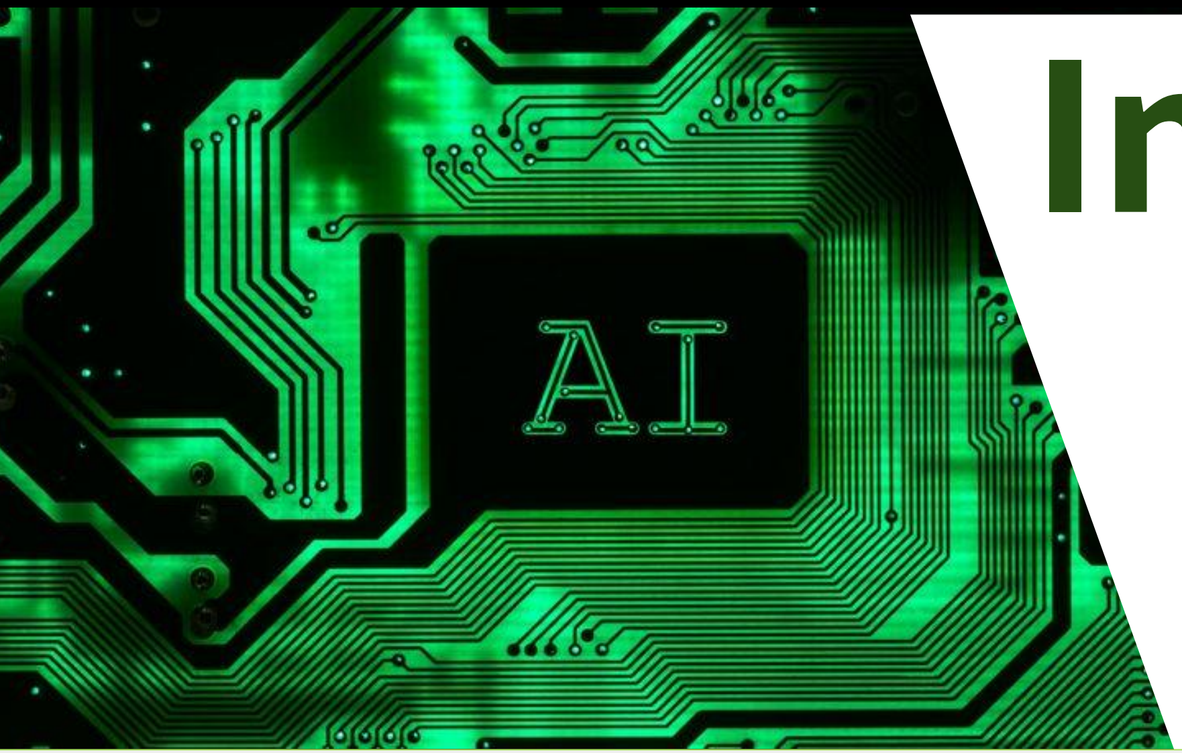
IFS DriverAlert



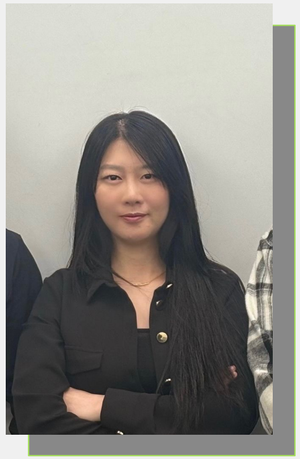
Intelligent Focus System

University of Regina

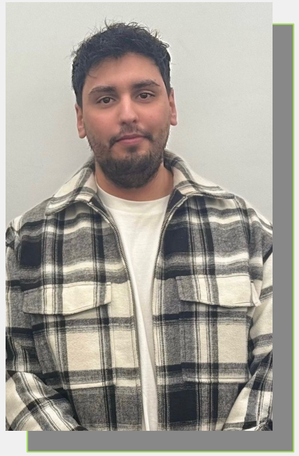
FACULTY OF ENGINEERING & APPLIED SCIENCE

Our Group

Feras Aljoudi



Seonyu Park



Ihab Mohamad

Introduction

What are We Building

- IFS-DriverAlert is a real-time system that monitors a driver's face to detect signs of drowsiness.
- When signs are detected, the system plays progressive audio alerts to warn the driver before accidents happen.
- It runs fully offline on a Raspberry Pi 5 using MediaPipe and OpenCV.

Target Customers

- **Primary Focus:** Trucking companies, where drivers spend long hours on the road, often at night.
  - We spoke with companies like Jay’s, Co-op, and Brandt, who showed interest in the system.
- **Secondary Focus:** Everyday drivers, especially those with older vehicles that do not have built-in drowsiness detection systems.

Commercial Video

IFS DriverAlert

Stay Awake
Stay Alive

Commercial Video

Why Is This System Needed?

[Accidents in North America]

CAA QUEBEC

Every year in Quebec, nearly a quarter of all road accidents resulting in injury1 involve driver fatigue.

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

drowsy driving is a factor each year in as many as 7,500 fatal motor vehicle crashes (approximately 25%) in the United States

Global NEWS

CAA says drowsy driving as dangerous as drunk driving following AAA study

Yoassry Elzohairy
Ontario Ministry of Transportation
17 PUBLICATIONS 268 CITATIONS

26.4% of all fatal and injury crashes in Ontario are fatigue-related

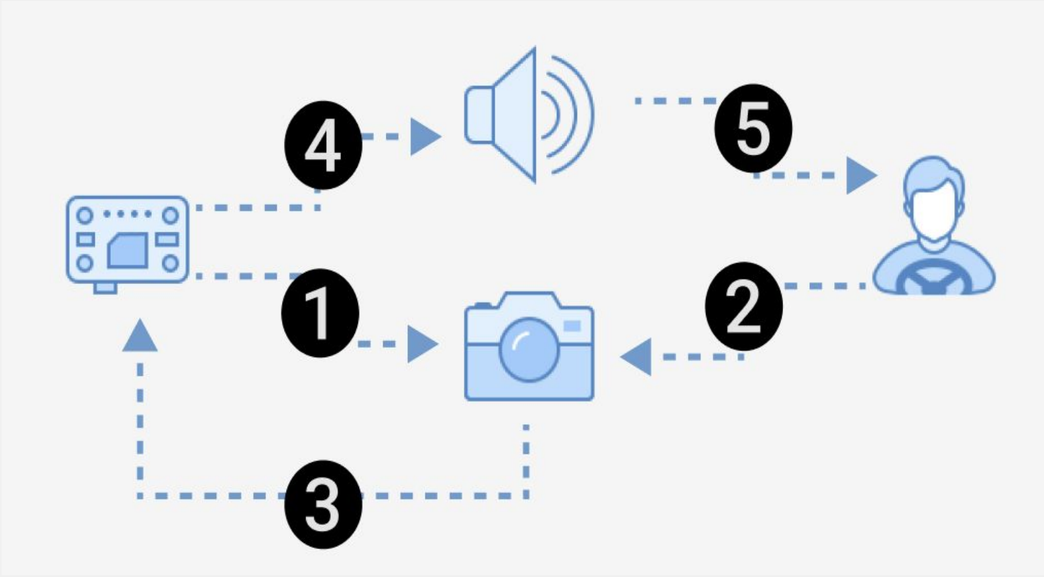
[Why IFS-DriverAlert Matters?]

- Drowsiness detection exists today, but only in high-end luxury vehicles like Tesla.
- Most drivers (especially truckers and owners of older cars) do not have access to this safety feature.
- The material costs of the system is around $275 CAD, making it affordable to every driver, without needing to buy an expensive car.

System Overview

How It Works

- The camera monitor the driver's face.
- MediaPipe detects eyes, mouth, and head position by tracking facial landmarks.
- OpenCV processes the video frames.
- If drowsiness is detected, the speaker plays a progressive audio alert.



Key Features

- Real-Time detection and alert.
- Offline operation.
- Privacy first; no video or images are saved/transferred.
- The system has Auto and Manual modes.

Auto Mode

What is Auto Mode?

- The system uses a GPS module to monitor the vehicle’s speed.
- Detection activates automatically when the vehicle reaches 20 km/h or higher.
- The detection stays off when speed is below 20 km/h.

Why Is It Needed?

- **Saves Power:** The system only runs when needed.
- **Prevents False Alerts:** No detection when the vehicle is stopped or moving slowly.
- **User Convenience:** No need for the driver to manually start or stop the system every time.

GPS Limitations and Manual Mode

[GPS Limitations]

- GPS signal can be weak or lost in some places (ex. tunnels).
- When the GPS signal is lost, Auto Mode can not be activated.
- If GPS signal is lost, an audio reminder will play every 10 minutes.
  - “Auto detection is off, consider turning it on manually.”

[Manual Mode]

- Manual Mode allows the driver to turn the system on manually using a physical switch.
- In Manual Mode, detection runs continuously without GPS signal.
- This ensures the system can work at all times, even if GPS is unavailable.

Alert System

When signs of drowsiness are detected, the system plays a progressive audio alert through the speaker.

[Progressive Alerts]

- Different voice messages are played based on how many times drowsiness is detected.
- Volume increases with each repeated detection.
- After 3rd detections, a loud beep sound is played before the voice message.
- The system resets detection counters every 5 minutes.

[Detection Timing]

- **Closed Eyes:** Triggered after 1 second of eyes being closed.
- **Yawning:** Triggered after 2 seconds of mouth being open.
- **Looking Away:** Triggered after 3 seconds of face not facing forward.

Demo

Project Challenges and Improvements

[Project Challenges]

- **Camera Positioning:** If the camera is not parallel to the driver’s view, false positives may happen.
  - Clear instructions were added to the user manual for proper camera setup.
- **Startup Delay:** Detection takes 4–6 seconds to start after activation because of Raspberry Pi processing time.
  - Once started, detection runs in real-time with no noticeable delays.

[Future Improvements]

- **Steering Wheel Vibration Motor:** Adding a small vibration motor to the steering wheel to give physical alerts.
  - Useful for loud environments or deaf drivers.
- **Pause Car Music During Alerts:** Automatically lower or pause car music when the alert is triggered to make the warning more effective.

References

Elzohairy, Yoassry. (2007). Fatal and Injury Fatigue-Related Crashes on Ontario's Roads: A 5-Year Review Why do We Need An Operational Definition of Fatigue-Related Crashes.

Recognizing and preventing driver fatigue. (n.d.). CAA-Quebec. https://www.caaquebec.com/en/advices/mobility-on-the-roads/recognizing-preventing-and-responding-to-driver-fatigue

Steeves, S. (2016, December 9). CAA says drowsy driving as dangerous as drunk driving following AAA study. *Global News*. https://globalnews.ca/news/3117892/caa-says-drowsy-driving-as-dangerous-as-drunk-driving-following-aaa-study/

Drowsy Driving and Risk Behaviors — 10 States and Puerto Rico, 2011–2012. (2014, July 4). https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6326a1.htm?s_cid=mm6326a1_w

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