

E1.02 - Ground Control

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Project Overview

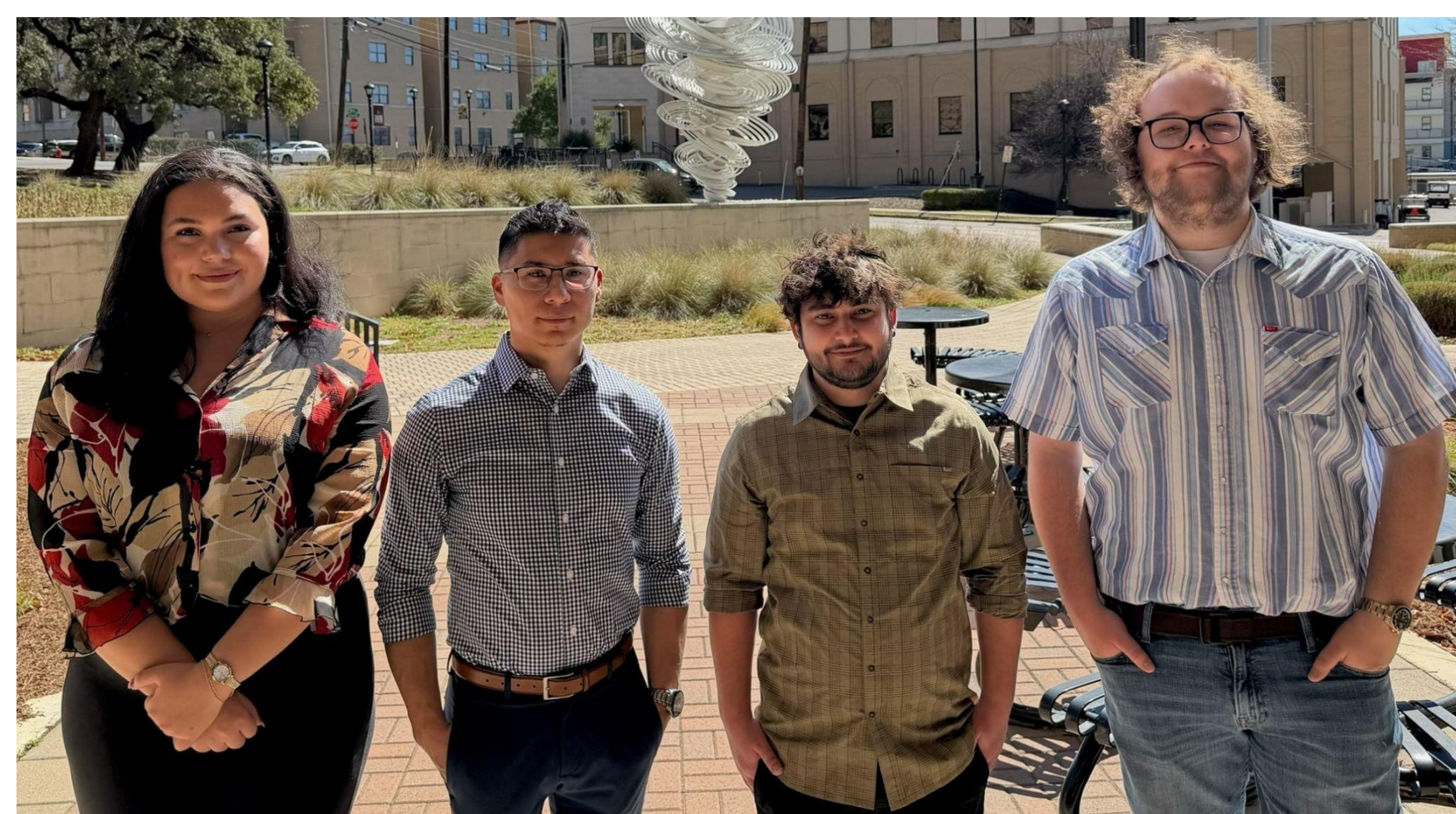
What Our Project is:

- Monitoring system that will **detect shifts in a home's foundation**, and **alert the homeowner** before structural damage occurs.
- Gives home owners a **live sensor data** readout to **visualize foundational displacement**.

Design Requirements

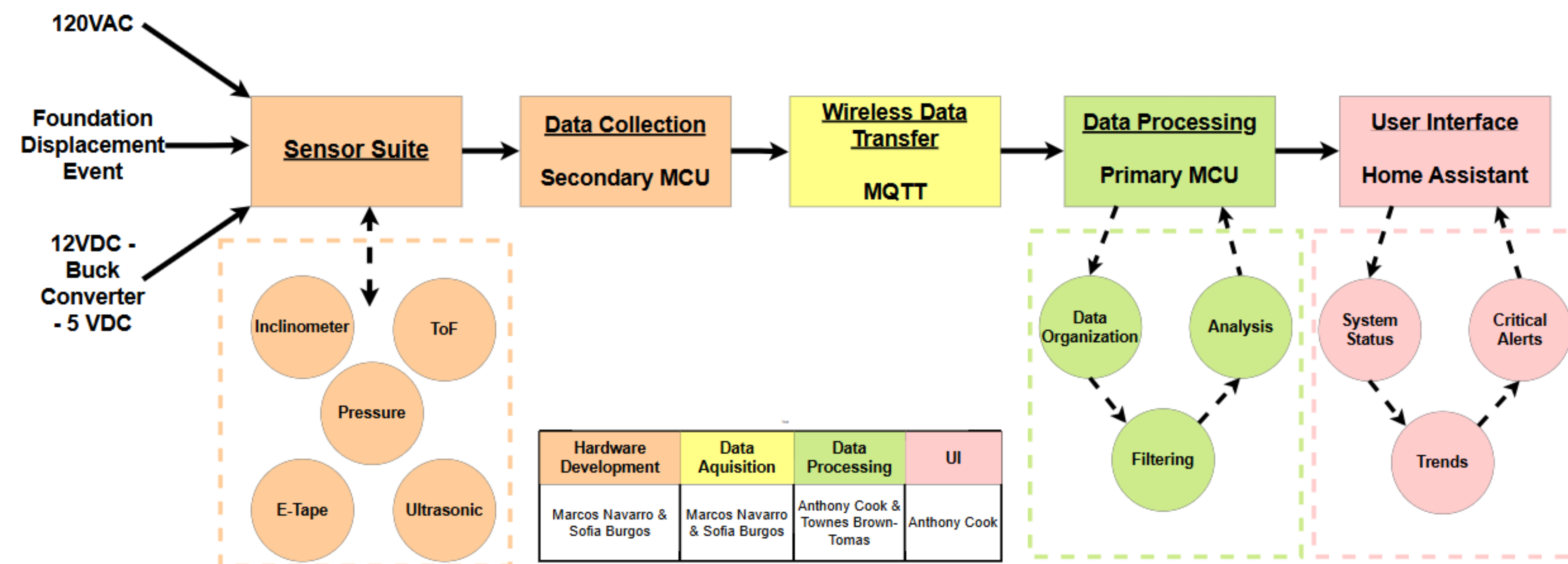
- Detect shifts** in slab foundations
- Use **wireless communication** for data transmission.
- Analyze and filter** collected sensor **data** into meaningful longterm trends.
- Display collected data** on graphs in Home Assistant.
- Utilize machine learning techniques for **anomaly classification**.

Meet the Team

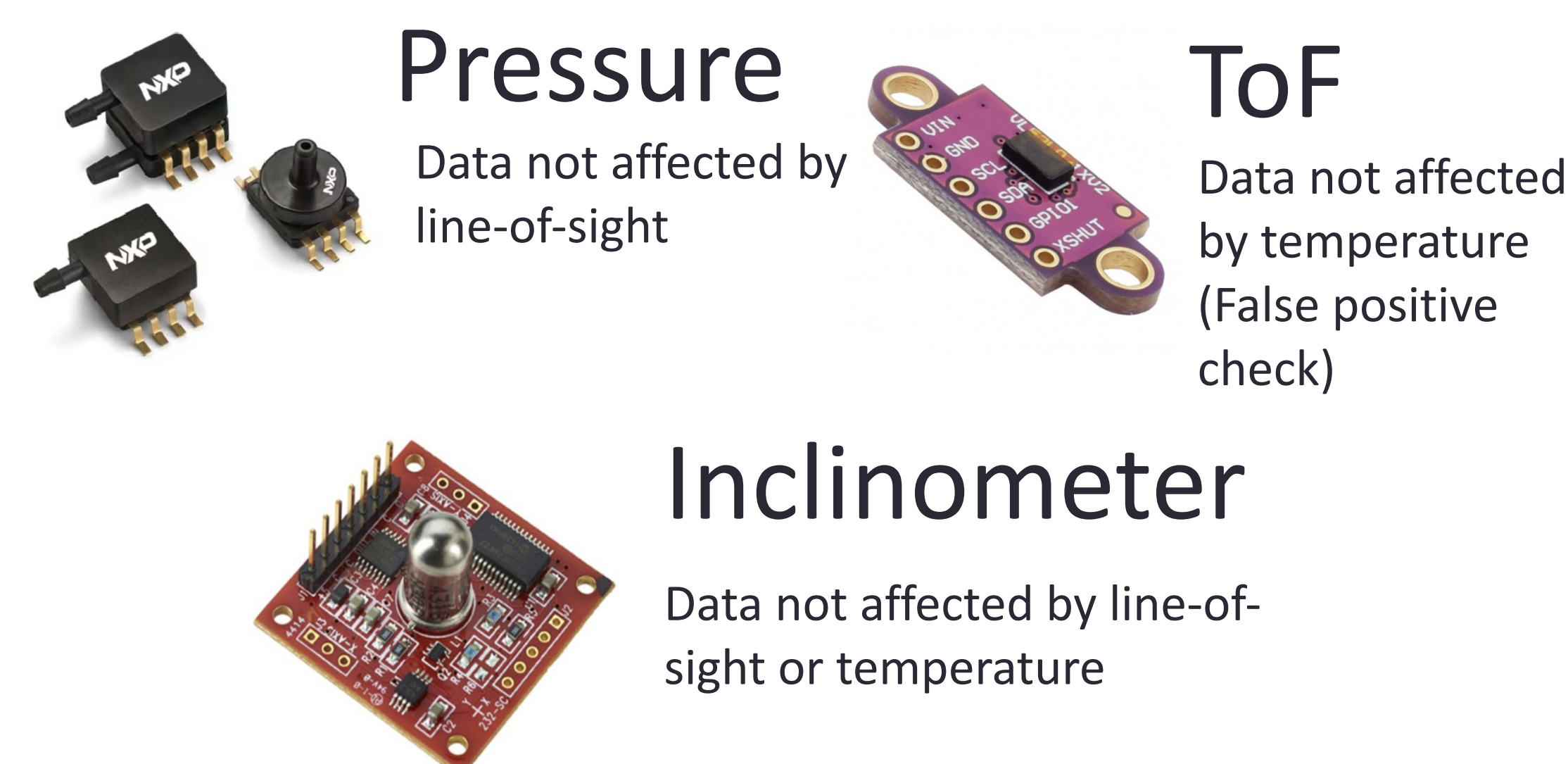
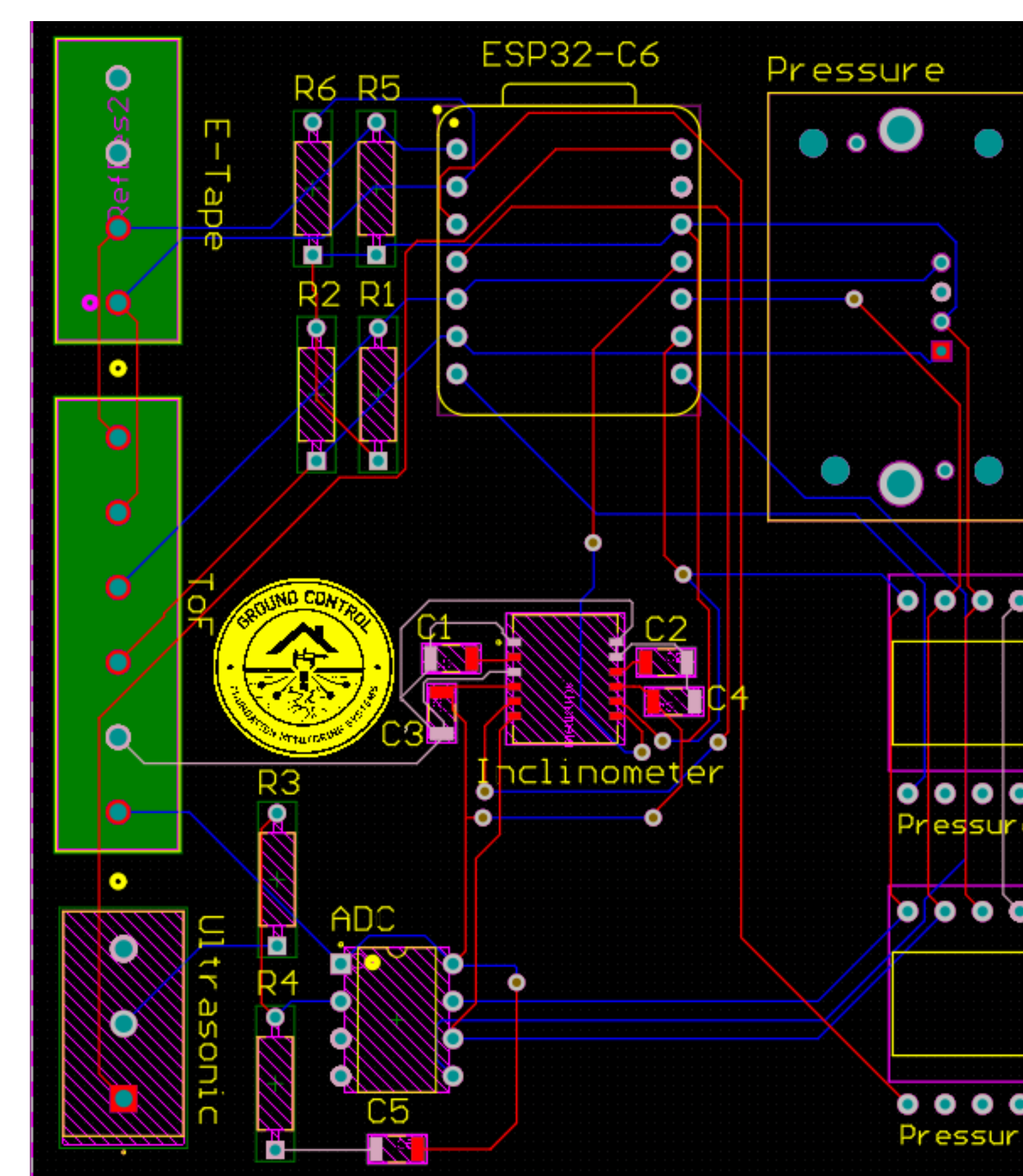


Sofia Marcos Anthony Townes

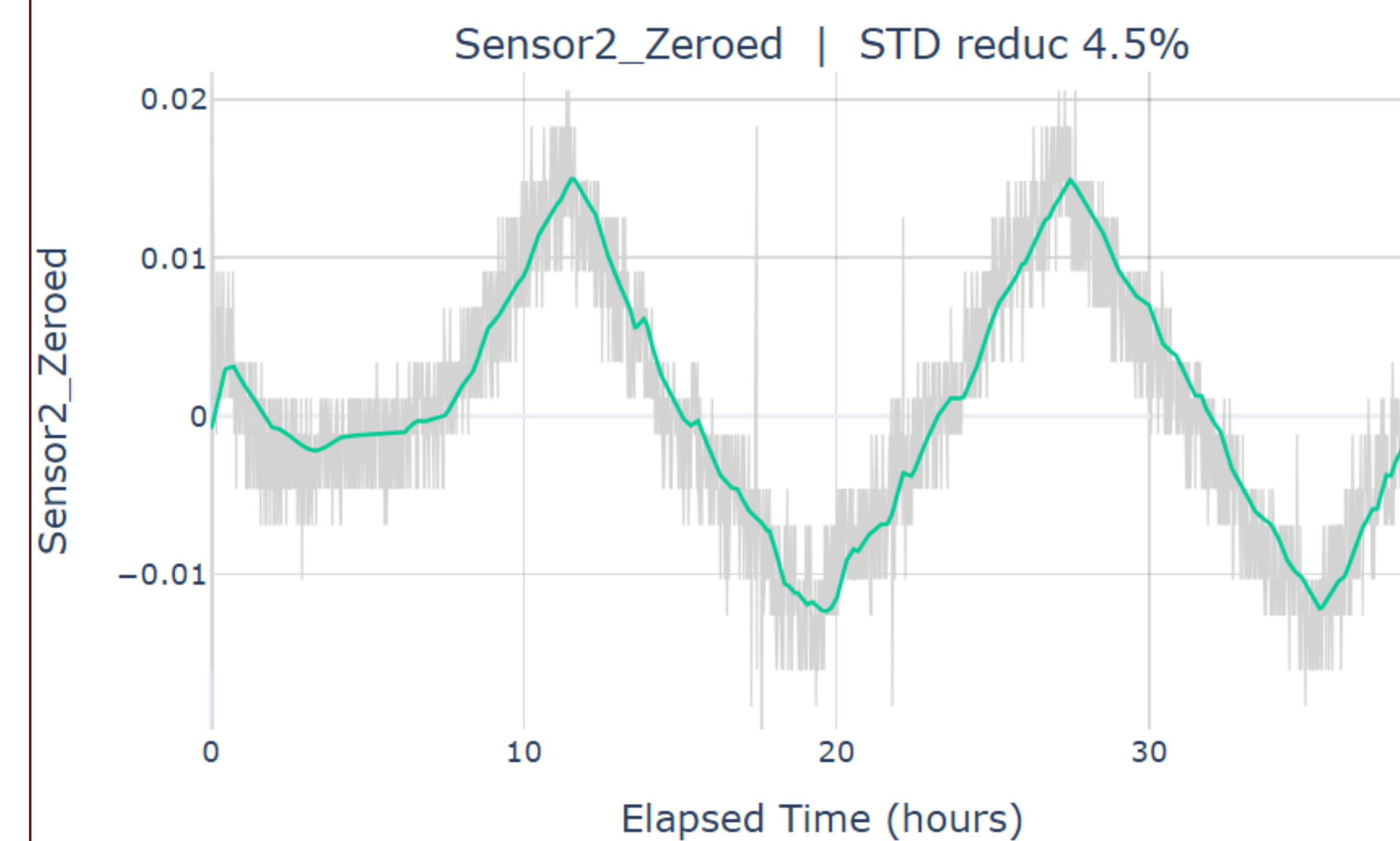
Top Level Block Diagram



Hardware & Sensors



Filtering & Processing



- Multi-stage digital filter **extracts trends from raw data**.
- Spike rejection **removes anomalous readings**.
- Polynomial smoothing **preserves shape of readings while suppressing noise**.
- Adaptive weighted average produces a **clean, continuously updated displacement estimate in real time**.

D1 Accomplishments

- Built a platform** capable of dependably traversing required distances for testing.
- Manufactured G.C.'s first PCB** for sensor testing & completed next design iteration to accommodate the preliminary seven sensor suite.
- Constructed filtering pipeline** to clean sensor data to be posted to the UI.
- Ran preliminary tests** for ToF, Pressure, and Inclinator sensors.
- Stress tested wireless data delivery** to optimize payload content.
- Refined Home Assistant** to accommodate new sensor selection and desired data display.

D2 Plans

- Implement ML model** for anomaly classification
- Refine sensor selection** to most optimal/efficient selection.
- Long term **stability testing**
- Filter optimization** and validation
- Complete final PCB** design for finalized sensor selection.

Acknowledgments

- Chalmette Ray & Stable Options LLC
- Advisor: Mark Welker
- SATOP
- Mentor Team: E2.03
- Previous Team E2.03: As Above, So Below