Engineering Endowment Fund

Project Application Form

Applicant Information

Project Title: **LockedIn** Date: **2025-01-22**

Brief Description: 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. If potential risks are identified, the system will alert the driver and contact a third party, and record event logs via internet.

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Funding Request: **$500**
Amount of funding to be used on Transportation & Accommodations **$0**

Submitted By: **Aaditya Shah**

Numbers of Pages Attached: **7**

Office Use Only

Project Number: _____ Received By: _____ Date: _____

Disclaimer and Signature

I certify that my answers are true and complete to the best of my knowledge.

I acknowledge that my request will considered by the following Funds:

- *Engineering Endowment Fund (for undergraduate engineering students only)*
- *Centre for Entrepreneurial Engineering Design*
- *Brunsfield Centre Group*
- *Faculty of Engineering*

Signature: **AS** Date: **2025-01-22**

Project Description

This project aims to develop a driver alert system that can be easily integrated into any vehicle. The system would detect and alert drivers who may be falling asleep or experiencing distress. Driver fatigue is a leading cause of accidents, and this system would address this issue by providing real-time monitoring and alerting capabilities.

Our system will use sensors and artificial intelligence to identify signs of drowsiness or distress in drivers. The hardware will include an MCU such as the Jetson Nano, a camera to monitor facial expressions and eye movements, flexible pressure sensors on the steering wheel to detect the person's hands on the wheel, and a heartbeat sensor on the steering wheel to monitor physiological changes and detect if the person is holding the wheel. The data collected by the camera will be processed by an AI/ML model trained to detect drowsiness and distress with high accuracy. Our system will also have a 60 HZ mm-wave radar sensor to detect the breathing patterns of the driver. The data collected from the sensors will help strengthen the prediction of the AI model, and we will have supplementary information to detect drowsiness and distress.

When the system identifies a risk, it will alert the driver through an audible buzzer and display a message on a mounted screen. The system will continue to flash the warning on the screen and ring the buzzer until the driver acknowledges the alert on the screen. The alert will be dismissed once the driver appropriately repositions their hands on the wheel. The repositioning of the hands on the wheel will be detected via the pressures and heartbeat sensor on the wheel. The system we are building can be implemented at retail or commercial levels. An example of a commercial application would be trucking companies or delivery drivers. During long hauls, it would be beneficial to have a system that can monitor and alert the driver, and the appropriate dispatch team can contact the driver when such events are detected. To enhance functionality, the system will include a user interface (UI) that logs drowsiness or distress events for future review. This UI would be tied to an account that the user is responsible for registering, and depending on their use (retail or commercial) they will have access to different dashboards. The commercial dashboard would have a list of all the drivers and their current status, and in the event a driver is drowsy, the status will be shown on the UI so that the relevant third party can take action to contact the driver. The data from the Jeston will be transmitted to a cloud database via an internet connection (for prototyping, we are using a mobile hotspot), enabling the UI to display the relevant information for the event logs and the driver's status.

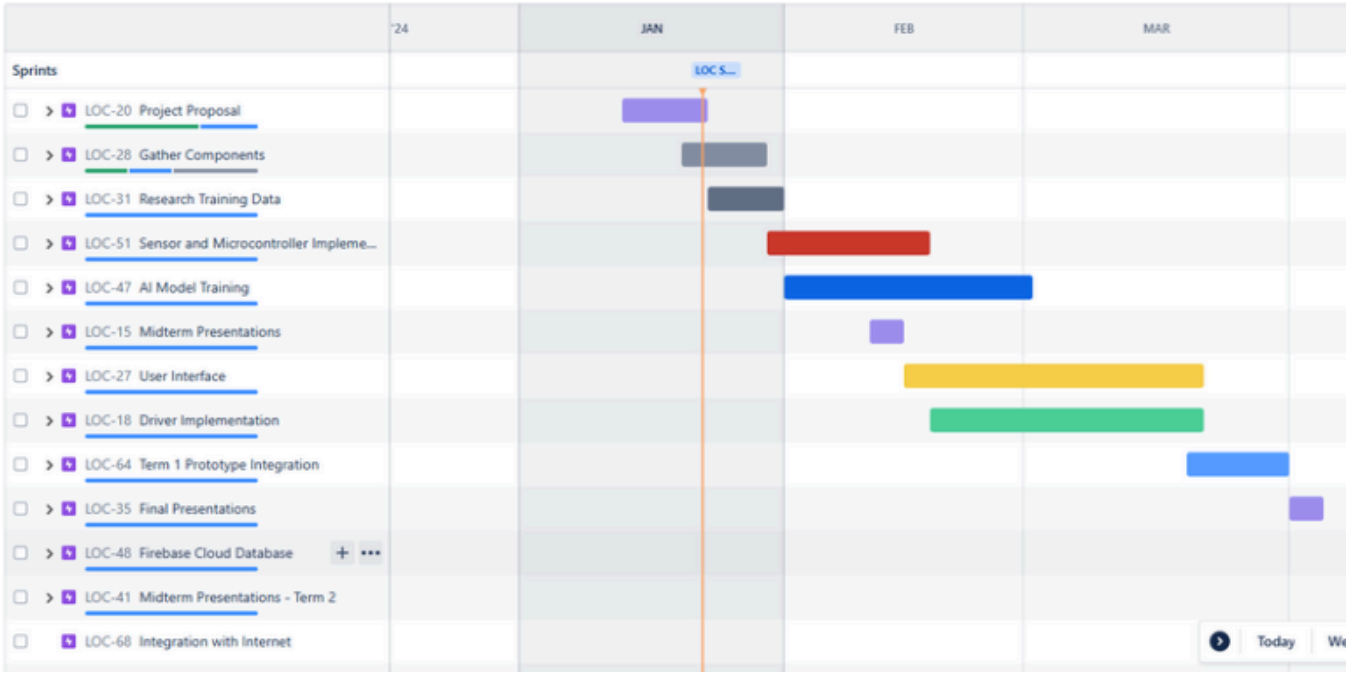
The primary challenges in this project involve the integration of multiple sensors and the development of a reliable and efficient AI/ML model. In addition to the camera and heartbeat sensor, we will incorporate an mmWave sensor to monitor breathing patterns. This sensor will provide a non-contact, continuous respiration measurement, offering another critical input to reinforce the AI/ML model's decision-making on driver drowsiness. Synchronizing the data from the mmWave sensor and heartbeat sensor would require us to create an algorithm to ensure accurate predictions. Another challenge lies in training the AI/ML model to interpret complex and multi-dimensional data, such as facial expressions while minimizing false positives or negatives. The system must also be compact and designed for seamless installation in various vehicle types. Balancing the cost of the sensors and the microcontroller with the need for affordability is essential for widespread adoption. Cloud connectivity and UI also require secure and scalable software to manage data effectively. We will be measuring sensitive data, so it is in our best interest to ensure that it is stored safely and securely.

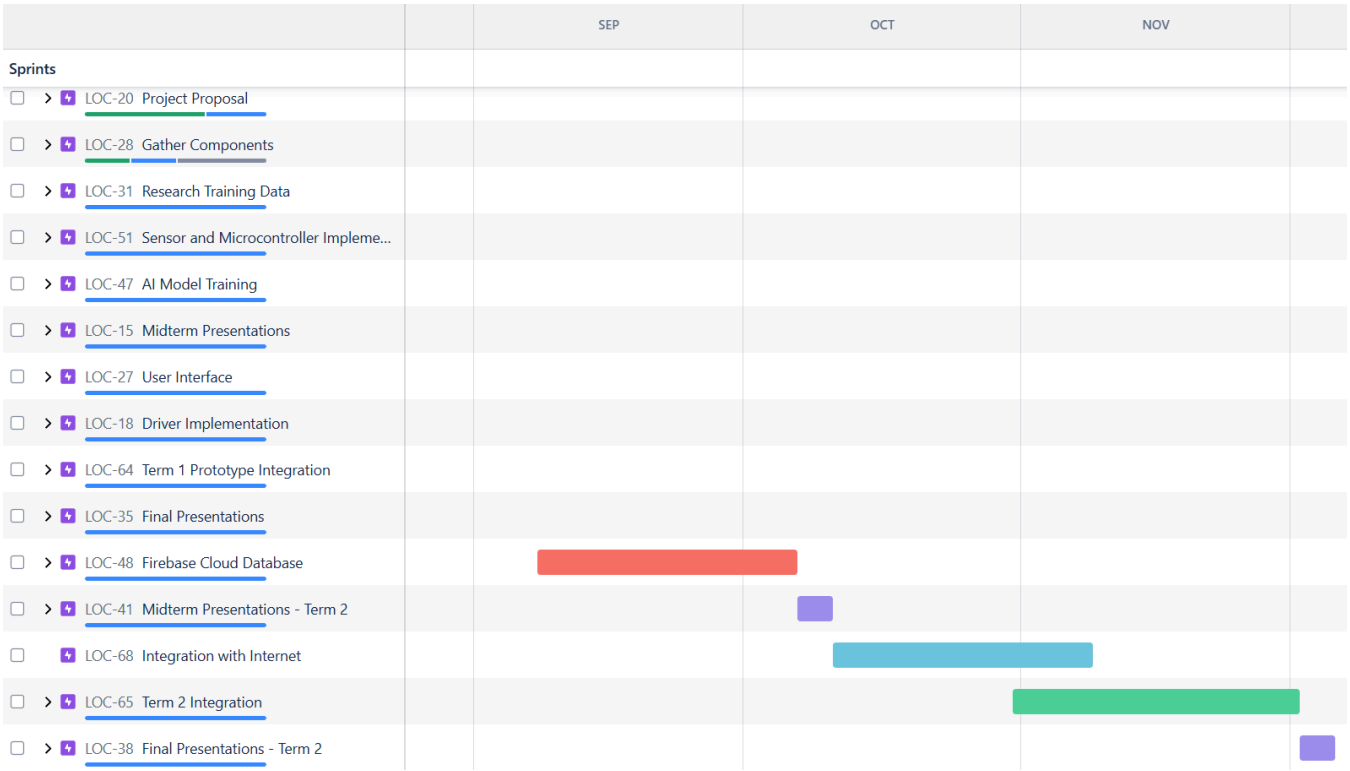
The items requested for funding in this application are essential for the project's successful development. These include high-quality sensors for accurate detection, a microcontroller or embedded

system to process the sensor data, and a screen to display the alert to the driver. Without these components, the system would be unable to achieve its intended functionality.

We have minimized costs by exploring affordable yet reliable components and reusing existing hardware where possible. However, due to the nature of the project, specific specialized equipment (such as the Jetson Orin Nano) is necessary as the nature leaves no room for error. This microcontroller has the power to obtain input and run it through the machine learning model with very minimal delay. We kindly request EEF's support in implementing this project. Below, we have included a detailed breakdown of the required materials and their costs, as well as key project milestones and deadlines.

Timeline and Milestones



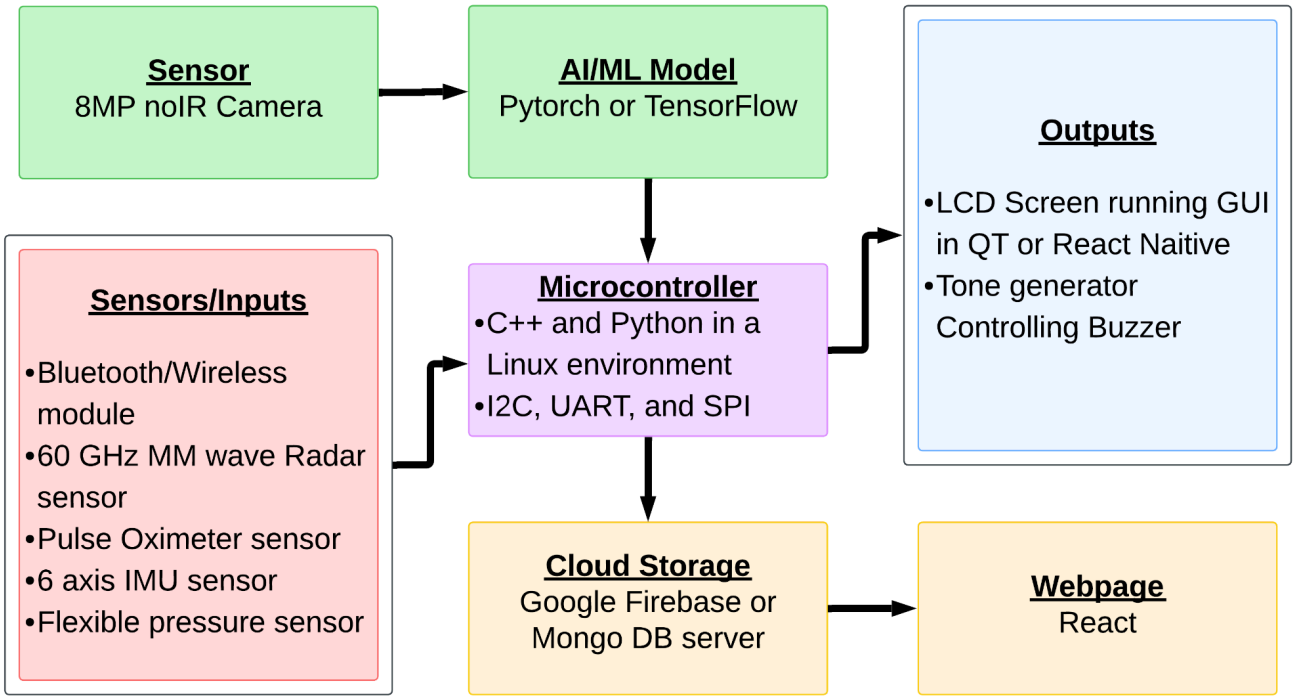


Budget Breakdown

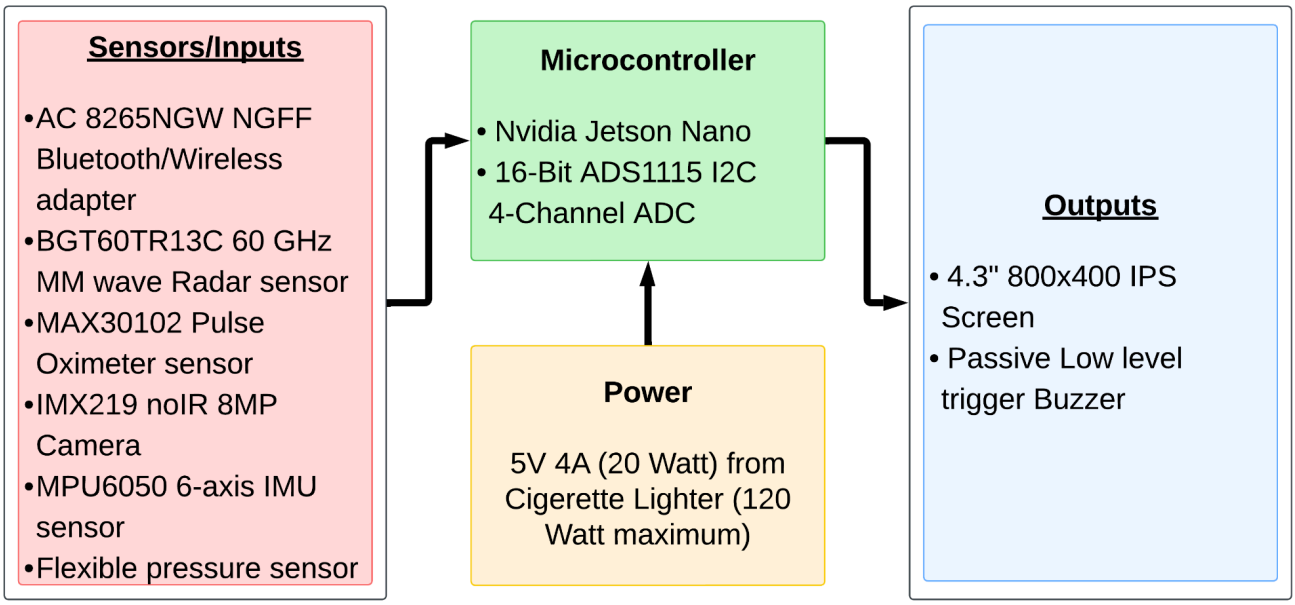
Component	Cost ($)	Link
Nvidia Jetson Orin Nano Super Developer Kit	395.34	https://www.arrow.com/en/products/945-13766-0000-000/nvidia
PI NOIR CAMERA V2 IMX219 8MP	42.91	https://www.digikey.ca/en/products/detail/raspberry-pi/SC0024/6152811?gQT=2
4.3inch HDMI LCD 800x480 IPS Capacitive Touch Screen	73.44	https://a.co/d/5GLenRh
DC 3.3-5V Passive Low-Level Trigger Buzzer Alarm Sound Module	11.29	https://a.co/d/fjKHHs3
Wireless-AC 8265NGW NGFF M2 Interface WiFi Bluetooth Adapter-Wireless-AC 1200Mbps	22.59	https://a.co/d/fd9tA20
GY-521 MPU-6050 MPU6050 Sensor Module 3 Axis Accelerometer and Gyroscope Module	18.07	https://a.co/d/gGHhDEE
Thin Film Pressure Sensor Flex Bend Sensor SF15 600 10kg	28.02	https://a.co/d/0nDhxGG
Digital ADC Module 16-Bit ADS1115 I2C 4-Channel ADC	18.07	https://a.co/d/h63XlNY
Heart Rate Sensor Module MAX30102 Pulse Detection Blood Oxygen Concentration	43.93	https://a.co/d/ftirkyS

Total Expenses: $653.66
Total Ask: $500.00
The $500 ask would be spent on the items listed above

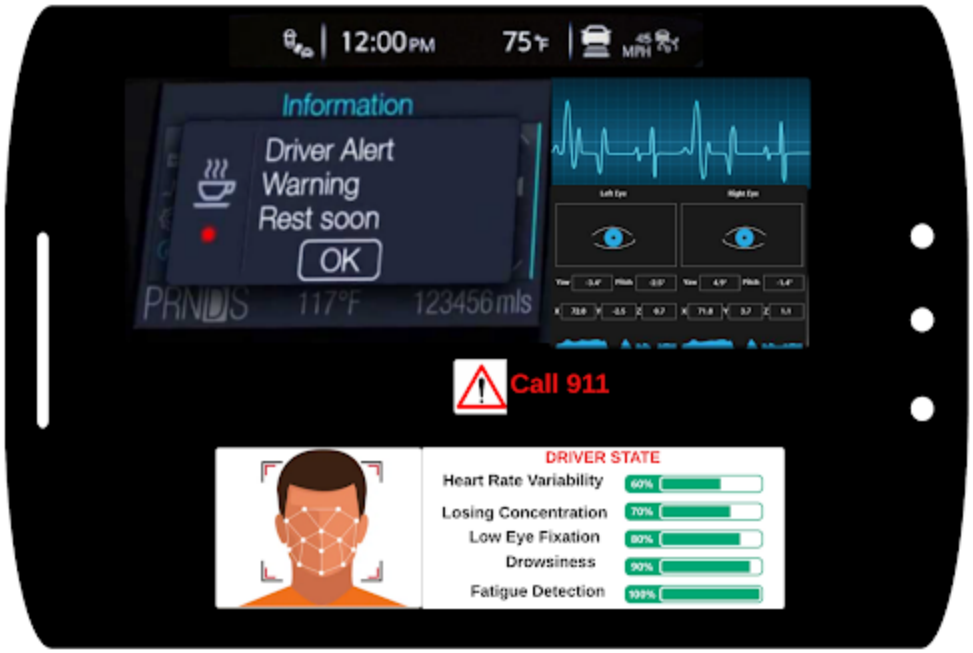
Diagrams



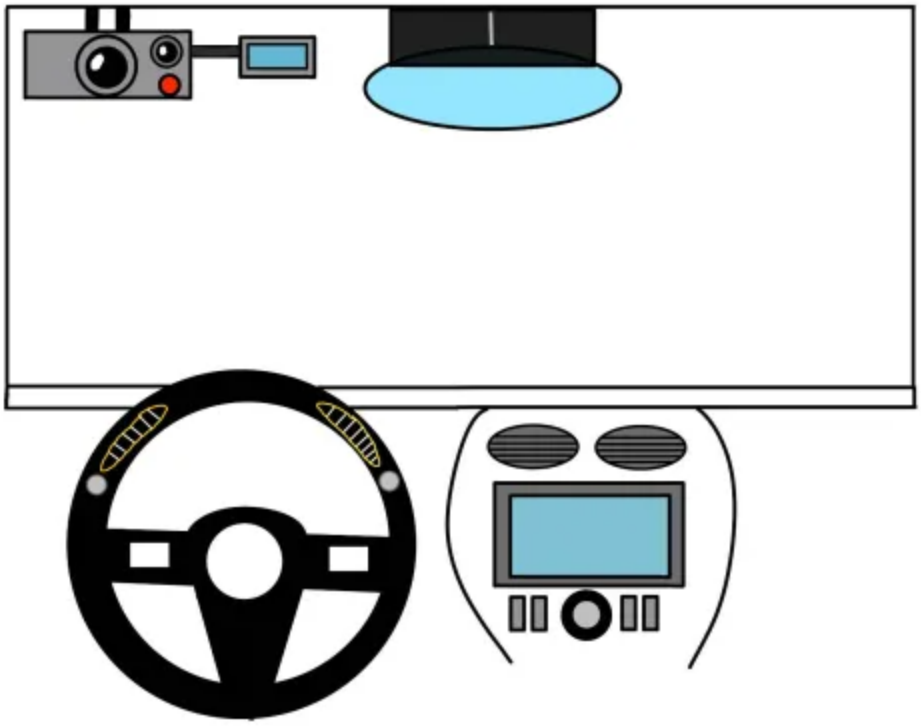
Software Architecture



Hardware Architecture



Screen mock-up



System mock-up