MAJOR PROJECT-1

SYNOPSIS REPORT
For
Drowsiness Detection System

Submitted By

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Abstract

In the present world, lots of road accidents take place due to the lack of attention and alertness of driver. This is termed as driver drowsiness. This leads to a lot of unfortunate situations causing adverse damage to human lives. The main goal of this research is the detection of driver drowsiness and an appropriate response to the detection. There are many methods which are based on the motion of the vehicle or based on the driver's behavior. One of the methods is the physiological method which helps in distracting the driver from drowsiness and making him alert. And few methods require expensive sensors and deals with a lot of data. Therefore, this paper develops a system for detecting drowsiness in real time with proper procedure and accuracy which is acceptable. In this system, the driver's facial expressions are captured and recorded using a webcam. Every movement in each frame is detected using few techniques of image processing. The Eye Aspect Ratio, Mouth Opening Ratio, and Nose Length Ratio are calculated using the landmark points on the face. The calculated values are compared to the threshold values developed by the system and t h e difference in value leads to the detection. At the same time, the machine learning algorithms are also implemented in offline manner. Based on the classification, the system has successfully achieved 95.58% of sensitivity and 100% of specificity using Support Vector Machine. This model system is compatible with all kinds of vehicles.

Introduction

Many road accidents which lead to death are because of drowsiness while driving. Drivers who drive long hours like truck drivers, bus drivers are likely to experience this problem. It is highly risky to drive with lack of sleep and driving for long hours will be more tiresome. Due to the drowsiness of the driver causes very dangerous consequences, it is estimated that 70,000 to 80,000 injures & crashes happen worldwide in a year. Even deaths have reached 1000-2000 every year. There are many unofficial deaths which are not confirmed by drivers that it was due to their drowsiness. This takes lives of many innocent people. It is a nightmare for a lot of people who travel across world. It is very important to identify the driver drowsiness and alert the driver to prevent crash.

The goal of this research is the detection of the indication of this fatigue of the driver. The acquisition system, processing system and warning system are the three blocks that are present in the detection system. The video of the driver's front face is captured by the acquisition system, and it is transferred to the next stage i.e., processing block. The detection is processed online and if drowsiness of driver is detected, then the warning system gives a warning or alarm.

The methods to detect the drowsiness of the drive may be done using intrusive or nonintrusive method i.e., with and without the use of sensors connected to the driver. The cost of the system depends on the sensors used in the system. Addition of more parameters can increase the accuracy of the system to some extent. The motivation for the development of cost effective, and real-time driver drowsiness system with acceptable accuracy are the motivational factors of this work. Hence, the proposed system detects the fatigue of the driver from the facial images, and image processing technology and machine learning method are used to achieve a cost effective and portable system.

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Literature Review

Pre-built Drowsiness Detection Systems-: Several drowsiness detection systems are available on the market, offering different approaches to monitor driver alertness.

1. **SmartEye:** A commercial system used in vehicles to monitor driver behavior. It uses advanced facial recognition technology to track eye movement and head position. However, it requires high-end hardware and is costly to implement[4].
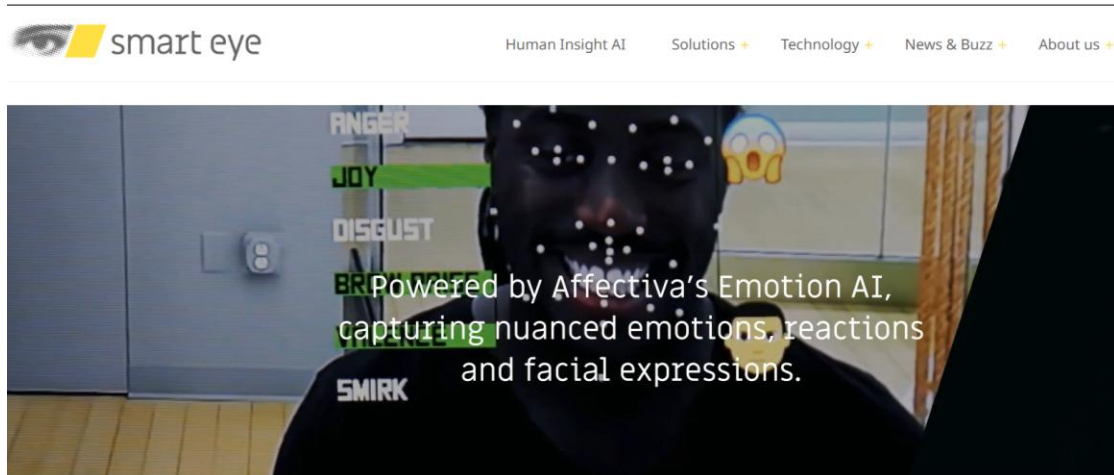

Figure 1: SmartEye system monitoring driver behavior.

2. **Seeing Machines:** This system is integrated into several commercial vehicles and offers real-time monitoring of driver alertness. It uses a combination of facial analysis and machine learning algorithms. While effective, the system is designed for commercial vehicles and might not be suitable for personal use due to its complexity and cost[5].
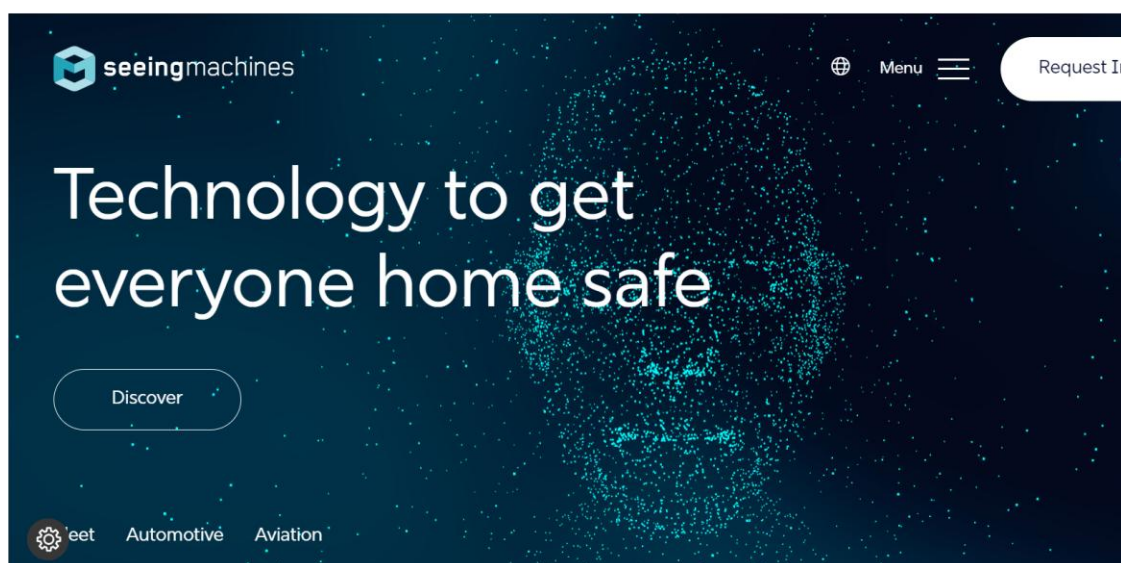
Figure 2: Seeing Machines driver monitoring system.

3. **Guardian by Guardian Systems:** This aftermarket solution uses AI to monitor driver drowsiness and distraction. It's popular in the trucking industry but can produce false positives under certain conditions, such as low light[6].

Figure 3: Guardian system installed in a commercial truck.

Problem Statement

Almost all drivers have experienced this drowsiness problem while driving [1]. Youngsters and professional drivers are mostly affected by this drowsy driving because of continuous hours of driving without any rest. In many cities, auto drivers and cab drivers drive continuously overtime sometimes to complete their targets or at times to get bonus profit. Many of the poor workers to meet their daily expenses and for the sake of their loved families tend to work in night shifts for long time, this can be one of the main reasons for accidents taking place because of drowsy driving.

Objective

The primary objective of this project is to develop Drowsiness Detection System that can accurately and efficiently detect driver drowsiness in real-time using visual information and Algorithms like Histogram of oriented gradients (HOG) and SVM. The specific objectives include:

- To design and implement a computer vision-based system that captures and analyses facial and eye movements to monitor driver alertness levels.

- To provide real-time alerts to drivers upon detecting signs of drowsiness, thereby reducing the risk of accidents caused by driver fatigue.
- To evaluate the system's performance across diverse conditions, including varying lighting, face orientations, and levels of driver fatigue, ensuring robustness and reliability.
- To enhance road safety by minimizing the occurrence of drowsiness-related accidents through proactive driver monitoring and timely alerts.

Methodology

1. A webcam has been used to record the video of the driver.
2. The webcam is arranged in such a way that it captures the front facial image of the driver [2].
3. Once the video capturing is done, the recorded frames are then pulled out to get the 2-Dimensional images [3].
4. The object (Face) in the frames is detected by HOG and SVM algorithm.
5. The drowsiness features Eye Aspect Ratio (EAR), Mouth Opening Ratio (MOR), Nose Length Ratio (NLR) are calculated.
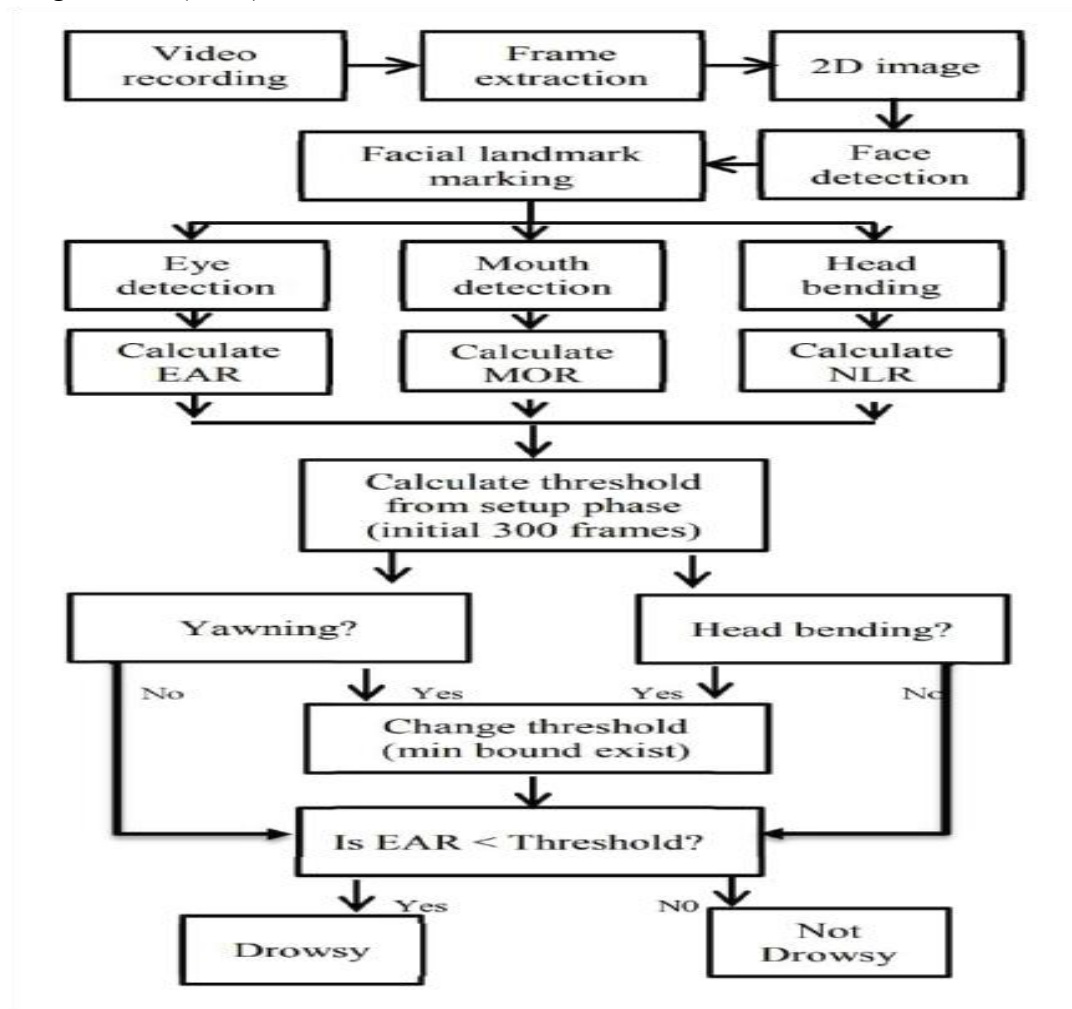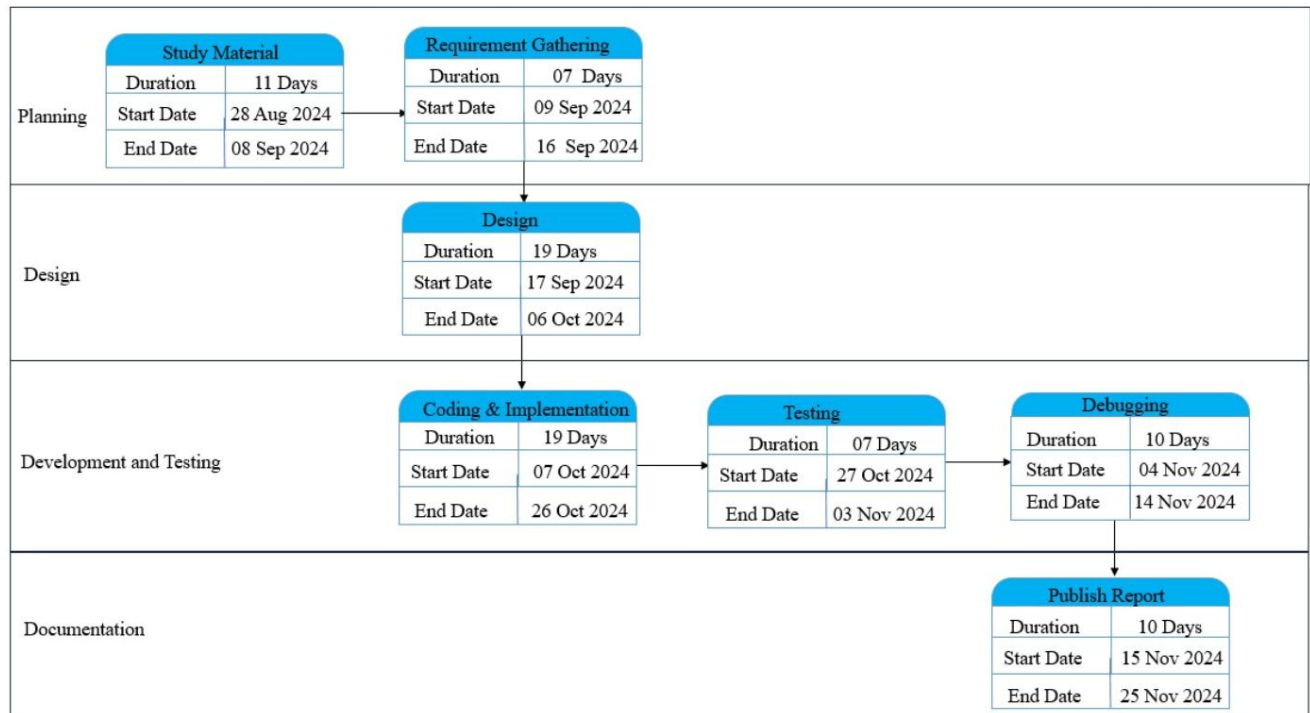

Fig.4 The block diagram of drowsiness detection system

PERT Chart

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