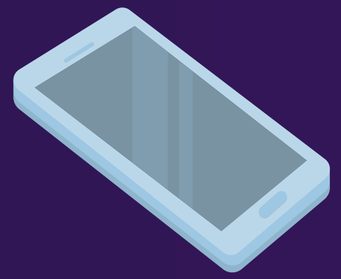
IDS (Intelligent Driving System)



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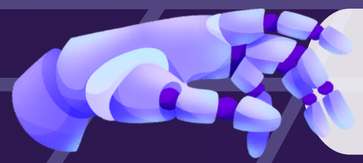


Dr. Khaled Elmenshawy
Eng. Alaa Abushysha

AGENDA

1. Introduction
2. Problem Statement
3. Our solution and the value offered
4. System's technology and implementation
5. Mobile application
6. Future Developments

INTRODUCTION!

Ensuring Safer Journeys with Advanced Driving Safety Technology

Our IDS's aim is Improving road safety by monitoring driver behavior and attentiveness.

Our system uses advanced computer vision and machine learning technologies to detect distraction and sleep, and uses advanced telecommunication and geolocation technology to reduce the risk of road accidents significantly.

PROBLEM DEFINITION

- **To improve road safety, and address driver distraction** emerges as a critical challenge. According to the World Health Organization (WHO) reports approximately 1.35 million people die each year due to inattentiveness.

- **Slow Medical Responses to emergencies on traveling roads for fleet drivers.**

- **In Egypt, road traffic injuries are also a major public health problem**. In 2019, there were an estimated 12,325 road traffic deaths in Egypt, with 23.5% of those deaths attributed to speeding, **15.5% to distracted driving, and 9.3% to fatigue.**

- **Some Road being unsafe to drive on during the night** with not enough data provided to the DOT about their potential dangers

EFFECTIVE TARGET AND AUDIENCE

Our solution aims to aid in the following Categories Effectively:

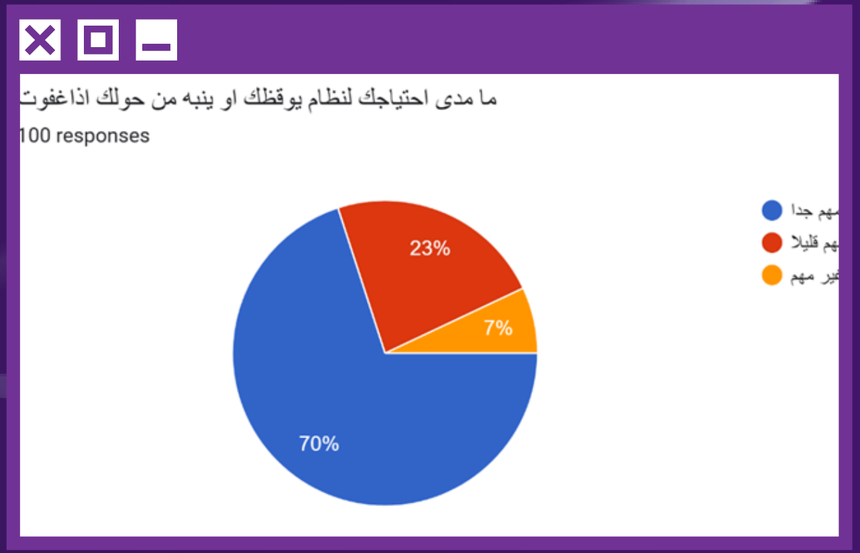
- Swiftly detecting and preventing sleep and lack of focus for **casual drivers**
- Providing fast response time to emergency scenarios an a security system fo**r fleets and traveling workers with a detailed report**
- Provide analysis of driver behaviors to legally aid the **trasportation industry**
- Provide detailed analysis on accidents, and emergencies and their predicted location through a sophisticated database for the **DOT**

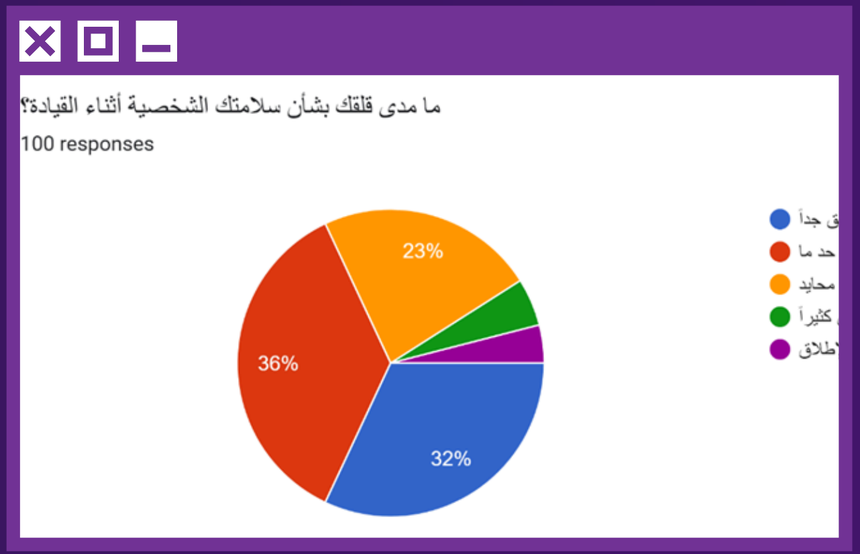
OPINION SURVEY RESULT

In an effort to gauge public opinion and gather feedback on the Safety Driving System, we conducted an extensive survey among a diverse group of participants, including drivers, traffic safety experts, and technology enthusiasts. The survey aimed to assess the perceived effectiveness, usability, and potential impact of the system on road safety. Here are the key findings

Key Findings:

- **High Concern for Drowsiness Detection**
- **Support for Emergency Features**
- **Positive Reception to Force Feedback**

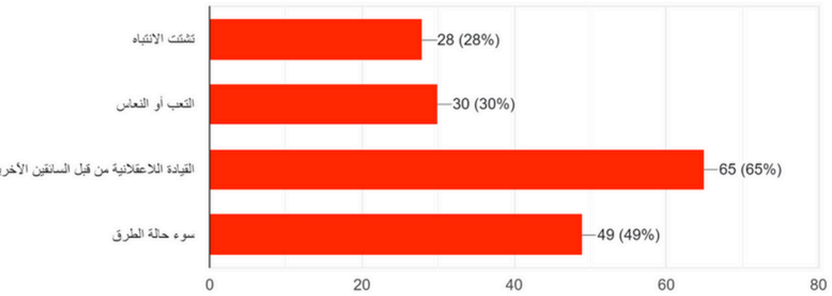




SURVEY RESULT

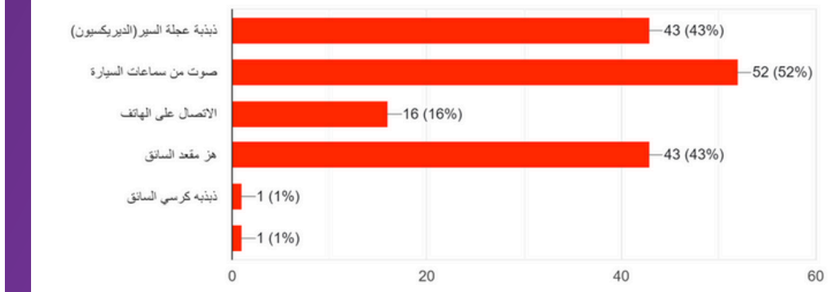
حدد ما هي أكبر التحديات التي تواجهك اثناء القيادة(يجوز عدة اختيارات)

100 responses



حدد كيف قد تود ان ينبهك النظام في حالة الغفوة او تشتت الانتباه(يجوز عدة اختيارات)

100 responses



ما مدى أهمية التواصل في الوقت الحقيقي تلقائيا مع خدمات الطوارئ في حالة حدوث حادث أو حالة طارئة

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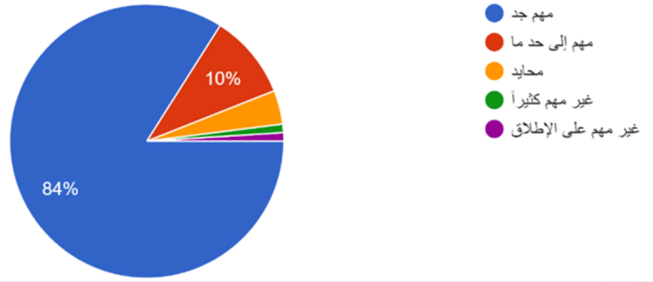
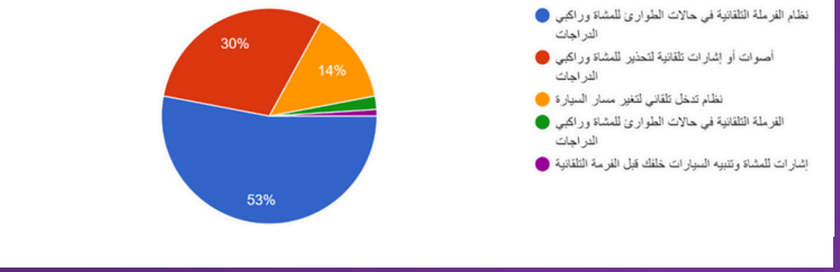


أي نوع من ميزات السلامة تود رؤيتها مُطبقة في السيارات لحماية المشاة وراكبي الدراجات؟

100 responses

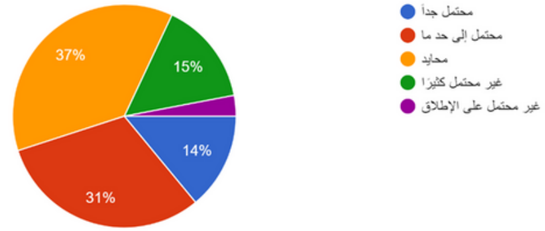


حدد الطرق التي تفضل الحصول على نظام امن لسيارتك بها؟

100 responses

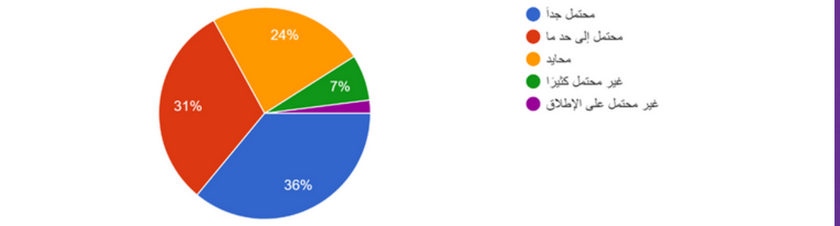
مدى احتمالية ثقتك في سيارة ذاتية القيادة تمامًا لنقل آمن؟

100 responses



في حال حصولك على سيارة بتقنية القيادة الذاتية, ما احتمالية اشتراك في تأمين يسمح لها بنقلك ذاتيا في حالات الطوارئ او الغفلة

100 responses



ما مدى رغبتك في ان يجمع النظام عنك معلومات عن عاداتك و اكثر المسارات المؤثرة عليك لاعطائك مقترحات و ارشادات

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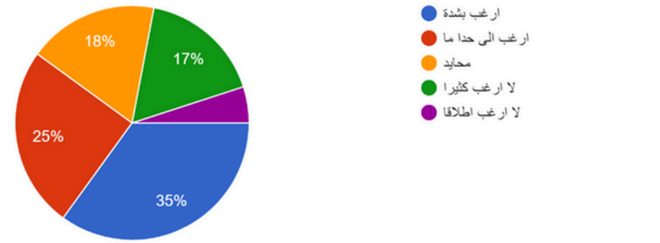
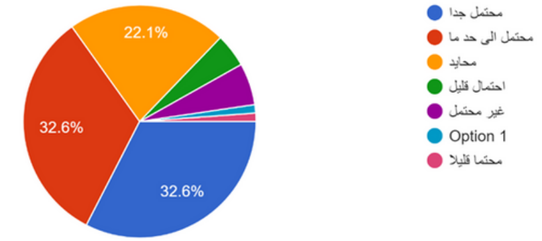


هل قد يكون لديك استعداد مادي لتحمل زيادة في سعر سيارة من اجل انظمة امان ذكية؟

86 responses



PROPOSED SOLUTION

Our solution tackles each scenario effectively with a respective system through:

- **using Computer vision(CV) with landmarkers** to track eye and face movements providing alerts againt sleep and inattentiveness.
- **Using CV with Geolocation and cellular technology** to recognize and contact help during emergencies swiftly.
- **Provide longterm tracking for driver's state** and responding with suggestions and storing analysis .
- **Provide robust backend** that houses a large database with a log of emergency locations.

THE VALUE OFFERED

Our system offers unparalleled value by:

- **Money saving on legal persuasions**
- **Automatic emergency response and tracking**
- **Cheap additional Security system**
- **effective accident accountability boost**
- **valuable data about local transportation routes**

SYSTEM ARCHITECTURE

POWER MANAGEMENT

DETECTION PERPHERALS

COMMUNICATION NETWORK

MOBILE APP

TECHNOLOGY OVERVIEW

Our Safety Driving System is a testament to the synergy between cutting-edge software and robust hardware. Here's a breakdown of the technologies that power our system:

Software:

- **Bookworm Raspberry Pi Linux OS**
- **Machine learning models**
- **Computer vision algorithms**
- **Data management software**
- **GPRS, GSM, And cellular network**
- **GPS processing**
- **Flutter + Firebase mobile development**
- **UART COMMUNICATION**

HARDWARE

1.Central Micro-controller Board: Raspberry Pi 5

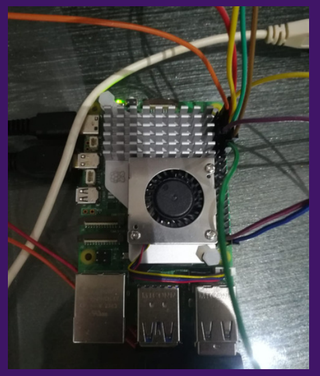
2. High-Resolution Camera

3.Cellular Communication module

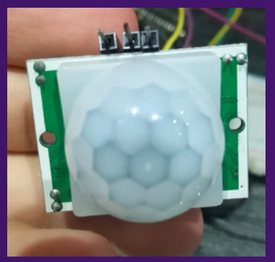
5. GPS & AGPS module

6. Built in Smart Power management

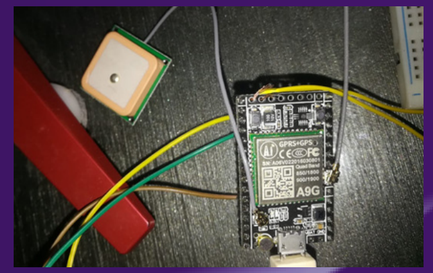
7. Additional Smart Security System



Raspberry pi 5



PIR motion sensor



A9G for GPRS
and GPS

redragon hitman gw800

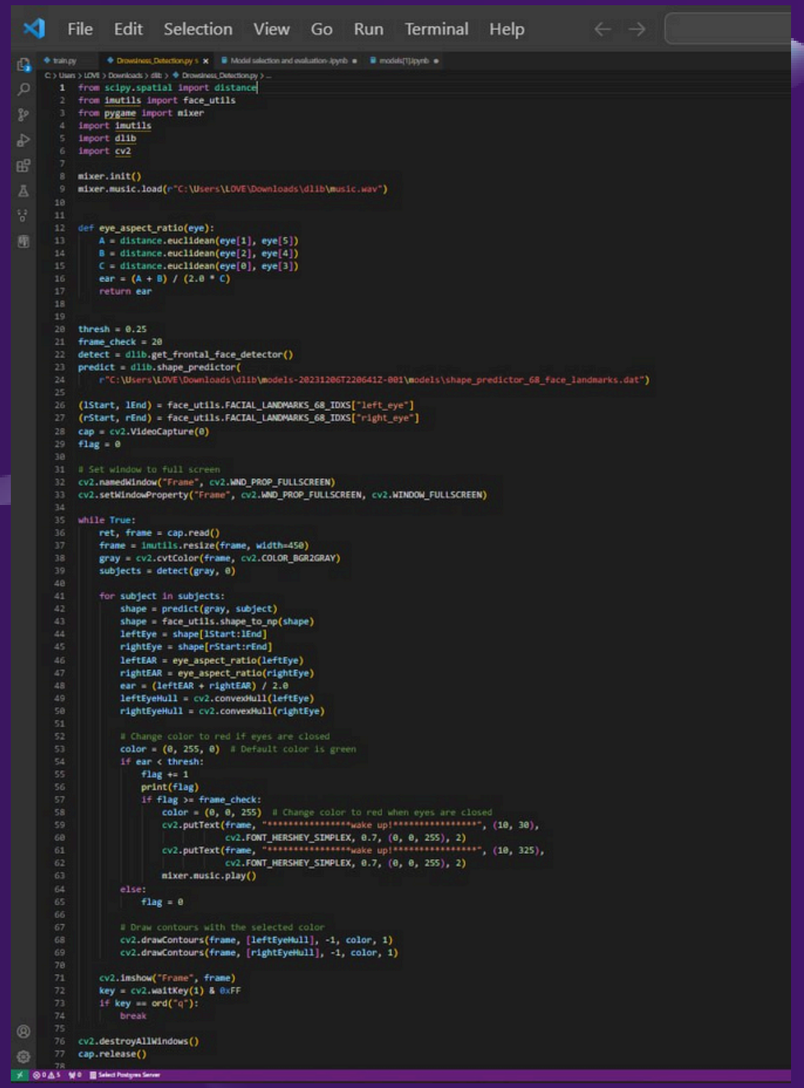
SOFTWARE

- **Demo Version:** To showcase the capabilities of our system, we have developed a demo version that features: Real-time drowsiness detection with visual and audio alerts.
- **Requirements Specification :**
- **Python:**

-Libraries :

1. Numpy
2. dlib
3. Scipy
4. Pygame
5. Mediapipe
6. Imutils
7. opencv, etc

- **Operating System:** Windows or Ubuntu
- **Raspberry pi 5**
- **cam**



FINAL DMS SYSTEM (HIMOQ AGENT)

Driver Monitoring System Implementation: The DMS leverages a combination of computer vision and facial landmark detection algorithms to monitor the driver's eye blink frequency, yawn occurrences, head position, and overall attentiveness.

By analyzing these physiological indicators, the system can identify early signs of fatigue or distraction**.**

Key components of the CV system include:

- **OpenCV and MediaPipe:** For real-time facial feature tracking and analysis.
- **Pygame:** To generate audio alerts for immediate driver feedback.
- **CSV Data Logging:** For recording attentiveness metrics over time, aiding in long-term monitoring and analysis.

Implementation Details

1. Initialization: The system initializes the PIR sensor if security is enabled and once authorized, the camera is initialized and loads necessary models for facial landmark detection. It also prepares the CSV file for data logging.

2. Real-Time Monitoring: Through the camera feed, the system continuously analyzes the driver's facial landmarks, focusing on eye and mouth movements to detect blinks and yawns, respectively.

3. Alert Mechanism: Upon detecting signs of drowsiness (e.g., frequent blinking, prolonged eye closure, or yawning), the system triggers audio alerts to re-engage the driver's attention through either a speaker or a buzzer.

4. Data Recording: Each monitoring session's data, including time, blink count, yawn count, drowsiness occurrences, and fatigue status, are logged into a CSV file for further analysis. and a log is sent to the firebase RTdatabase regularly, along with emergency location info

5. User Log analysis and retrieval: the data is retrieved by the mobile application to be processed, viewed and configured by the user.

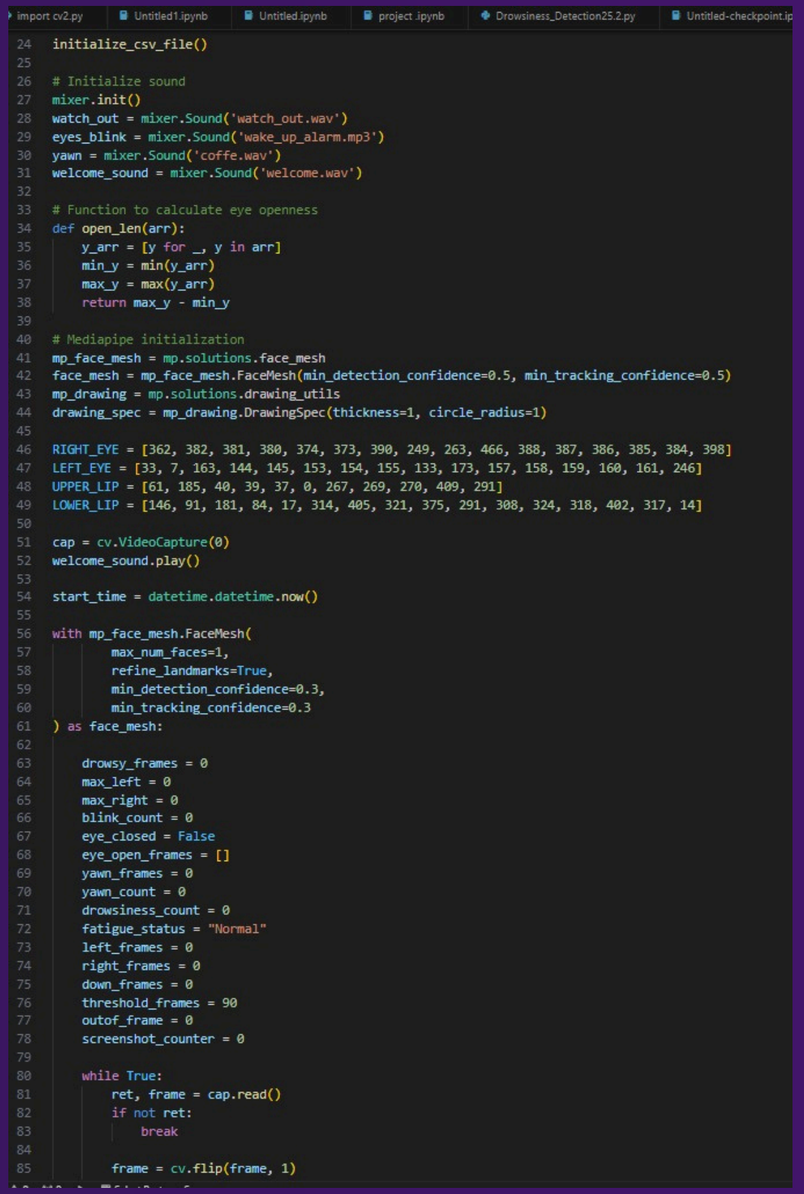
HIMOQ AGENT

Libraries Used:

- **OpenCV (cv2):** For video capture and image processing.
- **NumPy:** For numerical operations on image data.
- **MediaPipe:** For face landmark detection.
- **Pygame:** For playing alert sounds.
- **CSV:** For data logging.
- **OS:** For file system operations.
- **Datetime:** For timestamp management.

Main Loop:

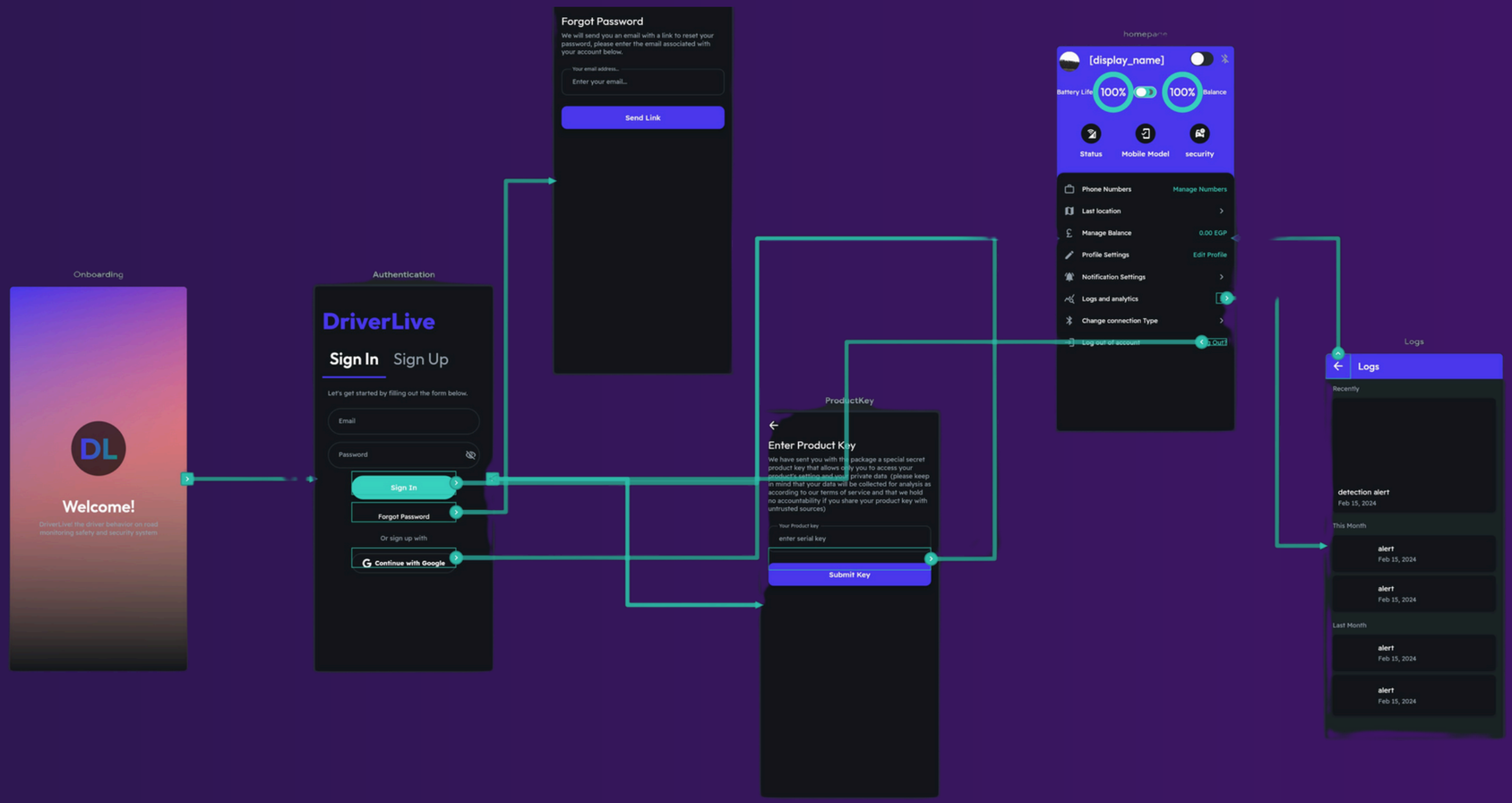
- Captures video from the webcam and processes each frame.
- Face Landmarks Detection.
- Eye and Mouth Detection.
- Drowsiness and Yawn Detection.
- Fatigue Status Calculation.
- Face Orientation Detection.



MODELS COMPARISON

Factor	Dlib	Mediapipe
Architecture	C++ library with Python bindings	Cross-platform framework for ML pipelines
Performance	Robust performance in facial analysis tasks	Efficient real-time performance for CV tasks
Ease of use	User-friendly Python interface	High-level APIs and pre-trained models
Flexibility	Versatile library for various tasks	Support for a wide range of CV tasks
Resource needs	Moderate resource requirement	Efficient resource utilization

MOBILE APPLICATION



STREAMLINING APP DEVELOPMENT WITH FLUTTER AND FLUTTERFLOW

Flutter for Cross-Platform Development

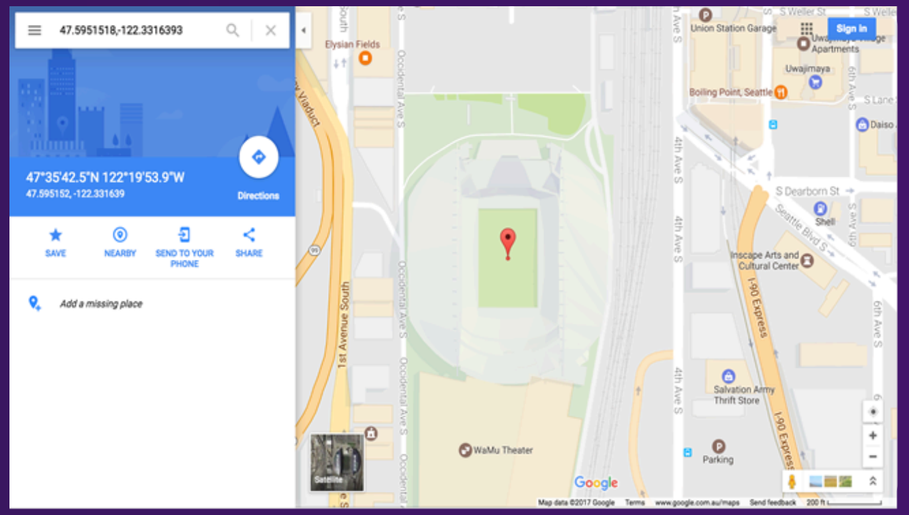
- **Single Codebase:** Develops apps for multiple platforms with one codebase, offering native performance.
- **Rapid Testing:** Speeds up testing and simulation of mobile functions without waiting for APK builds.

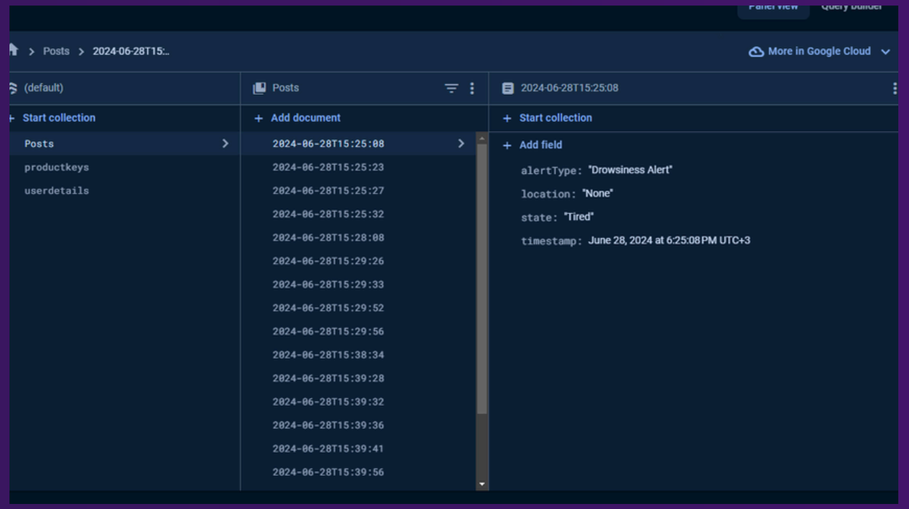
Key Benefits

- **Real-Time Simulation:** Immediate visual feedback accelerates development.
- **Flexibility:** Custom code support for complex requirements.

Google Maps URL for Location Services

- **URL-Based Approach:** Uses Google Maps URLs instead of API due to economic restrictions.
- **Cross-Platform:** Consistent functionality across Android, iOS, and web platforms.
- **Technical Considerations:** Proper URL encoding ensures compatibility and reliability.





FUTURE DEVELOPMENTS

Looking ahead, our safety driving system holds immense potential for further advancements and innovations. Here are some key areas of future development:

- **Integration with Autonomous Vehicles:** We aim to integrate our system with self-driving cars, enhancing their safety protocols with our advanced driver monitoring features.

- **Driver Feedback System:** Incorporate a feedback mechanism to provide personalized tips and recommendations for improving driving attentiveness and safety.

- **Lane detections:** Integrating lane detection with drowsiness detection enhances vehicle safety by alerting drivers if they drift out of their lane. Future improvements will focus on real-time, accurate lane detection using advanced machine learning.

- **Obstacles detection:** Integrating obstacle detection with drowsiness detection enhances safety by identifying and classifying road obstacles using LiDAR, radar, and cameras. Future advancements will develop algorithms to predict collisions and suggest evasive actions, reducing accidents from drowsy driving.


THANK
YOU!