DRIVER ASSISTANT SYSTEM

Leveraging an intelligent approach to road safety

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PROBLEM STATEMENT

Road traffic accidents continue to pose a significant threat to public safety globally, with millions of lives lost and injuries sustained each year. Existing road safety measures often lack real-time assistance to drivers, relying on reactive rather than proactive approaches to mitigate accident risks. The absence of effective Advanced Driver Assistance Systems (ADAS) exacerbates this problem, leaving drivers vulnerable to human errors, distractions, and fatigue, which contribute to a substantial portion of road accidents. Therefore, the pressing need exists to develop and implement comprehensive ADAS solutions that leverage advanced technologies to provide proactive assistance and enhance road safety for all road users.

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EXISTING SOLUTIONS

Existing solutions to road safety issues predominantly rely on reactive measures such as speed limits, traffic signs, and penalties for violations. While these measures play a crucial role in promoting safe driving behaviour, they often fail to address the underlying causes of accidents or provide proactive assistance to drivers in critical situations.

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OUR SOLUTION

- Enhancing Road Safety: Developed ADAS to proactively address road safety concerns and mitigate the incidence of accidents.
- Cutting-edge Technology: Utilize cutting-edge technologies such as computer vision, machine learning and sensor integrations to develop and integrate various modules within the ADAS system.
- Comprehensive Modules: Implement modules including drowsiness detection, lane detection, collision warning, object detection, and lane-keeping assistance to provide real-time assistance and enhance driver safety.
- Testing and Evaluation: Ensure the reliability and effectiveness of each module through rigorous testing and evaluation in controlled environments and real-world driving scenarios.

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OVERVIEW OF PROJECT OBJECTIVES

1. Develop and integrate various modules within the ADAS system.
2. Ensure the reliability and effectiveness of each module through rigorous testing and evaluation.
3. Implement proactive safety measures to mitigate accident risks and enhance road safety for all road users.

OVERVIEW OF THE MODULES IN THE PROJECT

1. Drowsiness Detection – using face landmarks
2. Lane Detection – Ultrafast Lane Detector v2
3. Collision Warning – Computer Vision and distance measurement
4. Object Detection and Recognition – YOLOv8
5. Lane Departure Warning and Lane Keeping Assistance - Ultrafast deep lane detection with hybrid anchor drive ordinal classification

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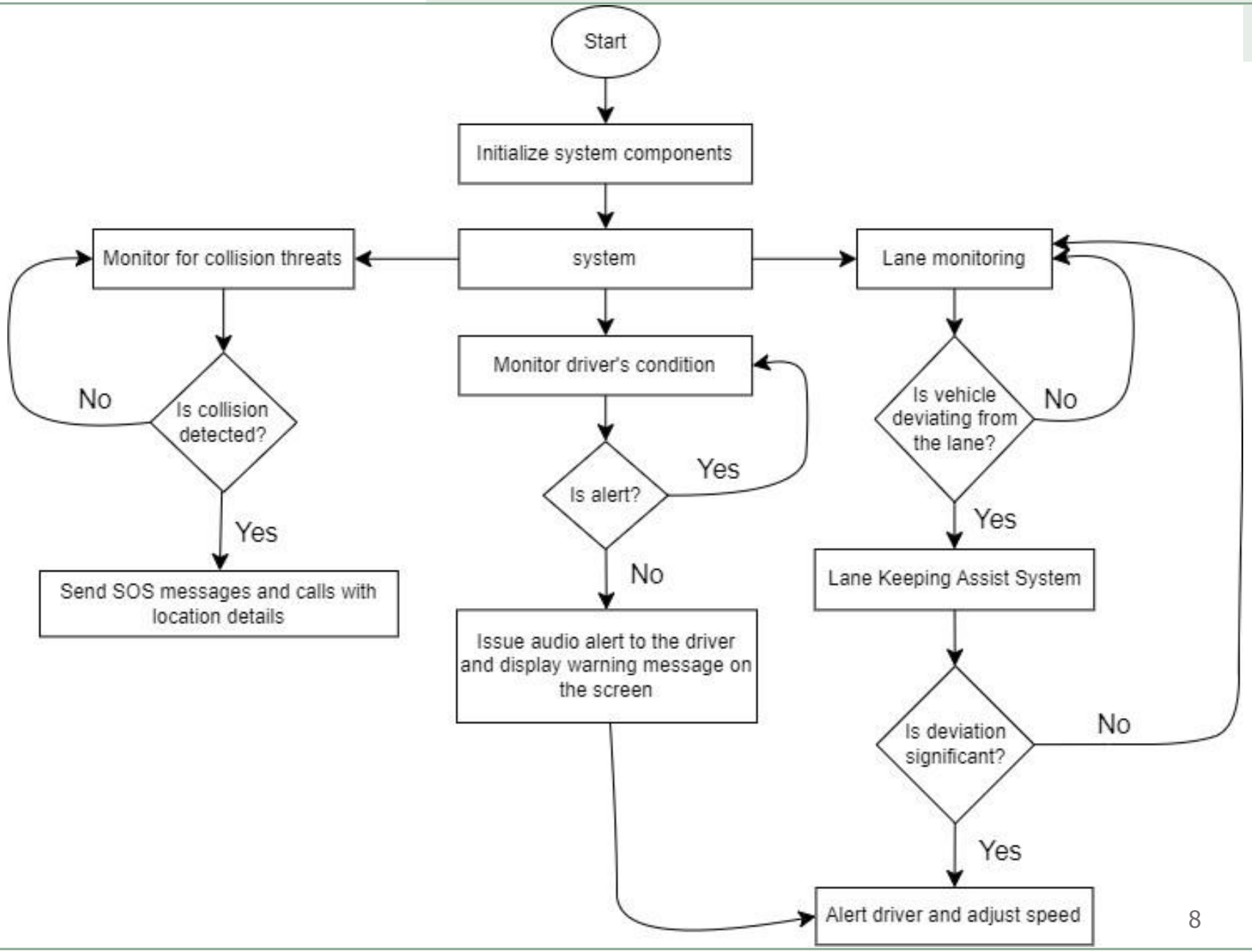
WORKING OF THE SYSTEM



TECH STACK USED

HARDWARE COMPONENTS

- Jetson Orin Nano
- Raspberry Pi Camera Module 3
- ADXL-345 Accelerometer
- Arduino Nano
- GSM SIM800I Module
- GSM Neo-6m Module
- LM2596 Step-down Converter

DEVELOPMENT ENVIRONMENT

- Visual Studio
- Arduino IDE
- Terminal Emulators

LAPTOP SPECIFICATIONS

- Apple M1 chip
- 8-core GPU
- 8-core CPU
- 256 GB SSD +8 GB RAM
- 16-core neural engine

SOFTWARE DEPENDENCIES

- Jetson Orin Nano SDK
- Python
- OpenCV
- Scikit-learn
- onnxruntime
- pycuda
- PyTorch
- Dlib
- SIM800I GSM Module Library
- NeoGPS Library

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RESULTS AND ANALYSIS

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DROWSINESS DETECTION

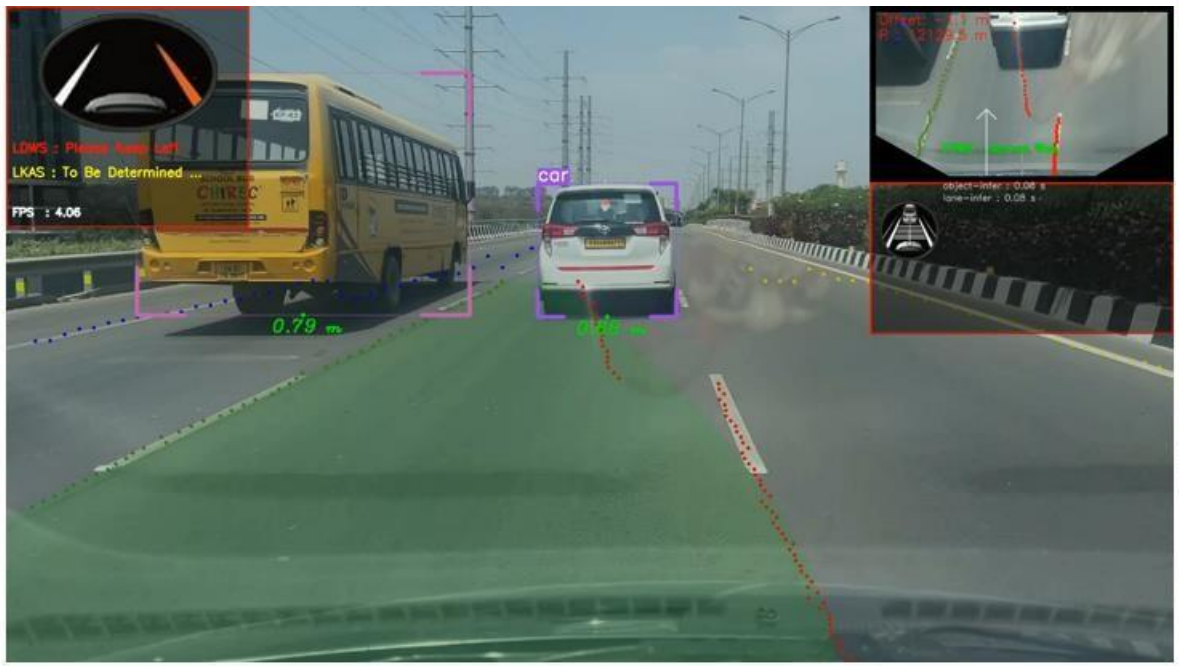

DROWSINESS ALERT!
E.A.R: 0.16


E.A.R: 0.34

REAL-TIME VIDEO STREAMING OUTPUTS

Lane Keeping Assist System showing a gentle right curve ahead

Lane departure and lane keeping system showing acceptable parameters with less chances of collision



Lane Departure System giving a warning to keep left

Lane keeping assist system determining its path

Lane departure system, lane keeping system, and collision warning system showing negative parameters

SWOT ANALYSIS

Strengths:

Proactive Safety Measures: Reduce reaction time.

Real-time Decision Making: Enhance accident prevention.

Weaknesses:

Dependency on Technology: System failures may lead to accidents.

Potential False Positives/Negatives: Algorithm inaccuracies.

Opportunities:

Integration with Autonomous Vehicles: Collaborative safety measures.

Continuous Technological Advancements: Regular updates for improved performance.

Threats:

Cybersecurity Risks: Potential hacking and misuse.

Public Resistance: Lack of trust in autonomous systems.

FUTURE SCOPE FOR INNOVATION

1. Integration with Autonomous Vehicles (AVs)
2. Vehicle-to-Vehicle Communication (V2V)
3. Cybersecurity and Privacy
4. User Interface Design
5. Integration with Cyber Physical Systems

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Thank you