**Project Report: Driver Drowsiness Detection System**

**1. Introduction**

Driver drowsiness detection is a crucial system designed to reduce accidents caused by sleepiness while driving. Fatigue-related accidents account for a significant percentage of road fatalities, making it imperative to develop an effective alert system. This project implements a driver drowsiness detection system that monitors eye movements to determine drowsiness and provides an audible alert to prevent accidents.

**2. Objective**

The primary objective of this project is to develop a system that:

* Detects the position of the driver’s eyes.
* Calculates the Eye Aspect Ratio (EAR) using Euclidean distance from the **shape\_predictor\_68\_face\_landmarks.dat** dataset.
* Determines drowsiness based on the eye closure ratio.
* Provides an audible alert using **pyttsx3** when drowsiness is detected.

**3. Methodology**

The drowsiness detection system is implemented using **Python** and leverages key libraries such as **dlib, face-recognition, and OpenCV**. The following steps are followed in this system:

1. **Face Detection**: The system captures live video feed using a webcam and detects the driver’s face using OpenCV and dlib’s pre-trained face detector.
2. **Eye Landmark Detection**: Using **shape\_predictor\_68\_face\_landmarks.dat**, the system identifies the eye landmarks (6 points for each eye).
3. **Eye Aspect Ratio (EAR) Calculation**: The Euclidean distance between specific eye landmarks is computed to determine the eye aspect ratio.
4. **Drowsiness Detection**: If the EAR falls below **0.25**, the system interprets the driver as drowsy.
5. **Alert Mechanism**: When drowsiness is detected, an alert sound is triggered using **pyttsx3** to wake the driver.

**4. Technologies and Libraries Used**

The project uses the following tools and libraries:

* **dlib**: For face and eye landmark detection.
* **face-recognition**: Assists in facial feature extraction.
* **OpenCV**: Used for image processing and video frame capture.
* **pyttsx3**: A text-to-speech library for generating an audible warning.

**5. Results**

The implemented system successfully detects drowsiness by continuously monitoring the driver’s eye movements. When drowsiness is detected based on the threshold EAR value of **0.25**, an audible alert is generated, reducing the risk of accidents.

**6. Conclusion**

This project demonstrates a real-time driver drowsiness detection system using image processing and machine learning techniques. By integrating an alert mechanism, the system effectively prevents accidents caused by drowsy driving. Future improvements may include head position analysis and machine learning-based classification for enhanced accuracy.

**7. Future Enhancements**

* Implementing a deep learning-based approach for higher accuracy.
* Integrating additional facial cues like yawning detection.
* Expanding the system to work in low-light environments.
* Deploying the model on embedded devices like Raspberry Pi for on-road implementation.

**8. References**

* OpenCV Documentation ([https://opencv.org](https://opencv.org/))
* dlib Library ([http://dlib.net](http://dlib.net/))