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Smart Driving Assistant: Real-time Safety Distance and RPM Guidance

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Abstract
This study presents the design and implementation of a novel vehicle safety system leveraging an ESP32 microcontroller and an array of environmental and motion sensors to dynamically calculate and display optimal following distances. Addressing critical factors influencing braking performance, the device integrates real-time data on vehicle speed, ambient temperature, and humidity to provide an adaptive safety margin, thereby significantly enhancing road safety. Furthermore, for vehicles equipped with manual transmissions, the system incorporates a unique feature that calculates and suggests the optimal engine revolutions per minute (RPM) for up-shifting, aiming to improve fuel efficiency and prolong engine life. This paper details the system architecture, sensor integration, algorithmic approach for distance and RPM calculations, and the practical implications for driver assistance and accident prevention. The developed prototype demonstrates a robust, cost-effective solution for enhancing driver awareness and optimizing vehicle operation under varying conditions. This project successfully integrates computational physics applied with driving assistant systems.
Keywords: Safety Distance, Braking Performance, Microcontroller, Sensors.

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