A

Project Report

on

P.R.A.Y.A.S

Prevention of Road Accidents
Yoking Advanced Sensors

Submitted for The Event

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CONTENTS

CHAPTER 1
Introduction

INTRODUCTION

A recent tragic car accident in Pune involving a Porsche has drawn national attention due to its legal and ethical complexities. The accident, which occurred on May 19, 2024, in Kalyani Nagar, involved a 17-year-old allegedly driving a Porsche at high speed, resulting in the death of two pedestrians.

In a tragic incident in Indore, a school bus from Delhi Public School (DPS) collided with a truck, resulting in the deaths of five students and the bus driver. The crash, which took place near the Kanadiya bypass, occurred due to a suspected steering failure. The front portion of the bus sustained significant damage, leading to serious injuries for several students who were rushed to a nearby hospital for treatment.

We were inspired by these events to think of ways that could have prevented these incidents.

1. Definition of the "Life Saver Suite"

Life Saver Suite is a product mechanism which will help the world and first of all our country to prevent accidents and incidents happening on roads regularly.

1.1 What is it?

The Life Save Suite integrates eye blink and pressure sensors in cars to prevent accidents caused by drowsiness. The system utilizes Arduino technology to detect changes in eye movement and steering wheel pressure, triggering an alert to keep drivers conscious.

2. Importance of the Life Saver Suite

Here's an elaboration of the benefits of the driver monitoring system:

2.1 Prevents Accidents

- Detects early signs of:
- Drowsiness (e.g., yawning, blinking, head nodding)
- Distraction (e.g., phone use, eating, conversing)
- Incapacitation (e.g., medical emergency, loss of consciousness)

2.2 Alerts driver with:

- Visual warnings (e.g., dashboard lights, heads-up display)
- Auditory warnings (e.g., beep, voice alert)
- Vibrational warnings (e.g., steering wheel, seat)
- Reduces risk of accidents caused by human error (up to 90% of all accidents)

2.3 Enhances Safety

2.4 Monitors driver attention and engagement through:

- Eye tracking
- Facial recognition
- Steering wheel grip analysis

2.5 Ensures safe driving practices by:

- Detecting signs of fatigue or distraction
- Providing real-time feedback
- Encouraging breaks and rest

- Driving habits (e.g., speed, acceleration, braking)
- Attention and engagement
- Safety performance

Encourages safe driving habits through:

- Personalized coaching

- Incentives for safe driving (e.g., rewards, insurance discounts)
- Improved driver self-awareness

Increases Vehicle Security

Prevents unauthorized vehicle use by:

- Detecting driver identity through facial recognition or biometrics
- Verifying driver alertness and attention

3. Scope of the Report

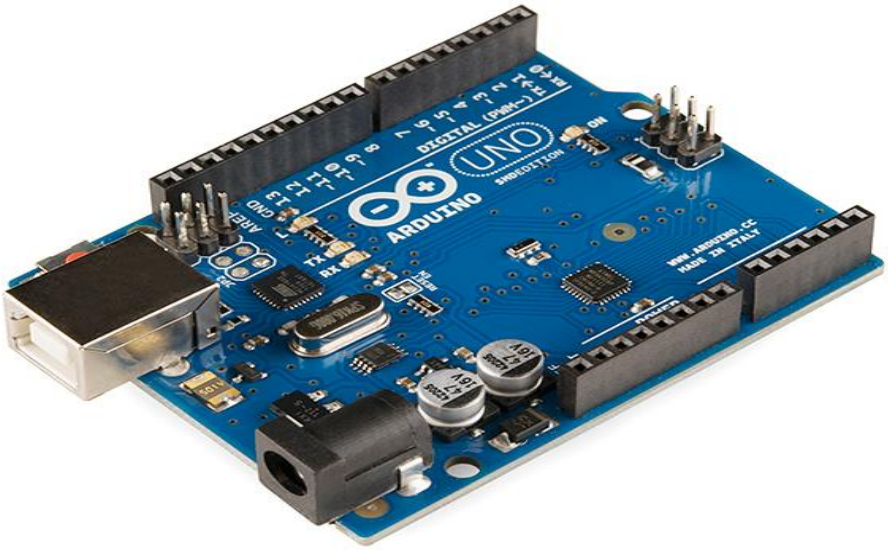
Now that you've established what the "Life Saver Suite" is and why it's important, briefly outline the scope of your report. What areas or aspects will your report focus on? This section helps the reader understand what to expect in the rest of the document.

CHAPTER 2
Technologies Used

CHAPTER 2 : **Technologies Used**

The Project has incorporated several Hardware and Softwares. These Components are as follows :

A. HARDWARE USED



1) Arduino UNO

The Arduino Uno is a popular microcontroller board for creating interactive electronic projects.

1.1 Key Features:

- Microcontroller: ATmega328P (8-bit, 16 MHz)
- Memory: 32 KB Flash, 2 KB SRAM, 1 KB EEPROM
- 14 Digital I/O pins, 6 Analog Input pins
- USB, Power jack (7-12V DC)
- Dimensions: 6.85 x 2.75 inches

1.2 Technical Specifications:

- Clock Speed: 16 MHz
- ADC: 10-bit, 6 channels
- PWM: 6 channels
- Interrupts: 2 external, 1 timer

1.3 Applications:

- Robotics
- IoT
- Home automation

2) EYE-BLINK SENSOR

The eye blink sensor **detects eye movements, tracking blink frequency and duration.**
It consists of:

- Infrared LED (emitter)
- Photodiode (detector)
- Amplifier circuit

2.1 Working Principle:

IR LED emits light towards the eye. Photodiode detects reflected light changes during blinking. Amplifier circuit processes signals.

2.2 Output :

- Digital signal (0/1) indicating blink detection
- Analog signal (voltage) representing blink duration and frequency
- Applications:
- Drowsiness detection systems
- Fatigue monitoring
- Eye-tracking technology

3) **Force Sensors**

A force sensor is an electronic component **measuring pressure, weight, or force applied to a surface**. It detects changes and generates an electrical signal. Used in various applications :

3.1 Types:

- Piezoelectric
- Capacitive
- Resistive
- Optical

3.2 Applications:

- Industrial automation
- Medical devices
- Robotics
- Weight measurement

4) **DISPLAY MODULE (LCD)**

LCD is a thin, flat display technology using liquid crystals to block or allow light passage.

It's **non-emissive, requiring backlight, and offers**:

- Low power consumption
- High resolution
- Compact size
- Wide viewing angles
- Used in watches, phones, monitors, and more.

5) **Buzzer**

A buzzer is an electronic device **converting electrical signals to audible sound**.

5.1 Types:

- Piezoelectric/Electromagnetic.

5.2 Features:

low power, compact size, adjustable frequency/pitch. Used in alarms, timers, notification systems, phones, and watches. Produces audible alerts and signal

6) **Battery**

A battery is a portable power source storing electrical energy in chemical form, converting it to electricity when needed.

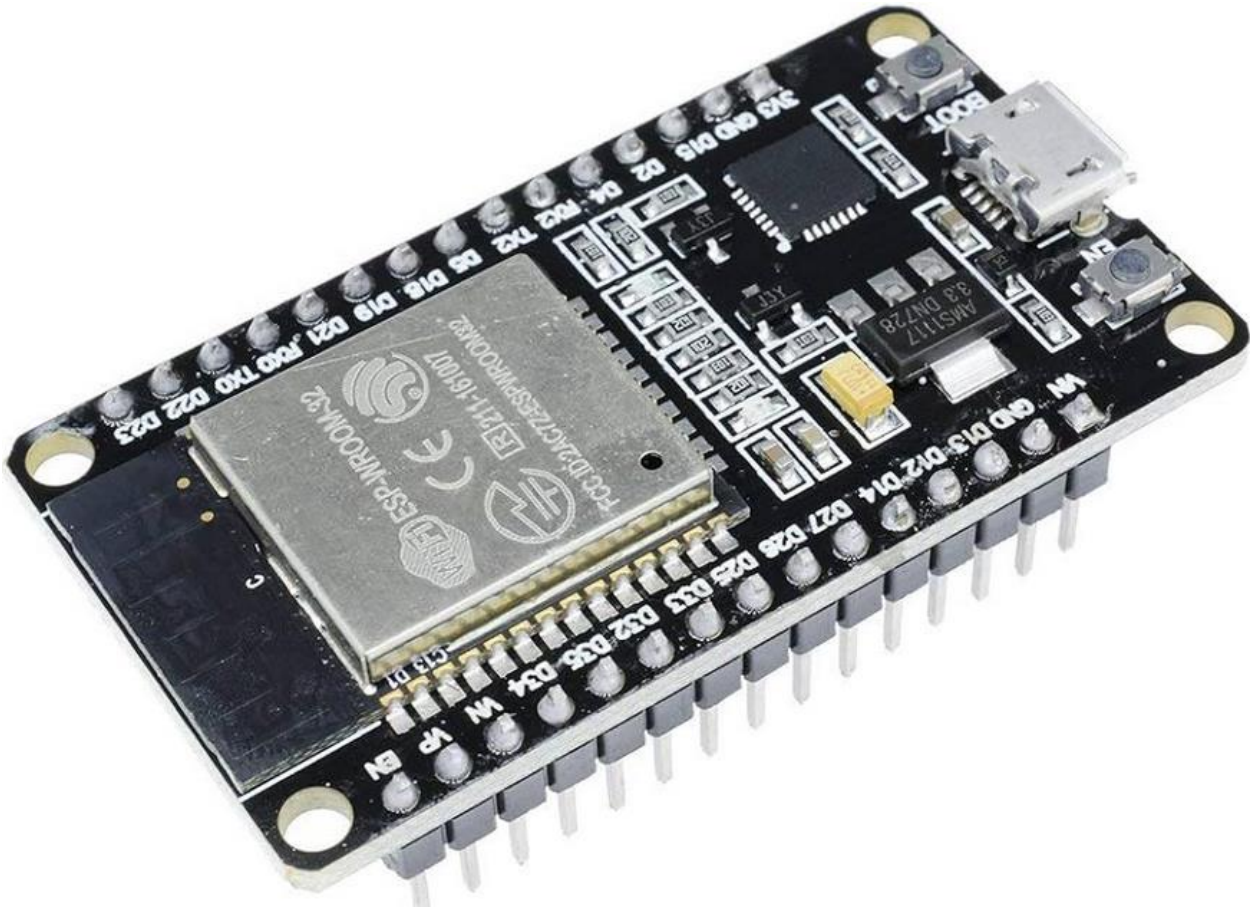
6.1 Types :

- Alkaline
- Ni-Cd
- Li-ion

6.2 Provides power to:

- Devices, appliances, and vehicles.
- Electric vehicles (EVs)
- Hybrid cars
- E-bikes
- Scooters

8) ESP 32



The **ESP32-WROOM-32** is a powerful, dual-core microcontroller module with integrated Wi-Fi and Bluetooth. It features a **240 MHz** dual-core processor, 4 MB of flash memory, and **520 KBS RAM**. The module **supports a wide range of peripherals**, including **GPIOs, PWM, ADC, DAC , I2C, SPI, and UART**.

8.1 It offers:

low-power modes making it ideal for battery-powered applications. Popular in IoT, wearables, and smart home devices, the ESP32-WROOM-32 is compatible with development environments like Arduino IDE, ESP-IDF, and PlatformIO, with excellent community support.

9) ESP32 CAM

The **ESP32-CAM** is a small and low-cost development board that **features an ESP32 chip, a camera module, and onboard storage for use in IoT (Internet of Things) projects**.

It is particularly popular for projects involving machine vision, security systems, or monitoring applications.

ESP32-CAM Specifications:

- Microcontroller: ESP32 (Dual-core processor, 240 MHz)
- Camera: OV2640 (2 MP camera with 640x480 resolution)
- Wi-Fi: 802.11 b/g/n
- Bluetooth: Bluetooth v4.2 BR/EDR and BLE
- Storage: External microSD card slot (supports up to 16 GB)
- Flash: 4 MB Flash memory

- Input Voltage: 5V (can be powered through a 5V pin or via the micro-USB port)
- GPIO: 9 GPIO pins (also supports PWM, ADC, I2C, SPI, and UART)
- Camera Interface: 2 MP, OV2640 (supports JPEG, YUV422, RGB565)
- Audio: Supports I2S microphone for audio applications
- Onboard LED: Built-in onboard LED for camera and indication purposes
- Size: 27 x 40.5 mm (approx. 1.06 x 1.59 inches)

B. SOFTWARES USED

1) C++ OR ARDUINO SKETCH

C++ is a high-performance, compiled, general-purpose programming language.

1.1 Key Features:

- Object-oriented programming (OOP)
- Template metaprogramming
- Multi-paradigm programming
- Low-level memory management
- Fast execution speed

1.2 Applications:

- Operating systems
- Games
- Web browsers
- Databases
- Embedded systems

1.3 Arduino Sketch

1.4 What is Arduino Sketch?

Arduino Sketch is a simplified C++ programming language used for Arduino boards.

1.5 Key Features:

- Simplified syntax
- Built-in functions for Arduino hardware
- Easy-to-use libraries
- Cross-platform compatibility

1.6 Structure:

- setup() function (runs once)
- loop() function (runs repeatedly)
- Variables and data types
- Control structures (if/else, for, while)
- Functions

1.7 Arduino Sketch Examples:

- Blinking LED
- Reading sensor data
- Controlling motors
- Communicating with serial devices
- Creating interactive projects

1.8 Benefits of using Arduino Sketch:

- Easy to learn
- Fast prototyping
- Large community support
- Extensive library collection
- Cross-platform compatibility
- Tools needed to write Arduino Sketch:
- Arduino IDE (Integrated Development Environment)
- Arduino board (e.g., Uno, Nano, Mega)

- USB cable
- Computer (Windows, macOS, Linux)

1.9 Resources:

- Arduino official website ((link unavailable))
- Arduino documentation
- Online tutorials and courses
- Arduino community forums

2) ARDUINO IDE : Arduino IDE (Integrated Development Environment)

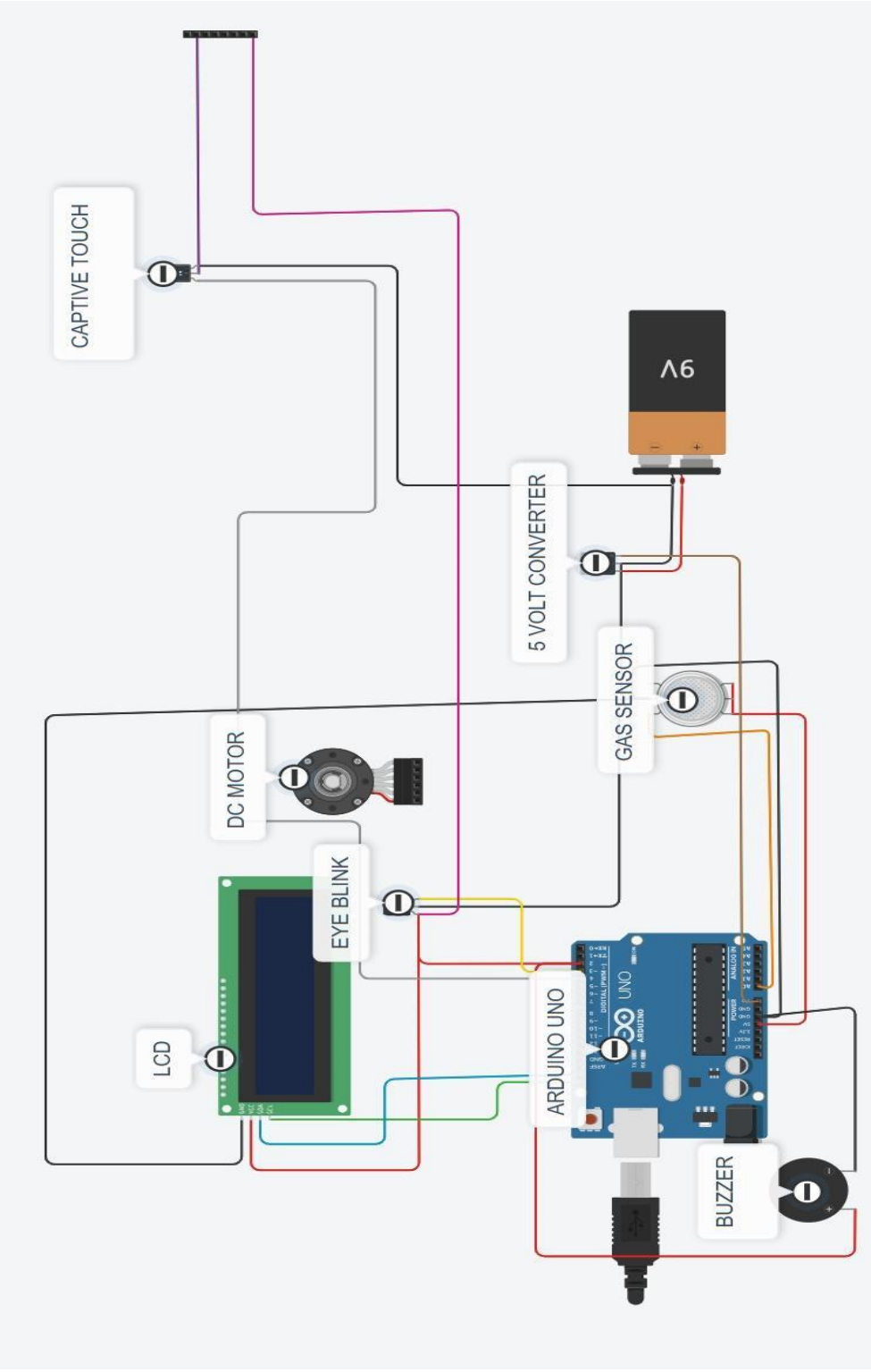
2.1 Overview

The Arduino IDE is a free, open-source software used to write, compile, and upload code to Arduino boards.

2.2 Key Features:

- **Code Editor:** Write and edit Arduino Sketch (.ino) files.
- **Compiler:** Converts code into machine-readable format.
- **Uploader:** Uploads compiled code to Arduino boards.
- **Serial Monitor:** Displays serial data sent by Arduino.
- **Library Manager:** Installs and manages libraries.
- **Board Manager:** Supports multiple Arduino boards.
- **Debugging Tools:** Error messages and line numbering.

CHAPTER 3
CIRCUIT DIAGRAM



The Circuit Diagram is as Above.

CHAPTER 4
Working

Chapter 4 : Working

Here's how each component functions in the circuit:

1. Power Supply (Li-Po Battery)

- A Li-Po battery is used as the primary power source for the system.
- The battery powers the Arduino, which in turn powers all other components.

2. Arduino Uno

- Acts as the central processing unit, collecting data from all the sensors, processing it, and executing actions based on programmed logic.
- Each sensor is connected to specific pins on the Arduino for reading input data, while outputs (like the buzzer and LCD) are connected to provide alerts to the driver.

3. Force Sensor (Self-made Captive Touch)

- The force sensor is installed on the steering wheel to detect whether the driver's hands are placed on it.
- If no force is detected for a certain duration, the Arduino triggers a warning on the LCD display and/or activates the buzzer to alert the driver.
- The force sensor connects to one of the Arduino's analog input pins, where it reads values to determine if force is applied or not.

4. Eye Blink Sensor (IR Sensor)

- Monitors the driver's eye blinks, providing input to the Arduino on eye activity.

- If the sensor detects rapid or prolonged blinking (indicating drowsiness), the Arduino processes this data and triggers a warning.
- The IR sensor typically connects to a digital input pin on the Arduino, sending a HIGH or LOW signal depending on eye movement.
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5. Ultrasonic Sensor (AJ-SR404M)

- This sensor is positioned at the front of the car to detect objects or vehicles within a 100 cm range.
- It measures the distance by emitting ultrasonic waves and timing their return after bouncing off an object.
- When an object is detected within 100 cm, the Arduino is programmed to activate the buzzer to alert the driver.
- The sensor has separate pins for the trigger and echo signals, both connected to digital pins on the Arduino for accurate measurement.

6. Buzzer

- Connected to a digital output pin on the Arduino, it provides an auditory alert to the driver.
- The Arduino activates the buzzer in response to the following conditions:

➢ - If no force is detected on the steering wheel.
➢ - If drowsiness is detected by the eye blink sensor.
➢ - If an object is detected within 100 cm by the ultrasonic sensor.

7. LCD Display

- Shows warning messages such as "Hands off the wheel," "Drowsiness detected," or "Object detected ahead."

- The LCD is connected to the Arduino via digital pins and communicates through either the I2C protocol (using an I2C module if available) or directly through data pins.
- The display updates based on input from the sensors to keep the driver informed in real time.
-

Circuit Connections

- **Arduino Pin Assignments**
- **Force Sensor** Connected to an analog input pin (e.g., A0).
- **Eye Blink Sensor** Connected to a digital input pin (e.g., D2).
- **Ultrasonic Sensor**:
- **Trigger Pin**: Connected to a digital output pin (e.g., D7).
- **Echo Pin**: Connected to a digital input pin (e.g., D8).
- **Buzzer**: Connected to a digital output pin (e.g., D9).
- **LCD Display**: Connected via I2C pins (SDA and SCL) or directly through data pins (if using a 16x2 LCD without an I2C adapter).

Circuit Operation Logic

1. **Force Sensor**: Arduino reads input from the force sensor. If no force is detected, it:
   - Displays a warning on the LCD ("Hands off the wheel").
   - Activates the buzzer for an audible alert.

2. **Eye Blink Sensor**: Arduino monitors blink frequency. If the frequency exceeds a threshold:
   - Displays "Drowsiness detected" on the LCD.
   - Activates the buzzer to alert the driver.

3. **Ultrasonic Sensor**: Arduino continuously checks distance data from the sensor. If an object is detected within 100 cm:
   - Displays "Object detected ahead" on the LCD.
   - Activates the buzzer to warn the driver.

CHAPTER 5
Conclusion

Chapter 5 : Conclusion

Project PRAYAS is designed as a multifaceted safety system that leverages advanced sensor technology to address critical driving risks such as impaired driving, underage driving, and driver fatigue, each of which contributes significantly to road accidents. By integrating various sensors, the project takes a proactive approach to accident prevention, enhancing vehicle safety and driver responsibility.

1. **Alcohol Detection**: The alcohol sensor in PRAYAS is a core component aimed at reducing incidents caused by drunk driving. Positioned strategically within the vehicle, the sensor can detect alcohol levels in a driver's breath. If alcohol is detected beyond a certain threshold, the system can disable the vehicle's ignition or alert the driver, ensuring that only sober individuals can operate the car. This feature helps prevent dangerous situations associated with impaired driving, which is a leading cause of road accidents globally.

2. **Minor Access Prevention**: Another critical feature of PRAYAS is its capacity to prevent unauthorized individuals—particularly minors—from driving. By employing age verification technologies, the system ensures that only licensed, authorized drivers can start the vehicle. This feature can be integrated with biometric verification or license scanning, creating a significant safeguard

against underage driving. By enforcing legal driving age, PRAYAS contributes to reducing accident rates involving inexperienced or unauthorized drivers.

3. **Driver Fatigue Monitoring**: PRAYAS also tackles the issue of driver fatigue, a factor that is often overlooked yet crucial in accident prevention. Through the use of pressure sensors in the seat and steering wheel, the system monitors signs of driver drowsiness, such as lack of movement or sudden changes in grip pressure. If these signs are detected, the system can alert the driver with audio or visual cues, or even activate the vehicle's safety measures to prevent accidents. This feature is particularly useful for long-haul drivers or those traveling on monotonous routes, where fatigue can set in unexpectedly.

By combining these technologies, PRAYAS presents a holistic solution that addresses multiple aspects of driver safety and responsibility. This project has the potential to not only reduce accidents but also serve as a model for smart vehicle safety systems that adapt to human behavior and legal requirements.

The integration of these sensors and automated responses creates a vehicle environment that actively protects both the driver and other road users, paving the way for safer roads and more responsible driving behavior.