

# REAL TIME ROAD MONITORING SYSTEM

# PROBLEM STATEMENT

- Increasing congestion
- Need for improved data collection systems
- Lack of real time insights
- Absence of real-time data on traffic flow and road condition



# OBJECTIVES

- Read real time data from car's CANbus
- Use sensors to sense pothole on road
- Use CANbus data to determine road conditions
- Send pothole and CANbus data to internet for data analysis



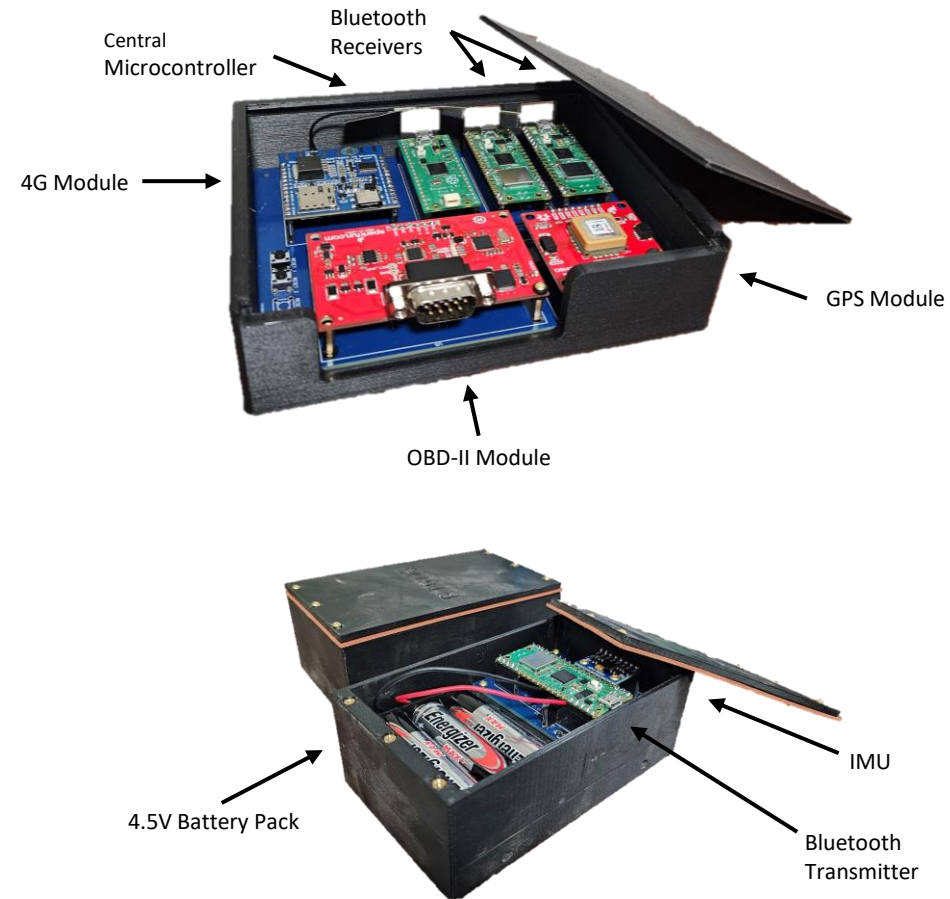
# DESIGN SPECIFICATIONS

- Data can be sent over 4G to a backend server using HTTPS
- detect pothole based on suspension of the vehicle
- Read a vehicle's speed and ABS data over the On board diagnostics port in real time
- Get GPS data of the vehicle
- Determine icy road conditions
- Use wireless communication protocol to get data from IMUs mounted on a car's suspension
- Get FreeRTOS working on pi pico
- Power peripherals using batteries
- Display Data on website with a heatmap
- Design and print PCB for project



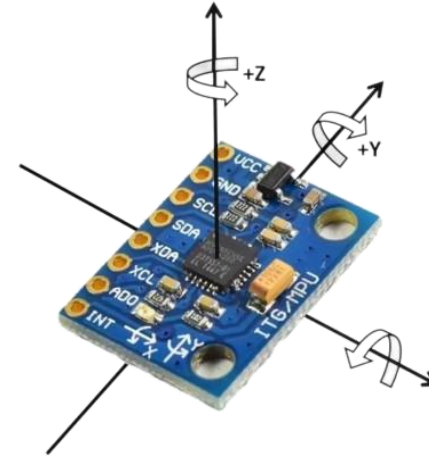
# OUR APPROACH

- Pothole Detection
- Bluetooth
- Slipping Detection
- 4G
- FreeRTOS
- Backend



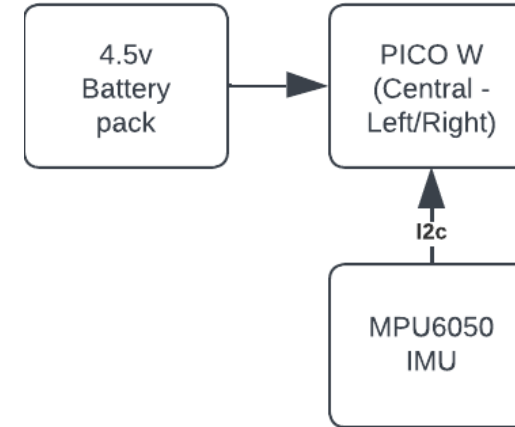
# POTHOLE DETECTION

- IMU (Inertial Measurement Unit)
- Contains on-board Accelerometer
- Budget friendly and commonly used
- Mounted on vehicle suspension



# BLUETOOTH

- BLE (Bluetooth Low Energy)
- Raspberry Pi Pico W
- Limited Documentation
- Alternatives



# SLIPPING DETECTION

- On Board Diagnostics Port (OBD-II)
- CAN bus protocol
- Vehicle speed
- Traction Control

```
09:48:54.538 Slipping: 31,  
09:48:54.538 Speed: 22,  
09:48:55.447  
09:48:55.447 Slipping: 31,  
09:48:55.447 Speed: 27,  
09:48:56.359  
09:48:56.359 Slipping: 31,  
09:48:56.359 Speed: 31,  
09:48:57.554  
09:48:57.554 Slipping: 31,  
09:48:57.554 Speed: 32,  
09:48:58.464  
09:48:58.464 Slipping: 31,  
09:48:58.464 Speed: 33,  
09:48:59.360  
09:48:59.360 Slipping: 31,  
09:48:59.360 Speed: 33,
```



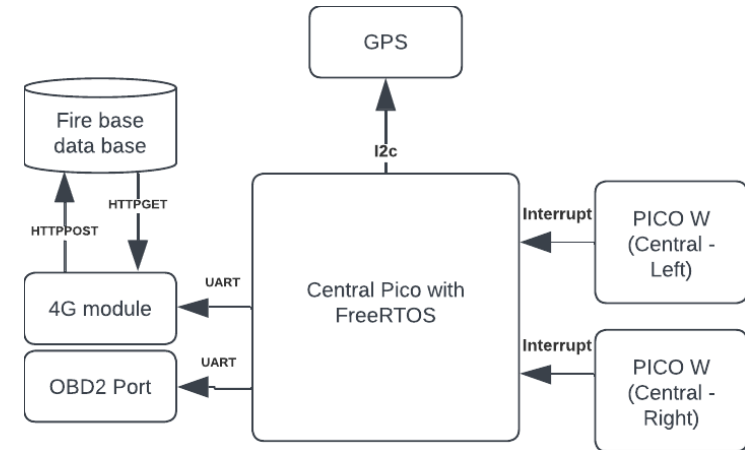
# 4G

- Sim7600 4G LTE module
- Connect to cellular network
- Send HTTP request to backend



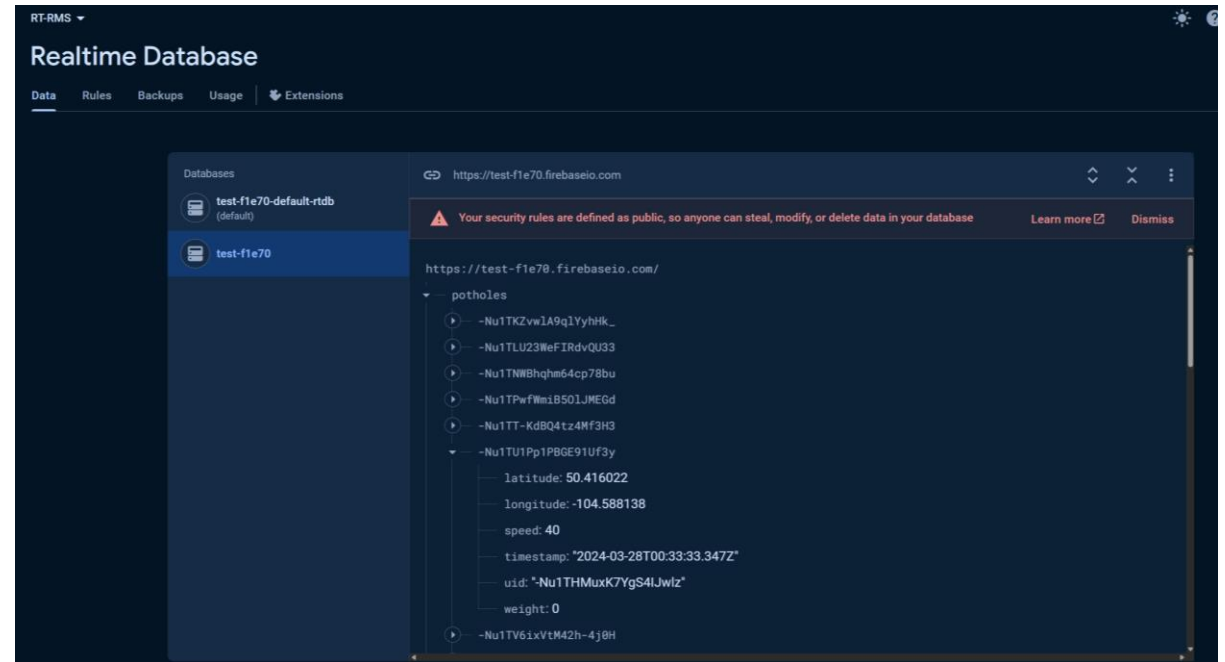
# FREERTOS

- Real Time Operating System
- Bundle data together
- Schedule running of different components
- Handle multiprocessing



# BACKEND

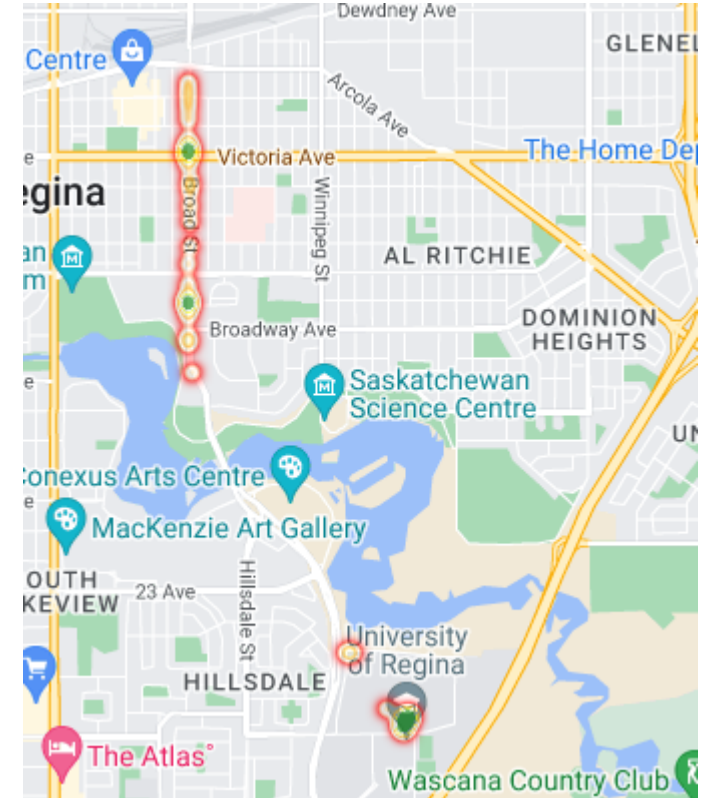
- Google Firebase Realtime Database
- Firebase Hosting
- Google Maps API



# RESULTS

- Pothole detection accuracy
- Slipping detection detection
- Backend

Pothole Zone	Accuracy	Attempts
Yellow	77%	30
Amber	68%	16
Red	72%	18



# BUDGET

Central	Qty.	Cost
Pico W	2	\$ 17.10
Pico	1	\$ 9.95
GPS Module	1	\$ 58.17
OBD-II Module	1	\$ 77.12
4G Module	1	\$ 78.55
PCB	5	\$ 49.30
Enclosure	1	\$ 2.65
<b>Total:</b>		<b>\$ 292.84</b>

Peripheral	Qty.	Cost
Pico W	2	\$ 17.10
IMU	2	\$ 10.34
Zener Diode	2	\$ 0.40
PCB	10	\$ 20.76
Batteries	36	\$ 26.98
Enclosure	1	\$ 3.03
Gasket	5	\$ 24.54
<b>Total</b>		<b>\$ 103.15</b>

# CONCLUSIONS

- Core objectives met
  - Pothole detection
  - Road conditions
- Future improvements
  - Design changes
  - Further testing
  - More data





THANK YOU