



Drowsy Driving Detection and Prevention System for Steering Wheels

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Link to Our Video:

https://youtu.be/R6WRlym_yQI



Drowsy Driving



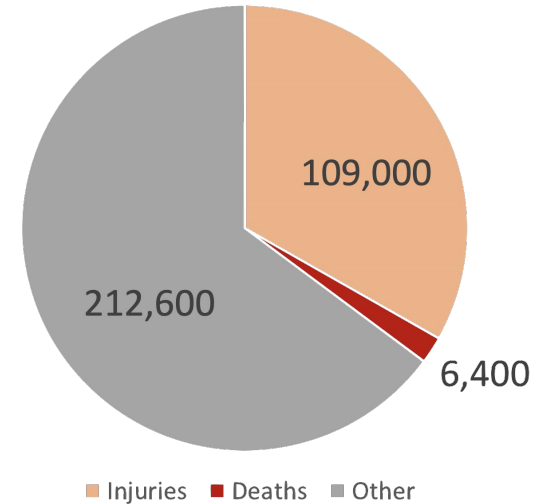
1 in 25

*Have fallen asleep at the wheel in the last 30 days*¹

Affects:

- Reaction Time
- Decision Making
- Attention²

Average Car Accidents per Year³



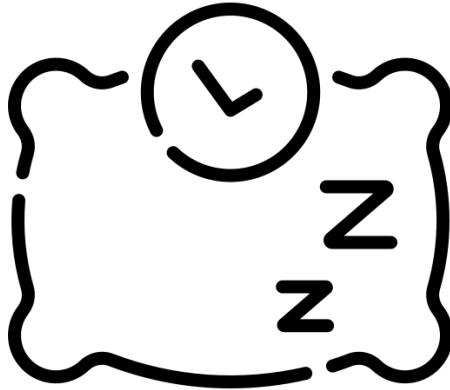
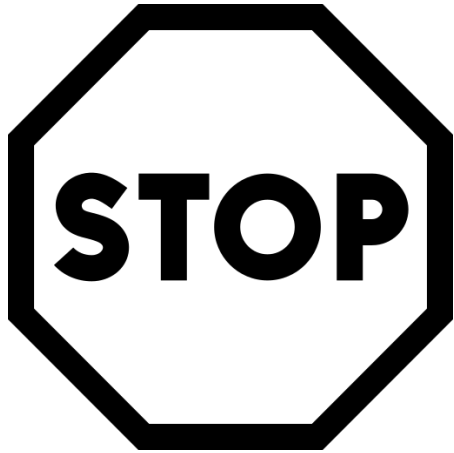
[1] Centers for Disease Control and Prevention, “Drowsy Driving: Asleep at the Wheel,” May 28, 2020. Available: <https://www.cdc.gov/sleep/features/drowsy-driving.html>

[2] NATIONAL SLEEP FOUNDATION, “Drowsy Driving Prevention Week, Drive Alert...Arrive Alive”, 2007. Available: <https://drowsydriving.org/wp-content/uploads/2009/10/DDPW-Drowsy-Driving-Facts.pdf>

[3] AAA Foundation for Traffic Safety, “Prevalence of Motor Vehicle Crashes Involving Drowsy Drivers, United States, 2009 – 2013”, November 2014.



Countermeasures⁴





Previous Systems

System	Pros	Cons	Closed-Loop?
PPG ⁵	Detect BP/HRV	Wear Device While Driving	No
PERCLOS ⁵	Most studied	False Negatives, Impractical	No
EDA ^{6,7}	Detect Arousal	Wear Device While Driving	No
EEG ⁸	Gold Standard	Impractical	No

[5] G. Li, W-Y. Chung, “Detection of Driver Drowsiness Using Wavelet Analysis of Heart Rate Variability and a Support Vector Machine Classifier”, December 2013.

[6] Malathi, D., Jayaseeli, J. D., Madhuri, S., & Senthilkumar, K. (2018). Electrodermal Activity Based Wearable Device for Drowsy Drivers. *Journal of Physics: Conference Series*, 1000, 012048. doi:10.1088/1742-6596/1000/1/012048

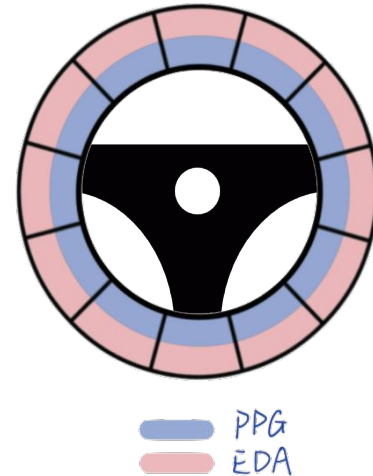
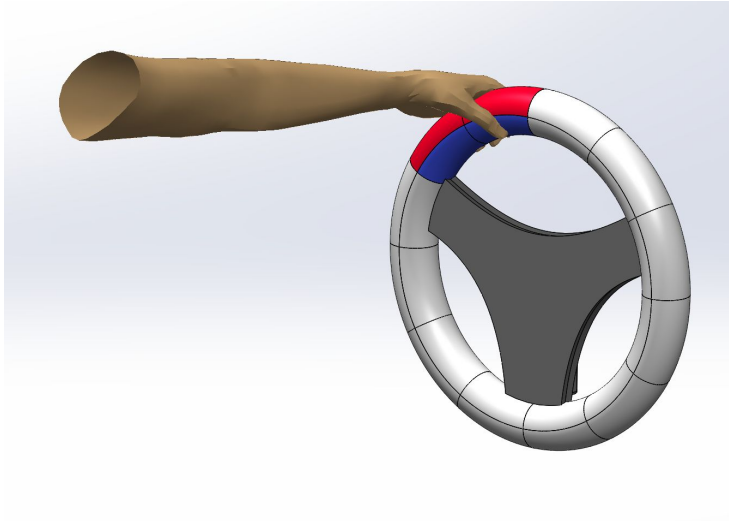
[7] Posada-Quintero, H. F., & Chon, K. H. (2020). Innovations in Electrodermal Activity Data Collection and Signal Processing: A Systematic Review. *Sensors*, 20(2), 479. doi:10.3390/s20020479

[8] Kar S, Bhagat M, Routray A, EEG signal analysis for the assessment and quantification of driver’s fatigue, Transportation Research Part F: Traffic Psychology and Behaviour, Volume 13, Issue 5, 2010, <https://doi.org/10.1016/j.trf.2010.06.006>.

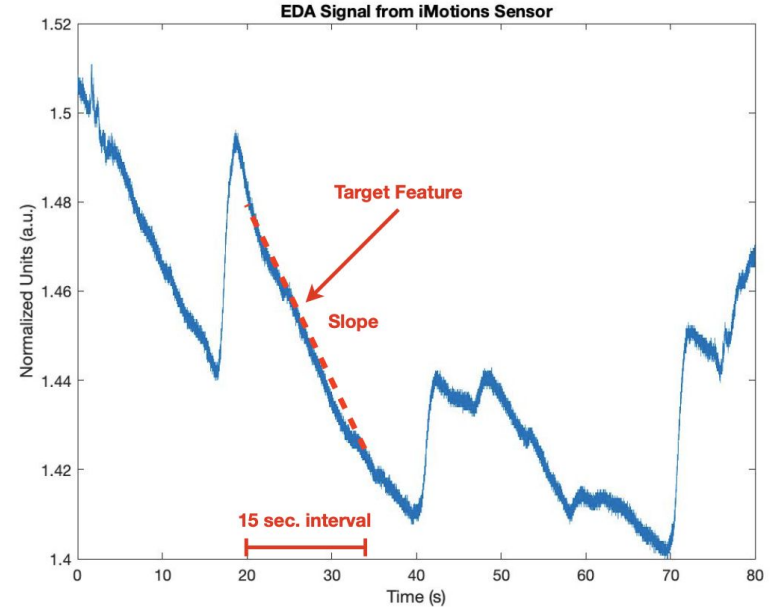
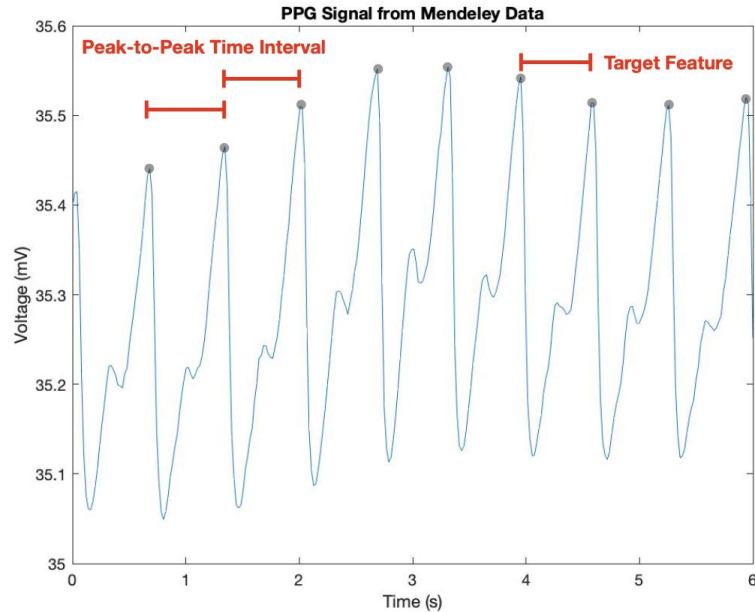


Our Idea

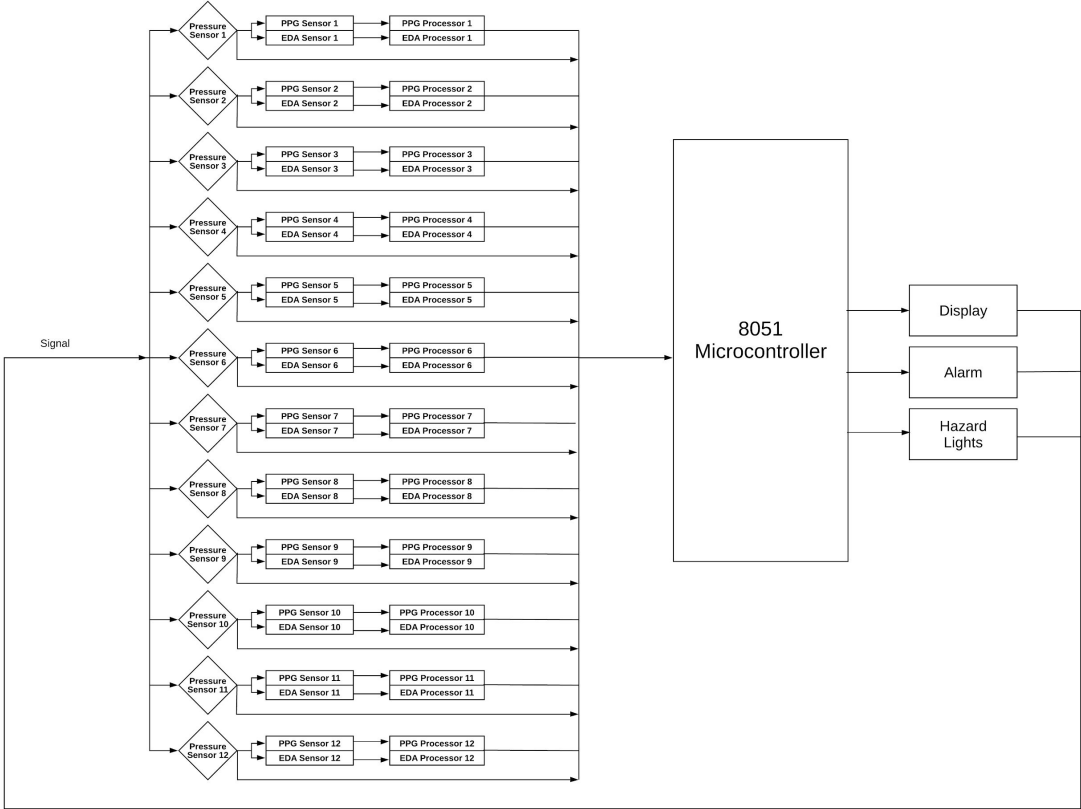
A closed-loop steering wheel design that can detect drowsiness from EDA and PPG signals to alert the driver and prevent accidents



Biosignals Chosen

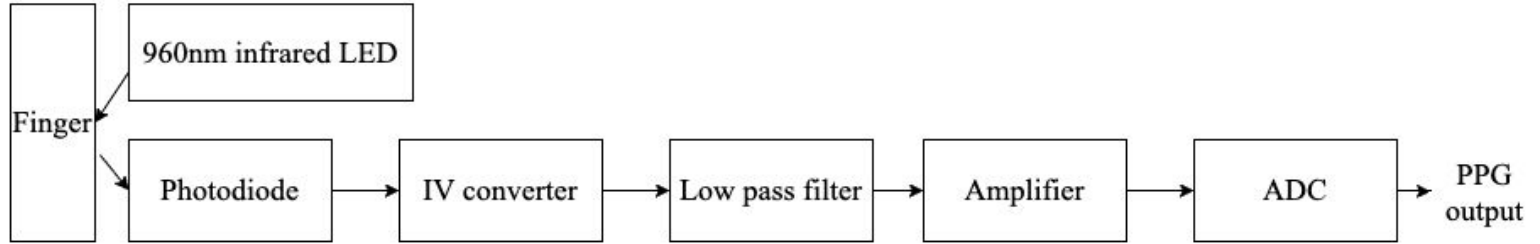


Overall Block Diagram

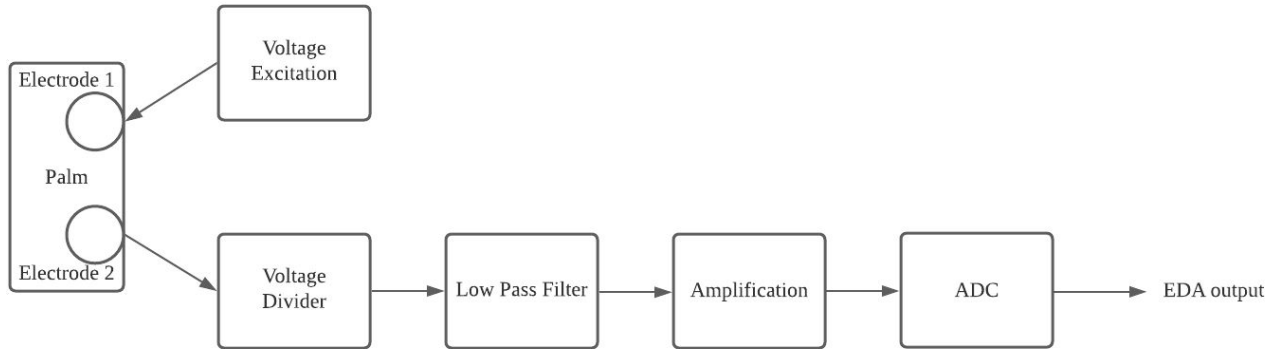


System - A Closer Look

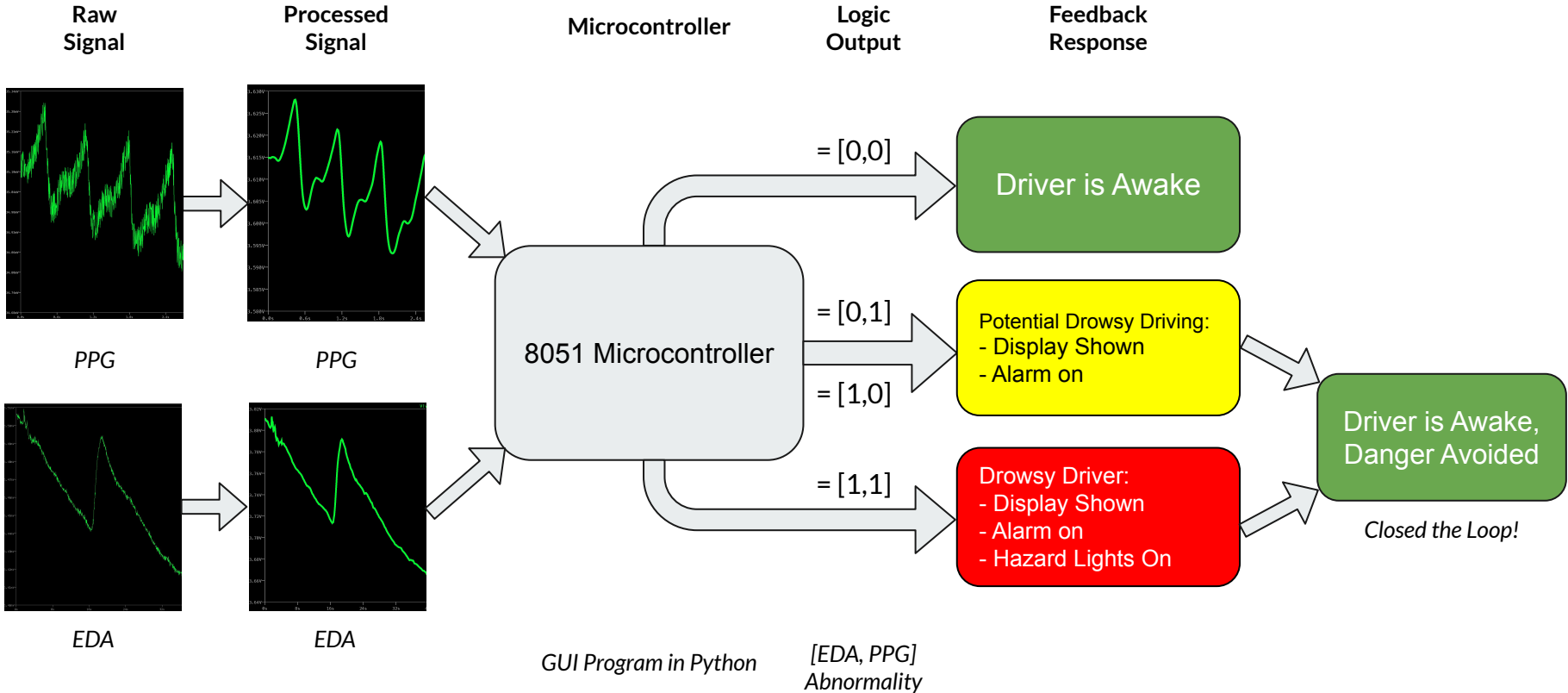
PPG



EDA



Simulation & Results



Key Conclusions & Future Direction

Future Direction:

- Physical Prototyping and Implementation
- Machine Learning Classification
- Robust Design

Classification into drowsy and non-drowsy states
Accuracy on test dataset: 1.0

