DRIVER DROWSINESS DETECTION SYSTEM

SYNOPSIS

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TABLE OF CONTENTS

Contents	Page Number
Abstract	3
Introduction	4
Programming Environment and Tools	8
Proposed Method/Algorithm	9
References	10

***Abstract**: The Driver Drowsiness Detection System (DDDS) project aims to improve road safety by addressing the dangers associated with drowsy driving. Utilizing advanced sensors and machine learning algorithms, the system monitors real-time physiological and behavioral indicators of the driver. Key components include a facial recognition camera, eye-tracking infrared sensors, and a heart rate monitor. The DDDS employs a multi-stage approach, analyzing facial expressions and eye movement for early signs of drowsiness. Upon detecting drowsiness, the system activates timely alerts, such as visual and auditory warnings, or haptic feedback to prompt the driver to take corrective action. The DDDS contributes to the development of intelligent transportation systems, prioritizing road user safety through proactive measures against drowsy driving.*

Introduction-

Operating a motor vehicle when sleepy is known as drowsy driving, and it can affect anyone who gets behind the wheel. Drowsy driving significantly increases the risk of accidents, leading to a troubling number of injuries and deaths every year.

Given the widespread sleeping problems among adults in India, greater awareness of drowsy driving can play an important role in public health. Knowing about the causes, consequences, and prevention of drowsy driving enables drivers to avoid unnecessary risks on the road.

Drowsy driving is a major contributor to motor vehicle collisions. According to the National Highway Traffic Safety Administration (NHTSA), in 2017 drowsy driving led to at least 91,000 crashes, resulting in roughly 50,000 injuries and 800 deaths. This data likely underestimates the impact of drowsy driving because it's often impossible to definitively determine whether drowsy driving caused an accident, especially after fatal crashes.

The development of technologies for preventing drowsiness at the wheel is a major challenge in the field of accident avoidance systems. Preventing drowsiness during driving requires a method for accurately detecting a decline in driver alertness and a method for alerting and refreshing the driver. Driver drowsiness detection system has been mainly implemented by researchers in four different ways, which utilizes four different input variants to classify driver's drowsiness level-

1. Image Based Measures- Here we detect the drowsiness of the driver using three methodologies namely, using face detection, eye detection and mouth detection. Here we place the camera in the car, and look for eye movement, mouth movement and head movement to determine whether the driver is in a state to drive and issue a warning message if he is not.

2. Biological Based Measures- Here biological measures relate to bio-signals given off by the driver and recorded by placing a special sensor on the driver's body. These biological signals also known as physiological measures, are proven to be more accurate and reliable for detecting drowsiness. EEG signals which reveal brain activity can be monitored to reveal brain activities.

3. Vehicle Based Measures- This method depends upon tracing and analyzing driving patterns. Every driver forms a unique driving pattern; thus, the driving patterns of a drowsy driver can be easily distinguished from those of an alert driver. We can use steering wheel angle (SWA) and lane departure data to assess the alertness of the driver.

4. Hybrid Based Measures- A Hybrid based system employs a combination of image-, biological-, and vehicle- based measures to extract drowsiness features, with the aim of producing a more robust, accurate, and reliable DDD system.

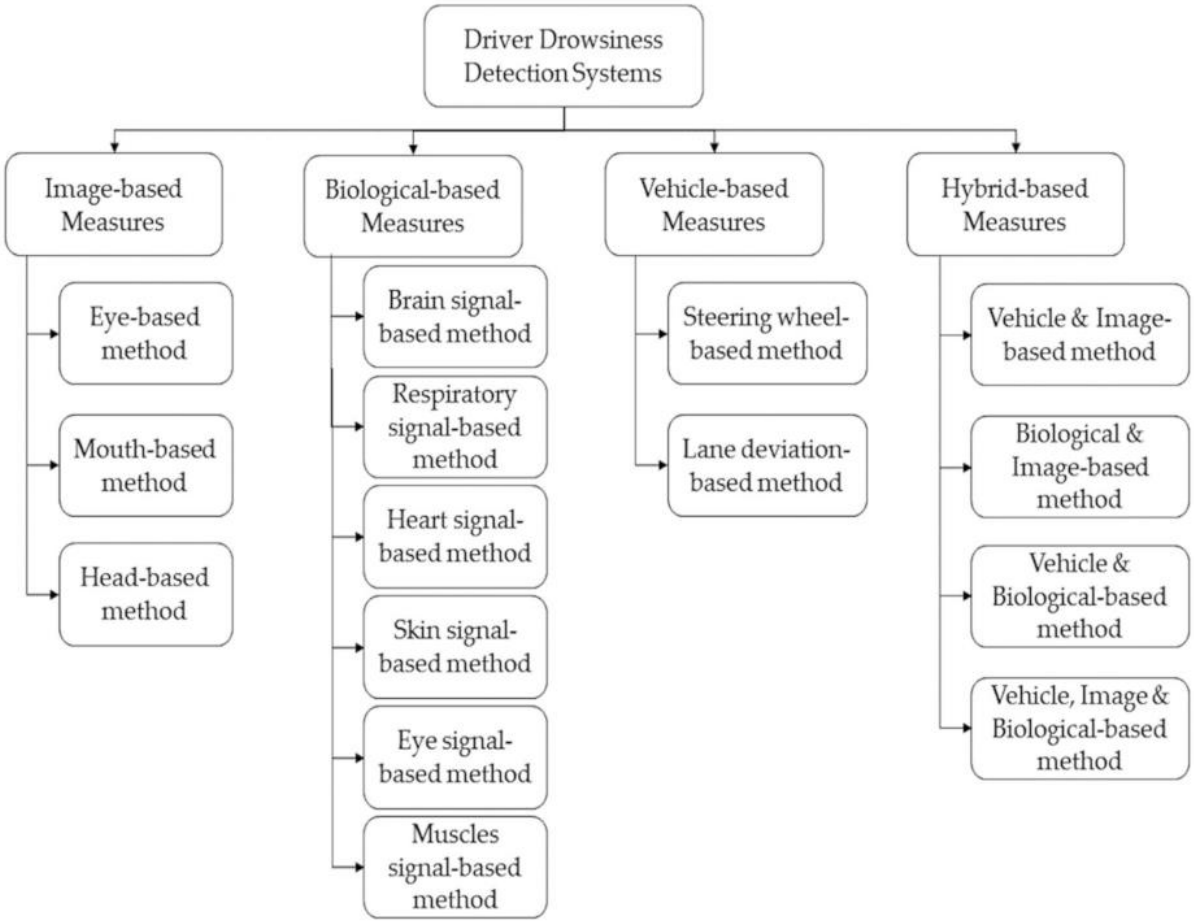

Figure : The flow chart shows the drowsiness detection methods.

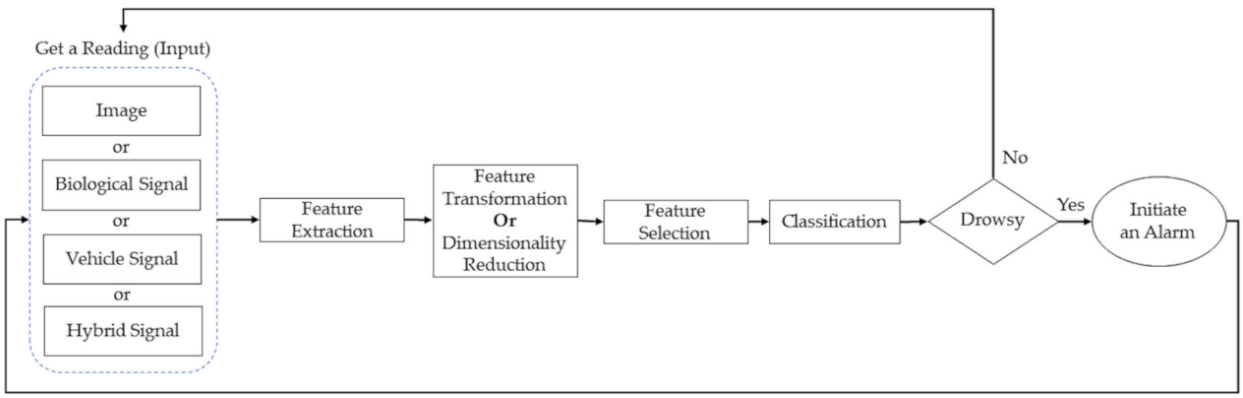

Figure : Driver Drowsiness Detection data flow.

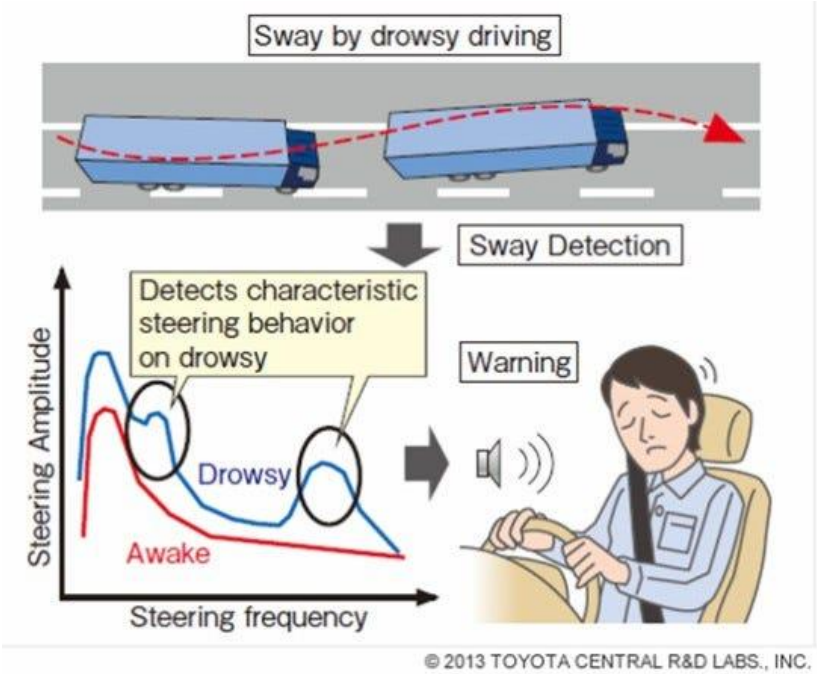

Figure: Steering-movement based drowsiness detection method

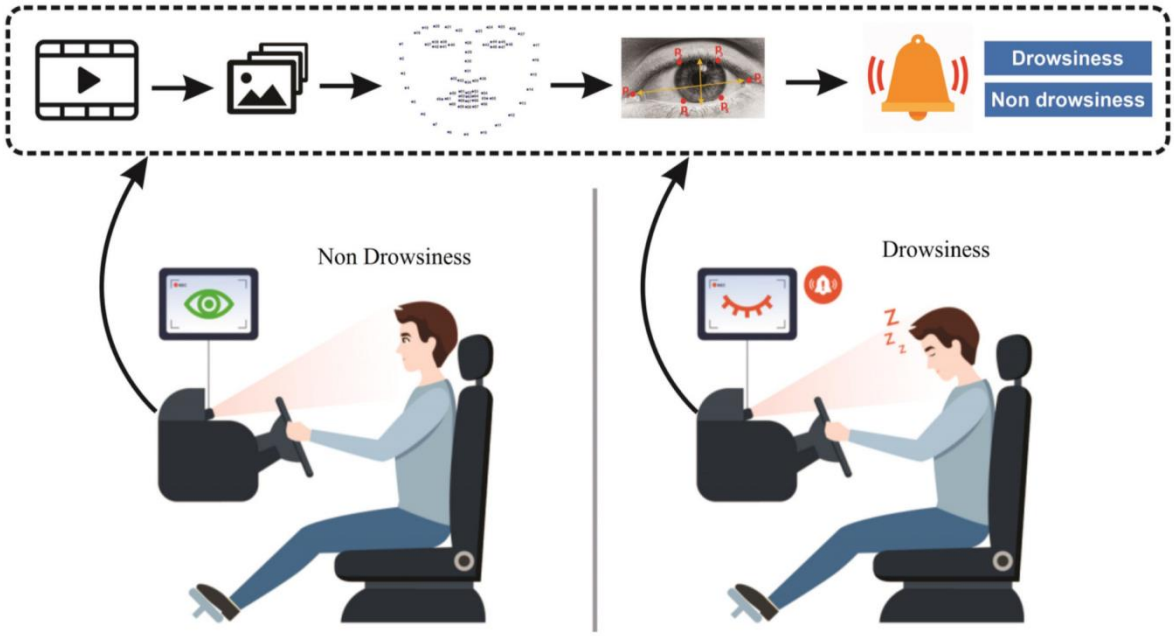

Figure: Overview of Image based Drowsiness Detection Method

Proposed Method/ Algorithm:

Our aim here is to implement Driver Drowsiness Detection System with the help of Computer Vision and Deep Learning Techniques. We will be using image detection techniques to determine eye movement, yawning, and nodding. In this project we capture footage of the driver using a webcam/phone upon which appropriate image-processing techniques are applied to detect their eye status as well as head movement to determine the condition of the driver. By constantly monitoring the eyes and head of the driver we will be able to detect driver fatigue in real time and able to alert the driver when needed. We will be utilizing computer vision models like YOLO and Open CV library to implement the it. The requirement for making an effective Drowsiness detection system is that it be Reliable, it should give Real Time response, Unobtrusive, Economical and Flexible. We are intending to implement this system on Smartphone.

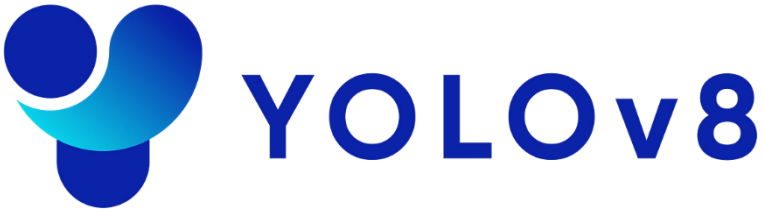

Figure: YOLO v8 LOGO

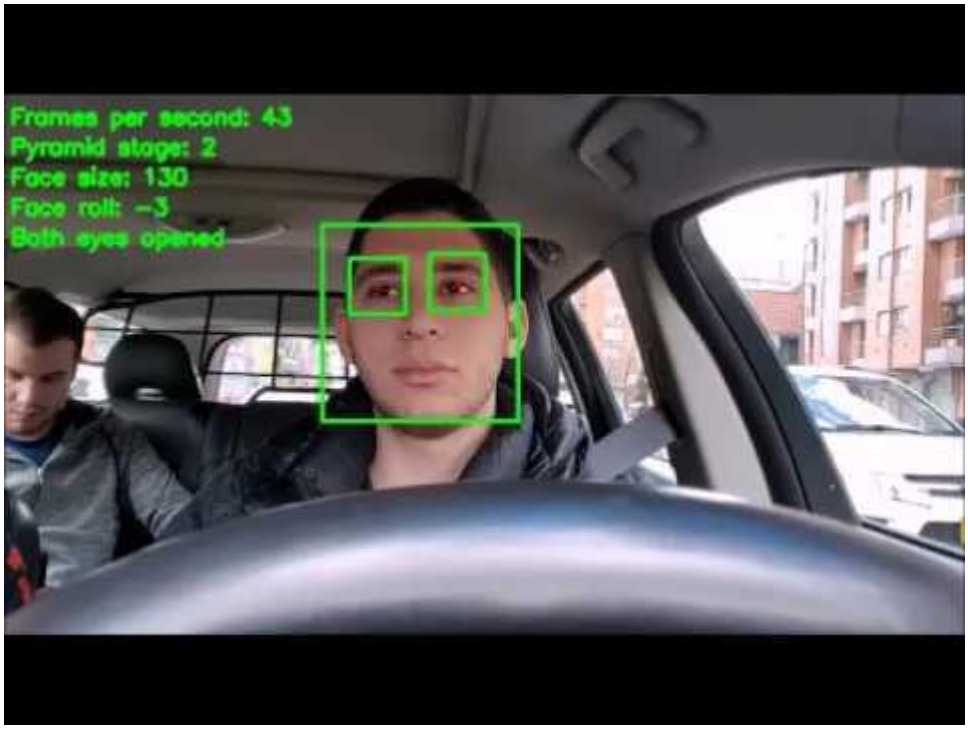

Figure: Driver Drowsiness Detection Implementation

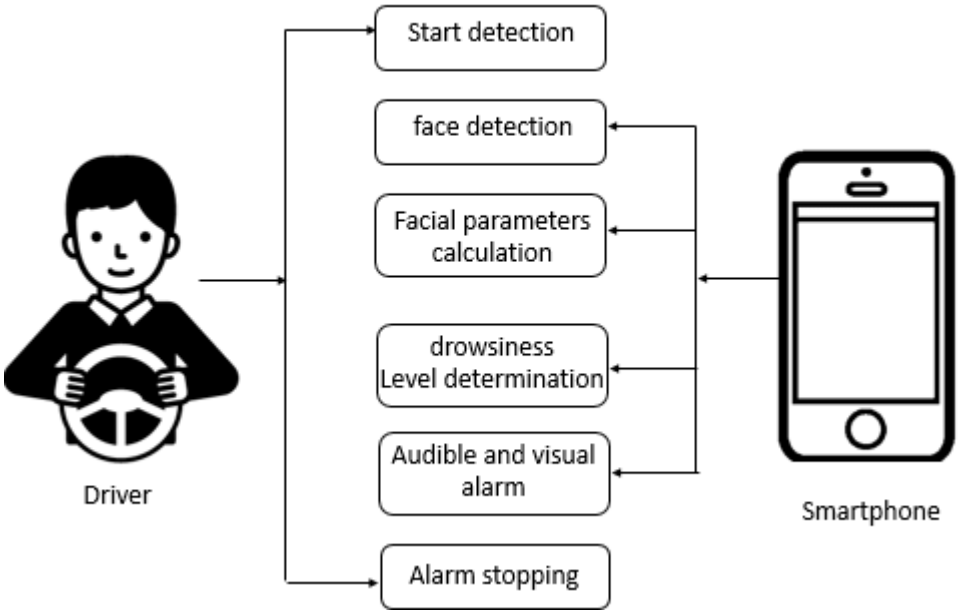

Figure: General Scheme of the Drowsiness Detection System

Programming Environment and Tools Used:

- Python 3 - Python brings an exceptional amount of power and versatility to machine learning environments. The language's simple syntax simplifies data validation and streamlines the scraping, processing, refining, cleaning, arranging and analyzing processes, thereby making collaboration with other programmers less of an obstacle.
- OpenCV - OpenCV is a great tool to play with images and videos. Either you want to give your photos a 90s black and white look or perform complex mathematical operations OpenCV is always ready to serve. If you are into computer vision, having knowledge of OpenCV is a must.
- PyTorch - PyTorch is a machine learning framework based on the Torch library, used for applications such as computer vision and natural language processing.
- YOLO -YOLO (You Only Look Once) it’s the state of the art Object Detection Model that is known for its speed and accuracy and is used for classifying images and makes object detection more easier.

References-

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- R. K. M, R. V and R. G. Franklin, "Alert System for Driver's Drowsiness Using Image Processing," 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), Vellore, India, 2019, pp. 1-5, doi: 10.1109/ViTECoN.2019.8899627.