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Driver Drowsiness Alert Application for Vehicles using ML

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***Abstract:** It is difficult to identify the state of the driver since road accidents can happen at anytime if the driver is not concentrating on the road. Hence to avoid accidents the driver's consciousness needs to be monitored throughout the journey. This paper proposes a method of monitoring the eyes and mouth of the driver which will provide the result that if the driver is in the drowsy state or not. This proposed method captures the real time features of the eyes and mouth of the driver which is implemented by using CNN algorithm and accurate results are provided on the basis of the information.*
***Keywords:** Conventional Neural Network, Haar cascades, Facial features.*

I. INTRODUCTION

Driver fatigue is one of the major causes of road accidents. Every year, they increase the amounts of deaths and fatalities injuries globally. Nowadays, driving support systems, such as car navigation systems, are becoming common, and they support drivers in various aspects. Driver alert system is developed by volvo which alerts the driver when he/she is drowsy. This is done by installing a camera which is attached to the Lane Departure Warning System (LDWS).[1] It is important to detect the driver's consciousness while he/she is driving a car for a very long time. Predominantly, detecting driver's drowsiness could prevent drivers from collisions caused by drowsy driving and losing their control over the vehicle. The system is based on facial image analysis to detect facial expressions of the driver. Whenever the system detects that the driver is drowsy by predicting the facial expressions, the driver is awakened by an alert. The alert is basically a beeping sound that does not cause any kind of panic situation for the driver by hearing the sound of the beeping alert. Real time facial features are extracted and used for further analysis. These features are necessary for distinguishing facial features and obtaining results. Then it recognizes changes on certain features such as eyes and mouth and calculates the percentage of drowsiness. This result used to check if the driver is drowsy.

II. PROPOSED MODEL

The proposed model includes hardware such as raspberry pi, infrared camera, buzzer for detecting the driver drowsiness. The infrared camera captures the images of the driver and is passed as input into the raspberry pi. The raspberry pi includes the haar cascade classifier and the CNN model. The haar cascade classifier extracts the facial features of the driver i.e eyes and mouth. This result is forwarded to the CNN algorithm which detects if the driver is drowsy or not. The below component block diagram depicts the proposed model.

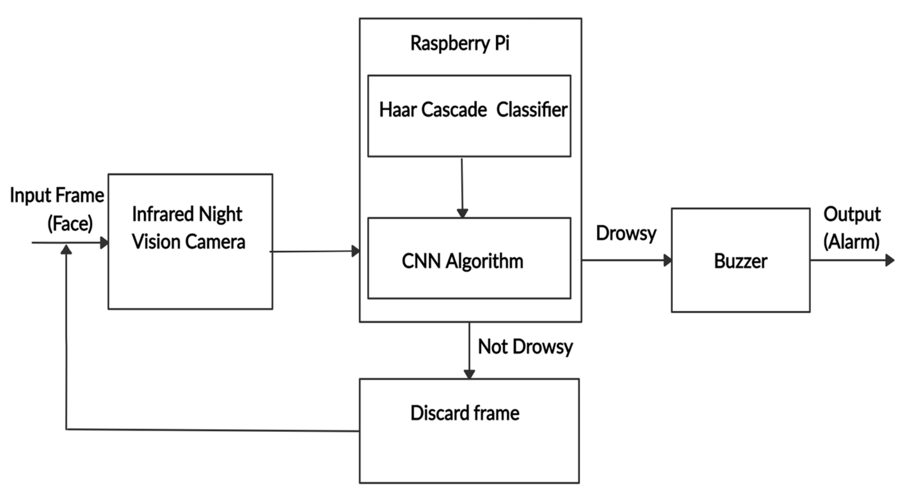

Fig 1:- Component Model Diagram

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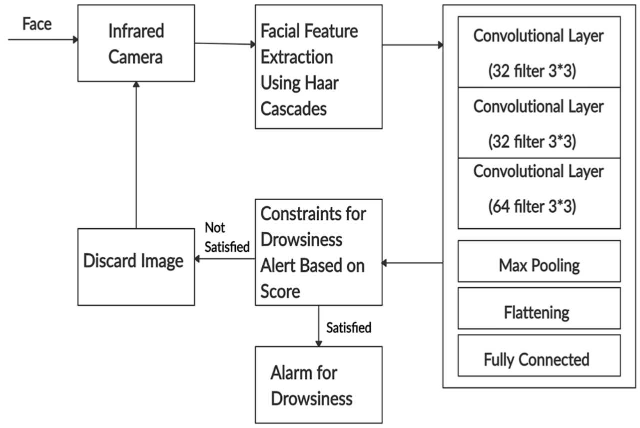

Fig 2:- Detailed block diagram

Fig. 2 explains the detailed working of the proposed model. The Infrared camera is used to capture facial images which are then converted into frames and forwarded to Raspberry Pi. The frames are given as input to Haar Cascade classifier. It is used to extract facial features of the driver's image which in our case is eyes and mouth. The extracted features are then given as input to CNN model which follows a series of steps for image classification. It is passed through three convolutional layers wherein the first layer and the second layer consists of 32 filters of size 3*3 and the third layer consists of 64 filters of size 3*3. Max Pooling gives the maximum value from the portion which is covered by the kernel. Flattening converts the data processed into a 1-D array for providing it as input to the next layer for classification. The fully connected layer analyzes the individual data and processes it according to the constraints and generates the result. If the constraints are satisfied the buzzer starts beeping else the image capturing continues.

III. HAAR CASCADE CLASSIFIER

Face has 65 physical features, such as the shape of a person's mouth, nose, neck, cheekbones and eyebrows.[2]

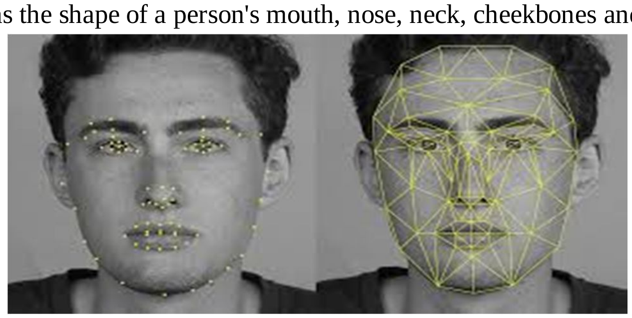

Fig 3 :- Facial Feature Detection

Haar cascades classifiers are used to detect facial expressions of the driver. It uses techniques for machine learning to achieve a high degree of accuracy from what is called "training results." It measures 2,500 related features for each 24* 24 window that are selected from 160,000 features. Because of an input image, it transfers the 24 * 24 window throughout the picture due to an input image and tests 2,500 features for each window, and takes a linear combination of all outputs to see if it exceeds a certain threshold.[3] Haarcascades discards non-faces quickly and concentrates on spending more time on probable face regions.The idea of cascades for each window, instead of calculating 2,500 features. 2,500 features in x different cascades. It linearly detects whether or not there is a face in various cascades. If cascade finds a face in a picture, the picture will pass to the next cascade. If no face is present, it switches to the next window if it is a cascade. This reduces the complexity of time. The Haar Cascade runs the frames and captures a series of target images called 'positives' in real time. Basically, Haar Cascade is a cascade classifier used to detect images saved at the source. A set of 'negative' images superimposes the object to be detected.[4] The features detected in this system are mouth and eyes and as soon as it detects any identifiable feature it compares with the training images stored at the source. Once the Classifier detects any of the two states, a beeping sound is generated so that the driver can be alert. Furthermore, the system takes enough care not to mark blinking as drowsy.

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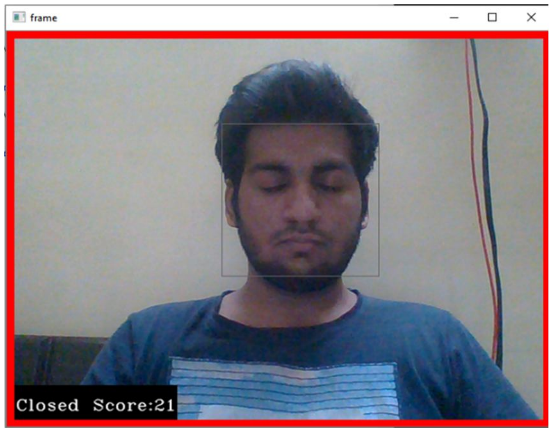

Fig 4:- Detection of eyes

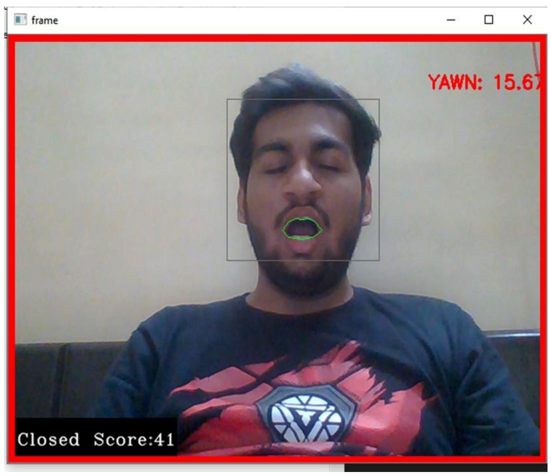

Fig 5:- Detection of yawning

IV. CONVOLUTIONAL NEURAL NETWORK

CNN is capable of capturing the input image and distinguishing the images on the basis of certain filters. It preprocesses a small part of the image and provides better results with higher speed as compared to other algorithms. As compared to other algorithms CNN provides better accuracy for classifying images. It even detects the eyes if the person is wearing a spectacle. The results gained by using haar cascades are fed as input into the CNN model. The CNN algorithm does the detailed analysis of the extracted features i.e the eyes and mouth and detects if the person is in drowsy state or not.

The model makes use of Keras which is a high-level neural network API which is implemented in Python.[4] CNN includes many architectures such as AlexNet, ResNet, Mobile Net and VGG Net. Among these architectures VGG Net architecture is a simple CNN architecture. The small-size convolution filters allows VGG to have a large number of layers which leads to improved performance and provides better accuracy.

V. CONCLUSION

Recent statistics have depicted the increase in the number of road accidents that occur every year and one of the major causes for that is drowsiness or distracted state of mind of the driver.. The proposed model shows how a camera can be installed on the speedometer of the car to capture the facial features of the driver and process it using machine learning algorithms, Convolution Neural Networks(CNN), and decide or predict whether the driver is drowsy or not. If the prediction is positive, an alarm is sound to alert the driver to be focused while driving. This proposed model uses VGG Net architecture that has a higher performance than any other architecture since it does detailed image classification. The model can detect the driver's eyes even if they are wearing spectacles and the drowsiness detection also works during the night due to the infrared camera. Future work concerns detecting the use of mobile phones while driving and detecting if the driver is drunk while driving using an alcohol sensor.

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