Vellore Institute of Technology

SWE1018 : Human Computer Interface E2 Slot

Winter Semester 2022-23

Realtime Facial Expression Recognition For Driver Safety

Review 3 : **Team 18**

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Under the guidance of Dr. Shunmuga Perumal P

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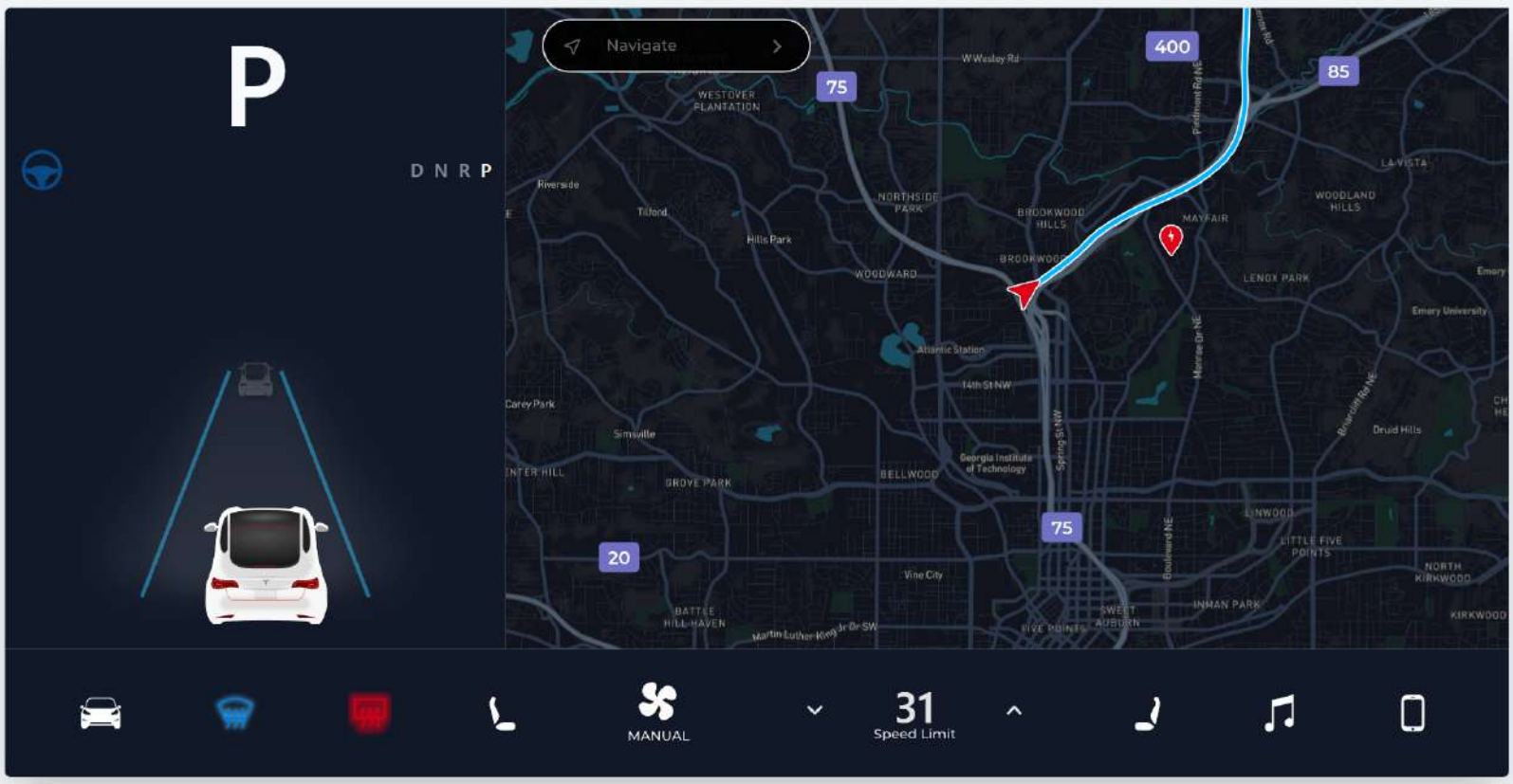


Realtime Facial Expression Recognition For Driver Safety

ABSTRACT

Real-time facial expression recognition system for driver safety, which is capable of detecting and recognizing facial expressions to identify driver fatigue, distraction, and drowsiness. The system uses a deep learning-based approach, specifically the convolutional neural network (CNN) architecture, to extract features from the facial images captured by a camera installed in the vehicle. The extracted features are then classified into different facial expressions using a support vector machine (SVM) classifier. The proposed system was tested on a dataset of facial expressions captured from drivers in real-world driving scenarios, and achieved high accuracy rates in detecting different facial expressions. The results show that the proposed system has the potential to enhance driver safety by providing real-time alerts to prevent accidents caused by driver fatigue, distraction, and drowsiness.

1. Complete List of Stakeholders

1. **Customers/Users/Drivers**: These are the people who will use the software and who will be directly impacted by its functionality and design.
2. **Management**: This group includes executives, project managers, and other decision-makers who have a vested interest in the success of the project.
3. **Development Team**: The development team is responsible for creating the software and ensuring that it meets the needs of the users and the business.
4. **Quality Assurance**: This group is responsible for testing the software and ensuring that it meets quality standards.
5. **Business Analysts**: Business analysts help to define the business requirements and ensure that the software meets those requirements.
6. **Marketing**: The marketing team is responsible for promoting the software to potential users and ensuring that it is marketed effectively.
7. **Sales**: The sales team is responsible for selling the software to potential customers.
8. **Support**: The support team is responsible for providing support to users of the software.
9. **Partners/Suppliers**: Partners and suppliers may be involved in the project, either as vendors or as providers of necessary resources.
10. **Regulators**: Regulators may be involved in the project if the software is subject to regulation.
11. **Investors**: Investors may have a stake in the project if they have provided funding for the development of the software.

2. Cognitive performance involved for each stakeholders

Sno	Stakeholder	Cognitive Performance
1	Driver	their ability to **understand and use the software**, their level of **satisfaction with the user interface**, and their ability to **provide feedback on the software**.
2	Management	need to be able to make **strategic decisions** based on data and information, and to **communicate effectively** with the rest of the team. They may also need to be able to manage and allocate resources effectively.
3	Development Team	need to be able to understand and interpret technical information, problem-solve, and collaborate effectively with other team members. They may also need to be able to manage their time effectively to meet project deadlines.
4	Quality Assurance	need to be able to pay attention to detail, identify potential issues or bugs, and provide feedback to the development team. They may also need to be able to work within tight timelines and prioritize their tasks effectively.
5	Business Analysts	need to be able to analyze and interpret data, understand business requirements, and communicate effectively with both technical and non-technical team members.
6	Marketing	need to be able to understand the target audience, develop effective messaging and communication strategies, and measure the effectiveness of their marketing efforts.
7	Sales	need to be able to understand the features and benefits of the software, effectively communicate those to potential customers, and close deals.
8	Support	need to be able to communicate effectively with customers, identify and troubleshoot issues, and provide solutions or workarounds in a timely manner.
9	Partners/Suppliers	need to be able to collaborate effectively with the development team, manage their own resources and timelines, and communicate effectively with the rest of the team.
10	Regulators	need to be able to understand and interpret regulations, communicate effectively with the development team, and provide feedback on compliance requirements.
11	Investors	need to be able to analyze and interpret financial information, communicate effectively with the rest of the team, and make strategic decisions based on that information.

3. Human Factors for all stakeholders

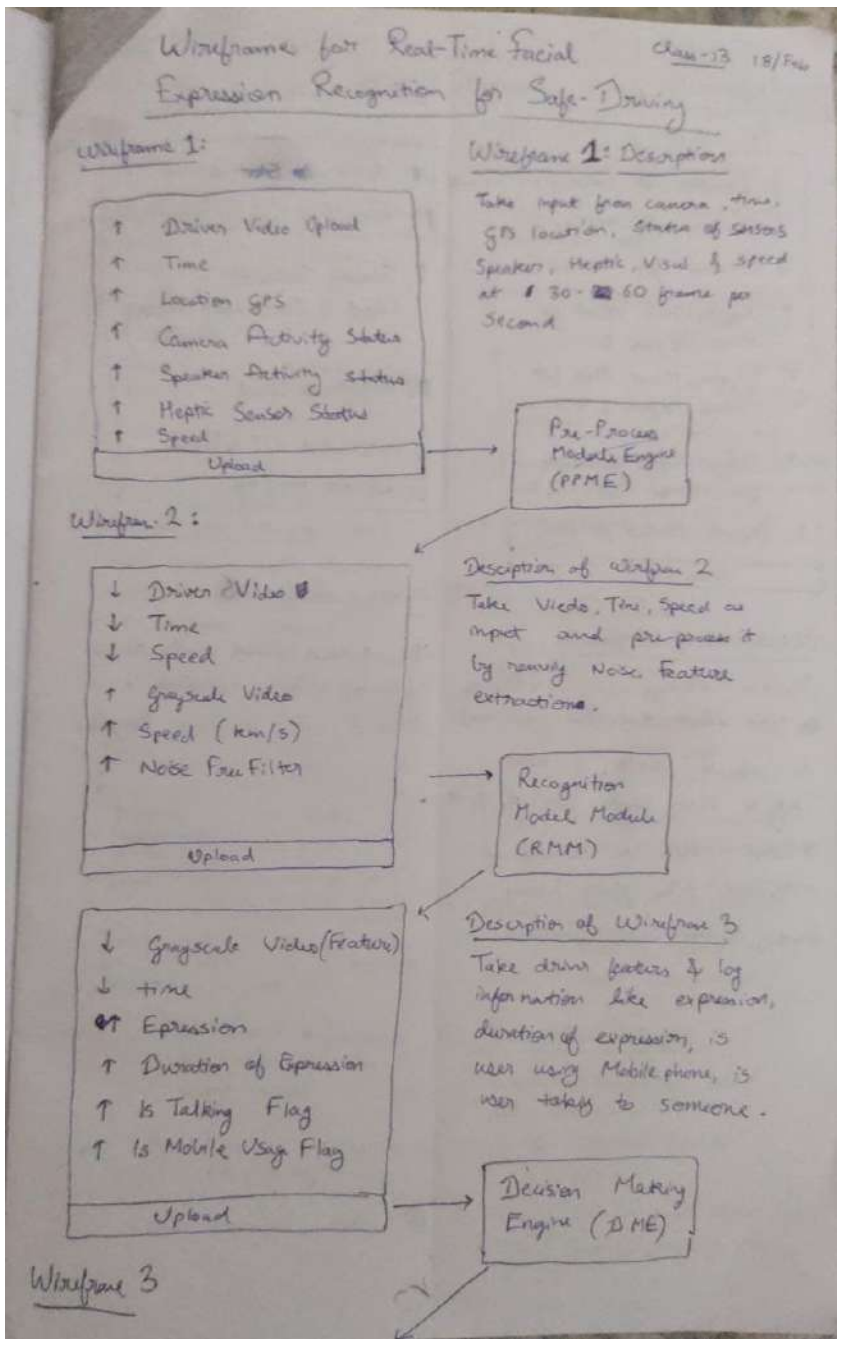
Sno	Stakeholder	Human Factors

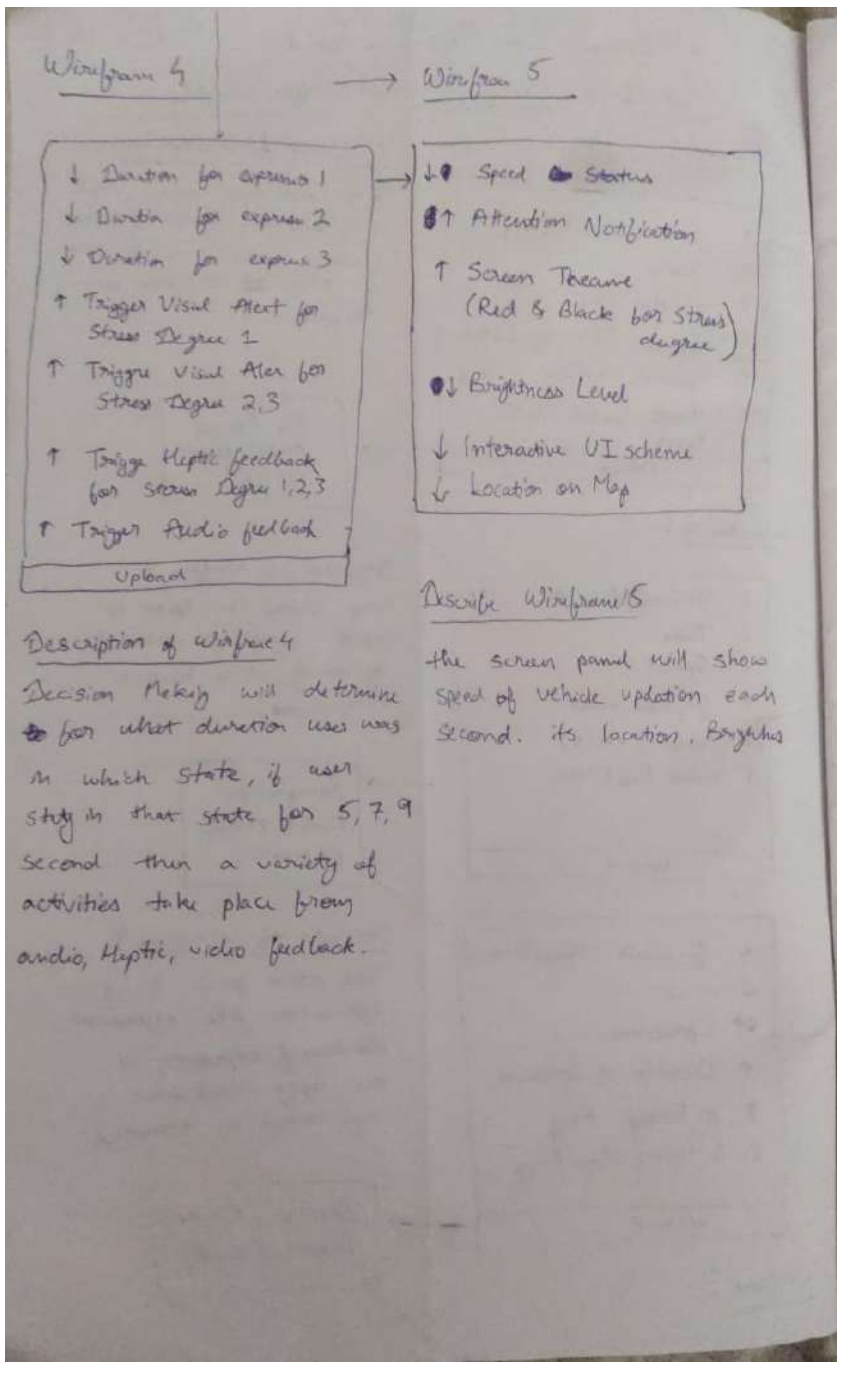
Sno	Stakeholder	Human Factors
1	Driver	include their physical abilities, such as vision or mobility impairments, and their cognitive abilities, such as language or literacy barriers. Designing software that is accessible and easy to use for a wide range of users can improve user satisfaction and adoption.
2	Management	include their leadership style, communication skills, and ability to manage and motivate their teams effectively. Effective leadership can help to ensure that the project is completed on time and within budget, while also fostering a positive team culture.
3	Development Team	their working conditions, such as ergonomic workstations and appropriate lighting, and their communication and collaboration skills. Building a positive team culture that fosters collaboration and effective communication can improve productivity and the quality of the final product.
4	Quality Assurance	include their attention to detail and ability to remain focused and objective while testing the software. Providing adequate training and support for the quality assurance team can help to ensure that they are able to effectively identify and report potential issues or bugs.
5	Business Analysts	include their ability to understand and communicate business requirements effectively, as well as their critical thinking and problem-solving skills. Providing appropriate training and support for business analysts can help to ensure that they are able to effectively translate business needs into technical requirements.
6	Marketing	their creativity, communication skills, and ability to understand and connect with the target audience. Providing appropriate resources and support for marketing can help to ensure that the software is effectively promoted and reaches its target audience.
7	Sales	communication skills, persuasiveness, and ability to build relationships with potential customers. Providing appropriate training and support for sales can help to ensure that they are able to effectively communicate the features and benefits of the software to potential customers.
8	Support	their communication skills, problem-solving abilities, and ability to remain calm and patient while dealing with frustrated or upset customers. Providing appropriate training and support for support staff can help to ensure that they are able to effectively troubleshoot and resolve customer issues.
9	Partners/Suppliers	their communication skills, ability to manage their own resources effectively, and willingness to collaborate with the development team. Building positive relationships with partners and suppliers can help to ensure that the project runs smoothly and that all necessary resources are available when needed.
10	Regulators	their communication skills, understanding of the regulatory environment, and ability to provide feedback and guidance effectively. Building positive relationships with regulators can help to ensure that the project meets all necessary compliance requirements.
11	Investors	their risk tolerance, communication skills, and ability to provide funding and support as needed. Building positive relationships with investors can help to ensure that the project is adequately funded and that the team is able to focus on completing the project successfully.

4. Wire Framing and Functionalities of all stakeholders

Take Input WebCam Feed	**Pre-Process**	**Feed to Recognition Model**	**Decision Making Engine**	**Visual/Heptic/Audio Feedback**

Wireframe





Functionalities

1. **Customers/Users/Driver**
   - A user-friendly interface that is accessible to a wide range of users, including those with disabilities.
   - A feature to track the driver's emotional state and provide appropriate feedback in real-time, such as audio or haptic alerts.
   - Customizable settings that allow users to tailor the feedback to their specific preferences and needs.
   - A feature that logs and tracks data on the driver's emotions over time, which can be used to identify patterns or potential issues.
2. **Management**
   - A dashboard that provides real-time updates on project progress, including metrics such as milestones, deadlines, and budget.
   - A feature that allows managers to assign tasks and track progress for individual team members.
   - Collaboration tools that allow team members to communicate and work together effectively, such as a shared calendar or project management software.
   - Tools that provide insight into team performance and identify potential bottlenecks or areas for improvement.
3. **Development Team:**
   - An integrated development environment (IDE) that supports the programming languages and technologies used by the team.
   - Version control tools that allow team members to collaborate and manage changes to the codebase.

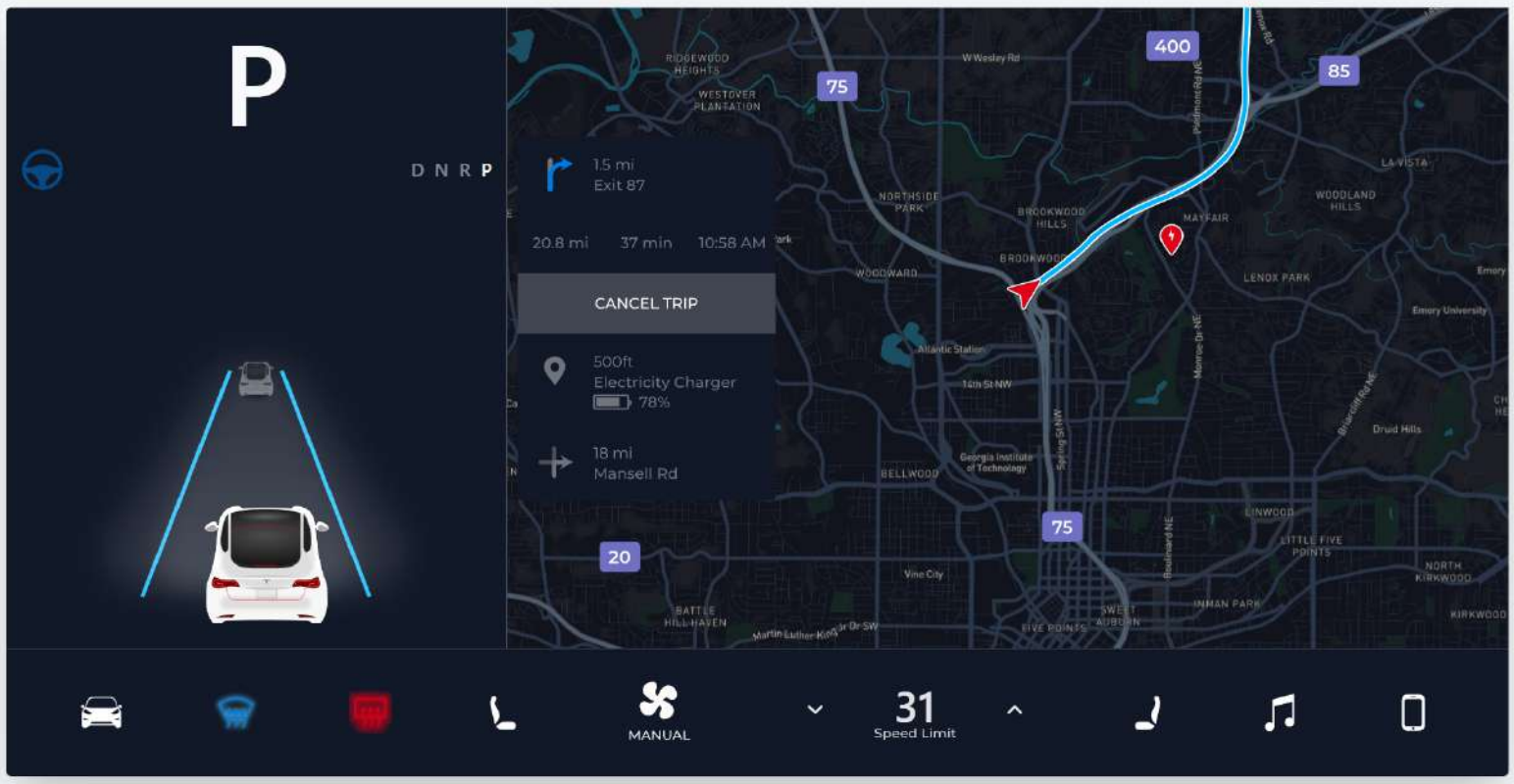
- Automated testing tools that can help to identify bugs or other issues early in the development process.
- Tools that provide insight into the performance of the application, such as response times and resource usage.

4. **Quality Assurance:**
   - A testing framework that allows for automated and manual testing of the application.
   - A bug tracking system that allows testers to report and track issues that are identified during testing.
   - Tools that provide insight into the performance of the application, such as load testing or stress testing.
   - Collaborative tools that allow testers to communicate and work effectively with other members of the team.
5. **Business Analysts:**
   - A system that allows business analysts to gather and document requirements, including use cases, user stories, and functional specifications.
   - Collaboration tools that allow business analysts to communicate and work effectively with other members of the team, such as developers or product owners.
   - Tools that provide insight into the performance of the application, such as user analytics or feedback data.
   - A dashboard that provides real-time updates on how the application is meeting business goals and KPIs.

5. 100% Demo Frontend Interface and Backend

Home Pannel: Menu Driven Graphics User Interface

1. Display Route
2. Search Route
3. Parking | Reverse | Nutral | Driving Status
4. Speed Limit (System Alert with audio when speed limit is reached)
5. AC control with Cool Air (blue icon) and Hot Air (red icon)
6. Music Icon To Play
7. Yawning (Visual + Audio Alert)
8. Detection of Phone (Visual + Audio Alert)
9. Drowsy (Visual + Audio Alert)



Audio + Visual Alert Yawning

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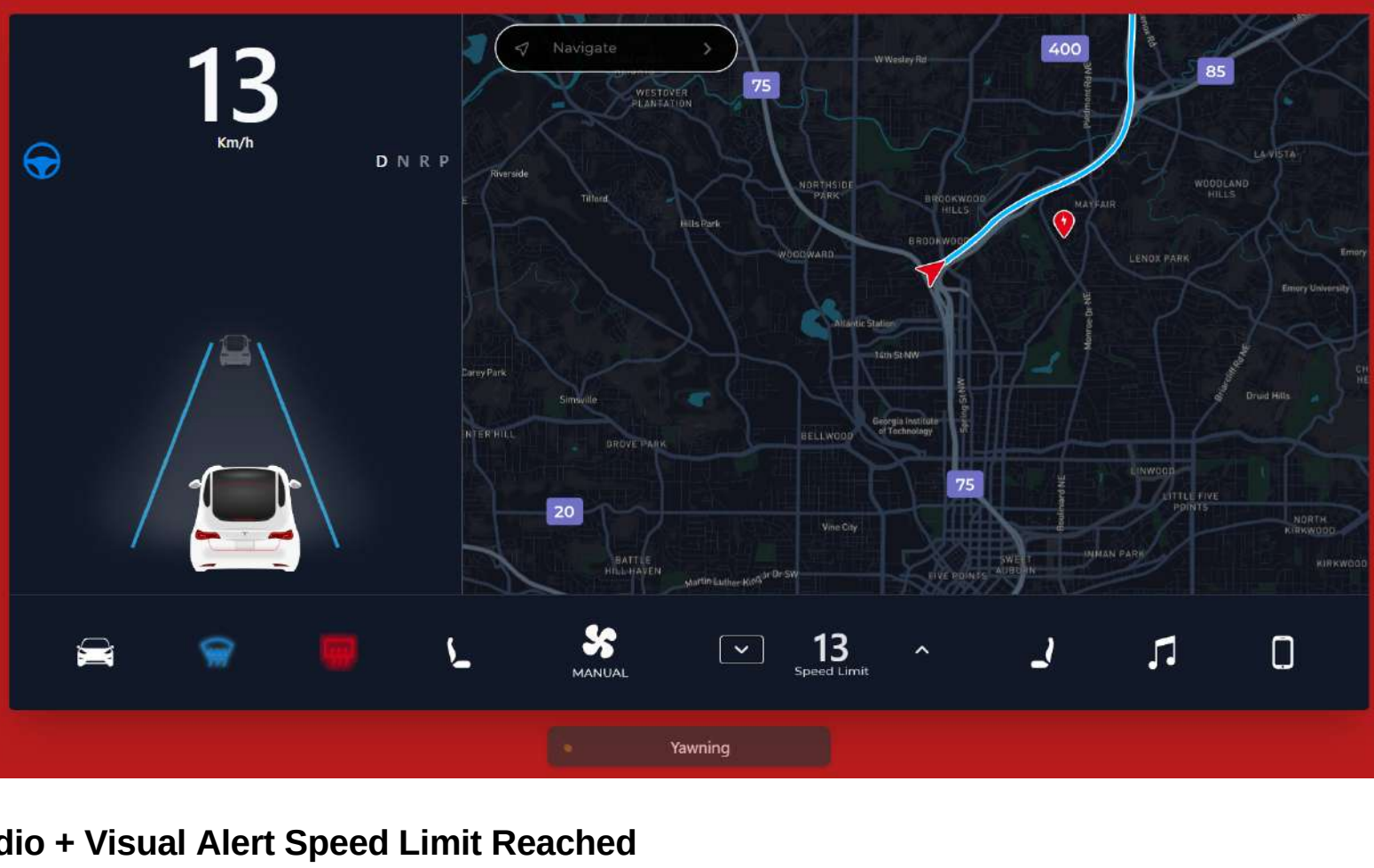
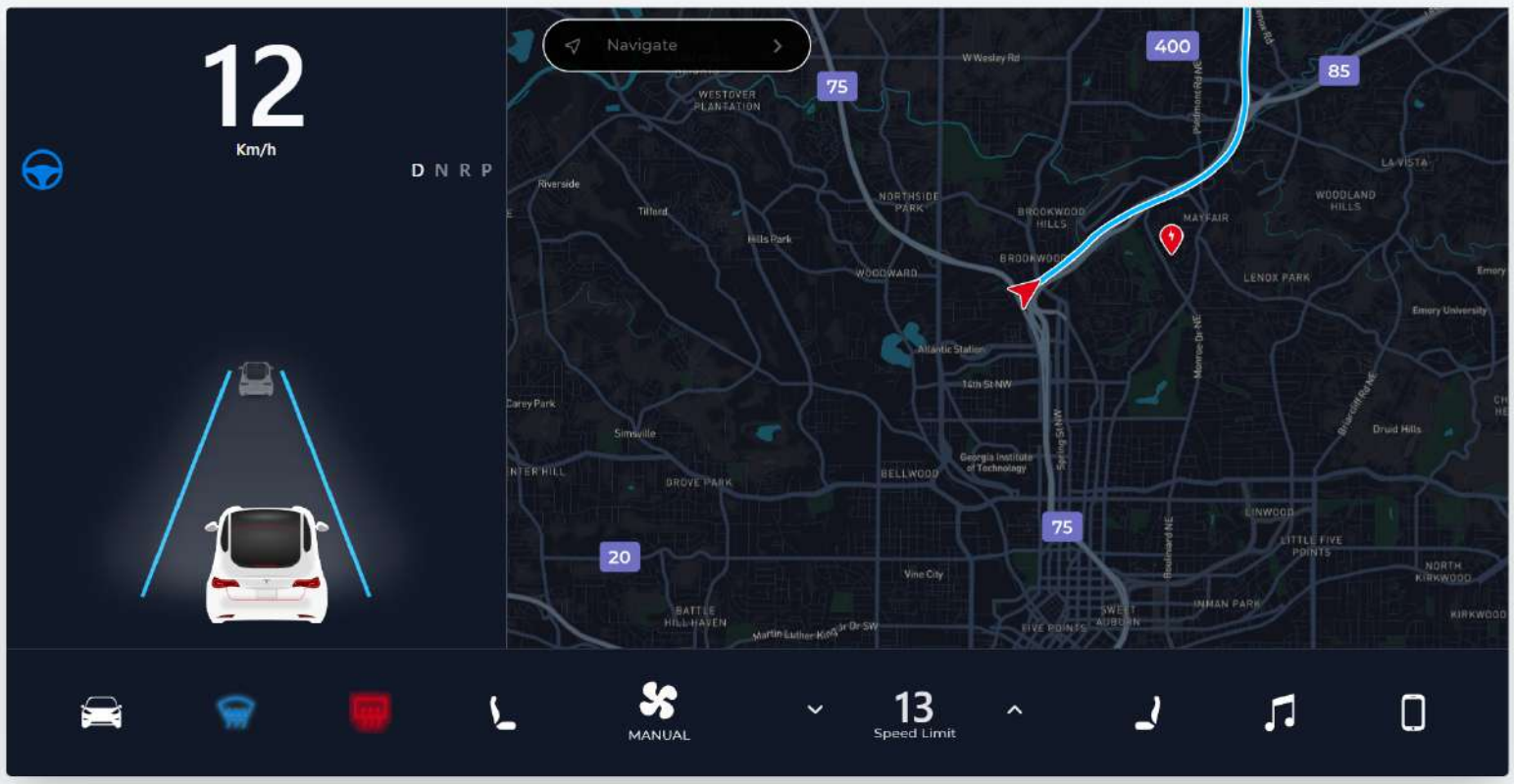


Audio + Visual Alert Speed Limit Reached



Audio + Visual Alert Drowsiness

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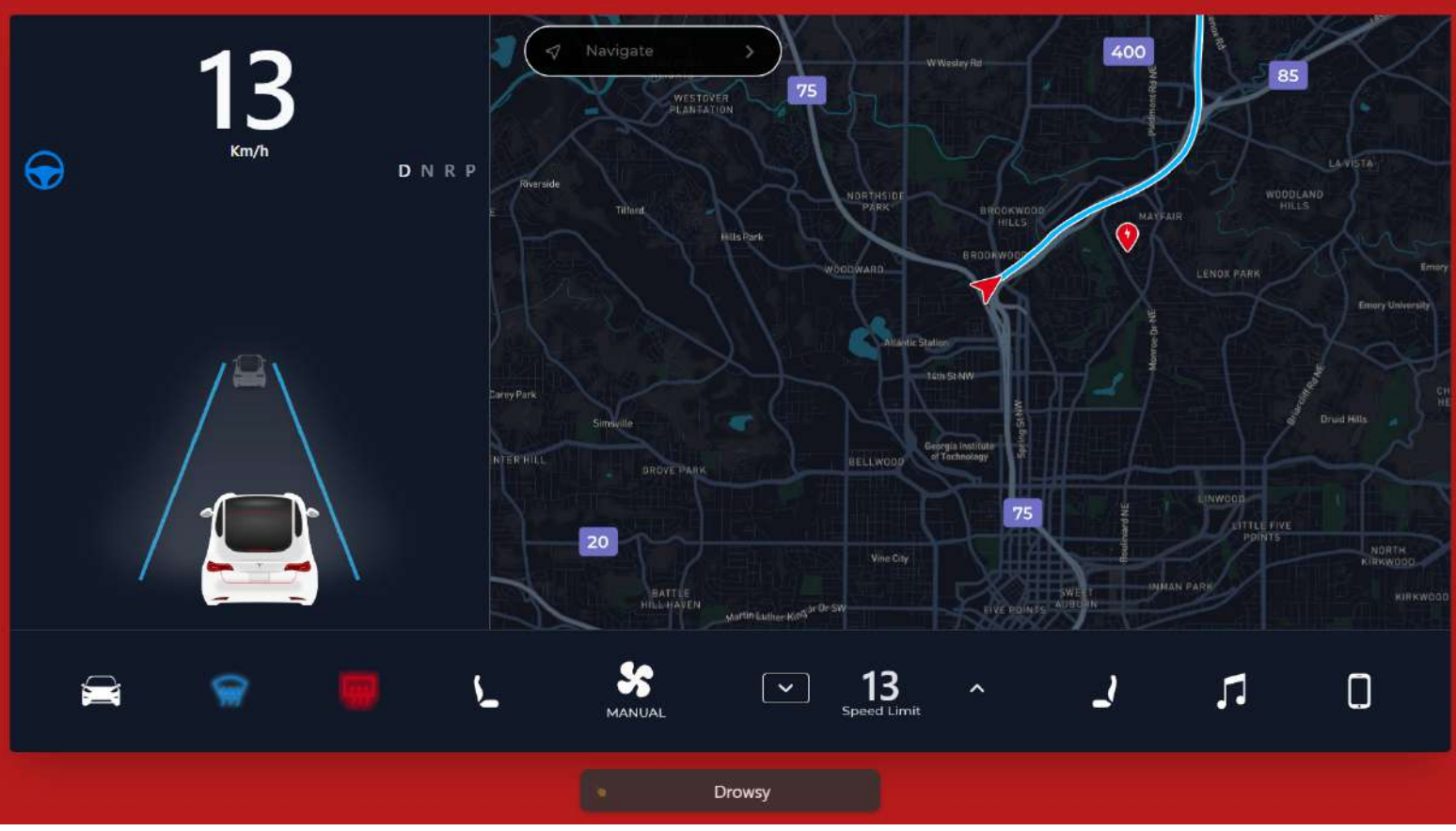

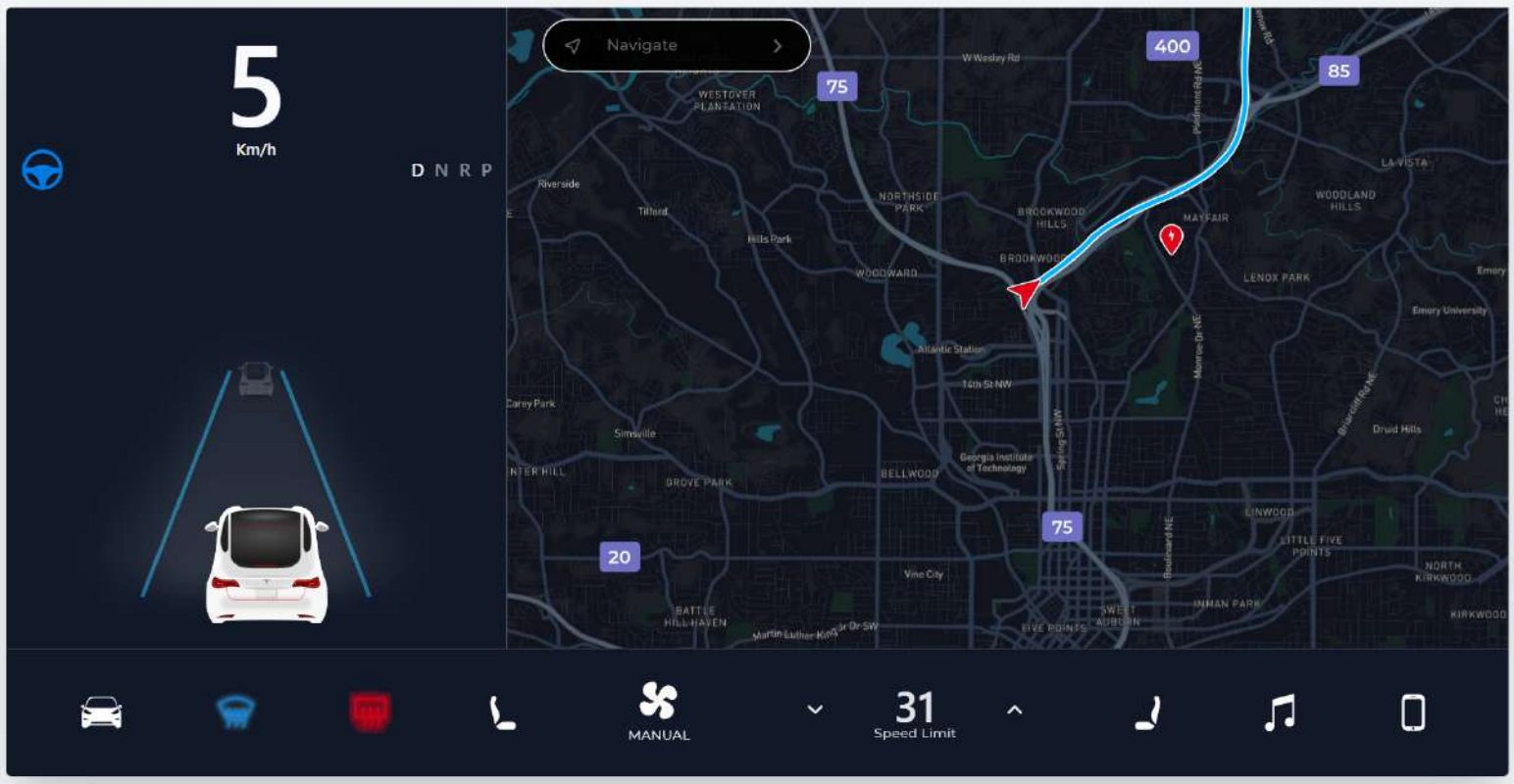

Audio + Visual Alert Phone Detected

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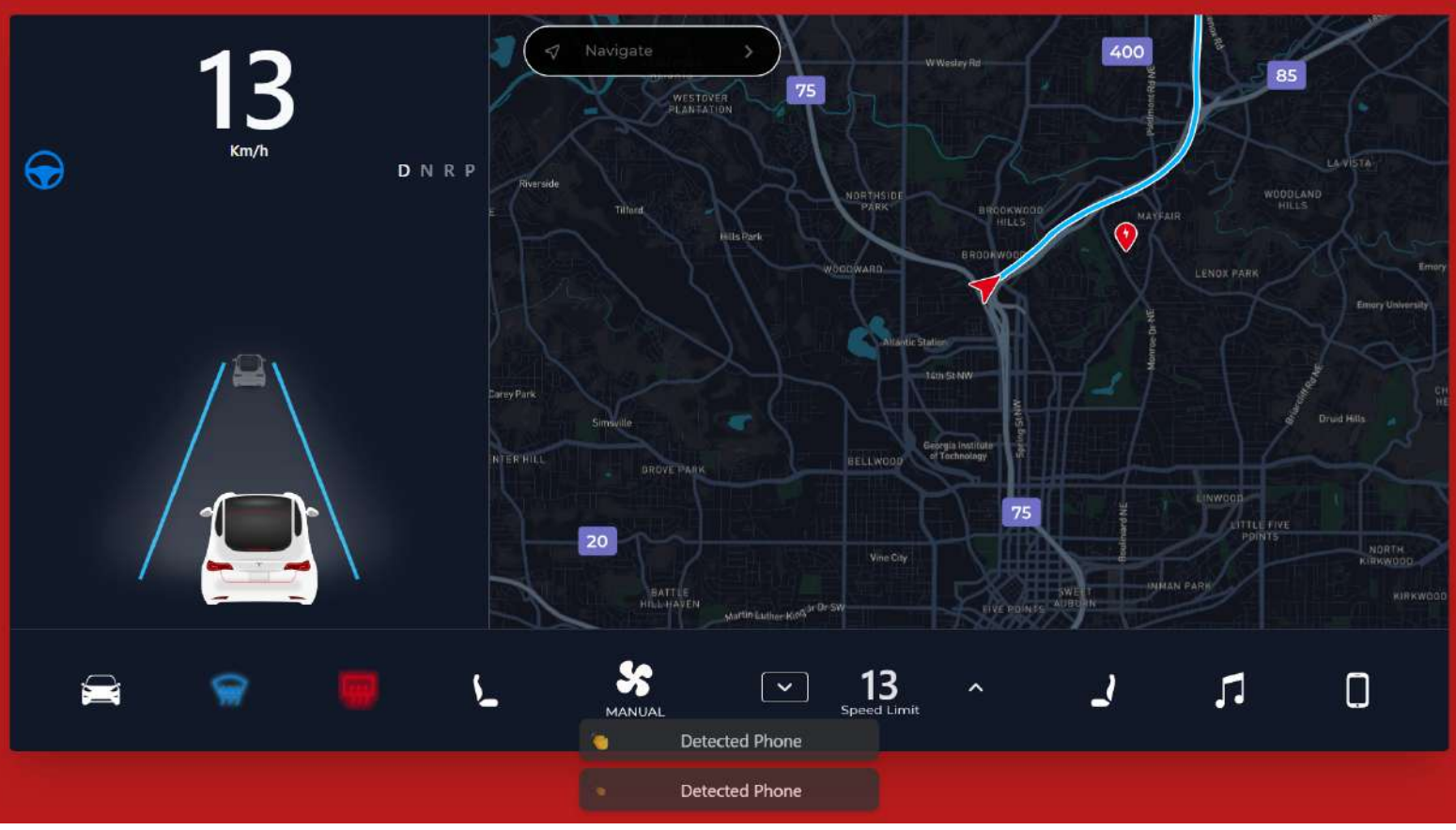


That sounds like a great approach to enhancing driver safety! Yawning detection, phone usage detection, and drowsiness detection are all important factors that can contribute to driver fatigue and distraction, which can lead to accidents on the road. By detecting these factors in real-time using a facial expression recognition system, you can provide timely alerts to the driver, such as visual or auditory alerts, to prevent accidents from occurring.

For yawning detection, you can use a combination of facial landmark detection and mouth region analysis to detect when the driver's mouth opens wider than a certain threshold. Similarly, for phone usage detection, you can use object detection algorithms to detect when the driver is holding a phone, and facial landmark detection to ensure that the driver is looking down at the phone for an extended period of time. For drowsiness detection, you can use a combination of facial landmark detection and eye region analysis to detect when the driver's eyes are closing or drooping, or when there is a significant decrease in the frequency of eye blinks.

Feedback

Visual feedback:

- Use bright, attention-grabbing colors, such as red or yellow, to draw the driver's attention.
- Display the feedback in a prominent location, such as the dashboard or windshield, so that it is easily visible to the driver.
- Use simple, easy-to-understand symbols or icons to indicate the type of hazard, such as a phone icon for phone usage, a yawn symbol for yawning detection, or an eye symbol for drowsiness detection.

Audible feedback:

- Use a clear, distinctive sound that is easily recognizable and not easily confused with other sounds in the car.
- Use a sound that gradually increases in volume and frequency to avoid startling the driver.
- Avoid using continuous sounds that may become annoying or distracting, such as beeping or buzzing sounds.

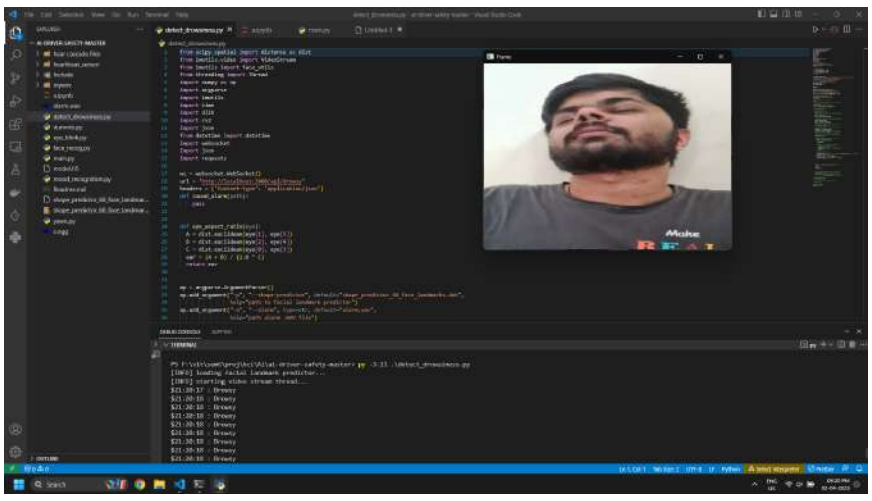
Haptic feedback:

- Use vibrations or pulses that are easily felt by the driver, such as on the steering wheel or seat.
- Use a pattern of vibrations or pulses that corresponds to the type of hazard detected, such as a single pulse for yawning detection, a double pulse for phone usage detection, and a triple pulse for drowsiness detection.
- Use a strength of vibration or pulse that is strong enough to get the driver's attention, but not so strong as to be uncomfortable or distracting.

Emotion Detection with Screenshots Backend

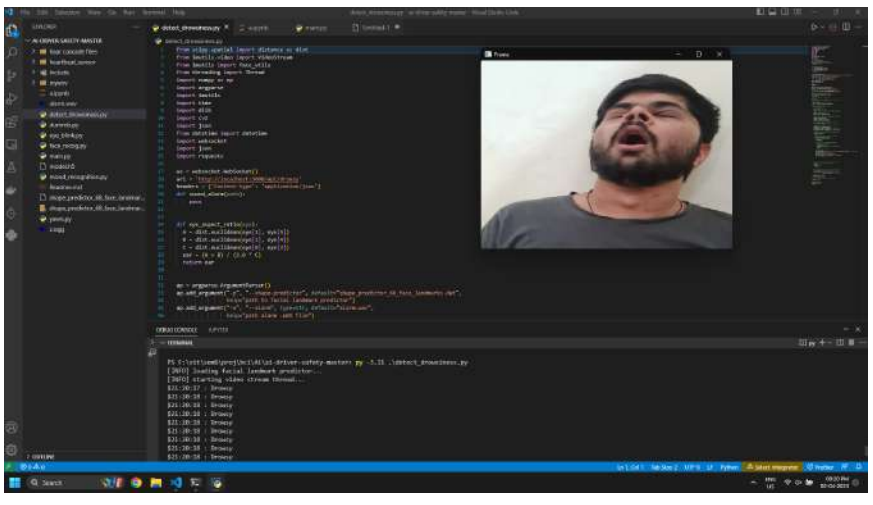
1. Drowsiness:

- Visual feedback: Use a bright, attention-grabbing color, such as red or yellow, to indicate drowsiness. Display an eye symbol on the dashboard or windshield.
- Audible feedback: Use a gentle chime or bell that gradually increases in volume and frequency to wake up the driver without startling them.
- Haptic feedback: Use a vibration that starts off mild and gradually becomes stronger, such as a slow, steady pulse on the seat or steering wheel.



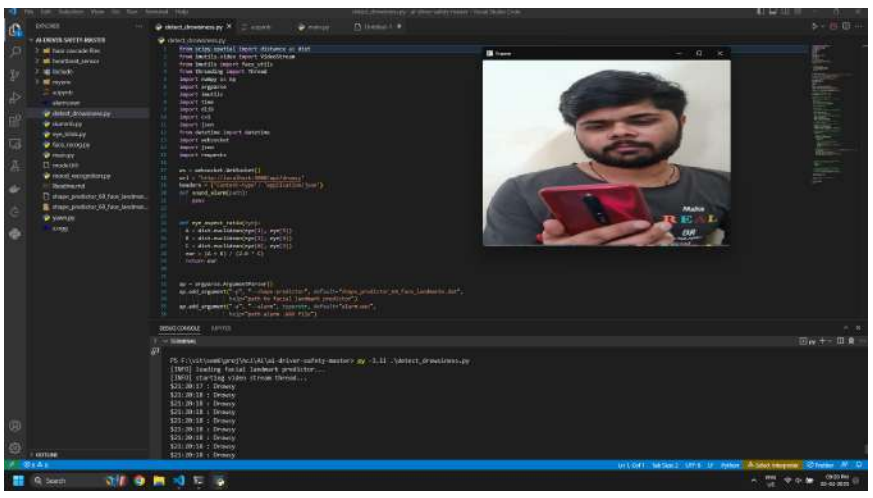
2. Yawning:

- Visual feedback: Use a bright, attention-grabbing color, such as red or yellow, to indicate yawning. Display a mouth symbol on the dashboard or windshield.
- Audible feedback: Use a brief beep or chime that gets the driver's attention without being too disruptive.
- Haptic feedback: Use a quick, strong vibration that jolts the driver out of their drowsiness, such as a sharp pulse on the seat or steering wheel.



3. Phone detection:

- Visual feedback: Use a bright, attention-grabbing color, such as red or yellow, to indicate phone usage. Display a phone symbol on the dashboard or windshield.
- Audible feedback: Use a voice alert that warns the driver to put down their phone, such as "Please hang up your phone and focus on the road."
- Haptic feedback: Use a series of quick, sharp vibrations that remind the driver to put down their phone, such as three quick pulses on the steering wheel.



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