Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 05, May-2021

A Survey on Speed Violation Detection System

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***Abstract*— The main goal of this paper is to develop smart speed violation detection system to control road accident. Traffic rule violation detection system is used to calculate the estimated speed of a motor vehicle at a given prompt of time. In previous study current speed detection technologies and methods are available which are more costly, and it can be able to detect only single vehicle at a time. Many different technologies are available to devise over speed detection system like radar or laser gun technologies are devised which are not so accurate and also are more costly. The main goal of this paper is to study various technologies which are applicable for computer vision or sensor based. The input for such system is required in the form of video and then the steps involved in estimating vehicle speed of the vehicle and display it as an output. The main objective of this paper is to study various parameters which can efficiently detect the speed violation.**

Keywords*— *Image processing, Object detection, Target tracking, Speed detection.

I. INTRODUCTION

Traffic rule violation detection system is one of the major mechanisms of traffic Monitor systems. Speed detection system can be separated into two main types built on their method being either hardware and software[6]. One is based on hardware which is detect how conveyed signals are exaggerated by a passing object in order to calculate the vehicles speed, e.g., a sensor based system on an induction-coil circlet, a radar speed measurement or a laser speed measurement. But radar and laser gun measurement are so expensive and it can able to detect only on object at a time. Above methods required efficient component, which is expensive to maintain and install and their application has limitation. The other is based on software, mainly including video-based measurement system, and adopt image processing technology to process the traffic flow video, it's main purpose to collect all kinds of traffic information. Video-grounded monitor systems have developed more popular because of the technical developments in cameras and computer devices, Due to which it becomes more effective, obtainable and consistent [3,6].

The problem of real-time speed monitoring system based on video image can be divided into two aspect, moving target detection and moving target tracking[3]. Numerous image processing techniques and pattern recognition methods have been working to realise this task. At present there are three main methods of target detection.

The frame difference method can maintain the motion path of the moving target in two consecutive frames of images and eliminate the interference of unstable factors. The major limitation of this technique is that it cannot spot slow-moving vehicle. The most critical step of background difference method is background modelling, which extract accurate and steady background images, and uses background images to separate moving object from original frame.

The optical flow methods have been used in many applications for motion of a subset of point in a scene. Optical flow method reflects the change of pixel points in the time domain of the imaging plain coordinate system by calculating the optical flow value of video image pixel points, and finds the corresponding relationship between adjacent frame, and the calculate the image displacement of the tracked target and other information[3,4,6].

II. RELATED WORK

The vehicle speed monitoring system contains the retrieval of images and scrubbing of raw data by eliminating outliers that yield a segmented output of vehicle boundaries. It is an dynamic and demand field of invention. The study of vehicle speed detection system is incessantly under process to high security by observing the movement of vehicle on busy road so that effort used by traffic police for reducing their work [4].

Current development and their technologies depict some drawbacks. Now a day's surveillance camera is generally available all places, using this camera video can be captures easily of moving vehicle. Then captured video processed by using some image processing techniques, using image processing techniques we can easily detect the moving object and we can easily track them and find out the vehicle speed.

III. GAPS IDENTIFIED

Advanced into the Vehicle Speed Detection systems has led the researches to reach the optimal resolution in this area. Now, we will discuss some of the important role into this section of research by frequent studies and briefly designate their instrument and implications inferred from their work.

Advanced Vehicle Over Speed Detection and Billing System (AVOSDABS). By P. Vijin, V. Suhail Basheer, P. K. shaab Mon, M.K. Sabin, V. Nikhil, k. Nisi [1]. In this paper input is taken from video cameras using image processing method. The main purpose of this paper is to hypothesis an advanced over speed vehicle detection classification with reducing the limitations of current methods.

Assessment of Vehicle Speed Detection from Camera Stream Using Image Processing Approaches in 2017 by J. Great, D. Sopiak, M. Oravec, J. P. [2]. In this paper input is video record produced by industrial camera. Techniques used in this paper is Gaussian mixture models, DBSCAN, Kalman filter, Optical flow.

Real-time Detection of Vehicle Speed Based on Video image in 2020 by G. Cheng, Y. G., X. Cheng, D. Wang, J. Zhao [3]. Input taken in this paper is by video images. The main purpose of this paper is advance and improvement of

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Intelligent transportation system. In this paper KNN (K-Nearest Neighbor) is used.

Vehicle Speed Detection System using Motion Vector Interpolation in 2019 by J. K. J. Julina, T. S. Sharmila, S. J. Gladwin [4]. In this paper input is taken from video cameras in real-time or also taken from highway dataset. This system will detect the speed of vehicle as well as send notification to the external world. In this paper Motion Vector Interpolation techniques is used.

Classification and speed estimation of vehicle via tire detection using single-element piezoelectric sensor in 2016 by S. Rajab, M. O. Al Kalaa, Hazem Refai [5]. Input is taken in the form of video which is captured by traffic camera. Technique used in this paper is KNN (K-Nearest Neighbor) algorithm.

Vehicle speed measurement model for video-based systems in 2019 by S. J., M. Dahl, M. I. Pettersson [6]. In this paper input video is captured by a smartphone device and an off-the-shelf handheld camera. The main objective in this paper is development of Intelligent transportation system. Technique used in this paper is Motion analysis, Machine vision, Pattern recognition.

Detection vehicle with Infrared Sensor Based on Raspberry, August 2020, in this paper speed calculation done by passing car one by one and calculate the distance between the sensor LDR A and LDR B, over 45 km/h it is not able to detect vehicle police number, it can detect vehicle police number only 66.7% of the test.

Research of vehicle speed detection algorithm in video surveillance, July 2016, input is taken in the form of video and speed calculate by using 3 frame difference method but it exists certain number of errors.

TABLE 1 COMPARATIVE ANALYSIS

S. No.	Input	Objective	Methodology	Achievements	Limitations
[1]	Input as a Video Streams	To Build an advanced over speed vehicle detection system with reducing the limitations of prevailing methods.	GSM technology, GPRS techniques	Automatic billing generator system can be implemented of any vehicle, it can able to track speed of vehicle anywhere.	It system can be implemented only highways not on connector roads.
[2]	Input video was recorded using camera	Detection of vehicle speed based on information from video record	Gaussian mixture models, DBSCAN, Kalman filter, Optical flow.	Solve problems of overlays, improve speed detection	Can not differentiate vehicles in cluster of objects.
[3]	Input video Images.	Continuous development and improvement of Intelligent transportation system.	KNN algorithm.	Relative error of speed detection is controlled by 5%, target Tracking	Real-time video monitoring is required.
[4]	In this paper input is taken from video cameras in real-time or also taken from highway dataset	This system will detect the speed of vehicle as well as send notification to the external world.	Motion Vector Interpolation	Detect multiple objects at a time.	97% efficient,
[5]	Input taken from single piezoelectric sensor.	To accurately identify vehicle.	K-Nearest Neighbor algorithm	Up to 97% classification accuracy	Can detect only single object at a time.
[6]	Input frames were captured by using self-handheld camera.	Development of Intelligent transportation system.	Motion analysis, Pattern recognition	Accuracy up to 98.3%	GPS enables vehicle is required.
[7]	By passing car through LDR A sensor and LDR B sensor.	To reduce the high no of accidents every year.	LDR sensors, Raspberry Pi with by using Python software with physics methods.	Easy to installation It can able to detect vehicle speed one by one efficiently	Over 45 km/h it is not able to detect vehicle police number, it can detect vehicle police number only 66.7% of the test.
[8]	Input is taken in the form of video.	To accurately identify vehicle using 3 frame difference method.	center of mass, feature extraction, velocity estimation, motion detection.	Accurate vehicle target detection and speed calculation, the method has good robustness and strong practicability.	it exists certain error's need to improve certain part.

From above Table 1 we analysed that none of the researchers have been able to achieve up to 100% accuracy and there is still lot of scope to improve the accuracy. There are different techniques which gives different results in terms of accuracy and efficiency.

IV. THE GENERAL SALIENT STEP IN SPEED VIOLATION DETECTION SYSTEM

In speed violation detection system, we have two methods for speed calculation one method is based on frame rat and other is sensor based. In frame-based system we will give input in the form of video camera or any other recorded traffic video, and in senor-based system will work on real time.

In this project there are three major part first one is object detection second one is object tracking and third speed calculation.

Object detection- in our previous study we look at various algorithm that can be used for object detection. It is the computer vision process of classifying and determine an object position in captured video. Object detection is done before object tracking. There are two

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 10 Issue 05, May-2021

method's for object detection either machine learning-based (support vector machine (SVM)) or deep learning-based approaches (convolutional neural network (CNN), Single Shot MultiBox Detection (SSD), You Only Look Once (YOLO)).

Object Tracking- there are huge no of techniques used for object tracking. Some techniques can be able to track only single object and some are able to track multi object in this project we will use multi object tracking algorithms that use deep learning methods or The Kalman Filter.
Speed calculation- We have two techniques to calculate the vehicle speed one technique is sensor-based and other is frame rate based we can use any of the techniques form given. The common formula to calculate velocity inside that function

$$V=d/t$$

Where "d" is distance travelled by vehicle, and "t" is total time taken by vehicle.

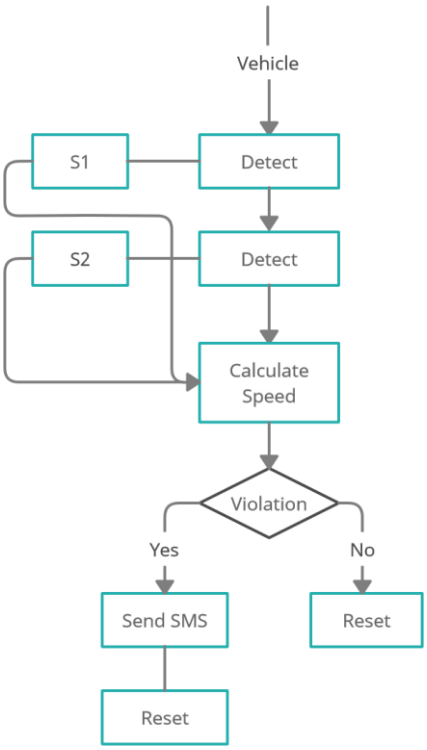

Fig: 1 Sensor-based

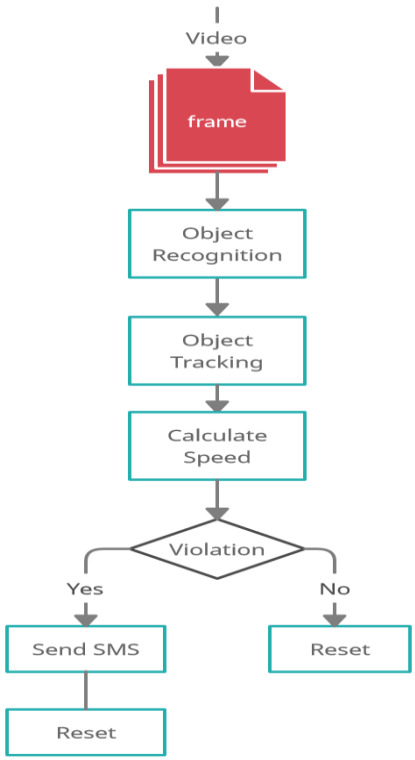

Fig: 2 Surveillance-based

V. CONCLUSION

Various speed violation system has been studied and conclude some of techniques can be able to detect only one object at a time and some of able to detect multiple objects, but it is not so efficient and accurate. We will develop a system that can detect violation, track vehicle effectively, and automatic save information like date, vehicle police number. This system will help to minimize the difficulties of traffic police in their work.

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