College of Computers and Information Technology

كليـــة الحـــاسبـــات وتـقنيـــة المعلومـــات

جامعة الطائف
المنظومة الجامعية

Drivers Drowsiness Detection

Capstone Project 2

Prepared by:

Abdulkarim Alahmari, Ahmed Alrashidi, Saad Alharithi,

Ammar Alsufyani, Abdullah Althrmani, Turki Altuwairqi, Hamza Alzahrani, Ahmed Alharithi

Supervised by:

Dr. Hattan Althebeiti

- Road accidents caused by driver fatigue are one of the leading causes of injuries and fatalities worldwide. With advancements in artificial intelligence, we now have the tools to address this problem effectively.

- This project proposes a Driver Drowsiness Detection System that leverages deep learning models to monitor drivers in real-time. By analyzing key indicators like eye movements, yawning, and head tilt, the system aims to identify signs of fatigue and issue alerts to prevent accidents.

Develop an efficient and accurate driver monitoring system.

Enhance the detection of driver distraction and fatigue.

Utilize artificial intelligence to analyze driving behavior and use eye tracking as cue to detect driver distraction.

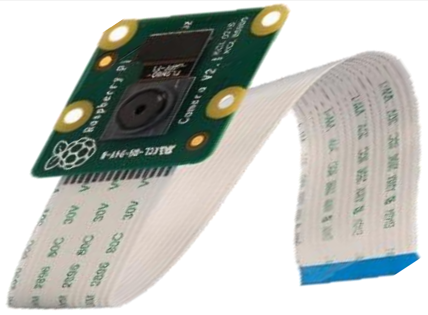
By the end of this project, we expect to obtain the following benefits:

- **Enhanced Driver Safety**
  - By continuously monitors driver behavior to detect signs of distraction and fatigue, improving overall safety.
- **Reduced traffic accidents**
  - By proactively identifies and mitigates risks like distracted driving and drowsiness, lowering the likelihood of accidents.
- **Road Safety Awareness**
  - Promotes responsible driving by emphasizing the importance of staying alert and focused behind the wheel.

System Components

The Driver Drowsiness Detection System consists of two main categories of components: hardware and software.

Hardware Components:

Raspberry Pi 4	The central processing unit of the system, capable of running machine learning models in real-time	
Raspberry Pi Camera	Used to capture live video of the driver’s face for analysis.	
Buzzer	Provides immediate auditory alerts when drowsiness is detected.	

Software Components:

The programming language used to develop and integrate the system.	python™
Deep learning frameworks used to build and train the driver monitoring model.	TensorFlow
The operating system that runs on the Raspberry Pi, ensuring efficient deployment of the trained model.	Raspberry Pi OS
For image processing tasks, including resizing and real-time video analysis.	OpenCV
A library for real-time tracking of facial landmarks, such as eyes and mouth.	MediaPipe

INTRODUCTION

OBJECTIVES

- Contributions of the Project

System Component

- HW Component
- SW Component

System Setup

- Hardware Setup
- Software Setup

System Model

Model Development

Real-Time Deployment

Testing Scenarios

Applications

Challenges and Future Work

CONCLUSION

To set up the Driver Drowsiness Detection System, both hardware and software components are carefully configured.

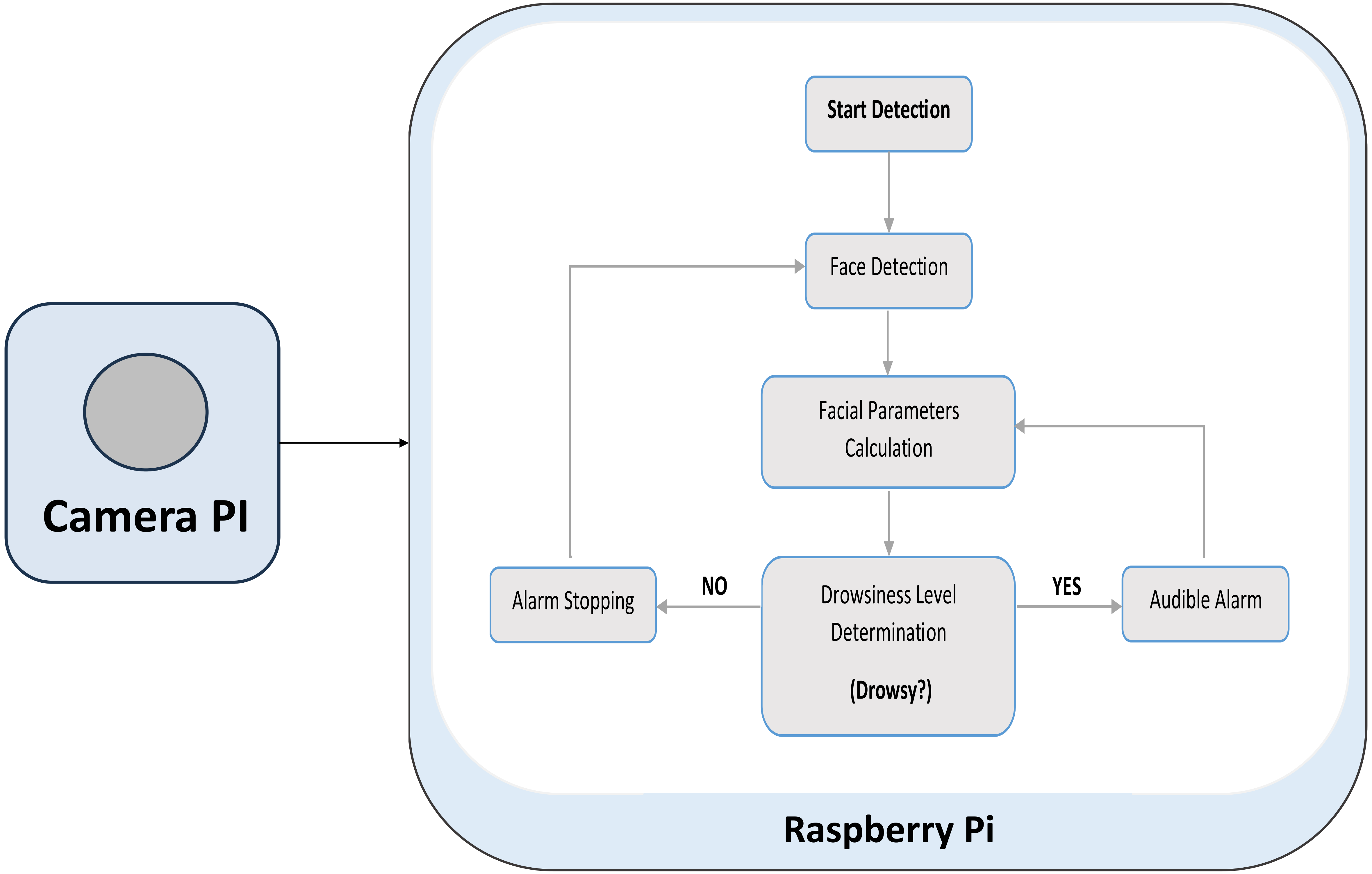
Hardware Setup:

The Raspberry Pi Camera is connected to the Raspberry Pi board through the Camera Serial Interface (CSI). This allows the camera to capture video frames of the driver’s face in real-time. The buzzer is also connected to the Raspberry Pi through the GPIO pins to sound alerts when drowsiness is detected.

Software Setup:

The Raspberry Pi OS is installed and configured to support Python programming and required libraries. TensorFlow and MediaPipe are installed to enable deep learning and facial landmark detection, respectively. The system is designed to operate efficiently on the Raspberry Pi, balancing accuracy and processing speed.

System Model:



The drowsiness detection model is built using a Convolutional Neural Network (CNN), a type of deep learning architecture suitable for image recognition tasks.

Steps in Model Development:

1. **Data Preprocessing:** Images of eyes (open and closed) were resized and labeled to standardize the input for the model.
2. **Model Architecture:** The CNN consists of convolutional layers for feature extraction, pooling layers to reduce dimensionality, and dense layers for classification.
3. **Training:** The model was trained on a labeled dataset to classify eye states (open or closed) with high accuracy.
4. **Performance:** The model achieved an accuracy of 99% on the test dataset, demonstrating its reliability in identifying drowsiness-related eye states.

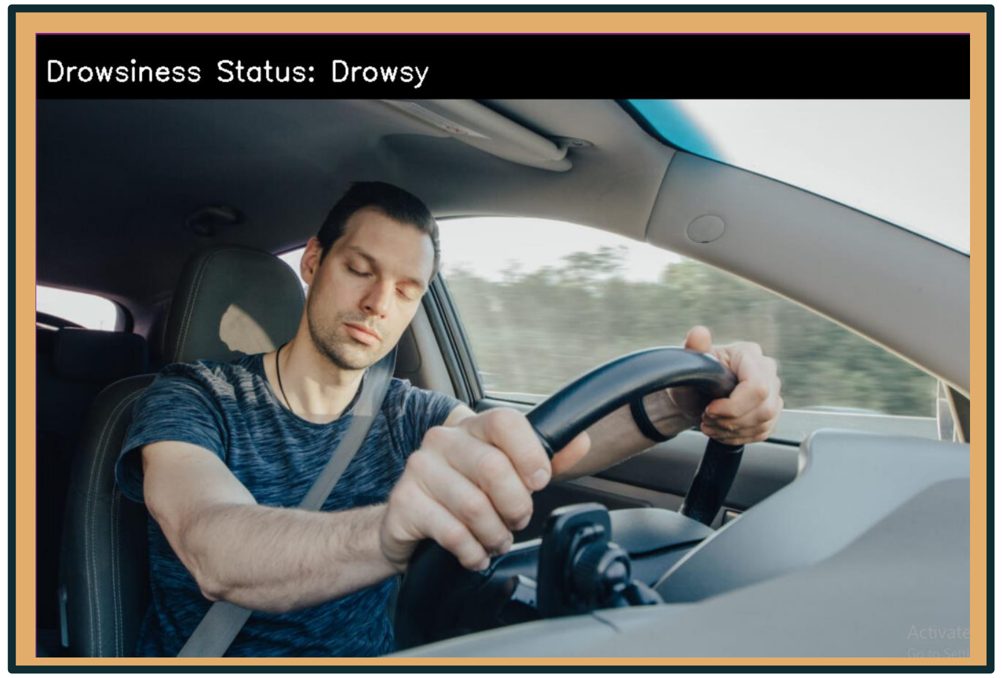
Real-Time Deployment

The trained model was optimized for deployment on the Raspberry Pi by converting it into a TensorFlow Lite format. This significantly reduced the model size, making it suitable for the limited processing power of the Raspberry Pi.

In real-time operation, the Raspberry Pi processes video frames captured by the camera. The model analyzes these frames to determine the state of the driver’s eyes. If the eyes are closed for a prolonged period, the system activates the buzzer to alert the driver immediately.

Testing Scenarios

The system was tested in various scenarios to evaluate its performance under real-world conditions.



Non-Drowsy State:

When the driver's eyes are open, their head is straight, and no yawning is detected, the system classifies the state as "Not Drowsy."

Drowsy State:

If the driver's eyes remain closed for an extended period, yawning is detected, or the head tilts significantly, the system classifies the state as "Drowsy" and triggers an alert. These scenarios demonstrated the system's ability to accurately distinguish between normal and drowsy states.

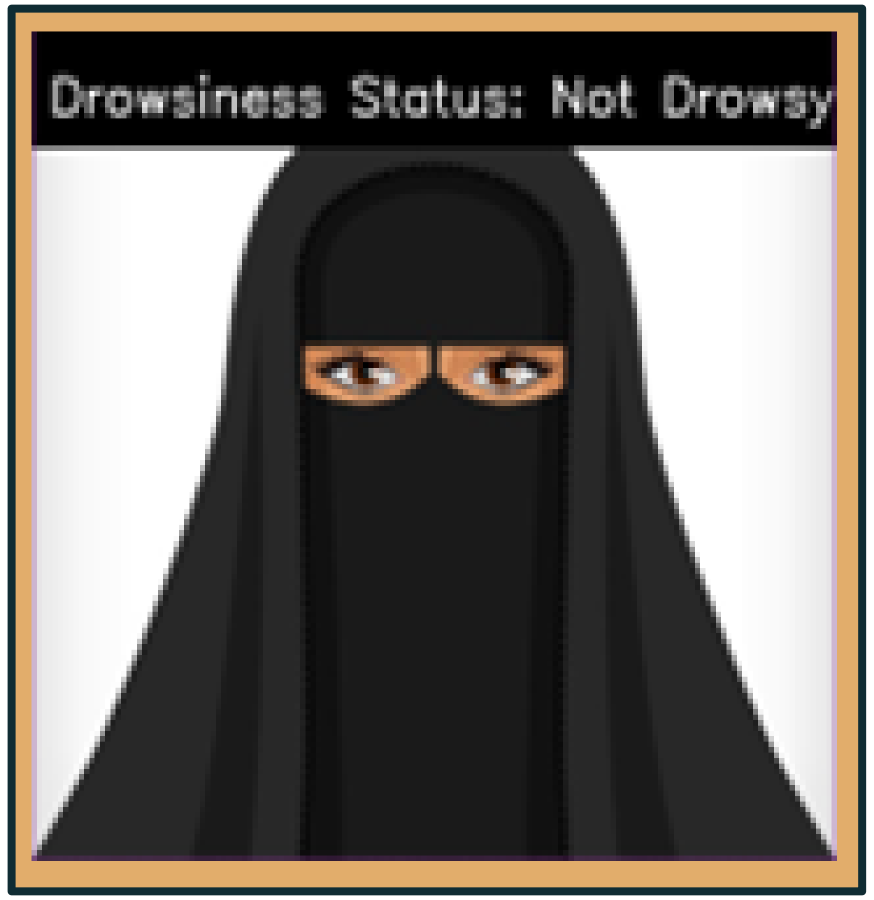
Applications

This system is designed to enhance the safety of **all drivers**, regardless of their gender, attire, or accessories. By focusing on universal indicators of drowsiness, such as eye movements, yawning, and head tilt, the system offers robust and reliable performance for a wide range of users.

One of the key **advantages** of this system is its adaptability to specific challenges:

Women Wearing Niqab:

The system accurately detects drowsiness even when the driver's face is partially covered. By focusing on eye movements, the model ensures reliable performance without requiring full facial visibility. Additional factors, such as yawning and head tilt, are analyzed using advanced libraries like MediaPipe..



Drivers Wearing Glasses:

The system is designed to function effectively for drivers who wear prescription glasses, overcoming potential visual obstructions to maintain accuracy in detecting drowsiness.

By addressing these unique cases, the system demonstrates its flexibility and inclusivity, making it a valuable tool for improving road safety for all drivers

Challenges:

- Sensitivity to lighting conditions and camera angles.
- Limited processing capacity of the Raspberry Pi, which can affect frame rates.

Future Work:

- Integrating advanced object detection techniques like YOLO to improve accuracy and speed.
- Expanding the dataset to include diverse driving scenarios, such as varying lighting conditions and more driver profiles.

Conclusion

The Driver Drowsiness Detection System represents a significant step forward in improving road safety through technology. By leveraging artificial intelligence to monitor drivers in real-time, this system addresses a critical issue with practical and impactful solutions.

The project has achieved high accuracy and reliability, showcasing the potential of AI in enhancing driver safety. With further development, the system can become a standard feature in vehicles, saving countless lives and preventing accidents caused by driver fatigue.

THANKS YOU

We welcome your questions and feedback.