Driver Drowsiness Detection using AI

Objective

To develop an AI-powered system that continuously monitors a driver's eyes through a webcam and detects drowsiness in real-time to prevent accidents caused by fatigue.

Tech Stack

Frontend: Streamlit

Backend: FastAPI

Model: CNN-based Eye State Classifier (Open Eye vs. Sleepy Eye)

Libraries: OpenCV, TensorFlow, NumPy, PIL, Requests

How It Works

1. Live Webcam Feed: Captures real-time video frames using the webcam.

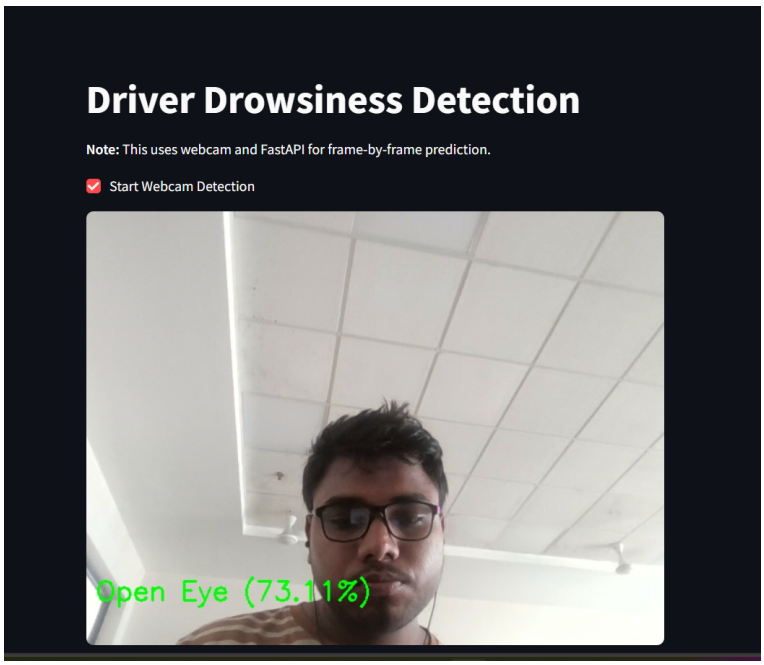
2. Frame-by-Frame Analysis: Each frame is sent to a FastAPI backend where the eye region is analyzed using a trained CNN model.

3. Eye State Classification: The model classifies each frame as Open Eye or Sleepy Eye.

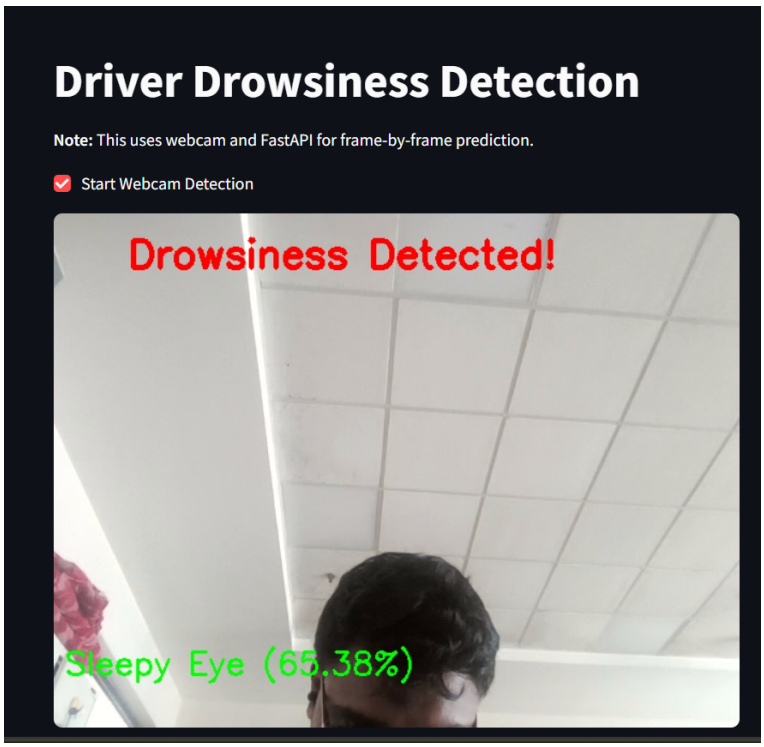
4. Drowsiness Detection Logic: If the eyes remain closed for a certain number of consecutive frames, a 'Drowsiness Detected!' warning is displayed.

Sample Output Screenshots

1. Open Eye (Normal State)



2. Sleepy Eye (Drowsiness Detected)



Model Highlights

Architecture: Convolutional Neural Network (CNN)

Classes: Open, Closed

Input: Eye-cropped grayscale images

Output: Probability scores for each class

System Architecture

```
User Webcam
    |
Streamlit UI
    |
Frame Sent to FastAPI Server
    |
Image Preprocessing (resize, grayscale)
    |
CNN Model Prediction
    |
Result Sent Back to UI
    |
Display Status (Open Eye / Drowsiness Detected)
```

Features

- Real-time detection

- High-speed frame processing

- Frame-by-frame prediction using FastAPI

- Alert overlay when drowsiness is detected

Use Cases

- Long-distance drivers

- Transportation companies

- Automotive AI integration

- Fleet management systems

Future Enhancements

- Sound/Beep Alert system

- Integration with vehicle control systems

- Mobile App deployment

- Blink pattern analysis