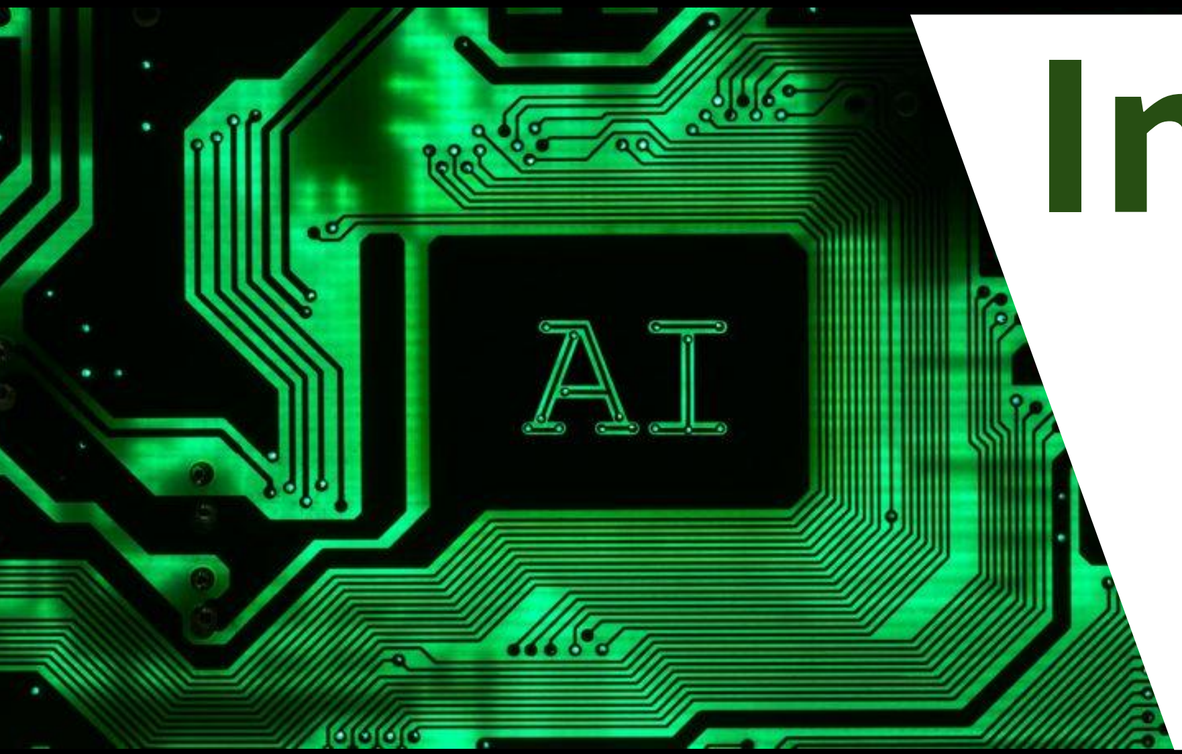
IFS DriverAlert



Intelligent Focus System

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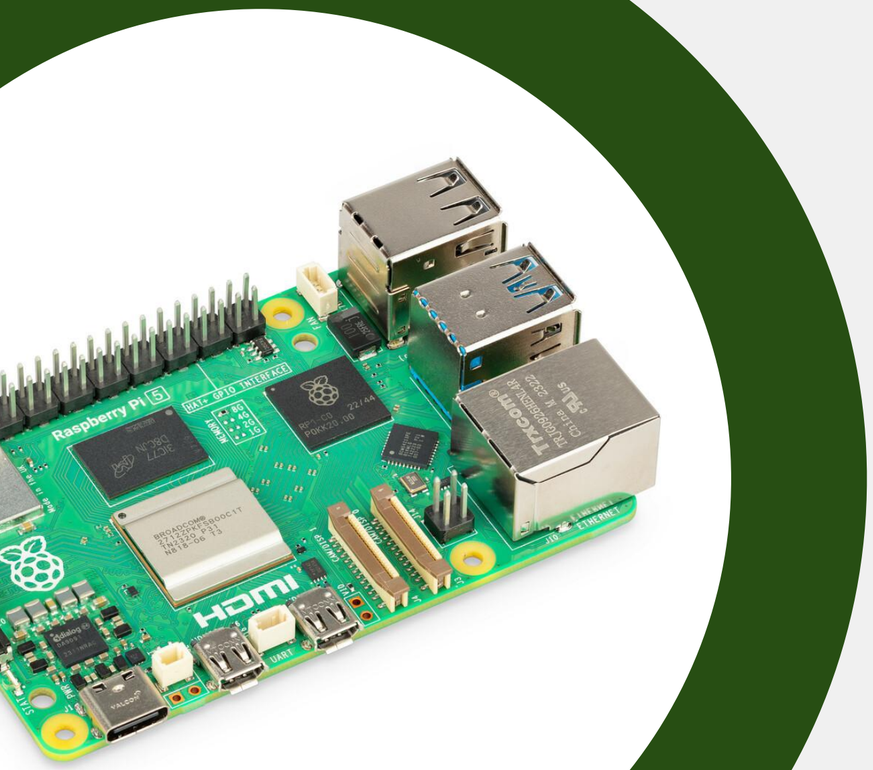
Quick Overview



We are developing a driver detection system that alerts when it detects drowsiness signs (eye closure, yawning) to prevent drowsiness-related accidents.

The goal behind our project is to enhance road safety by offering an affordable, offline solution that reduces accidents caused by drowsy driving.

Main components:

- Raspberry Pi 5
- Camera
- Speaker
- Switch

Project Enhancements and Methodology

Initial Requirement: Develop a model to detect eye closure and implement it on a system.

Our Enhancement: Added yawning detection as an extra measure to identify drowsiness more effectively.

Our two Methods:

- **Model Based (TfLite):** Our proposed method was using a trained deep learning model for eye closure detection.
- **MediaPipe Based:** A lightweight, real-time alternative for detecting drowsiness.

Goal: Compare both methods for effectiveness and efficiency in real-world scenarios.

TfLite & MediaPipe

This approach combines the power of a trained deep learning model with real-time facial landmark detection. It is designed for eye closure and yawning detection.

- Sequential CNN model trained on Google Colab.
- Model converted to tfLite on Google Colab.
- MediaPipe used to detect the face in a frame.
- Facial landmarks extracted to identify eye and mouth regions.
- TfLite model used to detect the eye status.
- Mouth aspect ratio is calculated using landmark points to detect yawning.
- Link to file

MediaPipe

This solution focuses solely on real-time facial landmark detection for lightweight and efficient performance. It does not rely on a separate machine learning model.

- MediaPipe used to detect the face in a frame.
- Facial landmarks extracted to identify eye and mouth regions.
- Eye aspect ratio is calculated using landmark points to determine eye closure status.
- Mouth aspect ratio is calculated using landmark points to detect yawning.
- Link to file

Live Demo for Both Methods

eye_detection_tflite.py

&

eye_detection_mediaPipe.py

TFlite vs MediaPipe

TFlite_vs_MediaPipe.pdf

Test Case	TFlite + MediaPipe	MediaPipe Only
Eye detection at close distance (less than ½ meter)	10/10	10/10
Eye detection at average distance (1 meter)	9/10	10/10
Eye detection at a far distance ([1.3, 2] meters)	3/10	10/10
Eye detection with glasses	No difference between with/without glasses	No difference between with/without glasses
Eye and yawn detected at same time	Displayed both alerts correctly	Displayed both alerts correctly
Eye detection in daylight.	10/10	10/10
Eye detection at night.	8/10	10/10
Resource Utilization		
CPU Usage	52.6%	41.3%
Memory Usage	7.3%	7.1%

Future Work

- Competing test code/documents.
- Complete Software/Hardware diagrams.
- Implement the system to work with the switch.
- Run the system in the car.
- Complete user manual.
- Complete System webpage.
- GitHub documentation.

Thank you