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Vehicle Over Speeding Detection

Pranay Vikas Boga[1], P. Vivek Patil[2], Lakhnapuram Shreya[3], B. Priyanka[4]
Professor, ECE, Sreenidhi Institute of Science and Technology, Ghatkesar, Hyderabad[1]
Students, ECE, Sreenidhi Institute of Science and Technology, Ghatkesar, Hyderabad[2,3,4]

Abstract: *Our proposed project aims to develop a system that detects cars driving at speeds over specified limit and inform concerned authorities immediately. Road accidents occurrences have increased recently so there needs to be a system that allows to detect over-speeding cars. Current speed detection systems are handheld guns held by police personnel that allow them to check car speed and then manually inform authorities about the vehicle. Whereas this proposed system does not need any human interception and records car speed as well as wirelessly informs authorities of over-speeding detections. The system first calculates the time required by the specific car for moving from first point to the second. Based on this data it calculates the car speed. This data is gathered and then transmitted by the system wirelessly to concerned authorities at a remote location. The mechanism consists of IT transmitter- receiver pair that work in combination for vehicle detection purpose. The microcontroller is now used to process this data and calculate the time required by vehicle to travel from one point to the other. Depending upon this time it now calculates vehicle speed as well as displays this on an LCD display. The system also sends this data wirelessly. It sounds a buzzer alarm if an over speed vehicle is detected. Over speeding of vehicles is the major cause of accidents in recent times. Monitoring of such over speeding vehicles especially on highways is of prime importance. Many manual methods are being used to detect the over speeding vehicles by traffic control team. However, these methods require lot of man power and continuous monitoring by traffic personnel. In this study, an attempt is made to develop an automatic speed monitoring system, which provides a simple way to monitoring speeds of all the vehicles from a centralized control room. This system calculates the instantaneous speed of vehicle with help of sensors and the over speeding vehicle is detected using an image processing technique using Python programming language. The developed model is validated with real world traffic data and comparative analysis of speeds obtained by manual method and developed model shows that model truly represents the field condition.*

Keywords: Handheld Guns, IT Transmitter – Receiver, Buzzer Image Processing Technique.

I. INTRODUCTION

In developing nations such as India, the vehicular growth rate is increasing exponentially which is worsening the traffic operations. Most of the urban cities in India are facing traffic related problems such as congestion, accidents, pollution, etc. during peak hours. The main cause for traffic congestion in such cities is mainly due to uncontrolled urbanization and extensive usage of private vehicles. The traffic congestion leads to many problems like increase in travelling time, health disorders and accidents. Road accidents in India claimed over 1.5 lakh lives in the country in the year 2018, with over-speeding of vehicles being the major cause. Ministry of Road Transport and Highways report on Road accidents in India stated that road accidents increased by a rate of 0.46 % in the year 2018 when compared to 2017 [1] [2]. Over-speeding accounted for 66 % in total road accidents due to traffic rules violation In spite of well- equipped traffic personnel with night vision speed guns it is a tedious task to identify over speeding vehicles. Indian Government increased the over speed fine by amending of the Motor Vehicles Act. Although over speeding is the main cause for accidents in India. In order to mitigate over speeding, continuous monitoring of highways is essential. But in densely populated nations such as India, the vehicular growth is at a faster rate and monitoring speeds of all the vehicles is a complex task for traffic authorities. The manual method of monitoring speeds (such as speed guns) requires lot of man power and continuous patrolling by traffic personnel. Hence an attempt is made in this study to develop an automatic speed detecting system by using Python Programming Language. A prototype model is developed to detect the speed and type of over speeding vehicle and the developed model is thoroughly validated using real world traffic data.

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II. LITERATURE SURVEY

In this section several literatures were reviewed to study the current methodologies adopted to detect speed and vehicle type for mixed traffic conditions. C. Mallikarjuna et al. developed a system to automatically analyse traffic videos and extract macroscopic traffic data such as classified vehicle flows, average vehicle speeds and average occupancy. Ranga H P et al. proposed an algorithm on the basis of image processing using dimensions of vehicles. The algorithm consists of various techniques such as image differencing, thresholding, edge detection and binary morphological process by using MATLAB [4]. Chandrashekhar. M et al. placed a camera alongside of the traffic light to capture image sequences. These images were processed to control the state change of the traffic light in order to decrease the traffic congestion and to avoid the wastage of time in a green light during empty road [5]. Khanke and Kulkarni studied traffic flow monitoring based on computer vision techniques installed in the SQL server using MATLAB. Images are scanned to detect the presence of an object ad information of the registered object can be tracked [6]. Omkar et al. analysed heavy traffic congestion using the MATLAB in order to prevent causalities. A new approach was adopted to count the number of vehicles present on the road at a given particular time with the help of area of the vehicles [7]. Uke and Thool proposed a system to convert video into frames and extract references background and perform detection of moving objects using image processing through python programming [8]. Gupta et al. calculated vehicle density using camera sensors and computational technology to regulate the traffic light [9]. Vidhiya et al. developed a model using Raspberry pi, IR transmitter and IR receiver to detect the traffic density. The model was mounted on either sides of road and aimed to reduce possible traffic jams and provide clearance for emergency vehicle whenever required [10]. Narkhede et al. developed an automatic registration plate recognition technique using image processing. In this model IR sensors were used to detect vehicles and by using image processing algorithm the registration number of vehicles are identified. SMS may be sent to traffic rules violators if any [11]. However, these models require thorough validation and also manual measures require a lot of man power for monitoring traffic manoeuvres throughout the day and even during night. Considering these aspects an attempt has been made in this study to detect over-speeding vehicles using image processing technique using Python programming language.

Following are some of the criteria's to be satisfied to select the study section.

- It should be two-lane or four-lane divided highway.
- The study stretch should be atleast 50 to 60m away from bus stop.
- There should be no cross road in the selected stretch.
- There should be no speed breakers and side interference like footpath, shops.
- There should be minimum pedestrian activities.

III. PROPOSED METHODOLOGY

The proto type model is developed in order to check the practical feasibility and real time implementation of the code developed. So that if the results obtained from the model and the results obtained from the manual method are almost near with permissible amount of errors the model can be implemented in real time traffic. It also reduces the time and man power required for classification and counting vehicles and also monitoring of over speed vehicles.

3.1 Components Used

The type of hardware components used and there specifications are listed below.

1. Web cam of minimum 5mp.
2. Memory card class 10 of 32 GB.
3. Power bank of 3.1 Amp output.
4. OLED display.
5. Jumper wires.
6. Sensor

3.2 Training Model

The coding which has been done in computer using Python software and which is tested using the pre-recorded video for classification and counting of vehicles and also for speed identification, until satisfactory results are obtained. After that

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following steps are as followed.

1. The code is transferred to memory card and it is inserted to the Raspberry pi.
2. Then the camera is connected to Camera Serial Interface (CSI) camera port and power bank is connected to Micro USB power supply port.
3. The OLED (Organic Light-emitting Diode) connected to Display Serial Interface (DSI) display port
4. The Raspberry pi is covered with casing along with fan mounted on it in order to avoid excess heating.
5. After all this setup model is placed on a highway such that there is obstruction for entire road width visibility and there is no over lapping of vehicles.
6. The results will be displayed on the OLED display.

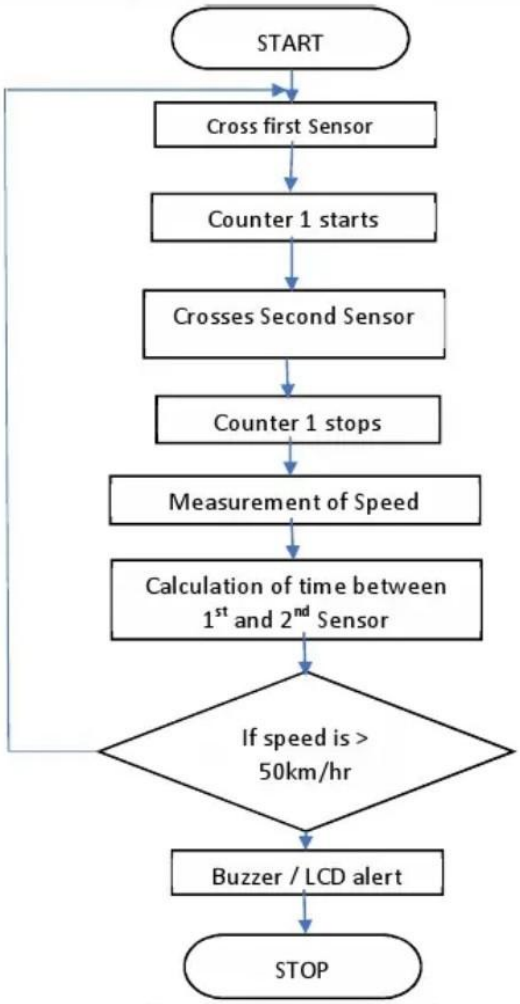

Figure 1: Steps involved in the model development

Detailed Working Procedure of Code:

The steps involved in model development are shown in Fig. 1. and explained as follows:

Step 1: Upload Video: The video graphic data collected from the selected site is used as input video to the application.

Step 2: Frames Extraction: Frames is extracted from the input video. The number of frames per seconds (fps) depends on the quality of the video if higher the quality greater will be the number of frames.

Step 3: Object Detection and classification: "You Only Look Once" is a massive Convolutional Neural network for object detection and classification. YOLO's sorts its output by the 49 grid cells (7x7) that it divides the image into. The

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cells are represented in this array left to right, then top to bottom. The data is organized into three parts.

Step 4: Road surface segmentation: This section describes the method of road surface extraction and segmentation. We implemented surface extraction and segmentation using image processing methods, such as Gaussian mixture modelling, which enables better vehicle detection results when using the deep learning object detection method. The road surveillance video image has a large field of view.

Step 5: Vehicle Trajectory Identification: Analysis of the trajectories of moving objects and the counting of multiple-object traffic information. Most of the roads are driven in two directions, and the roads are separated by isolation barriers. According to the direction of the vehicle tracking. We delete the trajectory that is not updated for ten consecutive frames, which is suitable for the camera scene with a wide-angle of image collection on the road under study. In this type of scene, the road surface captured by the camera is distant. In ten consecutive video frames, the vehicle will move farther away. Therefore, when the trajectory is not updated for ten frames, the trajectory is deleted. At the same time, the vehicle trajectory and the detection line will only intersect once, and the threshold setting thus does not affect the final counting result. If the prediction box fails to match in consecutive frames, the object is considered to be absent from the video scene, and the prediction box is deleted.

Step 6: Speed detection: The speed of the vehicle in each frame is calculated using the position of the vehicle in each frame, so the next step is to find the spots bounding, and the centre of gravity. Bubble centroid distance is important to understand the moving vehicle in consecutive frames and therefore is known as the frame rate for motion capture, the speed calculation becomes possible. This information must be recorded in a continuous array cell in the same size as the camera image captured because the distance travelled by the centroid is needed is a pixel with a specific coordinate on the image to determine the vehicle speed.

3.3 Data Extraction

The recorded video is processed in order to obtain the vehicle speed, composition and volume .The details of each component to be extracted by manual method is discussed below.

Vehicle Speed: Speed is considered as a quality measurement of travel as the drivers and passengers will be concerned more about the speed of the journey than the design aspects of the traffic. It is defined as the rate of motion in distance per unit of time. Mathematically speed or velocity 'v' is given by.

$$v=d/t$$

Where, v = Speed of the vehicle in m/s. d = Distance travelled in m. t = Time in seconds

3.4 Testing Model

The testing result of the seed detection system is shown below. Hardware Implementation of overall speed detection system vehicles. When the vehicle passes through the sensor I and sensor 2. LCD displays the speed of the vehicle. The time taken between two sensors is displayed on LCD. When the speed of the vehicle is not greater than the speed limit i.e. 50km/h, the LCD display the condition for under limitedspeed as shown in figure 2.

Figure 2. LCD Display for Under Limited Speed

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In this section, over speed condition is shown on the LCD display.

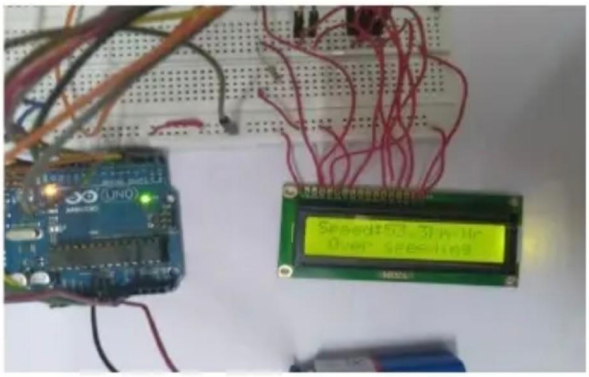

Figure 3. LCD Display of Over Speed (53.3 km/h)

Figure shows the vehicle speed 53.3 km/h and then it will also show a warning message.

As mentioned above, this project has two sensors. Here is the working of the project: A timer is started inside the microcontroller whenever a low pulse is received on the first sensor. Then microcontroller waits for pulse from second sensor. Timer is stopped whenever low pulse is received on second receiver.

This project contains following blocks:

1. Microcontroller - We have used 89s51 microcontroller which is 8051 series microcontroller.
2. Sensors - We have used IR sensors i.e. I transmitters and IR receivers.

IV. RESULTS AND DISCUSSIONS

The results of the final implementation are:

- The speed was measured accurately; GPS speed readings matched the car's speedometer readings.
- Speeds above the specified limit were successfully reported after the buzzer alarmed the driver.

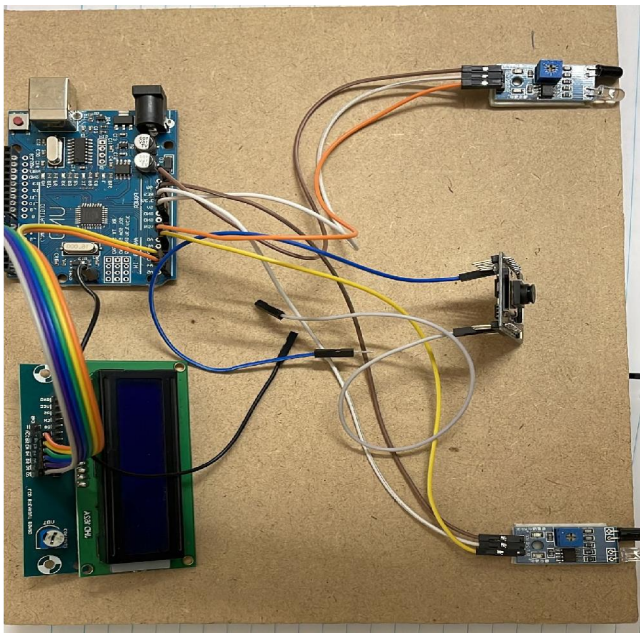

Figure 4. Prototype model development

While driving on highways, drivers should not exceed the maximum speed limit permitted for their vehicles. However, accidents keep on occurring due to speed violations as drivers follow their speedometers and control their speed according to them, and reduce the speed if they find it to be exceeding and beyond their control. A highway speed checker comes

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handy for the traffic police, especially against the speed limit violators because it provides the digital display as well as buzzing sound oralarm to detect any vehicle speed if the vehicle exceeds the permitted speed limit. The makeup of these highways, sometimes leads to accidents because most of the times, there is no rule to govern speed limits on these highways. To overcome this problem, we have implemented a circuit called as a speed checker for highways. This kit is inexpensive and it is used for considering the average and high speed of vehicles that move on the highways or roads. Since number of accidents on highways increases day by day so it is necessary to check speed of the vehicles on highways so as to remove accident cases and to provide a safe journey by controlling high speed of the vehicle. It also minimizes the difficulties of traffic police department and make ease to control the rash driving on highways. The police can perform their duties while sitting in control room and can provide their service with more ease and accuracy. This concept can be extended in future by integrating a camera with the system which could capture the image of the number plate of the vehicle to sends that to the traffic authorities.

V. CONCLUSION

The detailed study was conducted in order to detect the over speeding vehicles in the selected study stretch. An automatic speed detection model was developed using Python programming language. The developed code was also used to build a prototype model which detects type of vehicle along with the speed. The comparative analysis of speeds obtained manual and model shows that the developed model truly represents the field condition. The external validation of the developed prototype using a speed gun will enhance accuracy of the developed model. This prototype will be helpful to monitor the speeds automatically by reducing the requirement of manual traffic personnel.

The car over speeding detection system reduces the number of road accidents and provides a safe journey by controlling the speed of vehicles, in turn avoiding traffic collisions. Thus, the work of the traffic police authorities is minimized and they can control the rash driving of cars efficiently and accurately with ease by just sitting in the control room. In future, this concept can be further extended by integrating a camera with this system that will capture the picture of the over speeding vehicle's number plate and send it to the police authority for further process.

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