# **Driver Drowsiness Detection System Based on Computer Vision**

By Swastik Srivastava(E22CSEU0216) & Sarthak Anand(E22CSEU0157)

# Objectives

The primary goal of this project is to develop an intelligent, non-intrusive, real-time system that identifies early warning signs of driver drowsiness through computer vision methods. Driver drowsiness is a major cause of road accidents, particularly among truck drivers, taxi operators, and nighttime commuters. This system will:

* To create a real-time computer vision system that tracks drivers and identifies drowsiness or fatigue.
* To improve road safety by warning the driver or activating autonomous safety systems upon detection of drowsiness.
* To minimize accidents due to fatigue, especially in long-distance transport and logistics sectors.

# 2. Methodology

The proposed system uses a webcam or IR camera mounted on the vehicle dashboard to continuously monitor the driver's face in real-time. The following components form the core of the system:

**Face and Eye Detection:**

A live video stream is processed with Haar cascades or deep learning architectures (MTCNN or Dlib) for facial landmark detection, particularly around the mouth and eyes.

**Eye Aspect Ratio (EAR):**

The Eye Aspect Ratio is computed by the system to estimate eye opening. A low EAR for an extended period of time signifies eye closure or changes in blinking rate—a drowsiness indicator.

**Yawning Detection:**

Lip landmarks are used to monitor mouth openness. Repeated yawning is a good drowsiness indicator.

**Head Pose Estimation:**

By sensing pitch, yaw, and roll through 3D head pose estimation, the system looks for slouching or nodding—usual while a person is dozing off.

**Alert Mechanism:**

In case drowsiness cues are sensed, an alarm is triggered (vibration, audio, or even automated intervention in advanced vehicles).

**Model Training:**

Deep learning attention models (e.g., CNN + LSTM) are trained on datasets such as NTHU Drowsy Driver Detection Dataset to improve accuracy and for variation such as glasses, lighting, and head movement.

# 3. References

Soukupová, T., & Čech, J. (2016). "Real-Time Eye Blink Detection Using Facial Landmarks." University of Prague.

NTHU Drowsy Driver Dataset: http://cv.cs.nthu.edu.tw/php/cvproj.php?language=english&id=85

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Jo, K., et al. (2020). "Driver Monitoring Systems for Enhanced Road Safety: A Survey." IEEE Transactions on Intelligent Vehicles.