Overview:

This project focuses on building a real-time **Driver Drowsiness Detection System** using computer vision and machine learning techniques. The system aims to monitor the driver's eye movements to detect signs of fatigue, such as drowsiness, and alert the driver when necessary to improve road safety. The core of the system is based on detecting eye closures and calculating the **Eye Aspect Ratio (EAR)** to assess whether the driver is becoming drowsy.

Key Components:

1. **Computer Vision with OpenCV and Dlib:**

OpenCV is used for real-time video capture and image processing. It helps in capturing frames from the webcam and converting them to grayscale, making it easier to detect faces and landmarks.
Dlib is used for face detection and predicting facial landmarks, specifically the eyes, using its pre-trained shape predictor model (shape_predictor_68_face_landmarks.dat). The facial landmarks help in identifying the eyes' coordinates on the face.

2. **Eye Aspect Ratio (EAR):**

The **Eye Aspect Ratio (EAR)** is a crucial feature for detecting drowsiness. EAR is calculated based on the distances between specific facial landmarks around the eyes. A significant decrease in the EAR value (when the eyes are closed for a certain amount of time) is indicative of drowsiness.
The formula for EAR is based on three distances between points aroundthe eye,as described by the **scipy.spatial.distance.euclidean** function in the code.

3. **Alert System:**

The system uses a **threshold value (thresh)** to decide when the EAR is low enough to signify that the driver's eyes are closed for an extended period. o If the EAR falls below this threshold for a certain number of frames (frame_check), it triggers an alert. The alert includes a visual message displayed on the screen ("Alert Wake up!") and an audible sound, played using the **pygame mixer**.

4. **Webcam Integration:**

The webcam captures live video of the driver. The system continuously checks for faces in the video feed and identifies facial landmarks. It then tracks the driver's eye movements and assesses whether the driver is drowsy.

5. **User Interaction:**

The program runs in a loop, showing the webcam feed with drawn contours around the eyes for visual feedback.
If drowsiness is detected, the system alerts the driver with text on the screen and a sound alert.
The system can be terminated by pressing the 'q' key.