Elcano Simulator: Virtual Tricycle Localization

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Introduction

The Elcano Simulator project enables autonomous vehicle (AV) localization and navigation testing in a virtual environment:

- Physical AV equipment is expensive, and minimizing cost through simulation makes development accessible
- Developers can make small changes that can be tested quickly without having to deploy a physical trike
- Virtual environments minimize risk to pedestrians and obstacles

Overview

This project replaces the physical tricycle and sensors with a printed circuit board (PCB) and 3 microcontrollers (MCU):

- User interface uploads software to all MCU connected to the redesigned router PCB that passes information to and from the simulator.
- Simulated GPS and sensor signals are now transmitted from a virtual environment to the high level board for path planning.
- Localization and navigation data is communicated between microcontrollers over CAN bus and transmitted back to the simulator.
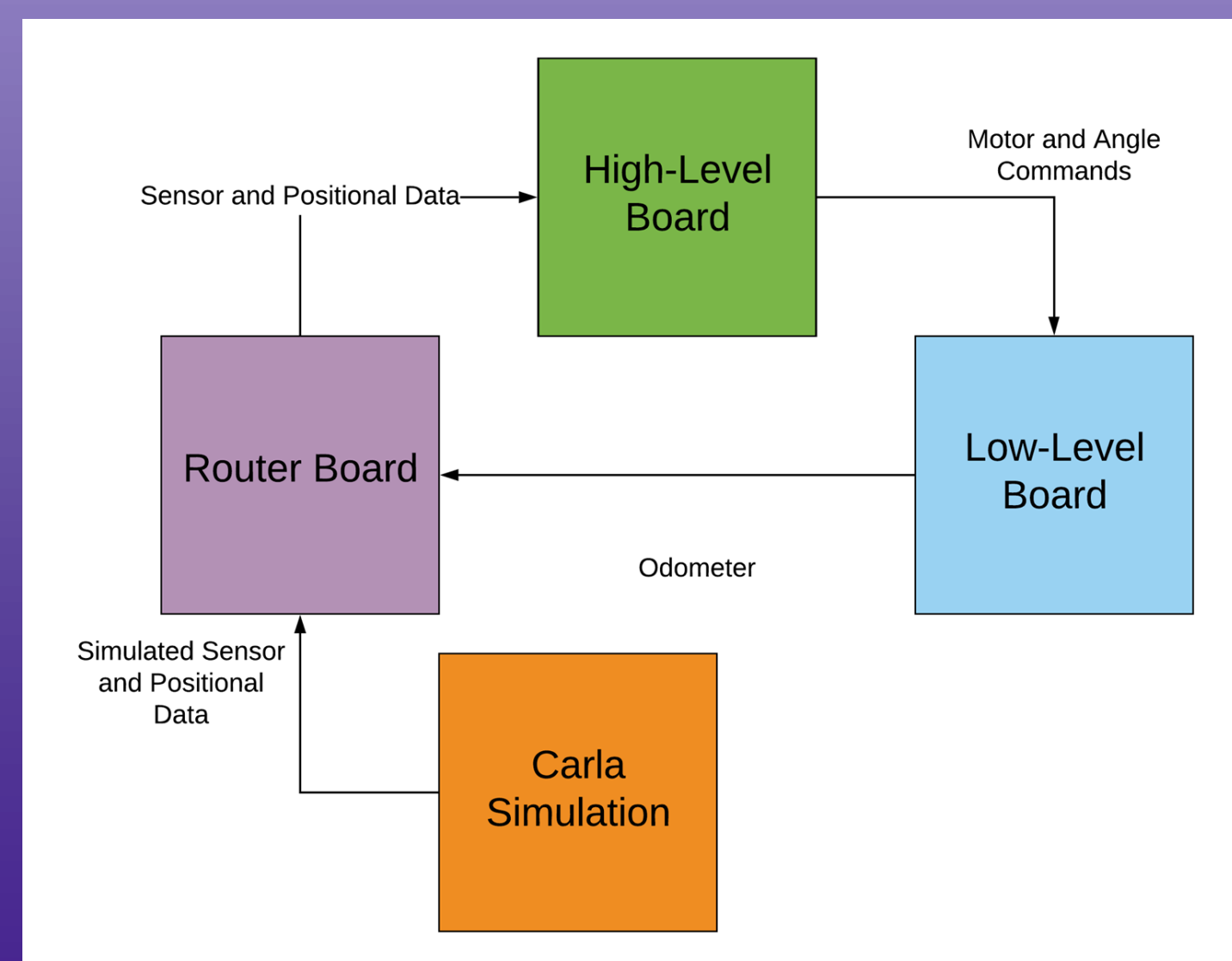
Elcano Data Flows between Systems

System Details

The figure below shows the connections between modules controlling the self-driving vehicle system.

Results

Localization data displayed in Carla HUD
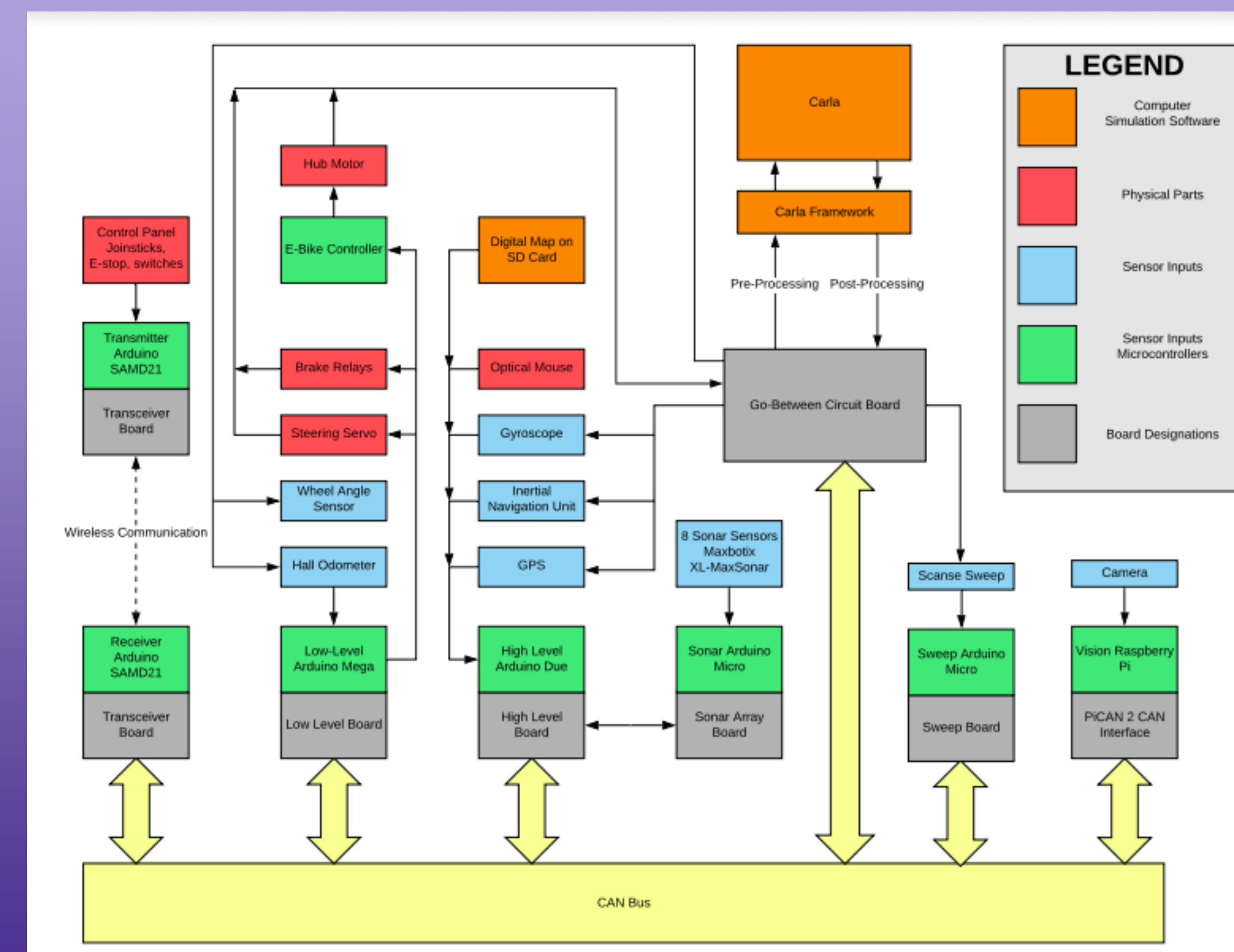
Conclusion

Accomplishments

- Software GPS for High Level (Arduino DUE)
- System onboarding User Interface
- Working router PCB
- Working CAN communication between microcontrollers
- Mapping & basic path planning implementation

Future Work

- Software I2C for simulated slave devices
- Simulate compass, accelerometer, & gyroscope
- Autonomous path planning and navigation

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References
Arduino Open Source Libraries
uC Experiment Arduino Scripted GPS Simulator v2.0
Carla Simulator