

TrackSide and RaceCar Software

Introduction

Formula SAE is a student competition focused on engineering design and innovation for a high-performance vehicle. The Telemetry App supports this project by providing real-time and historical vehicle data monitoring. The application is built with a Unity front end and a Golang backend to connect to the database in SQLite. This data is used to optimize performance and diagnose issues. For the car itself we have a Raspberry Pi-based Central Control Unit (CCU).

Objectives

- Provide real-time visualization of critical vehicle parameters during race and test sessions.
 - Store telemetry data for post-session analysis and performance tuning.
 - Ensure seamless integration with the Formula SAE vehicle systems, including sensors, the CCU, and other control units.
 - Ecosystem of inter-compatible software running on different hardware
 - Prioritizing a common communication protocol between different software suites
 - Research or develop a communication protocol that ensures safe and quick packet arrival
 - Different platforms for different software i.e. Arduino and raspberry pi (Linux)
 - Proper safety checks between different units

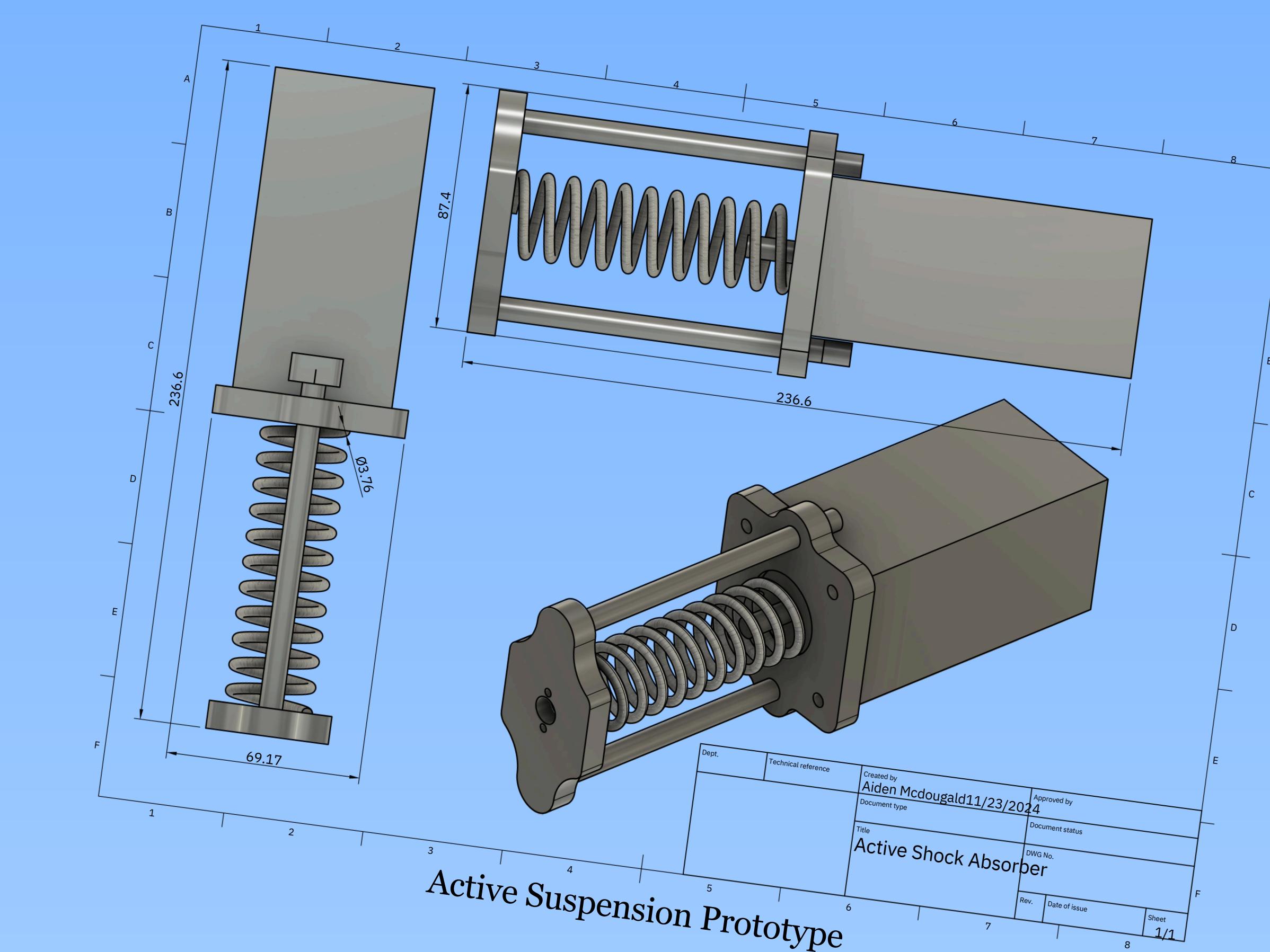
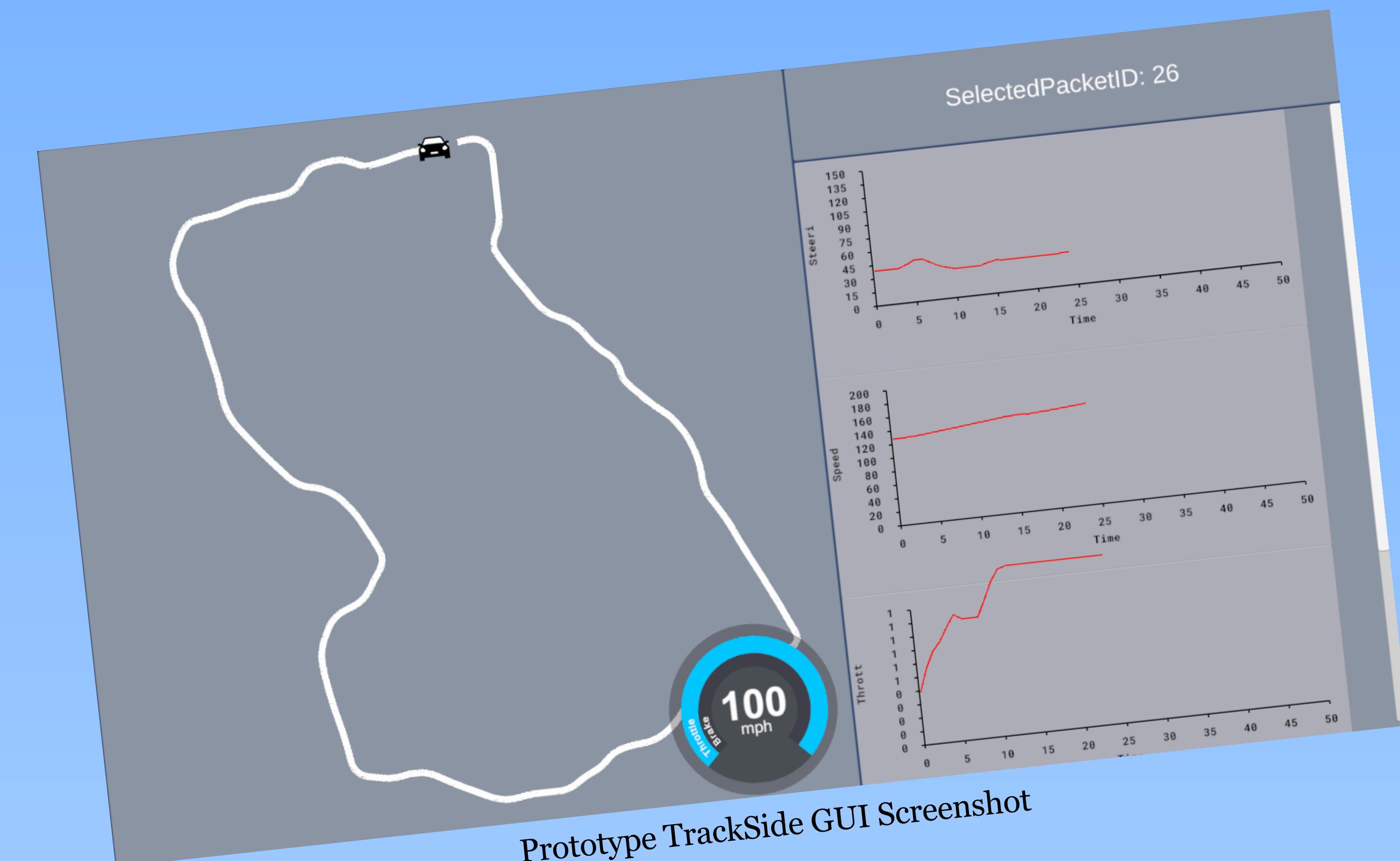
Design and Implementation

Tools & Technologies

- Programming Language: C#, Golang, C/C++
 - App: Unity Engine
 - Database: SQLite
 - Hardware: Raspberry Pi (CCU), Windows Machine, various sensors

Data Flow

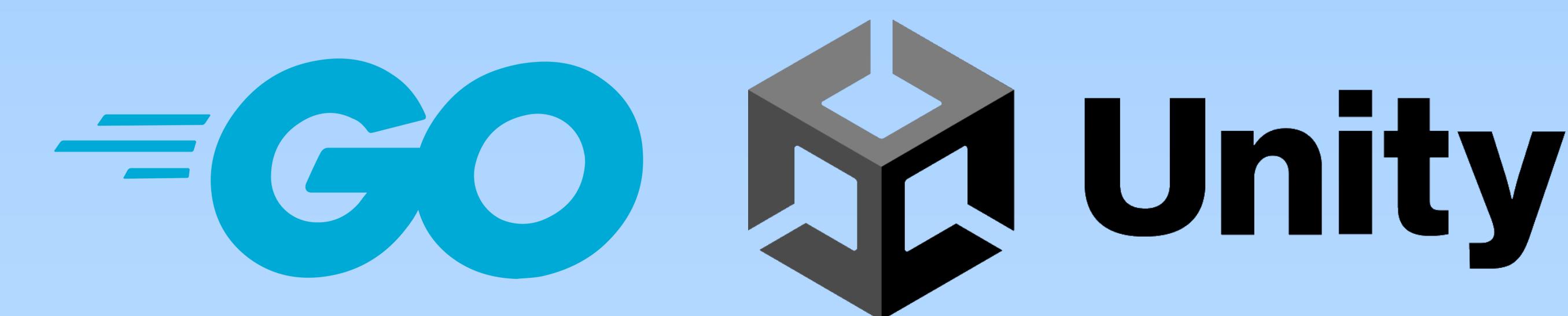
1. Sensors collect analog data and send it to the CCU via I2C bus.
 2. The CCU processes the data and transmits it to the database via WiFi.
 3. The GUI retrieves data from the database for live or historical display.



System Architecture

- Hardware Interfaces
 - CCU (Central Control Unit):
 - Manages data collection from sensors and sends it to the database.
 - Relays and controls operations for car like suspension stiffness and a virtual differential/traction control
 - Sensors:
 - Collect analog signals for steering, throttle, brake positions, tire temperatures, and GPS location.
 - Human Interfaces
 - Steering Wheel Interface:
 - Displays key metrics like speed, tire temperatures, and lap times on a steering wheel screen.
 - TrackSide:
 - GUI shows live diagnostics and allows for strategic decision-making during races.

Technologies



Future Work

- Integrate more advanced visualization tools for race strategy optimization.
 - Expand functionality for driver coaching using historical performance trends.
 - Ensure compatibility with additional vehicle subsystems (e.g., active suspension and traction control).

Unpaid Workers



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