Real-Time Vehicle Detection and Safety Alarm System

Jeetu Gwalani[1], Vishal Maurya[2], Datta Vardan Muvvala[3]

Project Guide: **Prof. Vinita Mishra**

Dept. of Information Technology, Vivekanand Education Society's Institute of Technology, Maharashtra, India

---***---

Abstract - *Road accident is one of a serious social problem which leads to both life and financial loss. The human factor i.e. driver and other road users plays a major role in these accidents which includes driver's behaviour, decision making ability, reaction speed and more importantly maintaining proper safe distance from other vehicles. So to find the solution of this problem, in this paper we propose the mobile application which contains the safety alarm system for road users. The Proposed system is divided into two features by keeping the highway scenario in mind. The vehicle detection feature is employed using the Google Tensorflow Object Detection API whereas the safety alarm feature consists of three phases: to calculate the safety measure; to determine the driving state and the audio alarm. The whole system is provided in form of a mobile application using flutter. For justification of the system, the real time road experiment is conducted. The results show the proper vehicle detection and properly indicating the danger or warning state by triggering the alarm.*

Key Words: (Size 10 & Bold) Key word1, Key word2, Key word3, etc. (Minimum 5 to 8 key words)…

1. INTRODUCTION

The rapid growth of technology and infrastructure has made our lives easier but also increased road accidents and frequent road accidents and caused significant loss of life, property and property due to incomplete emergency services.

The Jharkhand Government Department of Transport and many other sources say the main reason for the collision was a human error and speeding and many lives were lost due to this reason, the right distance between two adjacent vehicles is very important for road safety.

As in-depth learning has made significant progress in the performance of neural models, in this paper we use an in-depth acquisition-based object detection system, i.e., Google Tensorflow object detection in the proposed security alarm system. The main function of the system is to locate a vehicle in a real-time location and to alert drivers to potential collisions with safety and distance. The program is based on image and video processing. System to build IOS function program.

This paper is organized as follows. Section 2 explains the purpose of the proposed plan .Then the Literature Review in Section 3. Then the three main functions of the proposed program are described in Section 4. The conclusion is made in Section 4 where the case is considered. Finally, a conclusion is made in section 5.

2. OBJECTIVES

Following are the main objectives:

- Getting the real time data from the phone camera.
- Detect vehicles and classify them.
- Implement different methods algorithms for doing the task and to conclude which method is most suitable for task.
- Implement a proper warning/alarm system.

3. LITERATURE SURVEY

Numerous papers were examined and their discoveries are summed up in this part. This segment incorporates papers studied previously and during the development of the project. The papers helped in acquiring knowledge into existing arrangements, conceivable approaches to advance calculations and encourage the determination of calculations dependent on their presentation.

In [5] Design a Support Vector Machine-based Intelligent System for Vehicle Driving Safety Warning, the authors Che-Chung Lin, Chi-Wei Lin, Dau-Chen Huang, and Yung-Hsin Chen. The system utilizes the combination of Lane Departure Warning (LDW) work and Forward Collision Warning (FCW) work utilizing the Support Vector Machine (SVM) algorithm which is used as the classifier. The algorithmic parts of LDW work incorporate picture covering, middle channel, edge-upgrade channel, while the FCW work recognizes vehicles with an element based methodology and checks the vehicle competitors by the appearance-based methodology.

In [8] The study of vehicle's anti-collision early warning system supported fuzzy control, the authors Fangxiao Cheng, Danyang Zhu, Zhijun Xu. This article principally examines the car accident evasion framework dependent on fuzzy control. This framework also utilizes millimeter-wave radar to quantify the distance between two vehicles and the speed of an engine vehicle. First, make the security distance model of the engine vehicle brake. Besides, plan the fuzzy regulator for early warning. In conclusion, as per the public parkway well being guideline, likewise by breaking down the connected assets hypothetically, it tends to be affirmed that this framework can do the stunt of crash notice.

In [2] Demonstration of Forward Collision Avoidance Algorithm Based on V2V Communication, the authors Ahmed Hosny, Mohamed Yousef, Wessam Gamil, Mohamed Adel, Hassan Mostafa, M. Saeed Darweesh. This paper proposes a hardware implementation of a Vehicle-to-Vehicle (V2V) communication-based forward collision avoidance algorithm by alarming the driver about potential crashes. The proposed system gives advisory and imminent warnings according to the anticipated accident.

4. DATASET DESCRIPTION

The model is built on the coco or 'Common Objects in Context' dataset provided by google community that contains images of objects. The object is well known for the collection of various dailylife objects of the environment. The dataset is mainly use for the techniques such as detection, classification, segmentation,etc.

The models used on the dataset:

Model Name	Speed	COCO Map
rfcn_resnet101_coco	medium	30
ssd_inception_v2_coco	Fast	24
ssd_mobilenet_v1_coco	fast	21

5. SYSTEM DESCRIPTION

A. Object Detection API

In Proposed system, Google Tensorflow Object Detection API is used for real time detection of vehicles. The basic idea is that it catches the frames from camera of mobile phones and classify them according to the labels. The COCO dataset provided by the google is used to train the API. In this API, the model named 'ssd mobilenet v1 coco' is used because of its higher speed and greater efficiency.

The model is using the Support Vector Machine algorithm for the classification of the vehicles. And for the categorization the model is using the Faster Regional Convolutional Neural network.

This network helps in following processes:

- Find regions in image containing an object.
- Extract CNN from these regions.
- Classify them.

B. Flowchart for the Proposed System

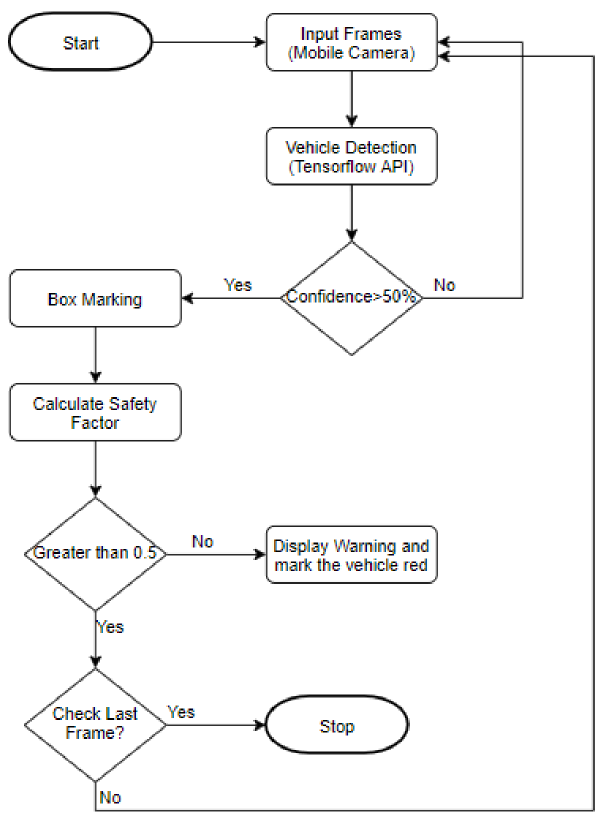

Fig -1: Proposed flow for Tensorflow model

The Overall flowchart of the system is shown in figure above. It starts with taking input frames from the mobile camera. Then these frames are passed into the the Tensorflow model. If the confidence level of presence of vehicle is greater than 50 percent, then the boxes are marked around the vehicle detected. After that the safety factor is calculated as explain in section 6.2. If the factor is greater than 0.5 then it will be considered for the checking of last frame else the 'Warning' alarm gets triggered in the system and the frames gets red marked indicating the danger state.

6. SYSTEM CORE FEATURES

The proposed system described consists of 3 core features which are vehicle detection, safety factor calculation and determine the driving state. The further details are given in following subsections.

A. Frontal Vehicle Detection

The system is more preferable for highway scenarios as mostly collisions occur in high speed only therefore we designed according to that only.
In COCO dataset provided by google we have chosen some categories such as the car, bus, truck, bike, etc as the objects

for detection of collision . With the help of google tensorflow object detection API we were able to detect object thereafter, in bounding box objects width has been found w= A(left)-A(right) [A= coordinate], the coordinate were already provided by tensorflow.

B. Safety Factor

By w of the object, safety factor is calculated. If we have a larger w value that means object is very close and vice versa for smaller w. Therefore safety factor should be proportional to 1-w.

S= 1-w

The safety factor s have been experimented in real time and given a range for threshold value, if s is greater than 0.4 that means it is in safe state and have a sufficient distance and if s is less than 0.4 then collision might happen and warning state will be activated.

To detect if car is in same lane or not we use centre of the bounding box object name it 'C' , if C is under range 0.3 is less than C is less than 0.7 then they are considered to be in same lane otherwise not.

7. EXPERIMENTAL RESULTS

The proposed system is verified by a real-world experiment on a street scenario in Mumbai where two states are checked in the driving situations, i.e., safe state, warning state.

A. Safe state

Above Figure shows a screenshot of a state when safety factor is under the range that we have defined be doing various experiment which will be best suitable range for non-collision. Here s is less than 0.3, and software is able to calculate the distance between the car. Therefore the box is coloured blue in this case. In a case when a car will be in beside lane then also it will be considered as safe state (i.e C is in range of [0.3,0.7]) .

A. Safe state

Above Figure shows the screenshot of a state when safety factor is above the range and crosses the threshold value of 0.4, in this state the boxes will turn red and create a alarming sound in device to remind driver to maintain a certain distance.

8. Conclusion

In this paper, we have successfully presented and implemented a real-time car detection and safety alarm system. The proposed solution consisted of 2 main parts: detection of car and alarming to driver before collision. In the car detection, frontal cars were box marked with the help of bounding box in flutter and their widths were calculated. Thereafter a safety factor was obtained through the box width and an estimated distance was given for safety factor. The proposed system was tested in a real world highway driving environment. The experimental results have shown to be positive and effective in the given cases.

ACKNOWLEDGEMENT

We would like to acknowledge our Project guide Prof Vinita Mishra for providing necessary guidance.

REFERENCES

[1] M. Betke, E. Haritaoglu, and L. S. Davis, "Multiple vehicle detection and tracking in hard real-time," Proceedings of the IEEE Intelligent Vehicles Symposium, Sep. 1996.

[2] Ahmed Hosny, Mohamed Yousef, Wessam Gamil, Mohamed Adel, Hassan Mostafa, M. Saeed Darweesh. "Demonstration of Forward Collision Avoidance Algorithm Based on V2V Communication," Proceedings of the IEEE Intelligent Vehicles Symposium 2000, pp.8th International Conference on Modern Circuits and Systems Technologies (MOCAST) 2019.

[3] A. Broggi, P. Cerri and P.C. Antonello, " Multi-Resolution Vehicle Detection using Artificial Vision," Proceedings of IEEE Intelligent Vehicles Symposium, pp.310-314, June. 2004.

[4] C.C. Wang, S.S. Huang and L.C. Fu, "Driver Assistance System for Lane Detection and Vehicle Recognition with Night Vision," IEEE International Conference on Intelligent Robots and Systems, pp. 3530-3535, Aug. 2005.

[5] C.-C. Lin, C.-W. Lin, D.-C. Huang, and Y.-H. Chen, "Design a Support Vector Machine-based Intelligent System for Vehicle Driving Safety Warning," IEEE Conference on Intelligent Transportation Systems, pp. 938-943, Beijing, China, 2008.

[6] M. Bertoui, A. Broggi, A. Fascioli, and S. Nichele, "Stereo Vision-based Vehicle Detection," Proceedings of the IEEE Intelligent Vehicles Symposium 2000, pp.

[7] M.Y. Chern and P.C. Hou, "The Lane Recognition and Vehicle Detection at Night for A Camera-Assisted Car on Highway," Proceedings of IEEE Robotics and Automation, vol. 3, pp. 2110-2115, Sep. 2003.

[8] F. Cheng, D. Zhu, and Z. Xu, "The Study of Vehicle's Anti-collision Early Warning System Based on Fuzzy Control," International Conference on Computer, Mechatronics, Control and Electronic Engineering, pp.

[9] Priya Dwivedi. (2017). Is Google Tensorflow Object Detection API the easiest way to implement image recognition? Available at:

https://towardsdatascience.com/is-google-tensorflow-object-detection-api-the-easiest-way-to-implement-image-recognition-a8bd1f500ea0

[10] S. S. Huang, C. J. Chen, P. Y. Hsiao and L. C. Fu,"On-Board Vision System for Lane Recognition and Front-Vehicle Detection to Enhance Driver' s Awareness," Proceedings of IEEE Robotics and Automation, vol. 3, pp. 2456-2461, May. 2004.

[11] I. Pavlidis, V. Morellas, and N. Papanikolopoulos,"A Vehicle Occupant Counting System Based on Near-Infrared Phenomenology and Fuzzy Neural Classification,"IEEE Transactions on Intelligent Transportation Systems, Vol. 1, No. 2, pp. 72-85, Jun. 2000.

[12] R. Taktak. M. Dufaut and R. Husson, "Vehicle detection at night using image processing and pattern recognition," Proc. Int.Conf. on Image Processing, 1994, pp.296-300.