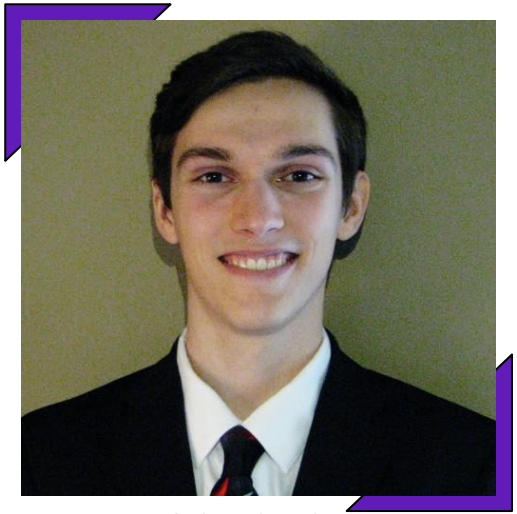
# Metaverse Maintenance

By: Cory Gish & Ryan Logsdon

# Project Members

Cory Gish: Electrical Engineering



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Ryan Logsdon: Computer Science

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Project Advisor: David Mackenzie - VP of Product Development at ITE
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# Project Overview

Project Purpose:

- Apply the acquired engineering skills acquired throughout the preceding years to document and develop a system capable analyzing vehicle diagnostic data to provide users enhanced ability to improve the performance and life of their vehicles.

Goal Statements:

- Display real-time diagnostic data for a driver using an in-vehicle user interface.
- Utilize cellular connection to monitor vehicle data using a cloud-based IOT platform.
- Develop a web-based application for mobile access to real-time vehicle data.
- Design a virtual environment to provide data visualization for a users vehicle.

# Abstract

The purpose of this project is to **design and implement** a device capable of reading On-Board Diagnostic (OBD) data from a vehicle, displaying real-time critical values to a driver, and storing that data for later use and analysis within a virtual environment. The device will utilize the mandated OBD port within modern vehicles to **collect and send data** through Bluetooth connections. A Raspberry Pi and connected graphical user interface (GUI) will **display real-time data** within the vehicle. This data will then be sent through the attached modem to a cloud-based IOT platform allowing for analysis to **improve vehicle life and performance**.

# User Stories

- As an **enterprise account manager**, I want to **quickly assess the operational status of all vehicles**, so that **I can accurately predict the value of assets and liabilities for my company.**
- As a **mechanic**, I want to **see diagnostic data on a vehicle**, so that **I will understand what components are causing problems for a client.**
- As a **driver**, I want to **see live diagnostic data**, so that **I can operate my vehicle in a more fuel efficient manner.**
- As a **fleet manager**, I want to **inspect company diagnostic data**, so that **I can manage and supervise the acquisition, utilization, maintenance, repair, and replacement of company vehicles.**
- As a **data analyst**, I want to **investigate diagnostic data stored from company vehicles**, so that I **can better predict efficiency of employees and vehicle breakdown.**

# Design Diagrams

Metaverse Maintenance

**Goal:** Create a system to provide real-time automotive diagnostics data across multiple platforms.

**Legend**

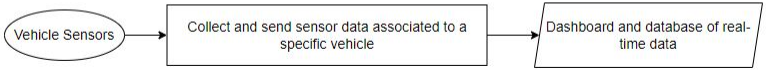
Inputs

Data Flow

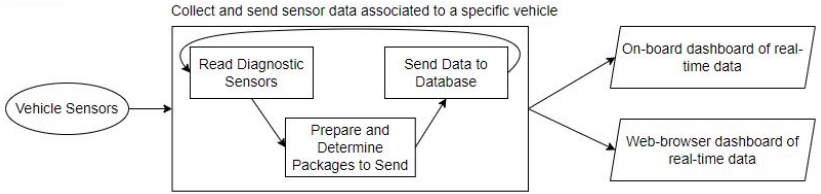
States

Outputs

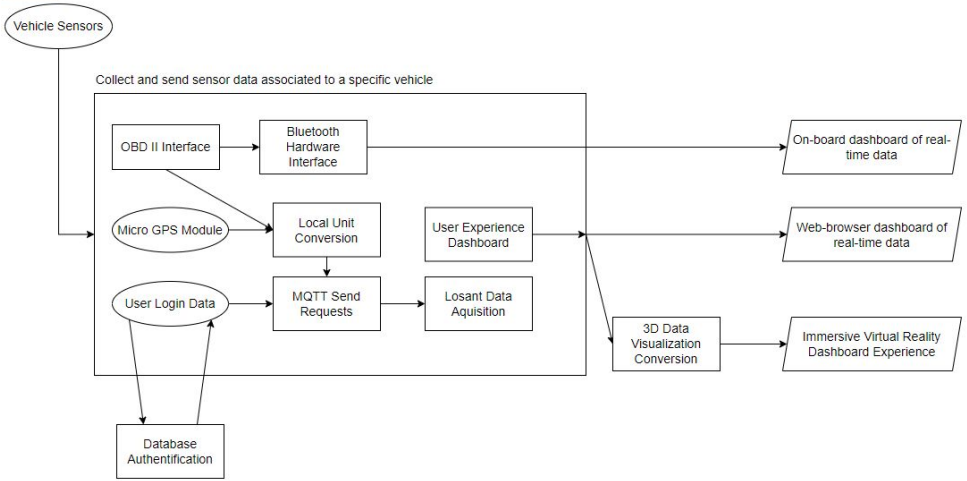
D0




D1




D2



# Major Project Constraints

**Environmental**

One major side effect of our project is an increased awareness for the efficiency of a user's vehicle. By providing a real-time user interface to display a variety of diagnostic data, a user will be more aware of how their **driving habits impact different attributes.** Moreover, many of these attributes give insights into environmental impacts that a vehicles emissions and performance will have. A major constraint on this project will be the ability to accurately and quickly measure such attributes to provide users with a clear understanding of **vehicle performance**. Thus, users will have the opportunity to understand how different driving tendencies can positively or negatively impact the environment.

**Ethical**

The ethical impact of this project most directly pertains to the analysis of diagnostic data from the vehicle. Due to the temperamental nature of most motor vehicle computer systems, any sub-par sensor performance can have **catastrophic impacts on the vehicles performance** and the **safety of all passengers**. Being able to safely read on-board diagnostic (OBD) data, without impacting any performance critical components of the vehicle is a major constraint of this project. If negative effects result from the use of the described system, the designers could be at fault for any related damages. Precautions that are being put in place to minimize this impact is the use of the **read-only OBD II** port of each vehicle. The mechanical safety constraints put in place through these components will eliminate any possibility of our software impacting the vehicle's performance.

# Major Project Constraints

**Economic**

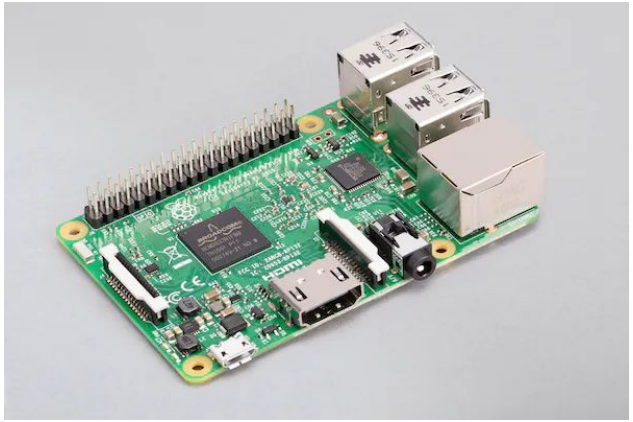
The main economic constraint that concerns this project is the silicon shortages and our ability to **source all necessary parts**. Our project uses a Raspberry pi and many electronic parts that have been difficult to find recently. Due to this, we are making sure we get all parts as early as possible once all details of the project are finalized. We are also limited by the UC budget for the project, but we predict everything will be within this budget. As for economic development, this project will help big or small businesses keep track of their **vehicle health to extend its life** and provide valuable data to the company that can be used for optimizations.

**Security**

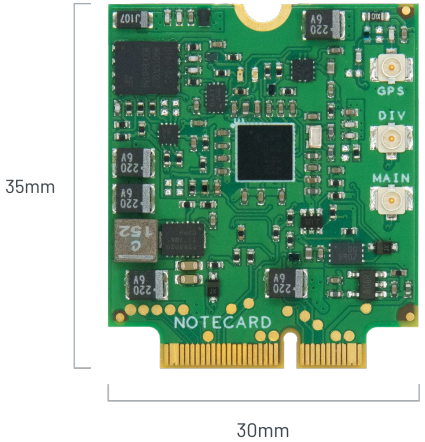
The data collected by the OBD II connector will need to be **securely transferred to the interface** and to the online database for the vehicle. By ensuring security within this system, drivers are more likely to use it and understand that their **data is protected**. The latest Bluetooth versions will be used, and no connections can be made to the interface while the vehicle is off as it is only powered by the vehicle while it is running. This allows the user to make sure they are connected to the interface via their preferred method, Bluetooth, wired, or even a just send it through the attached cellular modem. The online database will be **protected with usernames and passwords**, with only certain user having access to more data on the vehicle, which would be the case for company vehicle fleets.

# Current Project State

## Hardware:



Raspberry Pi 3 Model B




Blues Wireless Notecard

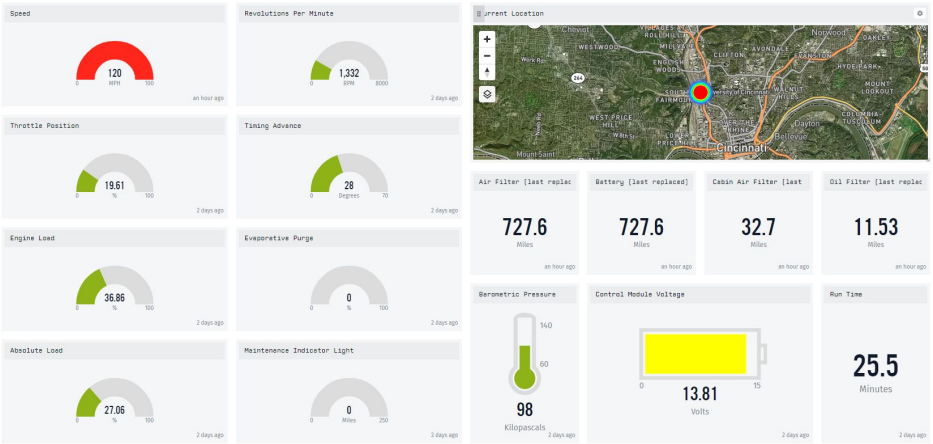

OBDII Diagnostic Interface

# Current Project State

IOT:

LOSANT

Losant - Web-based IOT Platform




Meta Quest 2

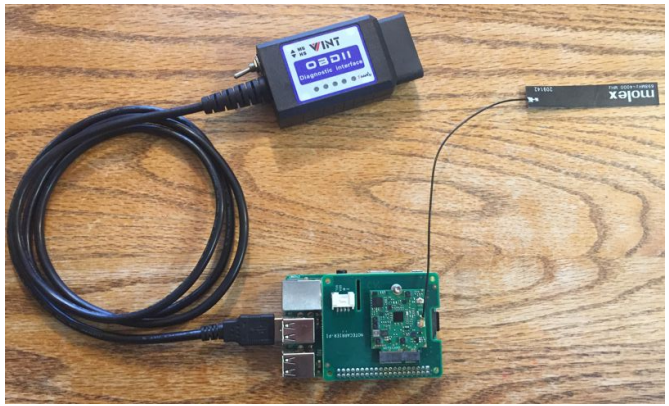
# Current Project State

Software:

W3 Schools - Website Development


noda.io - Virtual Reality mind-mapping tool

# Expected Accomplishments




## Functional Prototype:

- Read OBDII Data from motor vehicle
- Send diagnostic data and GPS location via Blues Notecard Cellular Modem

## IOT:

- Create live stream and historical dashboards
- Integrate dashboards into web application

## Software:

- Design 3D vehicle models within Noda.io
- Access Losant data via MQTT and Webhooks

# Division of Work

## Cory – Hardware/Electrical Components

- Read **diagnostic data** from the OBD port using a microcontroller
- Incorporate **status LEDs** to indicate power, data transmission, and errors
- Determine and send data through **Bluetooth** or through the **wired connection**
- Design and implement the **web-based login** to access authorized data
- Implement a screen for the dashboard of the OBD data in the car
- Source the parts for the OBD connector
- Source the parts for the screen dashboard
- Research shared OBD port data among multiple makes and models of vehicles



## Ryan – Software/IOT

- Research modems for **cellular connectivity**
- Design **database infrastructure** to hold user and vehicle data
- Investigate **virtual reality** software for three dimensional visualization
- Implement Losant IOT capabilities to store vehicle attributes
- Investigate API's for gathering OBD data from automotive vehicles
- Implement user authentication into the **web application**
- Survey potential users for feature requests that can be added to the application
- Design algorithm to place live data in three dimensional space
- **Design dashboards to display live and historical vehicle data**

# Expected Demo