

Parking Lot Monitoring System - Ground Based Approach

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Overview

The goal of the project is to develop an inductive loop-based system to determine the number of available parking spaces in a parking lot. The project is being designed as a proof-of-concept system that can be scaled up to span the entirety of campus.

Design

Ground Based Sensor Capabilities

The Loop Controller generates a sinusoidal wave to send through the inductive loops placed in the roadway for vehicle detection. The response from the inductive loops is converted into square waves that are sent to the ESP32 MCU.

Data System Capabilities

The ESP32 detects changes in frequency and determines if a vehicle is entering or exiting a parking lot using its thresholding algorithm. This data is saved locally and transmitted at regular intervals to the LoRaWAN cloud server.

Power System Capabilities

Two power systems are available for use:

1. Wall Power system that connects to a wall outlet and a backup battery in the event of power loss.
2. Solar Power system that connects to a solar panel and charge controller with two backup batteries if the sun is not visible.

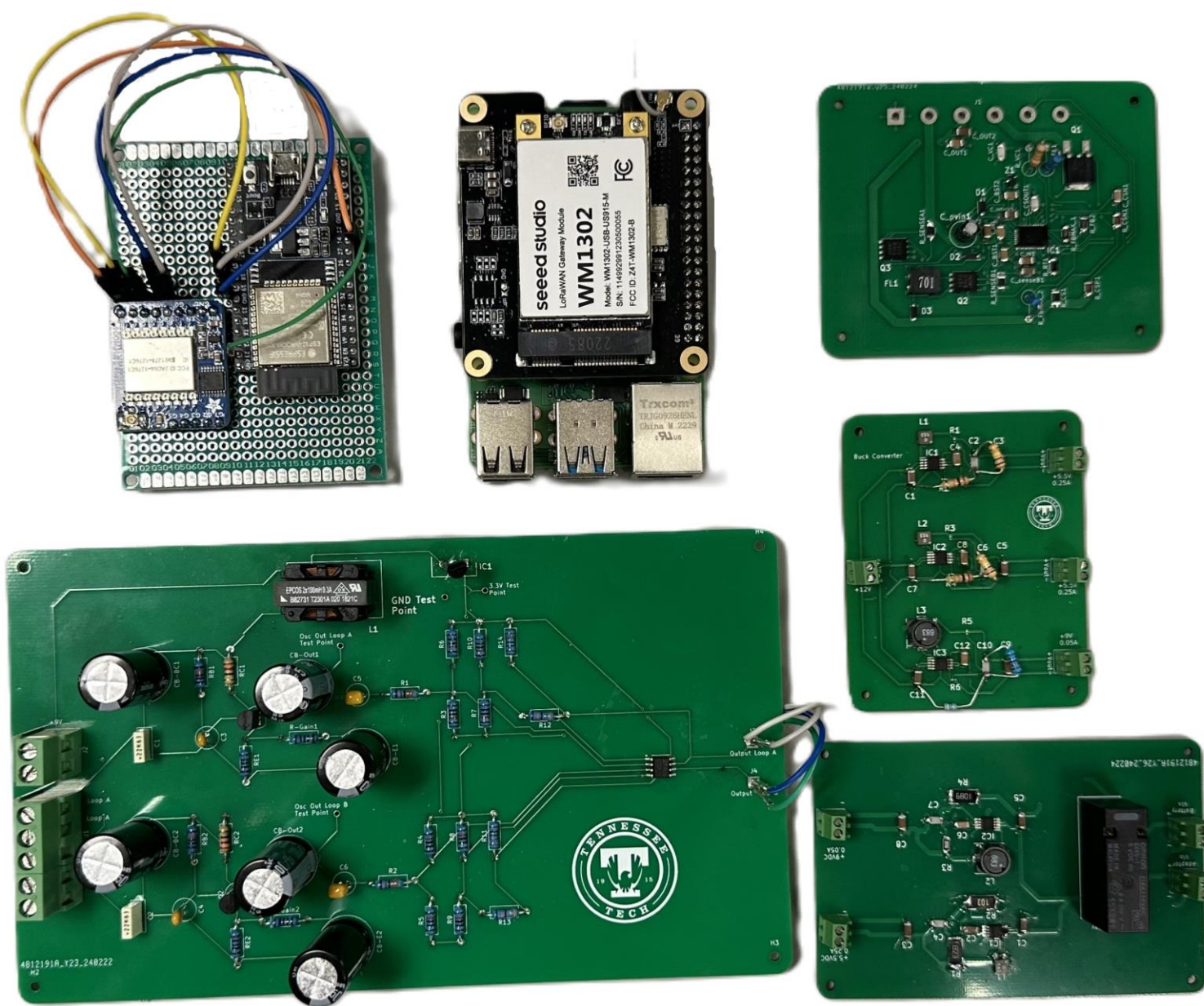
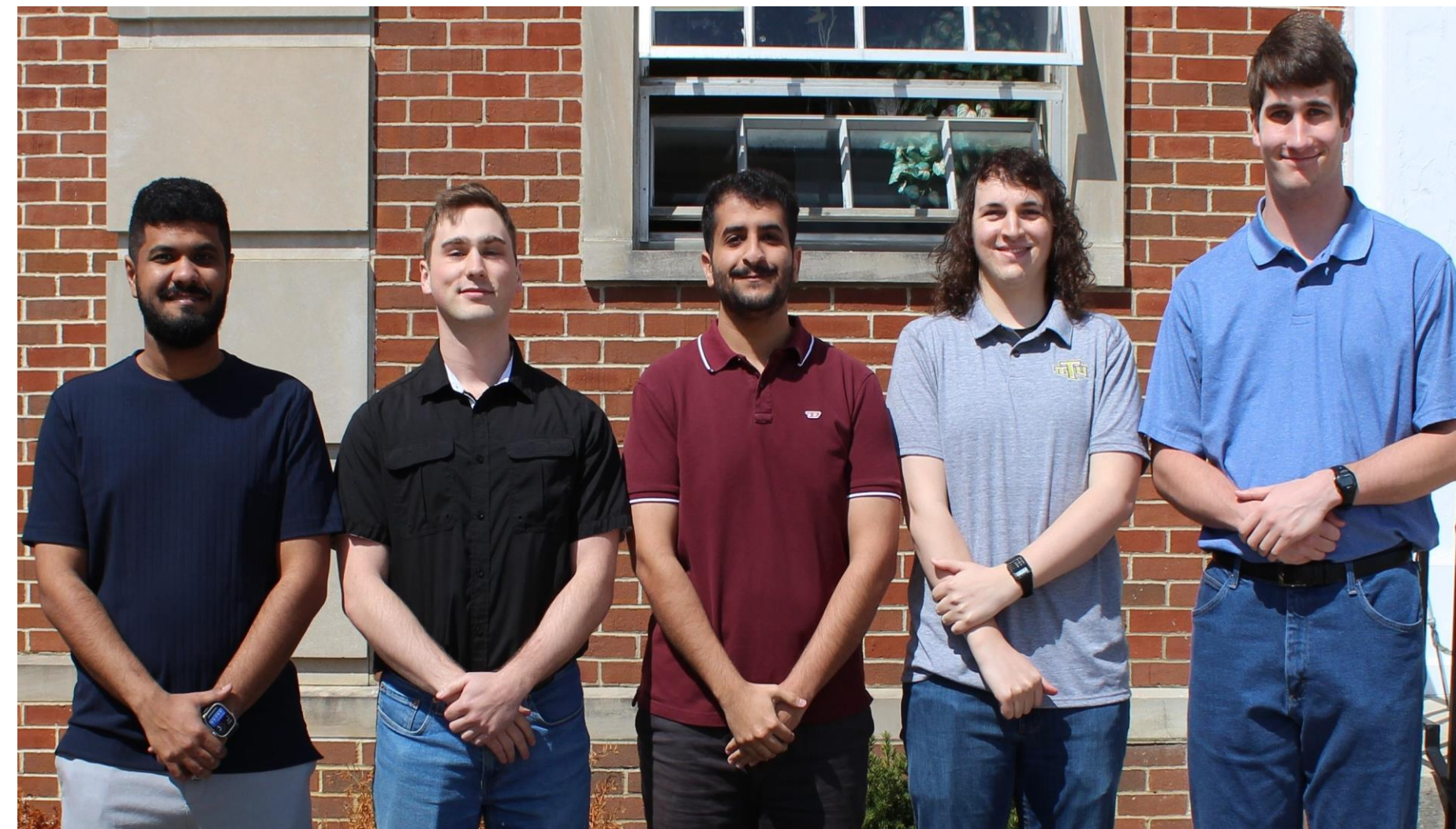


Figure 1: Project Hardware

Team



Left to Right: Abdulrahman, Brady, Khalifah, Kyle, Michael

Results

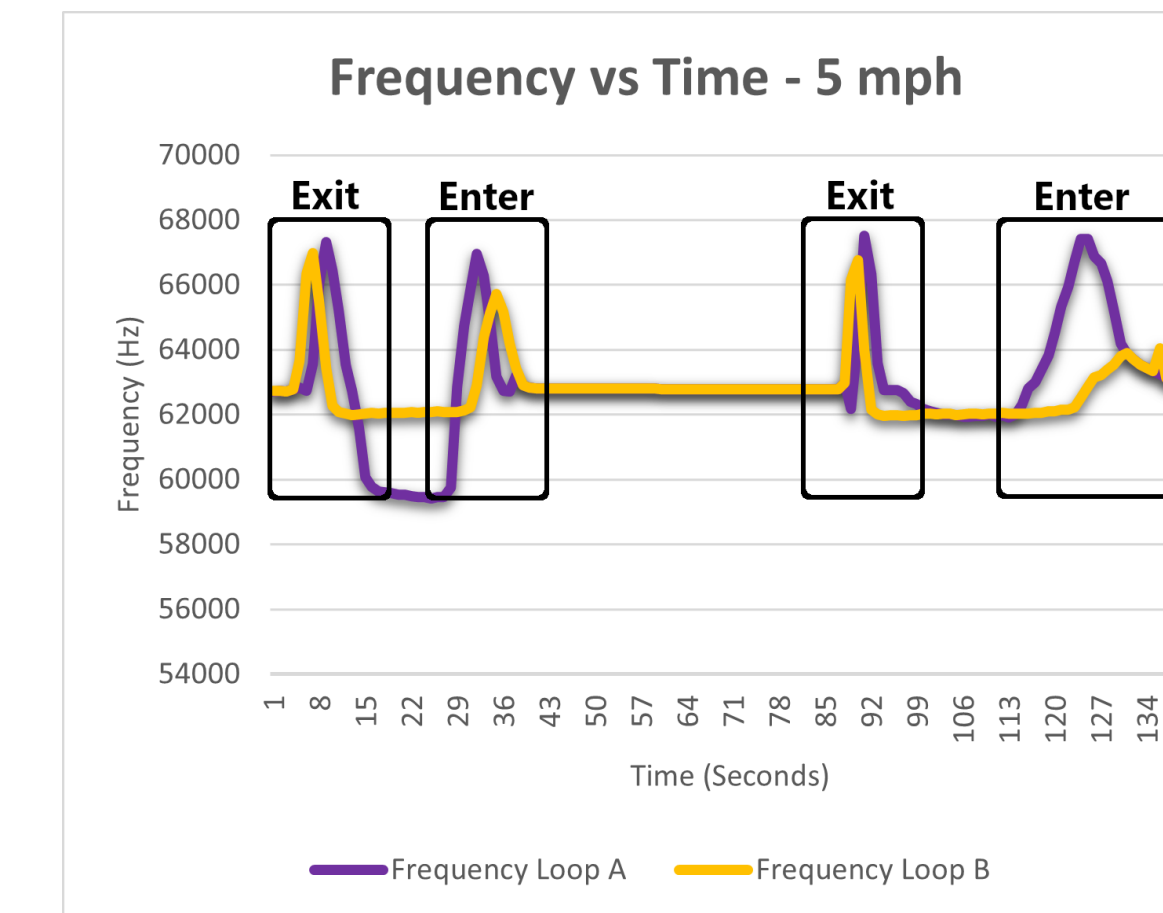


Figure 3: Frequency vs Time (5 mph)

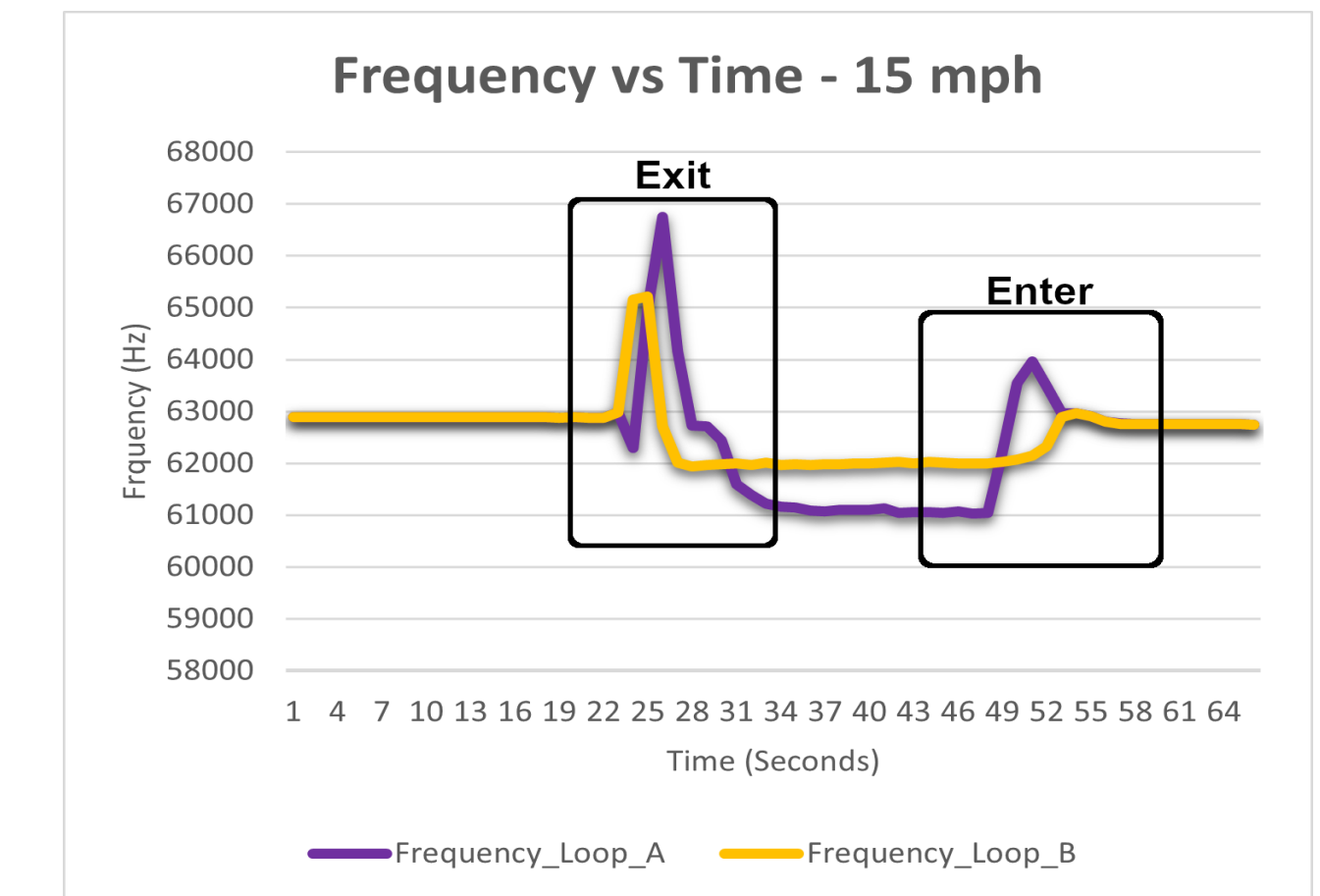


Figure 4: Frequency vs Time (15 mph)

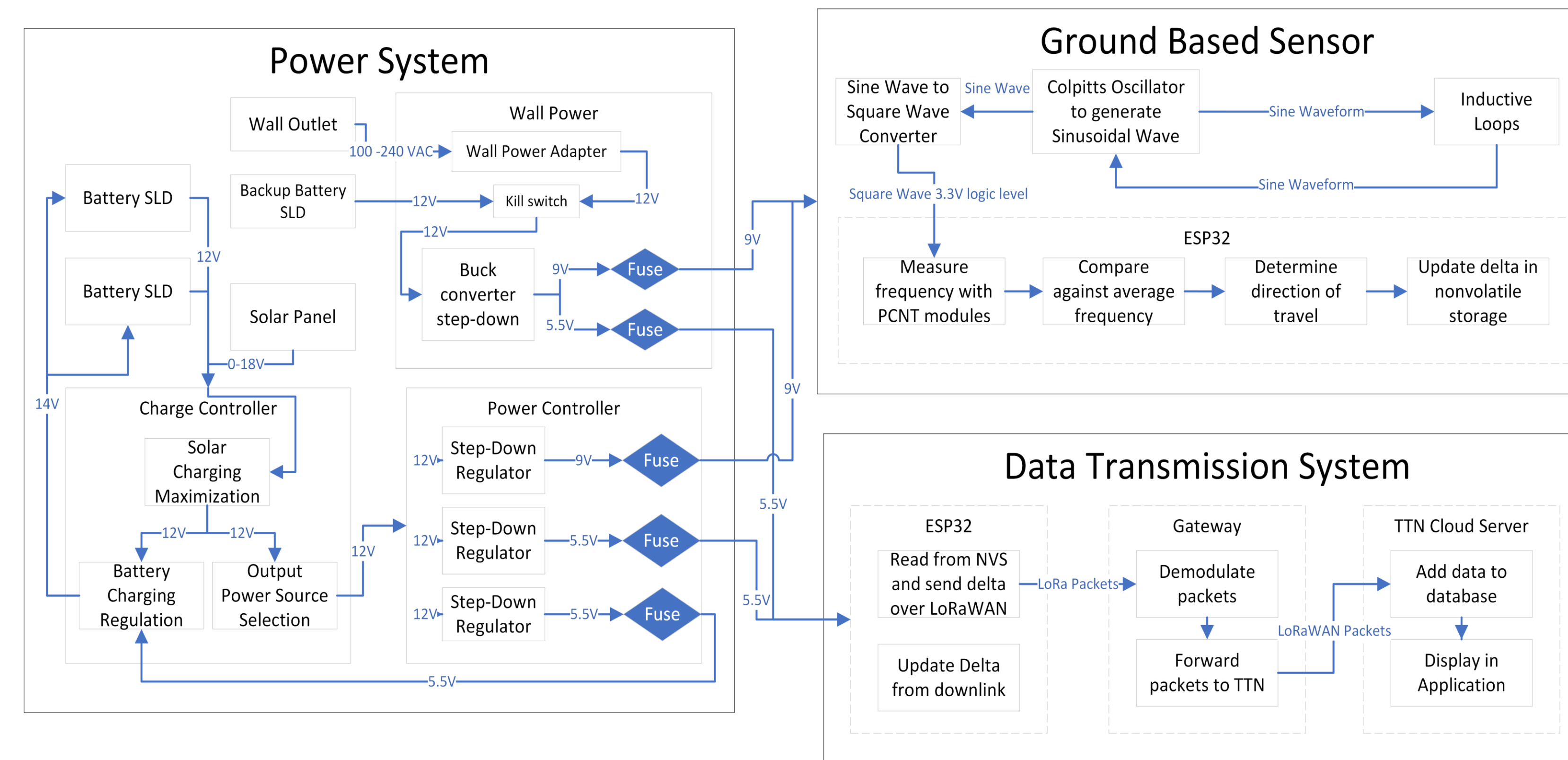


Figure 2: Project Block Diagram



Figure 5: System Implementation

Acknowledgements

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Future Work

1. Test against numerous vehicle classifications and how the frequency changes with each classification of vehicle.
2. Upgrade LoRaWAN equipment.
3. Improve vehicle detection algorithm.
4. Redesign Charge Controller PCB
5. Integrate LoRaWAN cloud server data with the previous ECE team's mobile application.