SafeRoad : Driver Behaviour Detection and Relative Autonomous Navigation

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Area of Attention & Motivation

Driver distraction and drowsiness account for over 20% of all road accidents. Manual monitoring methods are inherently unreliable for real-time intervention.

Real-time Challenges

Current systems struggle with continuous, reliable driver state assessment.

Scalability Issues

Traditional methods lack the scalability required for widespread adoption in diverse vehicle types.

Preventative Measures

AI offers a robust, scalable solution for proactive incident prevention.

Core Question

Can computer vision accurately detect risky driving behaviours before they lead to accidents?

HOW THIS WILL WORK

THE IDEA IS DIVIDED INTO 2 SEGMENTS

DISTRACTION MODEL(SIDE CAM)

IT WILL COVER 10 CLASSES -

- Safe Driving
- Texting (Right)
- Phonecall (Right)
- Texting (Left)
- Phonecall (Left)
- Operating The Radio
- Drinking
- Reach Side
- Hair and Makeup
- Talking to passenger

If a specific distraction is prolonged, a warning message is displayed. If the activity repeats, an alert sound is triggered.

DROWZYNESS DETECTION MODEL (FRONT CAM)

IT WILL COVER 4 CLASSES -

- Safe driving
- Sleepy driving
- Yawn no hand
- Yawn with hand
- Microsleep

OVERALL 2 CLASSES

- NOT DROWZY [0]
- DROWZY[1]

If the driver is detected as distracted or drowsy, the system activates blinkers, reduces speed, detects nearby vehicles, moves to the roadside, and safely stops the vehicle.

Methodology

Our system relies on a meticulously curated dataset to ensure robust model training and evaluation. The data undergoes rigorous preprocessing to optimise it for deep learning models.

Data Input

Dashcam video frames and static images, categorised into 10 distinct distraction classes and 2 for drowsiness states.

Sources

Primary data from driver_imgs_list.csv, augmented with custom test images and comprehensive zip archives.

Preprocessing Steps

- Image resizing to uniform dimensions.
- Pixel value normalisation (0-1 range).
- Label encoding for categorical outputs.

Data Splits

Strict partitioning into training, validation, and test sets to prevent overfitting and ensure generalisation.

Methodology

Live video or webcam input is processed through two VGG16-based models for behavior and drowsiness detection. Detected states are displayed in real time. If a distraction is prolonged, a warning appears; repeated events trigger an alert sound. Detection duration is logged, and signals are sent to the autonomous system for action.

TRAIN

Use VGG16 as a feature extractor → Added custom classification layers

TEST

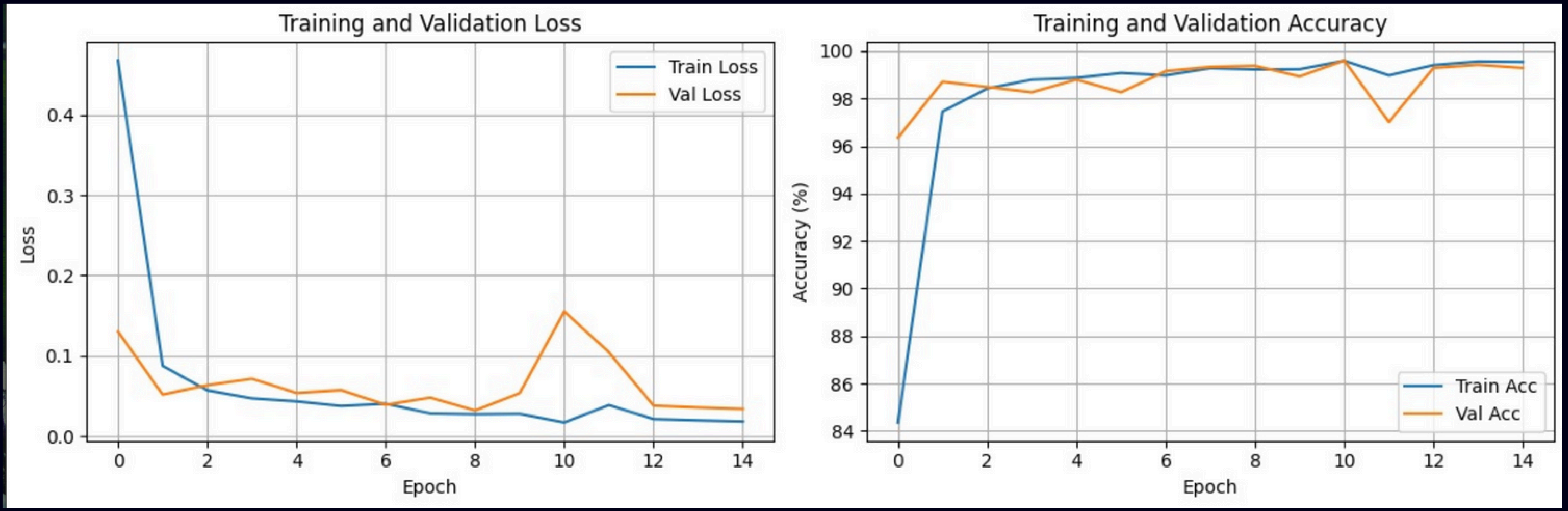
Video or webcam input is processed in real time to detect driver state. The result is displayed live, duration is recorded, and a control signal is sent to the autonomous system if needed.

PYGAME

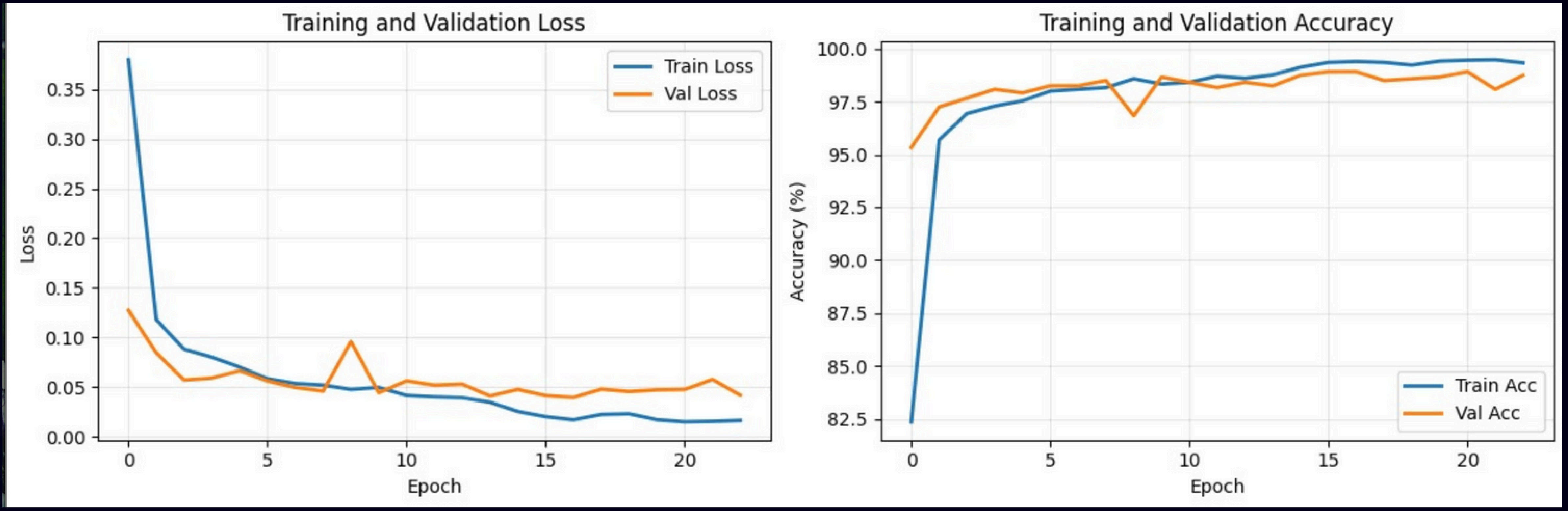
Most forms of distraction are handled with warnings, but in serious situations, the autonomous system takes control. A Pygame-based simulation demonstrates the system's response in such critical cases.

GARPHS

DISTRACTION MODEL



DROWZY MODEL



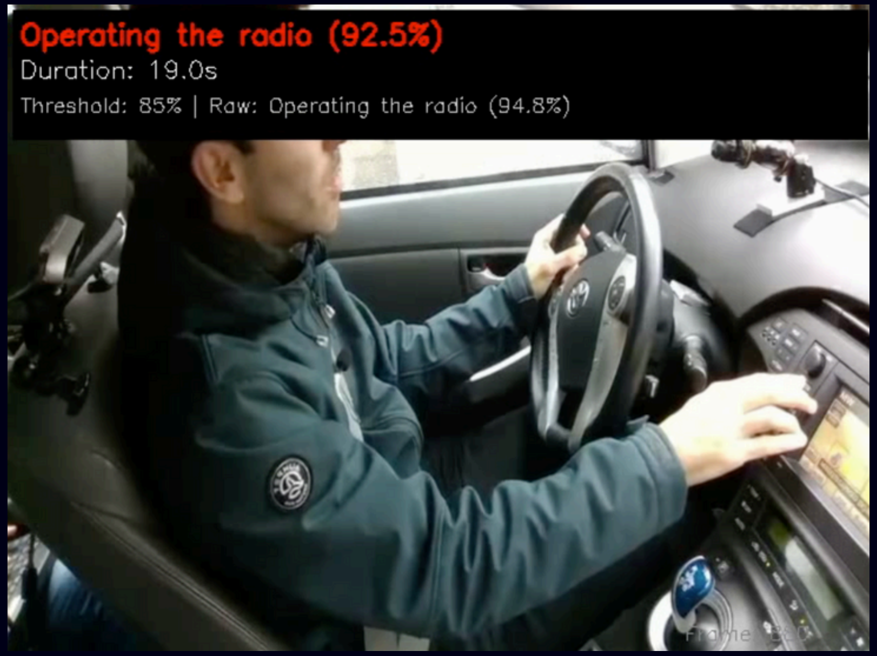
Model Comparison & Integration

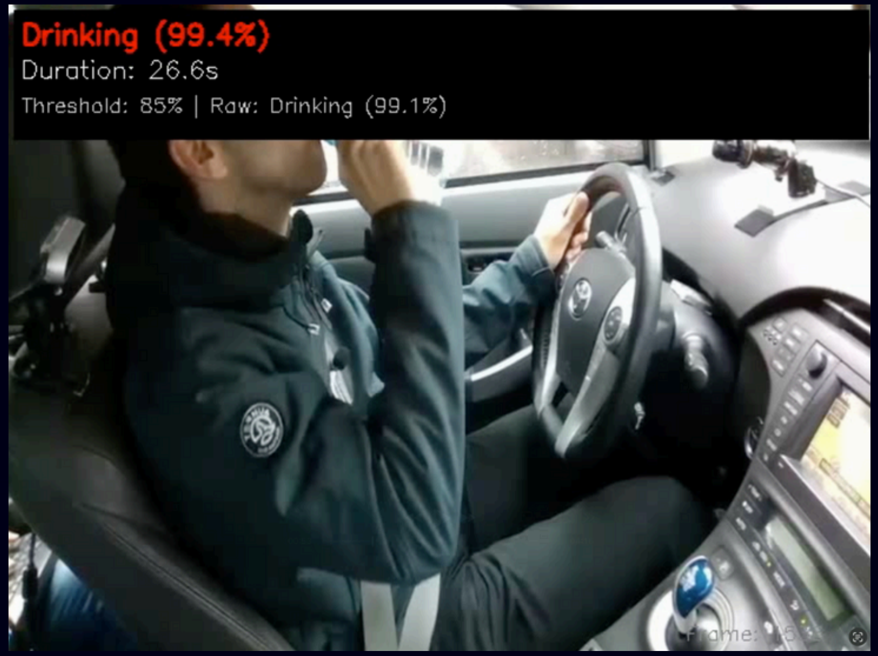
A critical analysis of our distinct models reveals optimal integration strategies for a robust Advanced Driver-Assistance System (ADAS).

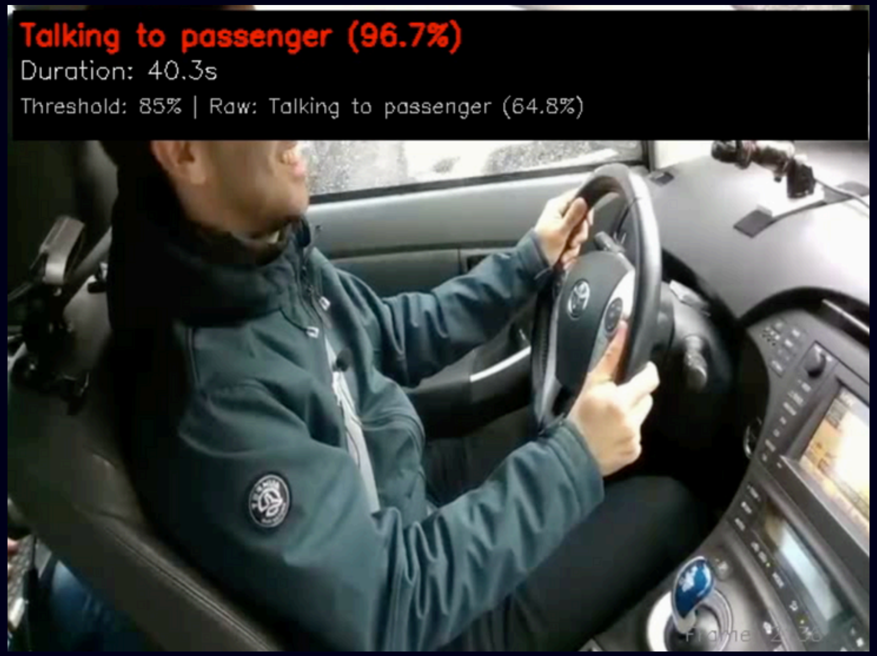
Feature	Distraction Model (VGG-16)	Drowsiness Model (FL3D)
Input Scope	Full driver body/posture for comprehensive activity analysis.	Focussed on facial features, eyes, and mouth for physiological states.
Inference Speed (FPS)	Moderate latency due to larger input context.	Higher frame rates (FPS) due to constrained input region.
Accuracy Trade-offs	Balanced accuracy across diverse distraction types.	High precision for specific drowsiness indicators (PERCLOS, Yawn Rate).

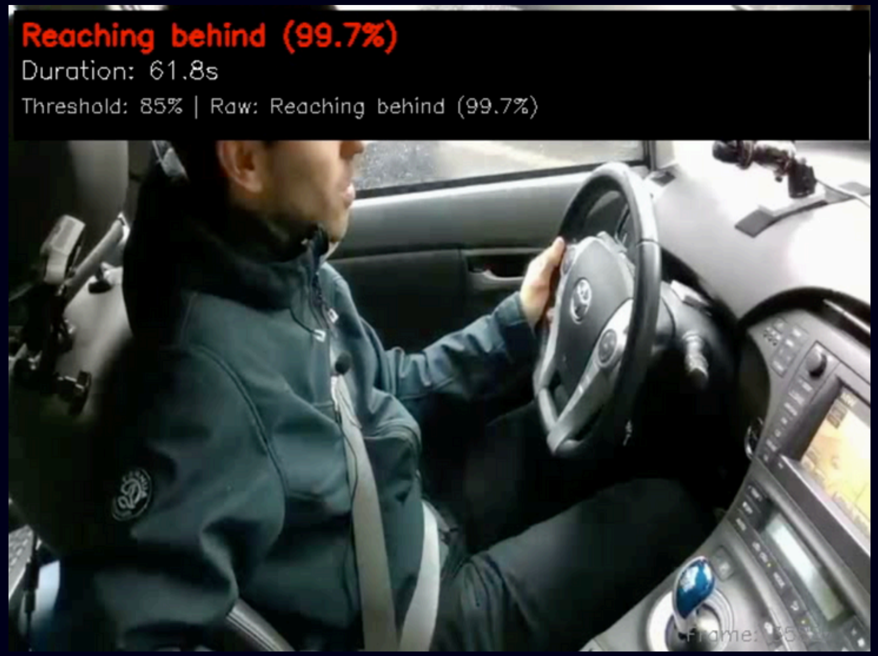
Best Practice: Combining both models offers a synergistic approach, ensuring comprehensive and reliable ADAS integration for holistic driver monitoring.

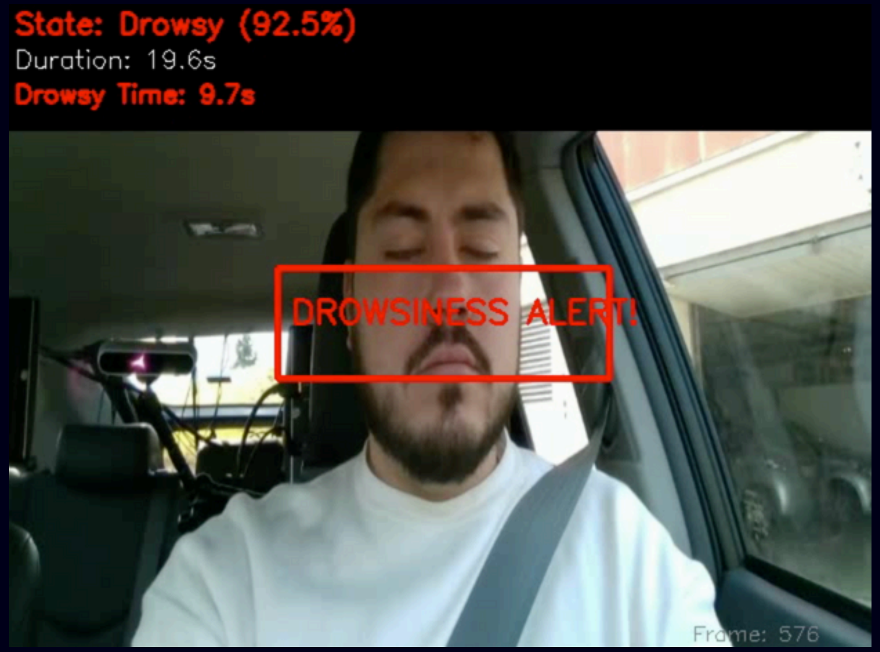
Real Time Outputs And Deployment











Conclusion & Future Scope

> AI offers an effective, real-time solution for monitoring driver behaviour, significantly enhancing road safety.

The successful Proof of Concept (PoC) validation opens significant avenues for deployment across diverse applications:

- **Fleet Management:** Optimising safety protocols for commercial fleets.
- **Commercial Vehicles:** Integrating into buses and lorries for enhanced public safety.
- **Personal Vehicles:** Empowering individual drivers with proactive safety features.

Future Plans

Edge Device Integration

Optimising models for low-power, high-efficiency hardware.

Mobile Dashboard App

User-friendly interface for real-time driver insights.

Enhanced Emotion Detection

Expanding capabilities to include emotional state analysis.