DRIVER DROWSINESS DETECTION SYSTEM

Beginner-Friendly Overview

How the system detects sleepiness using AI + Camera

Mamona Sadaf – Research And Devolpment

Minahel Ahsan – Simulation and Algorithms

Sarah Omer – Embedded and Hardware

SYSTEM GOAL

Monitors driver face in real time

Detects sleepiness indicators

Warns driver before danger

Works day & night

HOW SYSTEM SEES THE DRIVER

Infrared (IR) camera captures face

Facial points detected using AI

Works even in darkness

DETECTING EYE STATE

Eye region cropped & stabilized

AI model classifies OPEN vs CLOSED

Long closure → Sleepiness detected

DETECTING YAWNING

Measures mouth opening width

Large sustained opening = Yawn

Frequent yawns = fatigue

TEMPORAL FILTERING

Blinks are fast, yawns are slow

Checks how long eyes/mouth stay closed/open

Reduces false alarms

ALARM ACTIVATION

Triggers sound alert

Screen shows: Normal, Yawning, Drowsy

Helps prevent accidents

ALGORITHMS

- MediaPipe Face Mesh – landmark detection
- ROI Correction – stable eye region
- CNN – eye open/closed classification
- MAR – mouth opening measurement
- Temporal Logic – blink vs microsleep

The pipeline works by **detecting precise facial landmarks (MediaPipe) → stabilizing the eye region (ROI Correction) → classifying eye state (CNN) → measuring yawns (MAR) → using timing rules (Temporal Logic)** to decide real drowsiness vs normal behaviors.

MEDIAPIPE FACE MESH

468 facial landmarks

Robust in low light

Handles head movement

CNN EYE CLASSIFICATION

Learns eye patterns

More robust than geometric methods

Handles IR images and glasses

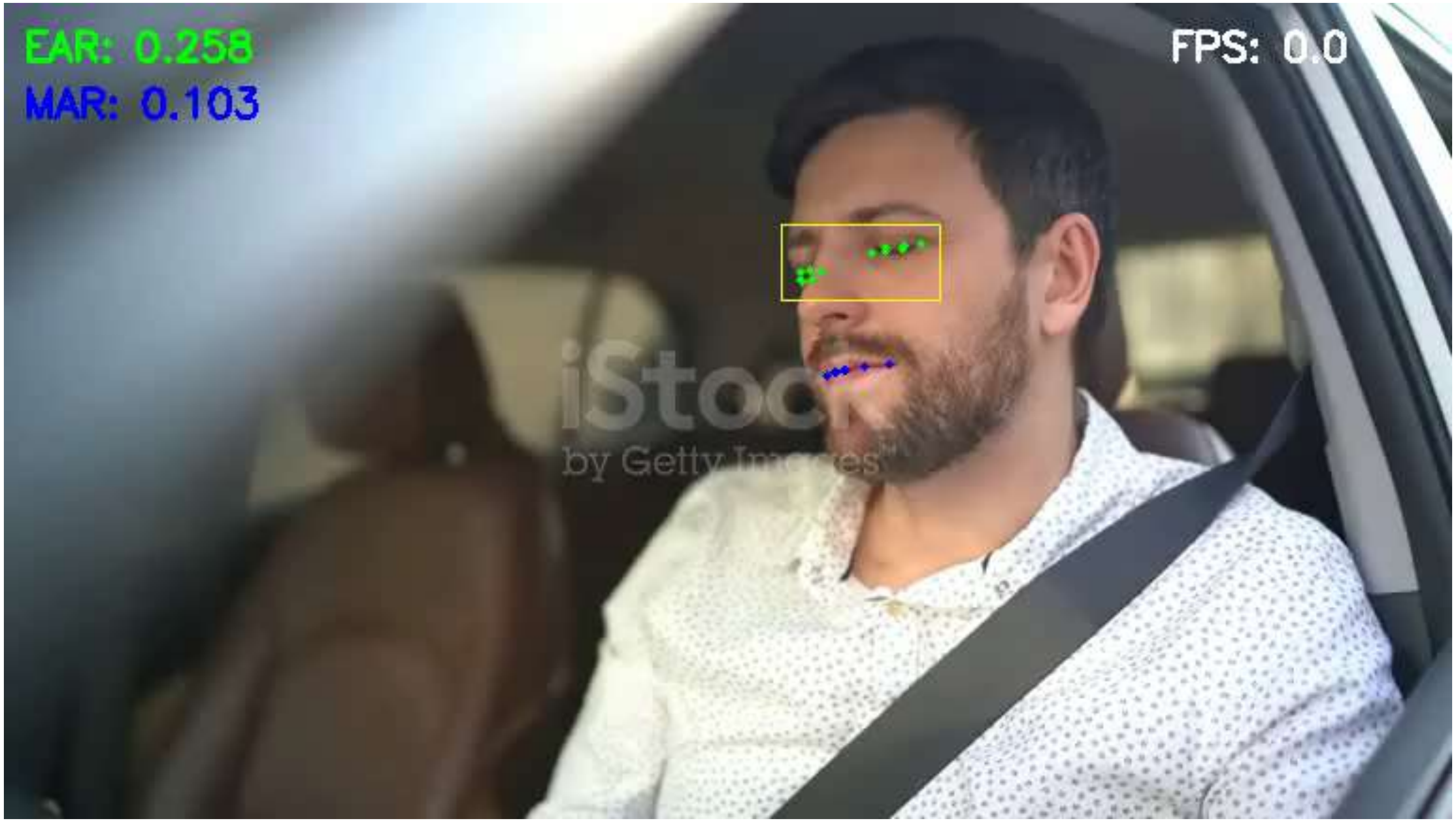
MOUTH ASPECT RATIO (MAR)

Geometric yawn detection

Lightweight & fast

No extra CNN required

PROTOTYPE



JETSON NANO INTEGRATION ISSUES

Limited 4GB RAM

Heavy GPU load from AI models

Thermal throttling

Lower FPS under load

IR noise affects landmarks

FINAL SUMMARY

Multi-stage AI pipeline

Accurate day/night drowsiness detection

Embedded optimized (Jetson Nano)

Reliable & real-time