Université d'Ottawa
Faculté de génie

École de science informatique
et de génie électrique

uOttawa

L'Université canadienne
Canada's university

University of Ottawa
Faculty of Engineering

School of Electrical Engineering
and Computer Science

Project Proposal: LockedIn

CEG 4912 - Computer Engineering Design Project I

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Submitted to: Dan Ionescu
Teaching Assistants: Ahmed Hassanein, Hamideh Ghanadian, Haseeb Ur Rehman

Group 3 :
Student 1: Keith Tran 300240028
Student 2 : Hajer Fguir 300266634
Student 3: Abdullah Ramadan 300218707
Student 4: Saurav Guduru 300234999
Student 5: Aaditya Shah 300236230
Student 6: Kevin Dang 300241133

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1. Project Rationale

We decided to choose this project not only because it is a technical challenge that provides an opportunity to develop our skills as computer engineers but also because it has the potential to have a real positive impact on society. According to the AAA Foundation for Traffic Safety (AAAFTS), 17.6% of all fatal crashes in the United States between 2017 and 2021 resulted in 29,834 fatalities (Tefft, 2024).

Drivers whose cars lack such a system, especially owners of older vehicles, will benefit significantly from this project, as our system will be able to detect signs of drowsiness and lack of attention while driving on the road and give ample warning to drive safely and attentively. The use of our project could significantly reduce traffic accidents and fatalities.

Our clients could include companies that employ truck drivers who drive an average of 12 hours daily (Mahindra Group, 2020). This demographic spends exhausting hours driving and developing a commercial system to help these companies improve the safety and well-being of their drivers.

2. Project Description

2.1 Project Overview:

The primary goal of our project is to develop a driver alert system that can be mounted into a vehicle to monitor and assess the driver's attentiveness in real time. The system will detect drowsiness or distress using various sensors, cameras, and software.

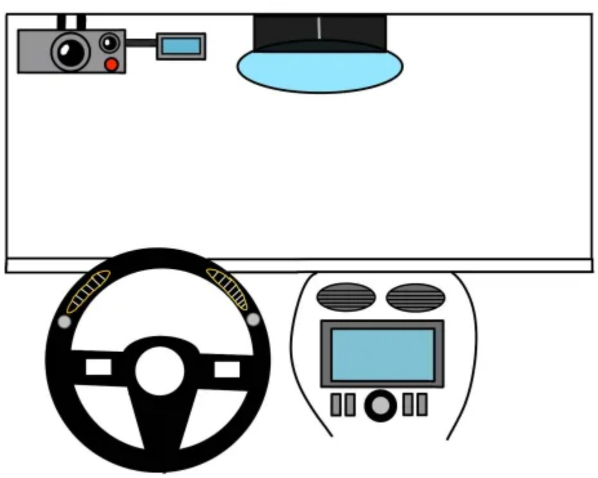

Figure 1: Mock system diagram.

When potential risks are identified, the system will alert the driver via a buzzer and notify a third party, such as a family member or emergency responder. This system will be connected to the internet, ensuring that logs and events are recorded**.**

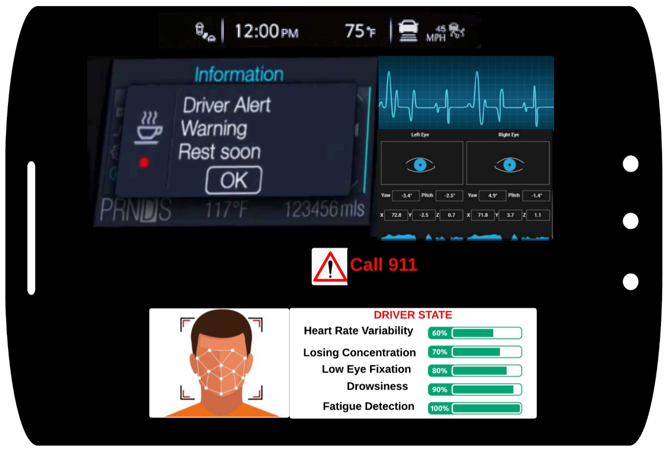

Figure 2: Mock UI drawing for the small embedded screen.

2.2 Requirements:

Functional Requirements:

- The system should not impede the driver.
- The system must detect when the driver is drowsy or in distress.
- The system must alert the driver if drowsiness is detected.
- The system should notify a third party (emergency contact or healthcare provider) if it detects that the driver is drowsy or in distress.
- The system should store all logs and events in the cloud.
- The system should retrieve logs from the cloud for third-party access upon request.
- The system should display information about the driver to any third parties.

Non-functional Requirements:

- The system must be enclosed in a casing to prevent visible cables or hardware components.
- The system should look sleek and modern.
- The system should be easily installed into a pre-existing cabin.
- The system should remind the driver to take breaks after several hours.
- The software UI must be simple to navigate.
- The user must be able to interface with the system via buttons/switches.

2.3 Architecture

Hardware Architecture

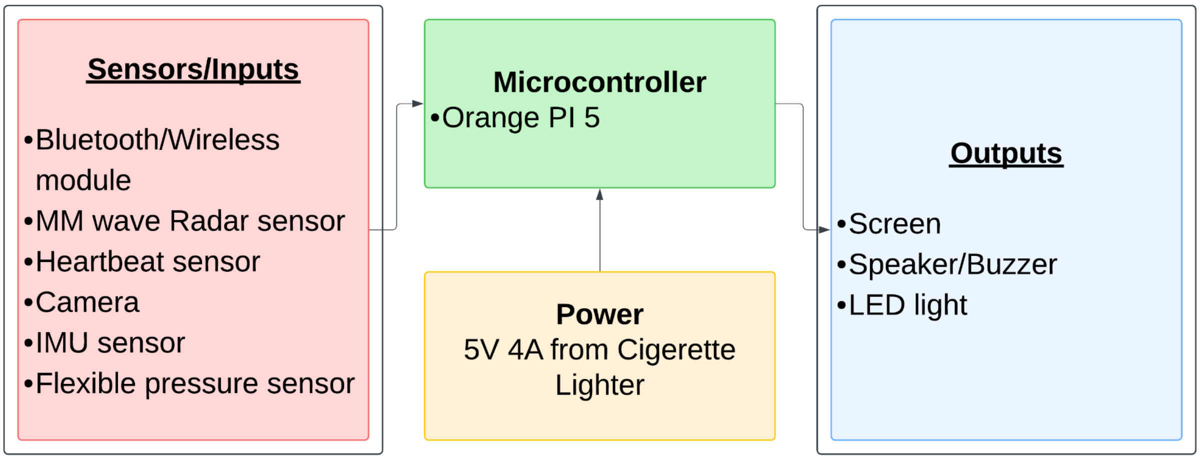

Figure 3: Diagram of the system hardware architecture (including inputs and outputs).

Hardware Components

- OrangePi 5
- Bluetooth/Wireless module
- MM wave Radar sensor
- Heartbeat sensor
- Camera
- IMU sensor
- Flex pressure sensor
- Screen
- Speaker/Buzzer
- LED light

Software Architecture

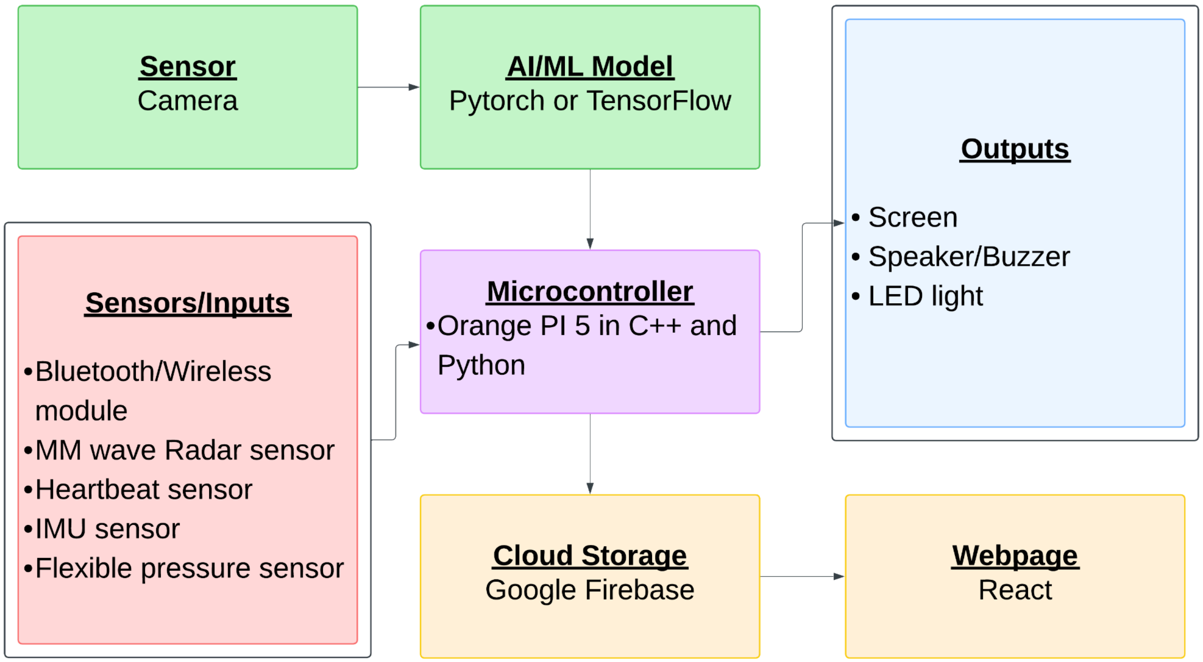

Figure 4: Diagram of Software Architecture of the hardware components with the AI and UI.

Software Components

- AI/ML compter vision facial scanning
- Firebase Storage Bucket Cloud database
- React Frontend
- Embedded sensor and camera interaction

2.4 Work Breakdown Structure (WBS)

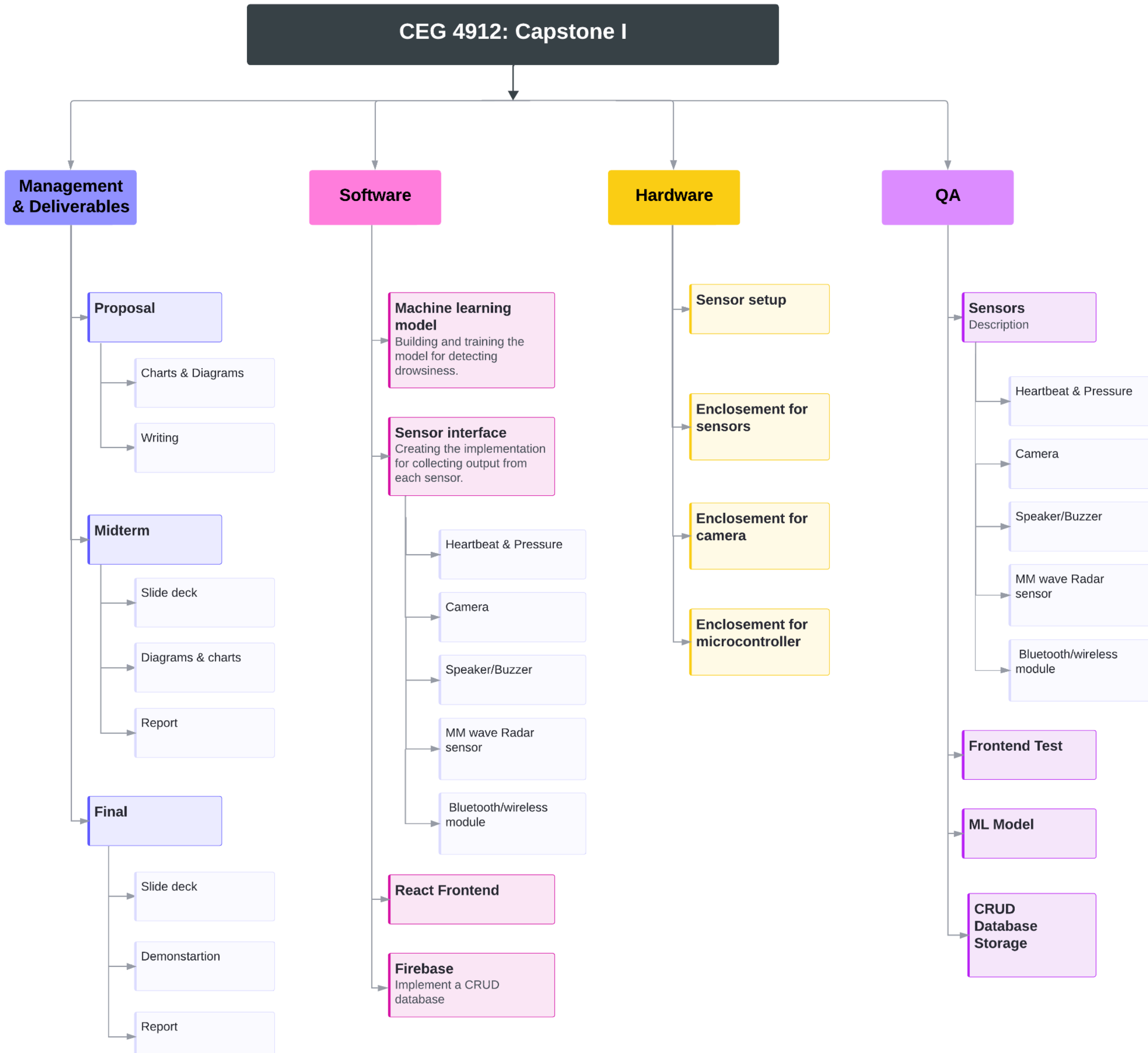

Figure 5: Work Breakdown Structure Diagram

2.5 Gantt Chart

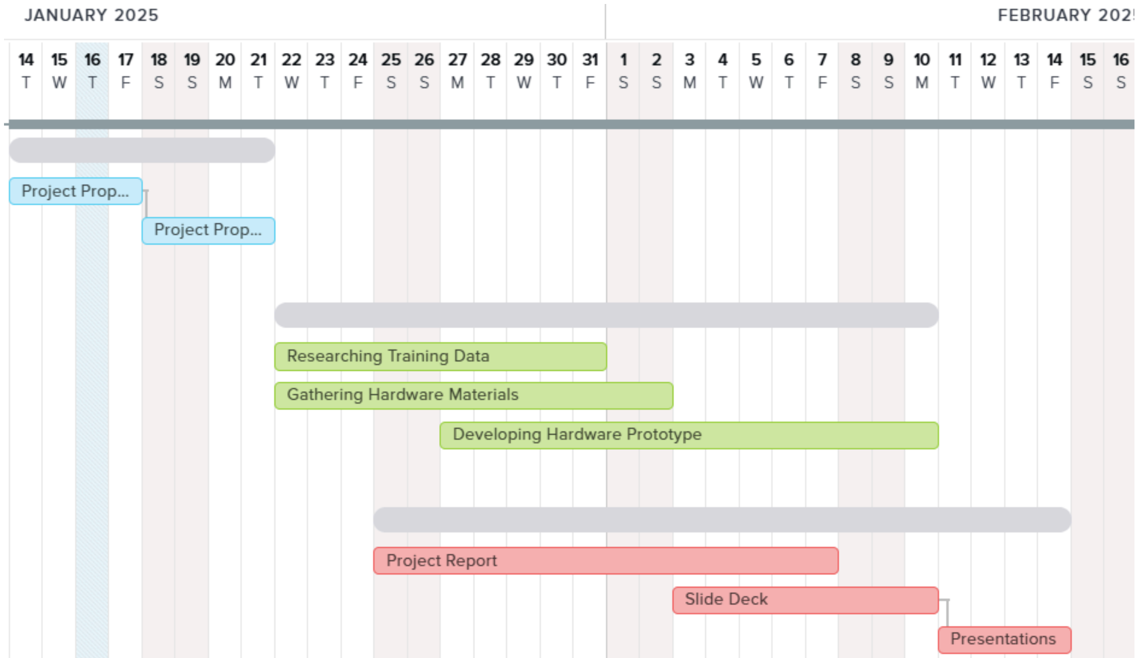

Figure 6: GANTT Chart displaying January to February project timeline.

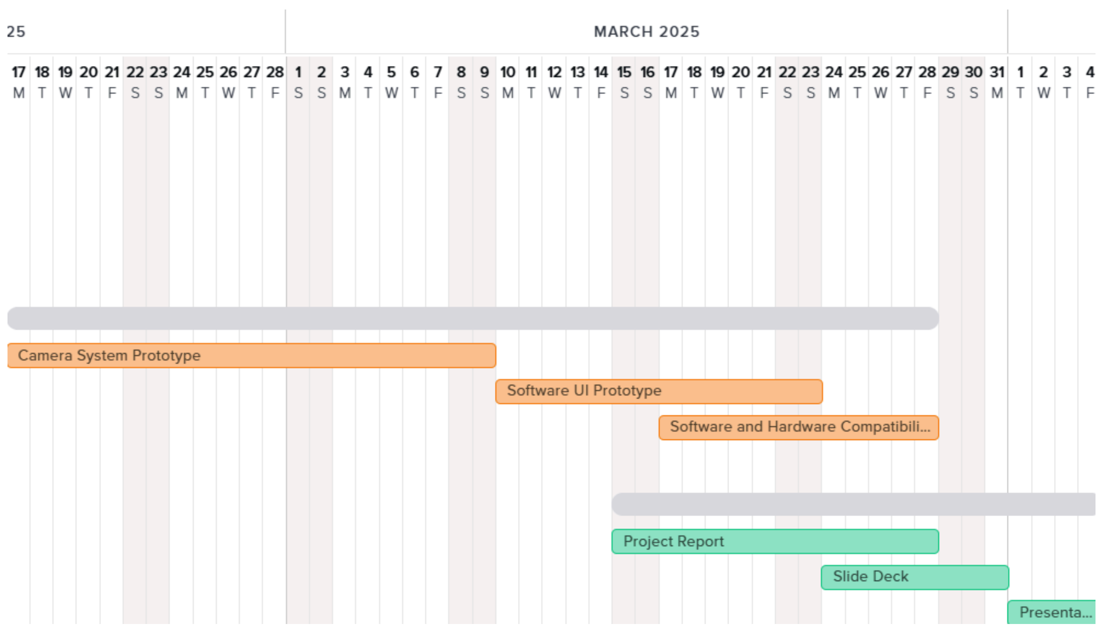

Figure 7: GANTT Chart displaying February to end of semester project timeline.

The Gantt chart outlines a timeline for each task within the Work Breakdown Structure. This will ensure the project is completed on schedule over two semesters, with milestones for each major phase.

2.6 Agile Management Board

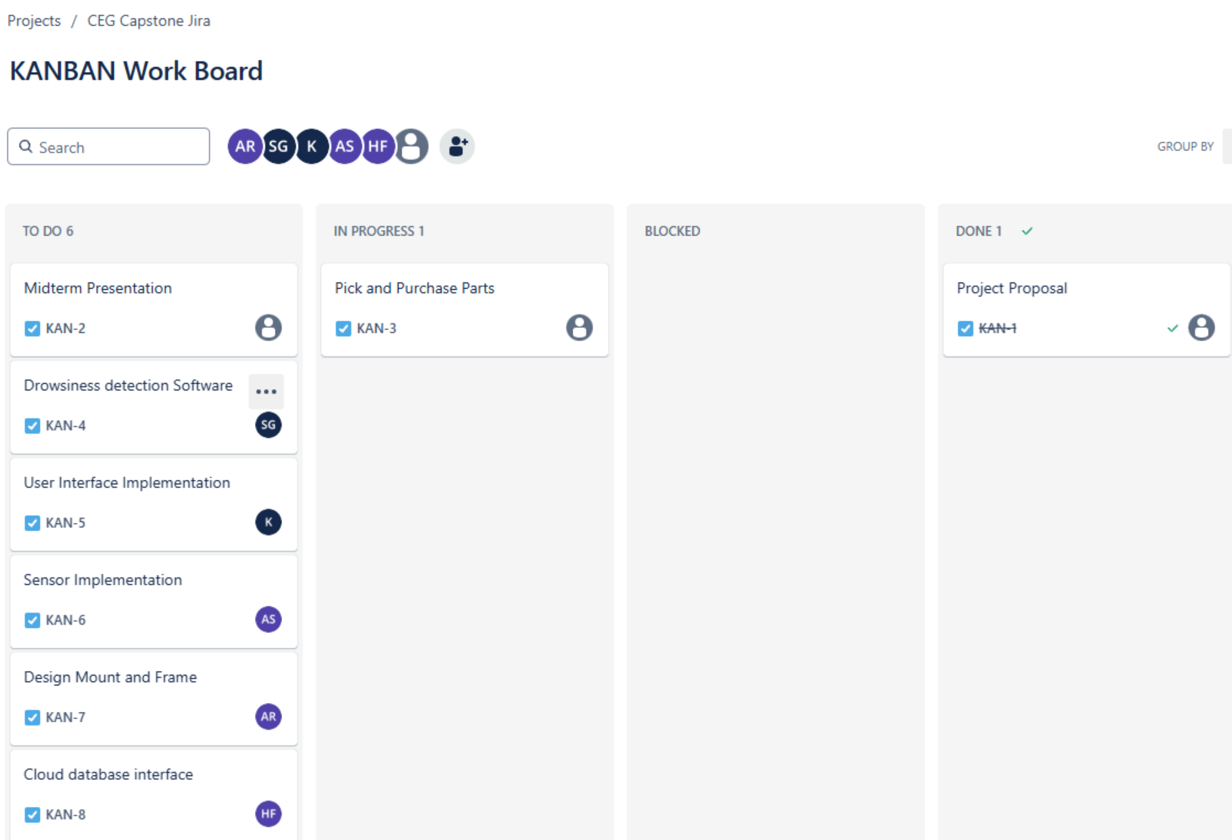

Figure 8: Jira Board for assigning tasks

We will utilize an Agile management approach to ensure effective management and tracking of the project's progress. We will use Kanban (Jira) to break down tasks, assign responsibilities, and monitor progress. Each team member will have specific tasks assigned, and regular updates will be made to ensure timely completion of milestones.

3. References

[1] Tefft, B.C. (2024). Drowsy Driving in Fatal Crashes, United States, 2017–2021. https://aaafoundation.org/wp-content/uploads/2024/03/202304-AAAFTS-Drowsy-Driving-Countermeasures.pdf

[2] Mahindra Group - average daily driving hours of truck drivers by city 2020: Average daily driving hours of truck drivers across India as of February 2020, by city. (2020). [dataset]. Statista Ltd. https://www-statista-com.proxy.bib.uottawa.ca/statistics/1109960/india-average-daily-driving-hours-truck-drivers-by-city/