DRIVING ASSISTANCE SYSTEM

(HasDAS)

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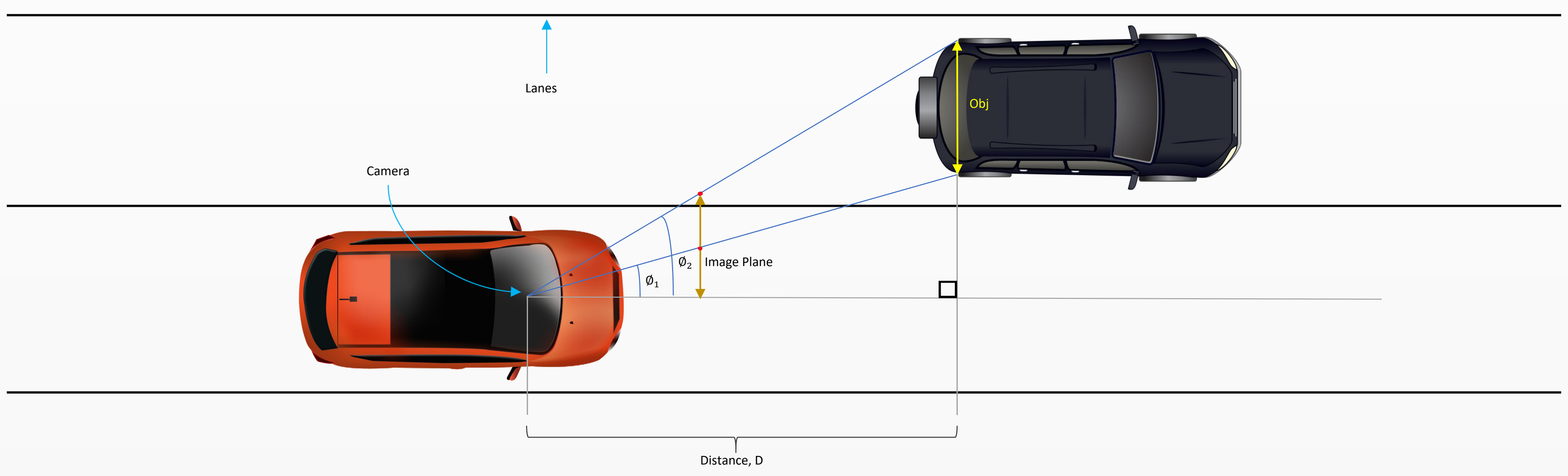
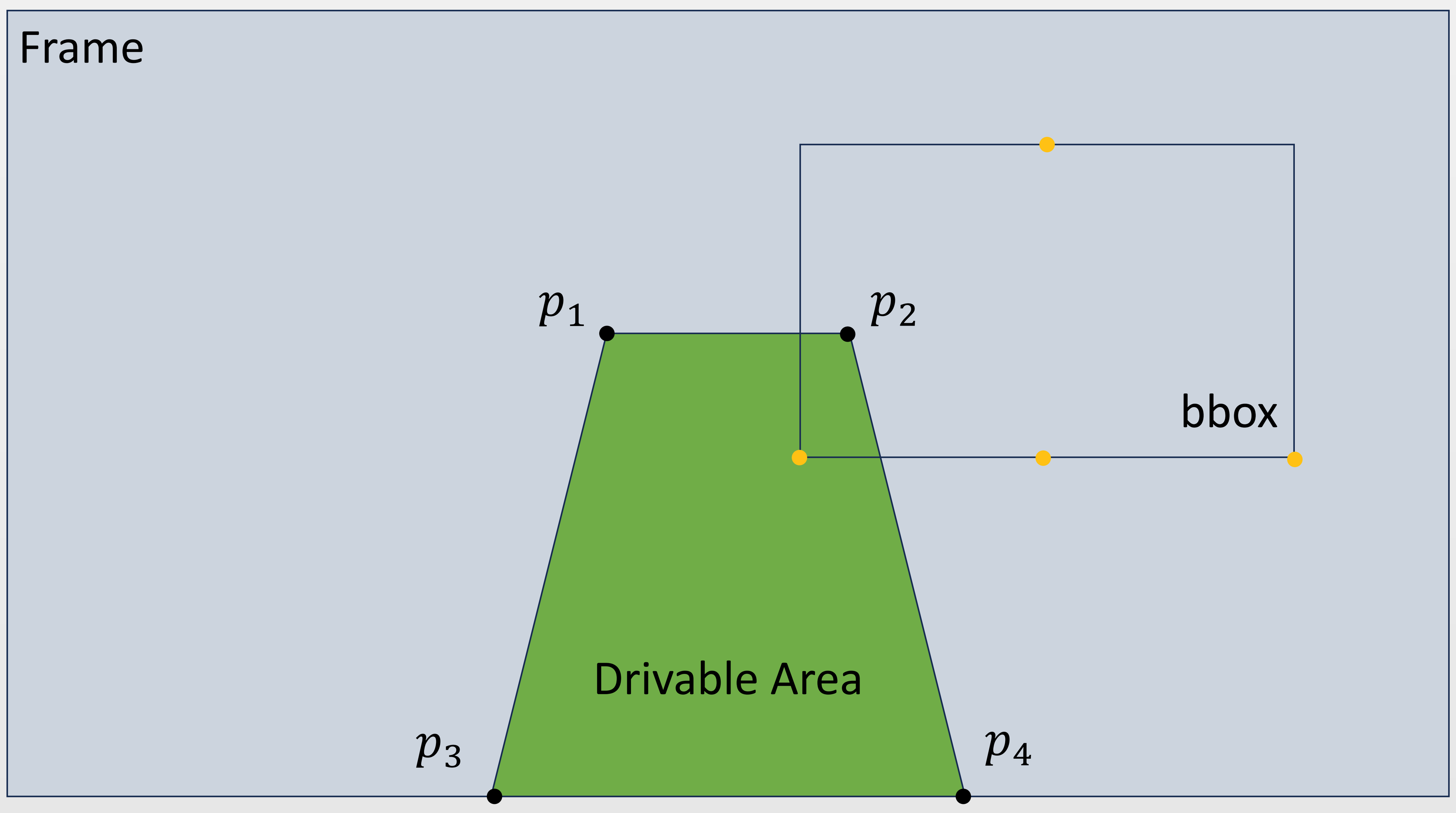
Introduction

- The project aims to develop an advanced driver assistance system, focusing on enhancing driving safety and efficiency through the integration of multiple key features.
- These include collision warning, fatigue detection, lane detection, and sign classification modules. The system leverages deep learning models for object detection and classification, ensuring robust performance in real time driving scenarios.



Specifications and Design Requirements

- The system is built around the NVIDIA Jetson Nano, selected for its GPU acceleration, affordability, and support from the developer community.
- The hardware setup includes dual cameras—one facing inward to monitor the driver and one outward for environmental detection. Additional sensors like the TFmini micro-LIDAR module provide depth data for accurate distance measurement.
- The software stack comprises various Python libraries, including OpenCV, dlib, and TensorRT, to handle tasks such as object detection, depth estimation, fatigue monitoring, and lane detection. The system also features a user interface for configuration and control.

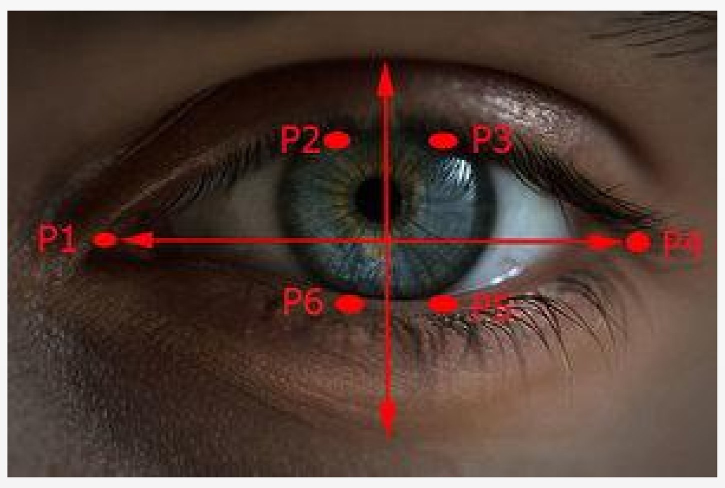


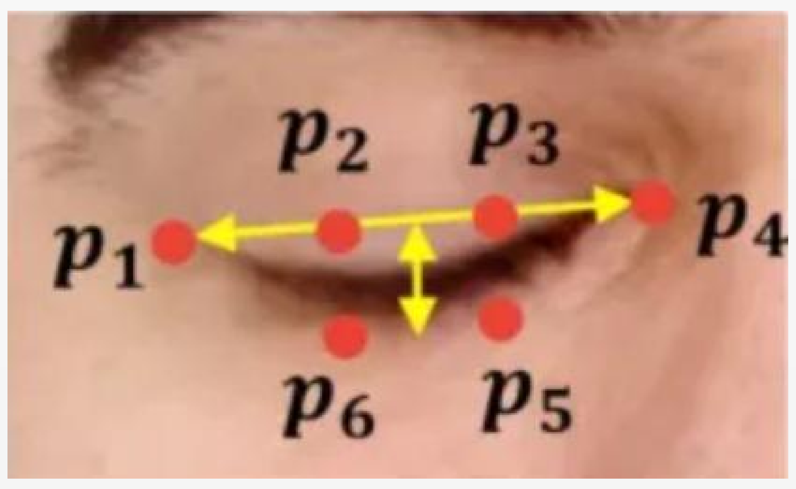
Solution Methodology

- **Collision Warning System:** Utilizes SSD-Mobilenet-v2 and DashCamNet models. Detects objects in real-time and generates alerts if they pose a collision risk. Configurable drivable area based on speed and lane curvature.
- **Fatigue Detection:** Employs the Eye Aspect Ratio (EAR) technique. Uses dlib to detect facial landmarks and calculate EAR. Issues visual and audio alerts upon detecting signs of fatigue.
- **Lane Detection:** Implements edge detection and lane model solving techniques. Uses Kalman filtering for improved accuracy. Adapts to various driving conditions, including low light and complex traffic.

Application Areas

- Driver-Assistance Systems represent a growing range of technologies designed to improve safety and comfort behind the wheel. These systems utilize a combination of sensors, cameras, and software algorithms to monitor the vehicle's surroundings, driver behavior, and road conditions.
- By providing real-time feedback and even taking corrective actions in some cases, DAS can significantly reduce the risk of accidents and make driving a more effortless experience. Some key application areas within DAS include collision warning systems that detect potential hazards, fatigue detection systems that monitor driver alertness, and lane detection systems that prevent unintentional lane departures. These systems work together to create a safer and more enjoyable driving experience for everyone on the road.





$$EAR = \frac{\|P_2 - P_6\| + \|P_3 - P_5\|}{2\|P_1 - P_4\|}$$

$$EAR = 0$$

Results and Discussion

- **Collision Warning Performance:** The SSD-Mobilenet-v2 model achieves 25 fps with nearly 100% GPU usage, indicating real-time detection. NVIDIA benchmarks show it can reach 39 fps on a Jetson Nano with a specific dataset, suggesting potential for higher performance with optimized training. The DashCamNet model delivers 17 fps with 80% accuracy, also at full GPU capacity. SSD-Mobilenet-v2 appears to offer better detection performance and higher fps compared to DashCamNet.
- **Fatigue Detection Performance:** Successfully detects driver fatigue using the EAR technique. Real-world testing needed to optimize threshold values and validate effectiveness.
- **Lane Detection Performance:** We tried several algorithms, but they did not work properley in real life scenario.

References

- “DashCamNet | NVIDIA NGC,” NVIDIA NGC Catalog.
- A. Alami, “Aeidle/EAR-Fatigue-Detection,” GitHub, Mar. 01, 2024. https://github.com/Aeidle/EAR-Fatigue-Detection
- D. Franklin, “Deploying Deep Learning,” GitHub, Jun. 12, 2022. https://github.com/dusty-nv/jetson-inference

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