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## Automated Driver Drowsiness Detection Using Eye Aspect Ratio (EAR) with Integrated Alert and Penalty Management

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Abstract: Driver fatigue is a major issue that leads to accidents around the world, causing serious injuries and even deaths. In this project, we introduce a real-time system that monitors drivers and enforces safety measures. This system detects drowsiness by analyzing the Eye Aspect Ratio (AER) and includes an automated alert and fine management system, inspired by the Auto Bazaar enforcement model. Our technology uses computer vision to track the driver's eye movements with a regular camera. We extract facial landmarks around the eyes using advanced deep learning tools like Dlib and OpenCV. The AER is calculated in real time to keep an eye on eye closure and blinking. If the AER drops below a certain level for too long, indicating that the driver is getting sleepy, the system sends out an audio alert to help the driver stay focused. To ensure safety, we also have a backend module that keeps track of repeated drowsiness incidents. If a driver ignores multiple alerts, the system creates a digital record and can issue a fine or warning, mimicking an automatic enforcement process. This module allows for realtime payments, penalty tracking, and syncing data with a central traffic database, so authorities can act without needing physical checkpoints. Additionally, the system features a "smart alert" module that adjusts the sound and message based on how the driver responds, making sure alerts are effective but not too annoying. Our approach combines simple geometric analysis (AER) with smart enforcement methods, offering a cost-effective, camera-based solution that requires minimal hardware and can be used in both personal and commercial vehicles.

**Keywords**: Driver Drowsiness Detection, Eye Aspect Ratio (AER), Real-Time Vision, Automated Alert System, Fine Payment Integration

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