Fig. 1. PRT - Morgantown, WV. Adapted From [1]

WVU PRT System Data Collection and Analysis:
Problem Statement, Feasibility, and Requirements Specification

PRT Capstone (Group 4)
Andrew DeGarmo
Sam Desai
Emma Kupec
Kevin Meyers
Omar Ndiaye
Greyson Weimer

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1 Problem Statement

While the PRT, in its current state, serves WVU's students appropriately, the system is not without its faults. Despite a movement rate of roughly 15,000 students per day, there are times when commuters are left waiting at a platform as empty cars leave. By equipping the PRT cars with a telematics device, some of these scenarios can be avoided. Equipping cars with sensors to track data such as power consumption, GPS location, and passenger capacity allows data to be analyzed to provide insights into how the PRT can be more efficient in transportation and energy consumption.

2 Feasibility

Due to the lack of realization of this capstone project in previous years, our group can be the first to implement this necessary solution. The lack of ability to analyze data associated with PRT use is detrimental to understanding the system and its points of inefficiency. The PRT has diligently served the students of West Virginia University for nearly 50 years. Throughout that time, technology has advanced drastically. Now, there is more reason than ever to invest time and energy into capturing data for analysis to provide future Mountaineers with an efficient and reliable form of rapid personal transportation.

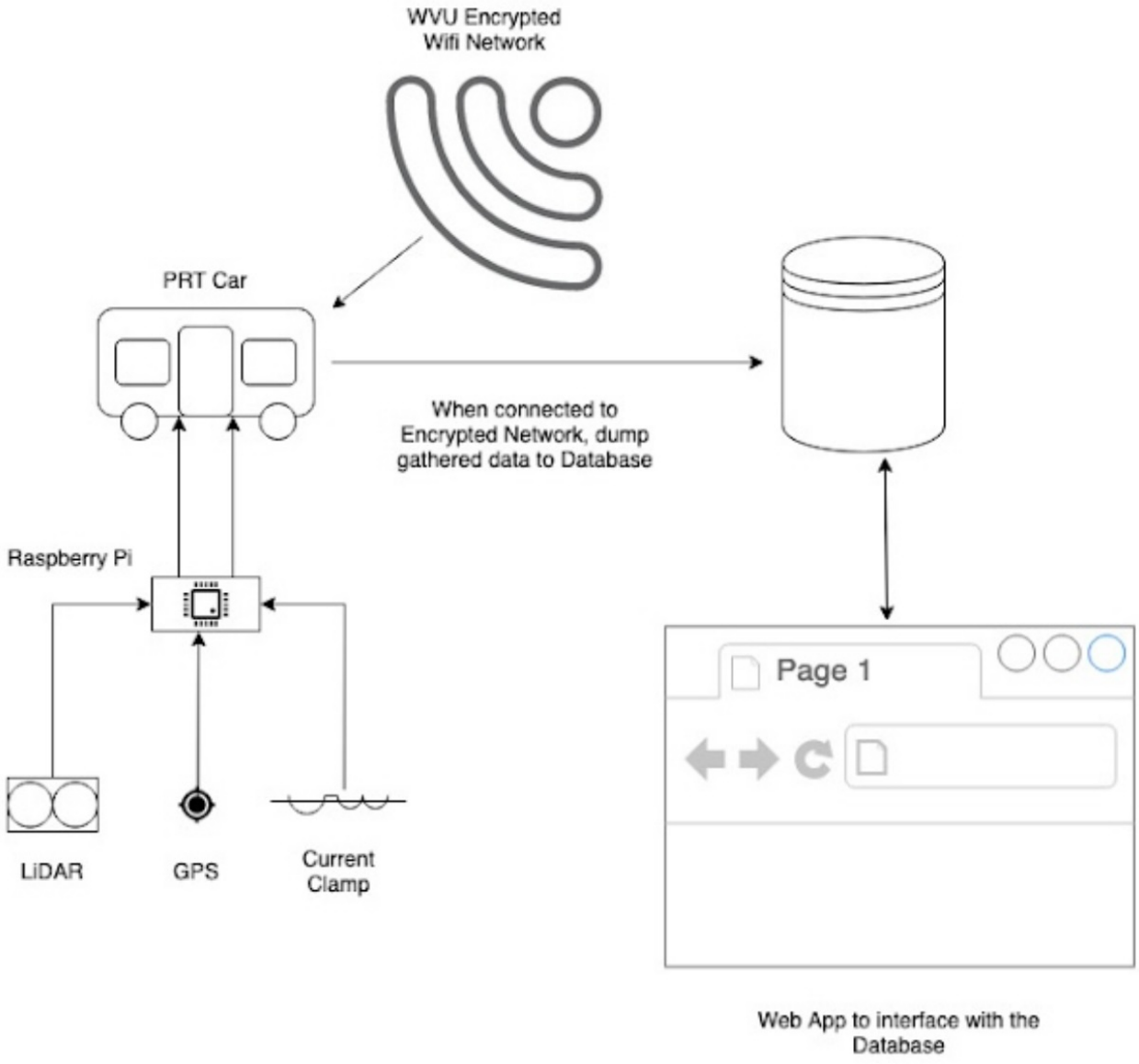
Our proposed solution is inexpensive, requiring only already-made components. The novelty of the design lies in how we combine components to solve the problem elegantly. Using a Raspberry Pi as a microcontroller provides a cost-effective solution for transmitting data to PRT engineers at the central maintenance station and incorporating devices like LiDAR and GPS. When connected to a GPS, the Raspberry Pi will determine its precise location in real-time and provide flexibility with the configuration of a GPS. A LiDAR sensor allows for real-time, high-accuracy identification of passengers on board the PRT while maintaining minimal costs.

As well as technical improvements, there are possibilities to improve the safety of passengers. Currently, when a vehicle experiences an issue, the PRT Engineers may not know with 100

3 Requirements Specification

1. Equip a PRT car with a Raspberry Pi 4 model B.
2. The Raspberry Pi should be in an enclosure with a footprint that does not exceed the limitations presented by the PRT team.
3. The enclosure should not be seen by the occupants. The enclosure should not interfere with typical use or passengers.
4. Collect PRT car movement via GPS tracking.
5. Collect PRT energy consumption via a current clamp.
6. Collect occupancy via Lidar or Infrared.
7. Sync data from the car to the database via encrypted WVU Wifi.
8. Store data in an SQL database.
9. Analyze collected data to generalize PRT car behaviors.
10. Present data through a single-page front-end display.
11. Allow a user to perform analysis and visualization.

4 Proposed Architecture



5 Proposed Timeline

As a team, we have committed ourselves to developing our solution throughout the next two semesters (Spring 2024 and Fall 2024). It is our intent to create a demonstration of the solution's hardware within the current semester. This demonstration, or mockup, will be used as a tool to pitch our solution to stakeholders in order to begin implementing our solution on the PRT system. Long term, there should be a refined solution present in the PRT system from which data may be collected and analyzed.

- Semester 1 (Spring 2024)

  - Hardware
    - Phase 1
      - Draft architectures
      - Acquire Raspberry Pi and hardware sensors
      - Test hardware and gather preliminary data
      - Configure hardware
    - Phase 2
      - Connect GPS to Raspberry Pi
      - Connect current clamp to Raspberry Pi
      - Connect LiDAR to Raspberry Pi
      - Test
      - Create Demo
    - Phase 3
      - Connect to PRT
      - Power Hardware
      - Hardware enclosure
  - Link
    - Phase 4
      - Draft data architectures
      - Configure data dumps
- Semester 2 (Fall 2024)
  - Software
    - Phase 5
      - Format data
      - Configure database
      - Data generalization
    - Phase 6
      - Data analysis scripts
      - Front-end data visualization

NOTE Phases can occur concurrently

6 References

[1] N. M, "Prt - morgantown, wv," Sep 2018. [Online]. Available: https://www.flickr.com/photos/nick-m/2861037302