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Driver Sleepiness Detection using Image Processing Technique

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Abstract. In a country like India with traffic issues, nearly 20% of the accidents are happening because of driver's carelessness (Driver feeling sleepy) while driving. we can reduce this with "Driver Sleepiness Detection" technique. Every vehicle is equipped with a camera on the dashboard of the vehicle, right in front of the driver's seat which will take pictures continuously till the vehicle's engine is on. whenever it detects that the driver is falling asleep, it will give an alarm which is a beep sound (loud sound). This detection is totally based on the images gathered by the camera, it will assign the distance of their eye lids and if they are closed for more than 2 seconds(48 Frames) then the alarm is activated. The driver and the co-passengers are warned that the driver is falling asleep. In this way many of the accidents can be avoided and can save many people from getting injured.

Keywords: Image processing, Driver's eyes detection, Drowsiness Alert message.

1 Introduction

In 2015, there were about five lakh road accidents in India, which killed about 1.5 lakh people and injured about five lakh people.A total of 4,64,910 road accidents have been reported by States and Union Territories (UTs) in the calendar year 2017, claiming 1,47,913 lives and causing injuries to 4,70,975 persons.For the second consecutive year, the number of road accidents has declined in 2017 over the previous year (2016). Similarly, the number of persons injured has been on the decline since 2015. In percentage terms, the number of accidents in 2017 has been lower by 3.3 per cent and injuries by 4.8 per cent over that of the previous year, 2016 Significantly, the number of persons killed in road accidents during 2017 has been less than that of 2016 by 1.9 per cent. In terms of accidents on road categories, the National Highways accounted for 30.4 per cent of total road accidents and 36.0 percent of deaths in 2017. Accidents on State Highways and other roads constitute 25 per cent and 44.6 per cent respectively. In case of fatality, State Highways and other roads have accounted for 26.9 per cent and 37.1 per cent, respectively.Among vehicle categories involved in road accidents, two-wheelers accounted for the highest share (33.9%) in total accidents and fatalities (29.8%) in 2017 as shown in Fig 1.1. Light vehicles comprising cars, jeeps and taxis as a category comes a distant second with a share of 24.5 per cent in total accidents and 21.1 per cent in total fatalities. This is a very alarming situation in India and We wanted to build a project which would significantly reduce these numbers and save many lives. This motivation inspired us to develop this "Driver Sleepiness Detection" system which is very cheap and very effective. In this we use a webcam and a central processing unit and as soon as the driver starts the engine, this system gets activated and continuously captures driver's face and with the help of Dlib library and manchine learning algorithms we determine the face of the driver and extract eyes of the driver and by using EAR(eye aspect ratio) formula we determine whether the eyes of the driver are open or closed. If the eyes of the driver are closed for more than 48 frames (2 seconds) then the buzzer is activated by which the driver and the passengers in the vehicle can be alerted. This can avoid many accidents in the society and can save many people's lives.

2 Literature Survey

In this section, recent developments on embedded vision systems are briefed, followed by the review of literature on real-time face detection and eye detection. Real time drowsiness detection has been implemented using different detection techniques analyzing various types of input data. The first approach is analyzing the measurement of physiological activities of the human

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body, such as brain wave (EEG), heart rate or pulse rate. Li presented a drowsiness detection system using ORD model using evidence theory.ORD is a subjective assessment of drowsiness that is reflected in people's physical appearance, behaviors and mannerisms. In recent work, detecting driver drowsiness and distraction are performed using HMM based dynamic modeling. Fortunately human face produces distinctive characteristics in different states. In drowsiness situation many visual cues can be detected in human face, such as eye blinking, yawning and head movement. Hidden Markov model analyzing the facial expressions of the driver to detect the drowsiness, Artem A. Lenskiy proposed a system that measures eye blinking rate and eye closure duration. The system consists of skin- color segmentation, facial features segmentation and iris positioning and blink detection. The proposed skin- segmentation procedure is based on a neural network approximation of a RGB skin-color histogram. Ayumi Tsuchida proposed a system using neural network based 'error correcting output coding 'in which laboratory experiments were conducted by using a proprietary driving simulator, which induced drowsiness among the test drivers. The purposes of these experiments were to obtain an electrocardiogram(ECG) and eye-blink video sequences. The drivers were also monitored through a video camera. Hong Su proposed a new technique of modeling driver drowsiness with multiple eyelid movement features based on an information fusion technique—partial least squares regression(PLSR), with which to cope with the problem of strong collinear relations among eyelid movement features. F. Friedrichs has proposed a camera based drowsiness detection in which the performance of the latest eye tracking based in-vehicle fatigue prediction measures are evaluated. The work provided a solution for driver monitoring and event detection based on 3-d information from a range camera. The system combines 2-D and 3-D techniques to provide head pose estimation and regions-of interest identification. Based on the captured cloud of 3-d points from the sensor and analyzing the 2-d projection, the points corresponding to the head are determined and extracted for further analysis.

3 Recommended System

Driver Sleepiness Detection using just USB webcam and a Processing unit. This system captures the face of the driver and with the help of machine learning and Dlib library we determine the face of the driver and determine the region of eyes and give coordinates to both the eyes and put those coordinates in a formula which is known as the EAR (Eye aspect ratio). The method implemented is that each eye is represented by 6(x, y) coordinates (P1,P2,P3,P4,P5,P6) as shown in Fig 1 and this is done by Dlib library, starting at the left-corner of the eye and then working clockwise around the eye and these are fed to the formula and a value is calculated. The speciality of this formula is that whenever human eyes are open the value of EAR is approximately equal to 0.3 and if we close our eyes this value decreases rapidly and reaches to zero. And if this value is equal to zero for 48 frames then the alarm is activated and the driver is alerted. This is how our "Driver Sleepiness Detection " system determines whether the driver is conscious or drowsy as shown in Fig 2.

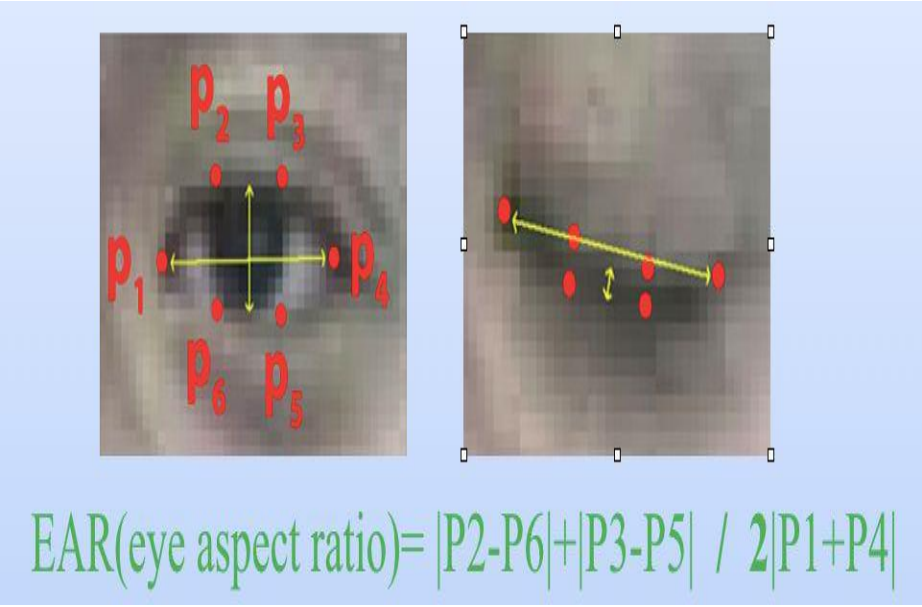

Fig. 2. EAR Formula

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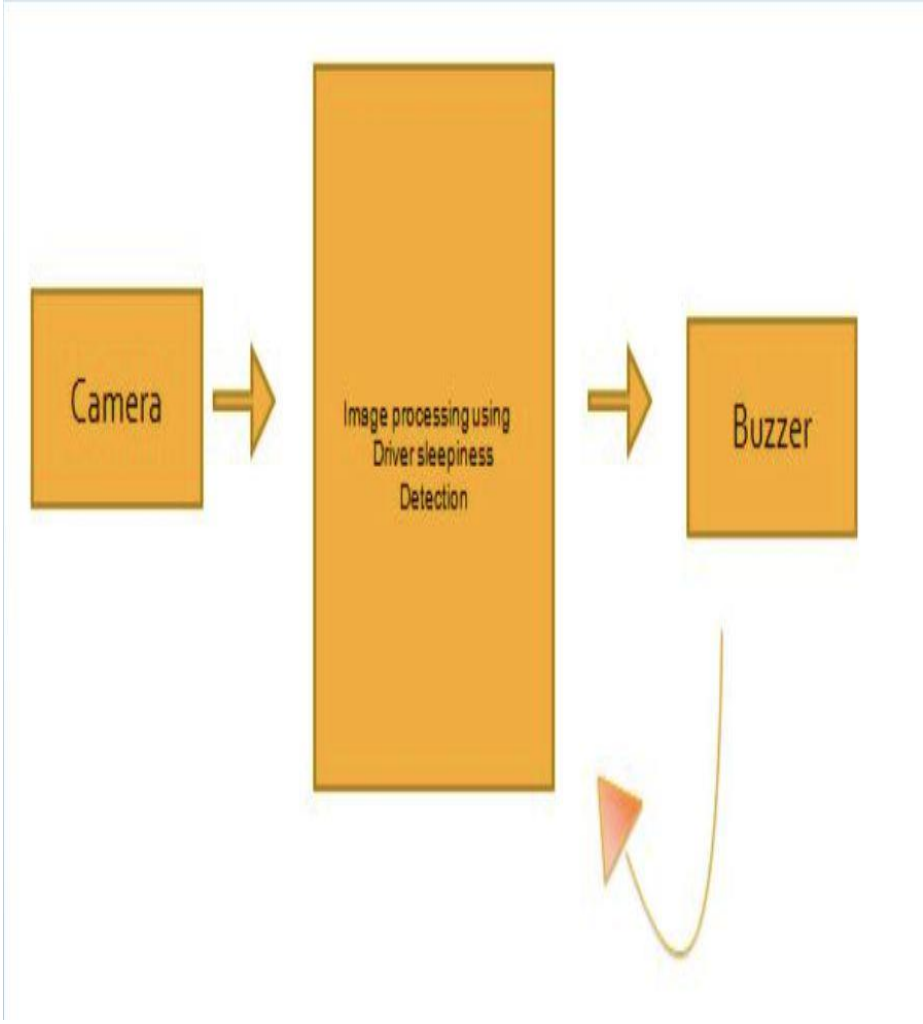

Fig. 2. Recommended Architecture of the Driver Sleepiness Detection

4 Experimental Results

First, we'll set up a camera on the dashboard of a vehicle in such a way that it does not interrupt the view of the driver. This camera is used to monitor the face of the Driver. We apply facial landmark detection and extract the eyes using dlib. Now that we have eyes, we can compute the eye aspect ratio(EAR) to determine if the eyes are closed or not the speciality of this EAR formula is that when the eyes of a human are open at that time this EAR value is approximately equal to 0.30 and as soon as we blink the value drastically decreases to zero. As soon as the driver closes his eyes then this value falls drastically and as it reaches to 0 means driver has fallen asleep. If this value is equal to 0 for 2 seconds then the buzzer is activated and Driver and co-passengers in the car are warned. This can reduce the road accidents which are happening in the society because of driver feeling fatigue.The detection of the driver's eyes from a video stream is shown in Fig 3.

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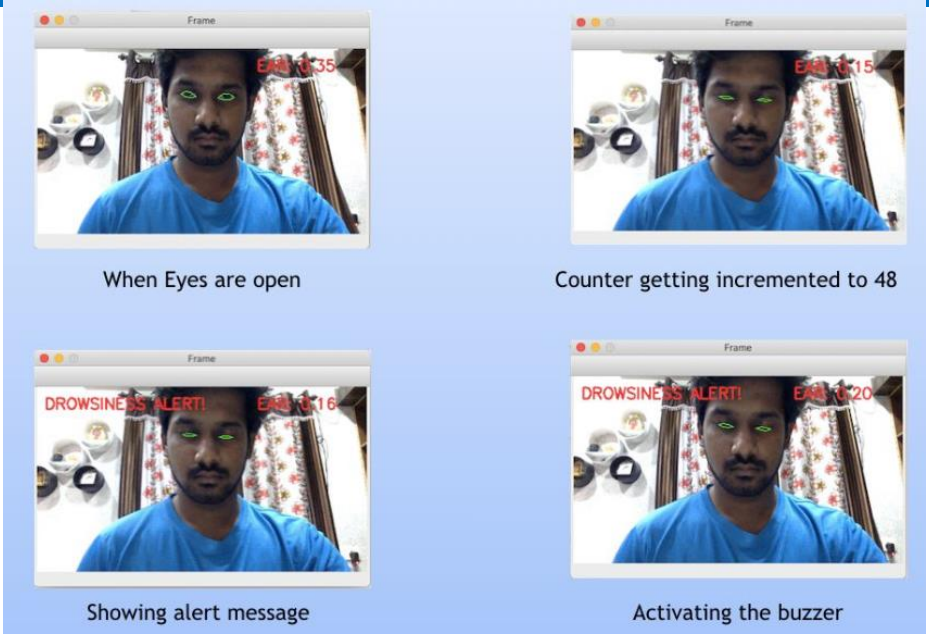

Fig. 2(a). detection of the driver's eyes from a video stream

5 Conclusion

The drowsiness detection and correction system developed is capable of detecting drowsiness in a rapid manner. The system which can differentiate normal eye blink and drowsiness which can prevent the driver from entering the state of sleepiness while driving. The system works well even in case of drivers wearing spectacles and under low light conditions also. During the monitoring, the system is able to decide if the eyes are opened or closed. When the eyes have been closed for about two seconds, the alarm beeps to alert the driver. By doing this many accidents will be reduced and provides safe life to the driver and vehicle safety. A system for driver safety and car security is presented only in the luxurious costly cars. Using drowsiness detection system, driver safety can be implemented in normal cars also because it is feasible and very easy to implement. This system is effective because it can be installed in any vehicle and it doesn't even require any kind of high maintenance. And this kind of safety is present in other countries and only in the top end version of costly vehicles. This system is to make sure that every vehicle is equipped with this driver sleepiness detection which indicates about the state of the driver and focuses on avoiding the occurrence of accidents on the road.

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