Introduction:

This project aims to enhance road safety by monitoring the driver's facial expressions to detect signs of drowsiness, fatigue, and distraction using computer vision techniques. The system utilizes facial landmarks to analyze eye and lip movements, alerting the driver in real-time.

Features:

1. **Drowsiness Detection:**
    - Uses the **Eye Aspect Ratio (EAR)** calculated from facial landmarks to determine drowsiness.
    - If the ratio falls below a specified threshold for several consecutive frames, a drowsiness alert is triggered.
2. **Yawning Detection:**
    - Monitors lip distance to identify yawning, indicating fatigue.
    - If the distance exceeds a set threshold over multiple frames, a fatigue alert is issued.
3. **Distraction Detection:**
    - Assesses whether the driver is looking at the road.
    - If the driver looks away for a prolonged period, a distraction alert is activated.
4. **Real-time Alerts:**
    - Displays alerts on the video feed for drowsiness, fatigue, or distraction, promoting immediate corrective action.

Technology Stack:

- **OpenCV:** For video capture and facial detection.
- **Dlib:** For extracting facial landmarks.
- **SciPy:** For mathematical calculations related to distance measurements.
- **Pandas:** For logging alert events and durations.

How It Works:

1. **Video Input:** Captures video from a source (webcam or video file).
2. **Facial Landmark Detection:** Uses Dlib to identify key points on the face.
3. **EAR Calculation:** Computes the eye aspect ratio to monitor drowsiness.
4. **Lip Distance Calculation:** Measures lip distance to detect yawning.
5. **Alert Mechanism:** Triggers alerts based on the analysis and logs the events.

Applications:

- **Driver Safety:** Reduces accidents due to driver fatigue or distraction.
- **Health Monitoring:** Useful in medical scenarios where patient alertness is critical.

Future Enhancements:

- **Mobile Application:** Adapt the system for mobile use.
- **Voice Alerts:** Include audio notifications for warnings.
- **Data Analysis:** Implement comprehensive logging for analysis of driver behavior over time.