

Smart Drowsiness Detection for Safe Driving

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Abstract: *Driver drowsiness and fatigue are paramount contributors to major road traffic accidents globally, leading to catastrophic human casualties and substantial economic losses, particularly during nighttime driving and long-distance commercial freight transit. This paper presents the design, implementation, and experimental validation of an affordable, non-intrusive, and standalone hardware-based solution for real-time driver state monitoring. The proposed system utilizes an Arduino Nano prototyping platform integrated with an Infrared (IR) eye-blink sensor module and an audible alarm notification mechanism. By actively measuring infrared reflection variances from the ocular surface, the system differentiates regular, high-frequency biological blinking from prolonged eyelid closures associated with micro-sleep and onset fatigue. Experimental validations indicate that the firmware algorithm efficiently manages adaptive threshold comparison to trigger localized auditory warnings without imposing high computational loads or necessitating external, internet-dependent edge-computing infrastructure*

Keywords: Driver Drowsiness Detection, Arduino Nano, Eye Blink Sensor, ATmega328P, Infrared Photodiode, Traffic Safety Systems