pixel per meter by dividing the distance of the road in pixel to meter.
- The pixel distance covered by the vehicle in one frame of our video is given by $v\_\ pixels$. To measure the speed of vehicle in any level unit we will change v_ pixels to v_ meters.
- Then, we will measure the speed ($speed = \frac{v\ (in\ meter) * frame\ per\ sec * 18}{5}$), where $v\ (in\ meter)$ are the distance covered in one frame. To find the speed in meter per second, just ($v\ (in\ meter) * frame\ per\ sec$) will do. We have to multiply the evaluated speed with $18/5$ to transform it into km/hr.

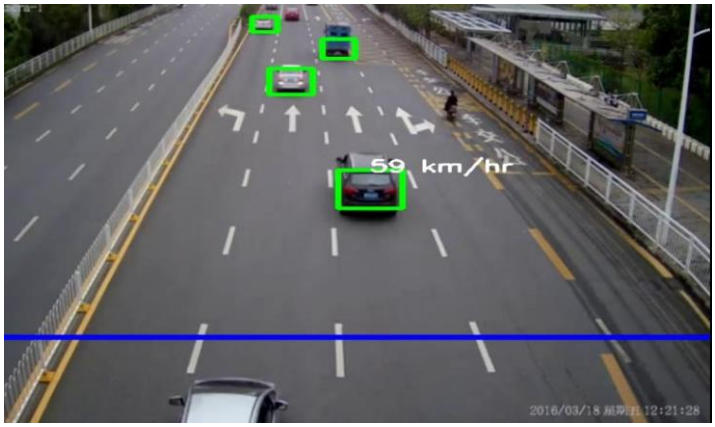

Fig 4: Speed estimation of tracked vehicle

IV. CONCLUSION

This paper proposed a video-based vehicle speed measurement system for traffic application as a part of intelligent transportation system. Our designed speed detection system continuously monitors the speed of the vehicles moving on the road. In this suggested approach we use the output of the video camera installed on the road as an input and detect the vehicle, and show vehicle speed and detection time. This method is having three main components i.e., vehicle detection, vehicle tracking and calculating the speed of the vehicles. It minimizes the problems of the traffic department and make control over the rash driving on highways. The average speed is measured inside a region of interest by calculating the average distance. To measure the speed vehicles are detected in a predefined region by viewing their motion parameter. The accuracy for vehicle detection is more than 95% and for speed measurement is more than 92%.

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