Design and Implementation of Driver Assistance System using Machine Learning

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Abstract. The main theme of the work is to detect the traffic sign boards and alert the driver accordingly, which helps in reducing the violation of the traffic rules and also reduces the accidents that occur in day-to-day life. The vehicle will be able to guide the driver by providing the details of speed limit, traffic sign boards in high pedestrian density areas and the driver can change the speed within which the vehicle needs to operate and drive safely. The components that are used in the system design are raspberry pi 3 (module-b), ultrasonic sensor and web camera. The images of the traffic sign boards are captured using a web camera and the speed limit of the vehicle can be changed accordingly by the driver and will not be allowed to exceed the speed limit. In addition this system may help in analyzing the driving pattern.

Keywords: Traffic sign boards, Raspberry pi 3 (module-b), Ultrasonic sensor, Web camera and Driving pattern

1. Introduction
Road accidents claim high number of lives every year and the reasons behind accidents are drunk and drive, driver negligence or distraction, over speeding etc. The majority of the accidents occur because of some fault of the driver or occupants of the vehicle. As per the Government of India “Road Accidents in India, 2011” report by the Ministry of Transport and Highways, about every 11th person out of one lakh died in a road accident and every 37th person was injured in one, making it an alarming situation for a cause of unnecessary death.[10]

Annual global road crash statistics [2013] says that nearly 1.25 million people die in road crashes each year, on an average 3287 deaths a day. 20-50 million people are injured or disabled. Each year nearly 4,00,000 people under 25 years of age die on the world’s roads, on an average over 1000 mortality per day. The World Health Organization (WHO) global status report on road safety [2018] says that annual road traffic deaths have reached nearly 1.35 million. This disproportionality borne by pedestrians and motorcyclists that too especially people aged between 5 to 29 years. According to Ministry of Road Transport and Highways (MoRTH), [10] Continuous efforts taken by the State Government through Transport, Police, Health, Highways and Education departments shows decrease in 24% of accidental deaths in 2018. (In the year 2018 the mortality due to accidents is 12,216 whereas in the previous year 2017 it is 16,157). This made us to further explore on accidents and accidental death, to propose some solution and to reduce this fatality. For this we studied the reports of year 2019, State Crime Record Bureau (SCRB), Road Accident Database Management System (RADMS), Vahan and Sarathy data etc and found that Total occurrences of accidents add up
to 5173, number of deaths is 993. [10] Also the maximum accidents (33.27%) and fatalities are caused by the two wheelers in State Highways. Nearly 63% of accidents occur both together in National and State Highways and 69.68% of the fatality occurs in National (36.25%) and State Highways (33.43%) in Tamil Nadu. [10]

2. Literature Survey
The existing systems use image processing techniques to detect the drowsiness of the driver and alert them. The idea is to capture the live image of the driver through the camera and check the iris position along with the facial expressions to detect the state of the driver. This method only produces an alert to the driver and moreover it has only a software module to identify whether the driver is awake or not. These systems mainly focus on drowsiness alert and not on other aspects. [1][5][14]
Our system is capable of acting in active as well as passive modes in order to prevent the occurrence of accidents. The system is not only capable of correcting mistakes made by the driver but also can make the driver follow the traffic sign rules at any cost. Along with software modules our system has hardware module in order to control the actions of the driver and to prevent the accidents, which makes the system more effective one.

3. Proposed System
In order to ensure pedestrian safety and vehicle speed limits in areas with high pedestrian density or residential areas, a system to detect the traffic density and accordingly warn the driver about the speed limit for vehicles is proposed.

![Block Diagram](image1.png)

**Figure 1. Block Diagram**

The sign boards are detected using an image processing algorithm called HAAR Cascade algorithm. Using this algorithm the sign boards to be detected are given as positives and those not to be detected are given as negative and stored in a folder (database).

![Haarcascade Flow Chart](image2.png)

**Figure 2. Haar cascade Flow Chart**
Then the folder containing the images are trained using Haar cascade CPU trainer, which generates XML files for trained images as shown in Figure 2 Haar cascade Flow Chart above. Further using image detection algorithm, accuracy of detection of boards can be tested. The web camera connected to Raspberry Pi board captures images and these captured images will be compared with the already trained XML files. If there is any deviation then the warning message will be sent through LCD display and gives an alert to the driver, as illustrated in Figure 3. Based on this alert speed limit can be modified. The active system is based on tensor flow algorithm and YOLO (You Only Look Once) where the image can be detected at any angle with slight match with the trained data. Here the system can make decisions based on the situation of the driving environment and help in reducing the fatal accidents that occur due to pre-emptive actions.

4. Results and Discussion
The Stop board detection output is presented in the Figure 4 below

Once after detecting the stop board sign, the system automatically sends an alert to driver and the alert is displayed in the screen as shown in below Figure 5.
Also the designed system identifies Human, animal and Pedestrian on roads and categorizes accordingly as shown in above Figures 6 and 7 respectively.

Similarly after detecting the pedestrian, the alert given to driver is shown in above Figure 8.
Every user will be given a **user id** and a **password** to connect their mobile phone with the application as shown in above Figure 9.

For illustration we have created a username and a password to login into the application, to demonstrate the working procedure of this application as shown in above Figure 10.

Once after logging into the application, customer can post service query information’s about the product to us by filling up the details like email id, subject and content of the message etc as shown in
above Figure 11. Once the details are fed, the message can be sent to the corresponding email id by clicking the send button.

![Figure 12. Service Query Message](image)

The message sent from the customer side through application will be sent to the referred email id and the alert message can be viewed on the inbox as shown in the above Figure 12.

5. Conclusion

In this work we have implemented a solution to overcome the issues of fatal road accidents, by equipping both safety as well as alert system depending based on the driver’s needs. With the introduction of these systems, safety that is prevailing in the present vehicles can be improved. When such systems are equipped, service can also be provided with the help of application for the interaction of the customer. This work can be further extended and can be analyzed in terms of Vehicle to Vehicle & Vehicle to Infrastructure communication. Further Vehicular Ad-hoc Network (VANET) routing protocols can be studied and new algorithms can be developed.

6. References

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