Human Machine Interaction Mini-Project Report

on

DROWSY DRIVING WARNING

by

1. Giriraj Belanekar (BE – A 812)
2. Bhaven Gore (BE – A 830)
3. Disha Shirdhankar (BE- A 831)

under the guidance of

Prof. Dnyaneshwar Dhangar

MCT

MANJARA CHARITABLE TRUST

RAJIV GANDHI INSTITUTE OF TECHNOLOGY, MUMBAI

Department of Computer Engineering

University of Mumbai

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Declaration

We wish to state that the work embodied in this synopsis titled “**Drowsy Driving Warning**” forms our own contribution to the work carried out under the guidance of”**Prof. Dnyaneshwar Dhangar**” at the Rajiv Gandhi Institute of Technology.

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Giriraj Belanekar (A-812)

Bhaven Gore (A-830)

Disha Shirdhankar (A-831)

MANJARA CHARITABLE TRUST
RAJIV GANDHI INSTITUTE OF TECHNOLOGY, MUMBAI

Abstract

The Human Machine Interaction (HMI) refers to the communication and interaction between a human and a machine via a user interface. Nowadays, natural user interfaces such as gestures have gained increasing attention as they allow humans to control machines through natural and intuitive behaviors. One of them is to detect the drowsy state of human.This project presents a design of a unique solution for detecting driver drowsiness state in real time, based on eye conditions.

Many approaches have been used to address this issue in the past. The frames are formed, and are provided as input to face detection software. In terms, our required feature (eye) is extracted from the image. Individually working on each eye, the system establishes a condition and suggests a specific number of frames with the same eye condition that may be registered. Our proposed system will detect driver drowsiness and give warning in the form of alarm.

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1. Introduction

Nowadays due to easier EMI options people are able to afford cars, bikes thus adding to the traffic day by day. Even some manufactures have adopted various marketing schemes. This not only adds to the traffic but also increases the risk of deaths due to accidents and vehicle collision. Due to heavy traffic on some roads , emergency vehicles can't arrive on time , leading to more deaths due to road accidents. This project uses OpenCv Algorithms of facial landmarks as a solution to the problem of accident detection and collision avoidance using present day technologies and also upcoming technologies like Global Positioning System (GPS), Global System for Mobile (GSM), Smartphones.

The main objective behind this project is to develop a nonintrusive system which can detect drowsy state of the driver and issue a warning. Driver drowsiness detection technologies can reduce the risk of a catastrophic accident by warning the driver of his/her fatigue. The development of technologies for preventing fatigue is a major challenge. To prevent drowsiness of drivers during driving requires a method for accurately detecting a fall in driver alertness. Microsleeps which are short periods of sleep lasting 2 to 4 seconds are a good indicator of fatigue state. Thus by constantly observing the eyes movement of the driver it can detect the drowsy state of the driver early enough to avoid accidents.

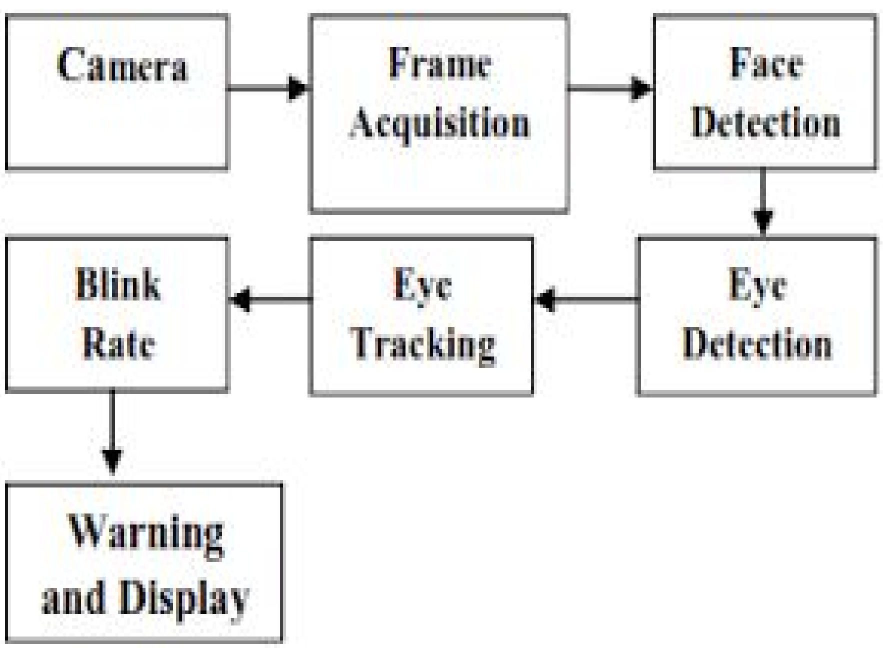

Fig 1. Flowchart for drowsiness detection system

2. Literature Review

The techniques of drowsiness/fatigue detection can be broadly classified into three major categories: Physiological measures,indirect vehicle behavior and directly observable visual behaviors.The best detection accurate techniques are based on physiological phenomena like brain waves, heart rate, pulse rate and respiration. These techniques are intrusive, since they need to attach some electrodes to the drivers, causing annoyance to them. Some representative projects in this line are the MIT Smart Car, and the ASV (Advanced Safety Vehicle) project performed by Toyota, Nissan.

Eriksson and Papanikolopoulos present a system to locate and track eyes of the driver. They use a symmetry-based approach to locate the face in a gray image, and then eyes are found and tracked. Template matching is used to determine if the eyes are open or closed. Singh and Papanikolopoulos propose a non-intrusive vision-based system for the detection of driver fatigue The system uses a color video camera that points directly towards the driver's face and monitors the driver's eyes in order to detect micro-sleeps.

Driver in-alertness is one of the important causes for most accidents related to vehicle crashes. Driver drowsiness resulting from sleep disorders is an important factor in the increasing number of the accidents on today's roads. Drowsy driver warning system can possibly reduce the accidents related to driver's drowsiness. By placing the camera inside the car, we can monitor the face of the driver and look for the eye-movements. The eye is the main facial parameter to monitor because if the driver is getting micro sleep then it will close eyes for a few seconds or longer which is the sign of driver drowsiness. So in such a case the system will alert the driver hence accidents can be tackled.

This paper describes how to find and track the eyes. Also it explains a method to determine if the eyes are open or closed. The main criterion of this system is that this system must be non-intrusive and the system should start when the vehicle is turned on without driver initiation of the system. Driver shouldn't provide any feedback to the system. The system must operate regardless of the colour, size texture of face and different illumination.

3. Proposed Methodology

Problem Formulation

Road accidents have been a major issue for most of the countries. Studies show that the number of deaths due to road accidents is increasing year by year making safety a major concern. Driver drowsiness is one of the major causes of road accidents in which driver's lack concentration on driving and traffic due to fatigue. Image processing algorithm, aims to minimize the deaths that occur worldwide due to road accidents and to increase the life span and mortality rate of persons, proposed System is designed to reduce road accidents due to drowsy driving .It will deal with the major issues about driver fatigue and Collision detection and suggest remedies.

Camera settings and initialization

The camera must be placed at a distance of 40 cm to 50 cm from a driver. This distance is approximately equal to the distance between the car steering and the driving seat. The camera must be placed at an angle of 45 degrees from the driver's face. At an angle between 35-50 degrees the face can be captured with perfection and ease. The first step is initialization of a camera and video processing unit, it acquires an image of the driver's face. Therefore, it is assumed that the eye is a plane Perpendicular to the optical axis of the camera, which is a photo eye 'in the central part of the frame.

Video Frames-

When the system is initiated a delay of two to three seconds is experienced for capturing the image for the first time. This results in losing the data from the first three frames. The segment of video thus obtained from the camera is then used to extract each segment of video frame i.e. 30 frames per second.

Eye Detection

Each face detected is stored for half a second to crop the image in order to detect the eye. Our proposed algorithm CropEye is used for eye detection. CropEye algorithm divides the face horizontally into two segments i.e. upper segment and a lower segment. Upper segment contains the image between the forehead to the eyes, and lower segment contains the image between the nose to the chin. We take into account the upper segment and lower segment is discarded. The upper segment again is divided horizontally into 2 segments, this time the upper up segment from the forehead to an eyebrow and the upper lower segment from eyebrow to a lower eyelash. After the eyes have been extracted from the image it is then that the current frame is replaced by a new one. The eyes extracted are now categorized in two parts through vertical calibration - the left eye and the right eye.

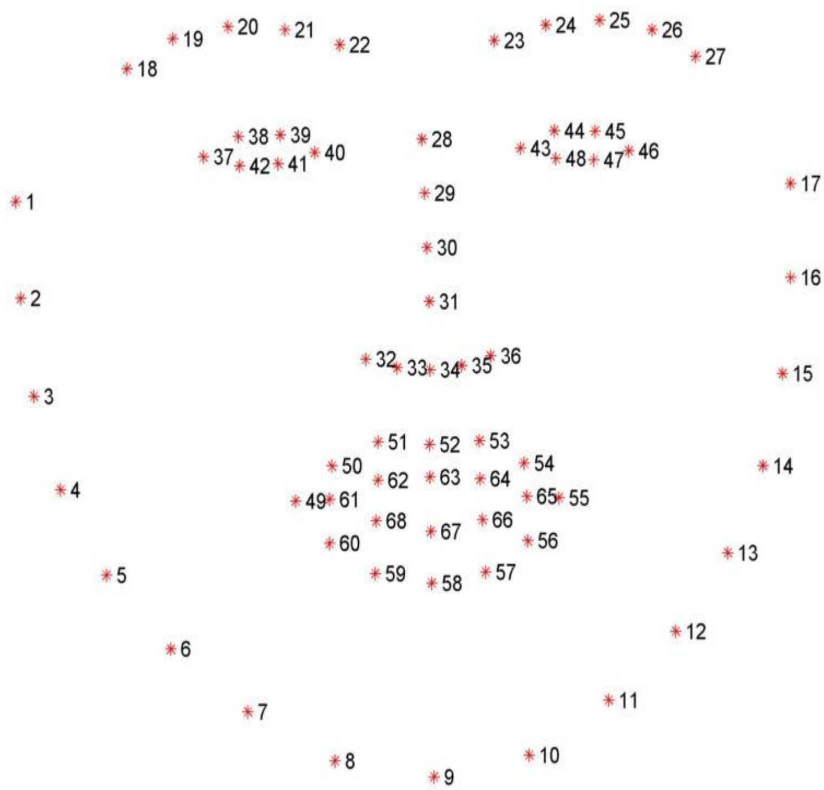

Fig 2. Facial Landmarks

Check condition for open and closed eyes

After the eye has been detected, the next step is to detect the eye's condition either they are open or close, so for this purpose intensity values are used. A graph is plotted which calculates the intensity distance in the eye separately through the eye lashes and eye brow and checks the state of an eye on this intensity distance. If distance is large, eye is close and when distance is less, eye is open. The distance can be evaluated by analyzing the samples of images. Both the eyes are binarized to determine the threshold value and then the results are produced. If the system encounters 48 consecutive frames with the eyes closed the alarm is triggered for the next five frames.

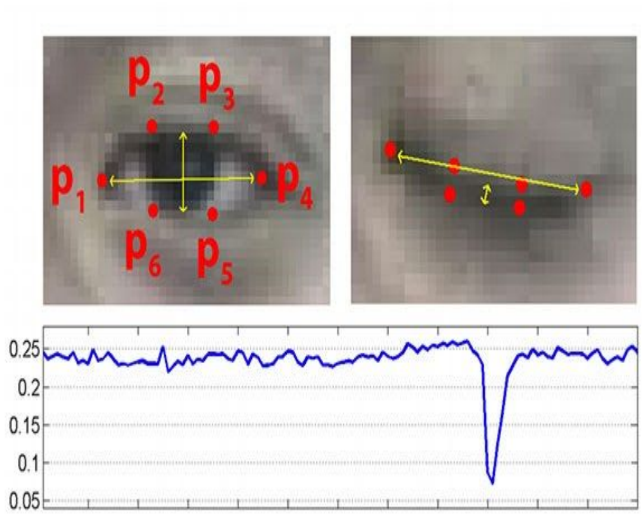

Fig 4. Eye Condition

4. Results

The First task is to find the location of the eye. As soon as it is located it checks for the height and breadth of both the eyes.
If it is below EAR which is fixed then a sound is made.

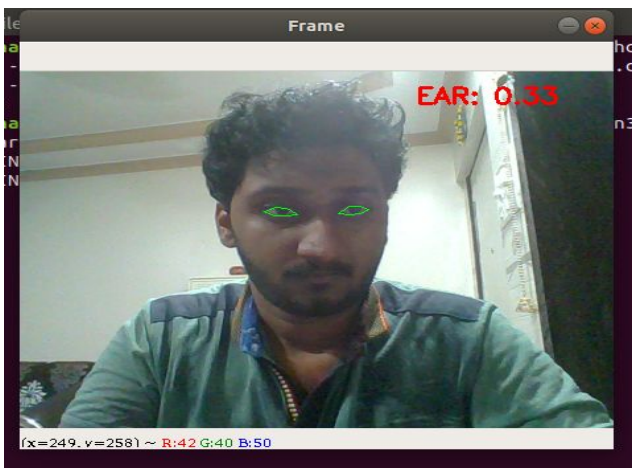

Fig 5. Proper Driving

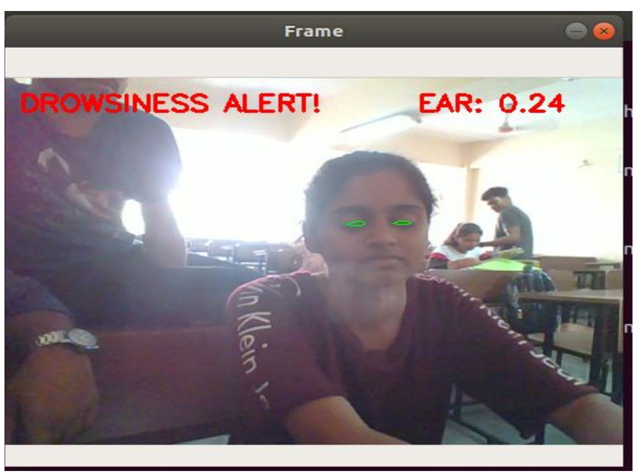

Fig 6. Drowsy driving

Conclusion

The proposed system can be used for driver's safety and its consequences. The system detects drowsiness of the driver through eye conditions. Based on the face detection algorithm, eyes are detected through a proposed crop Eye algorithm which segments the face in different segments in order to get the left and right eye. Conditions of open and close eyes are determined by intensity values, distance between eyebrows is calculated. If the calculated distance is greater than threshold value, eyes are closed otherwise open. The threshold 30 and above is set for Indian eye features, it can vary from region to region. An alarm is triggered if eyes are found to be closed for consecutive 48 frames. The system produces 90% accurate results for 50 different faces. However, its limitation is detecting the eyes of a person wearing glasses. Also it does not produce accurate results if any reflective object is found behind the driver.

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