International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Vehicle Accident Detection System

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Abstract - *To ensure the safety of the road commuters in such a network, it is imperative to enhance the performance of Advanced Driver Assistance Systems (ADAS). Real-time driving risk prediction is a fundamental part of an ADAS. Many driving risk prediction systems have been proposed. However, most of them are based only on vehicle's velocity. But in most of the accident scenarios, other factors are also involved, such as weather conditions or driver fatigue. In this paper we propose a system for vehicle accident detection using raspberry pi considering various factors.*

1. INTRODUCTION

To ensure the safety of the road commuters in such a network, it is imperative to enhance the performance of Advanced Driver Assistance Systems (ADAS). Real-time driving risk prediction is a fundamental part of an ADAS. Many driving risk prediction systems have been proposed. However, most of them are based only on vehicle's velocity. But in most of the accident scenarios, other factors are also involved, such as weather conditions or driver fatigue. In this paper we propose a system for vehicle accident detection using raspberry pi considering various factors.

2. LITERATURE SURVEY

Every year the lives of approximately 1.35 million people are cut short as a result of a road traffic crash. Between 20 and 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury. Many of these accidents have common causes such as distracted driving, speeding, driver drowsiness, weather conditions, improper turns, etc. More than 97k people died due to accidents caused by over speeding in 2018. According to NHTSA Distracted driving is dangerous, claiming 2,841 lives in 2018 alone. Among those killed: 1,730 drivers, 605 passengers, 400 pedestrians and 77 bicyclists. In a paper named "Driver Fatigue Detection Based Intelligent Vehicle Control" by Zutao Zhang, Jiashu Zhang they presented an intelligent vehicle control based on driver fatigue detection and eyetracking using haar algorithm. In this paper, driver fatigue can be detected when the eyes close over 5 consecutive frames and system will warn fatigue to driver. We have included this factor in our system. Similarly, In a paper named "Traffic Accident Prediction Using Vehicle Tracking and Trajectory Analysis" by Weiming Hy Xuejuan Xiao, Dan Xie, and Tieniu Tan they presented a probability model for traffic accident prediction. We have also considered this factor for our system Many organizations are trying to develop a system which detects and warns about an accident. Considering this scenario we are developing a system with various input factors that are object detection, driver drowsiness, mutual object detection and weather conditions.

3. METHODOLOGY

The four input factor and its implementations is as follows.

3.1 OBJECT DETECTION

In a collision warning that avoids traffic rear- ends accidents was proposed, in which all the vehicles were embedded with sensing and communication models. The sensing module can help vehicles sense the surrounding environment and detect nearby vehicle traffic density to predict crashes yielded by sudden braking. For this factor we have used an ultrasonic sensor which measures the distance between vehicle and object. If distance is less than critical distance then value is sent to the system. The ultrasonic sensor works continuously.

Figure 1:-Ultrasonic Sensor

3.2 DRIVER DROWSINESS

Detecting the driver's physical and mental fatigue is a critical factor for VAD development. The proposed model could be customized by including the driver's drowsiness by calculating the frames for which eyes of driver remain closed. If the score increases 15 frames it indicates that driver is feeling drowsy. The model we used is built with Keras using Convolutional Neural Networks (CNN). A convolutional neural network is a special type of deep

neural network which performs extremely well for image classification purposes. A CNN basically consists of an input layer, an output layer and a hidden layer which can have multiple numbers of layers. For implementation of this factor we Take image as input from a camera. Detect the face in the image and create a Region of Interest (ROI). Detect the eyes from ROI and feed it to the classifier. Classifier will categorize whether eyes are open or closed. Calculate score to check whether the person is drowsy. If the score is less than specified value then the person is drowsy else not.

Figure 2:-Open and Closed Frame

3.3 CONDITIONS

It defines the factor that predicts the accident by analyzing the sensed weather data obtained from weather forecasting system. The data in the format of cloudy, clear, light rain are the different categories of weather based approach. We have used Pandas. It is a Python library with many helpful utilities for loading and working with structured data. Next, we have wrapped the dataframes with tf.data. This enabled us to use feature columns as a bridge to map from the columns in the Pandas dataframe to features used to train the model. Now that we have defined our feature columns, we used a DenseFeature layer to input them to our Keras model. Further we created , compiled and trained the model using tensorflow with high level API tf.keras

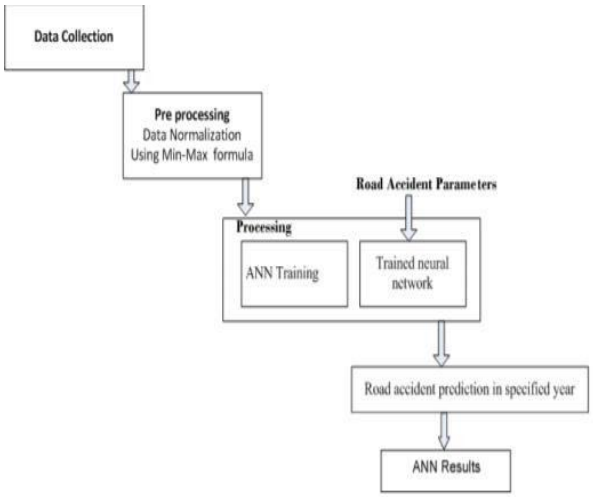

Figure 3:-Data Processing and Model Training

3.4 MUTUAL OBJECT DETECTION

It may happen that the vehicle is just waiting at a signal and other vehicle is just in front. This scenario may look like accident by our system as the distance between both objects is very less. To prevent such scenarios we include mutual object detection which will inform our system if mutual object is detected. For this factor we have trained a model in OpenCV which detects the objects in front of vehicle and passes the input to our system.

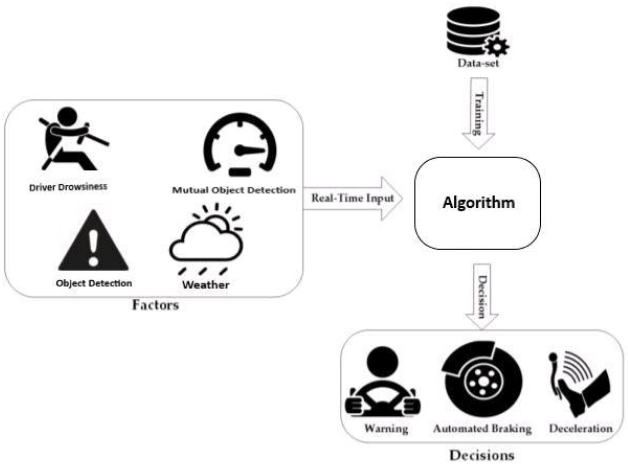

Figure 4:- Proposed system

4. OUTPUT FACTORS

4.1 ALARM

If driver drowsiness condition satisfies while the vehicle is moving then system is going to produce alarm which will help driver to recover from drowsy situation.

4.2 AUTOMATED BRAKING

If two or more conditions are satisfied and also the mutual object is not detected then in this critical situation the vehicle

will be controlled by automated braking.

4.3 DE-ACCELERATION

If only two condition are satisfied and the situation is not more critical. Then vehicle will be controlled by reducing velocity.

5. CONCLUSIONS

We have proposed vehicle accident prediction system for urban environments, in which we have considered the risk of the crash as a latent variable that can be observed using multi-observation such as speed, weather conditions, nearby vehicles density and driver fatigue. The

sensing module (ultrasonic sensor) senses the object and if the distance less than 50 cm the automatic breaking will get activate. In Driver fatigue, camera will capture the eye frame of a driver and provide score. If score greater than 15 then alarm will get activate. Mutual Object Detection used to detect the nearby traffic and provide the output accordingly. Weather Condition detects the weather and provides the output according to the condition (Alarm, De- acceleration and Automatic Breaking).

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