

E1.02 - Integrated Camera & Lighting System – Hazard Detection



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Problem Description

Lunar Terrain Vehicles require safe, effective operation in environments characterized by:

- **Rugged terrain**
- **High contrast lighting**
- **Regolith interference**

Our Solution

mmWave Radar Sensing

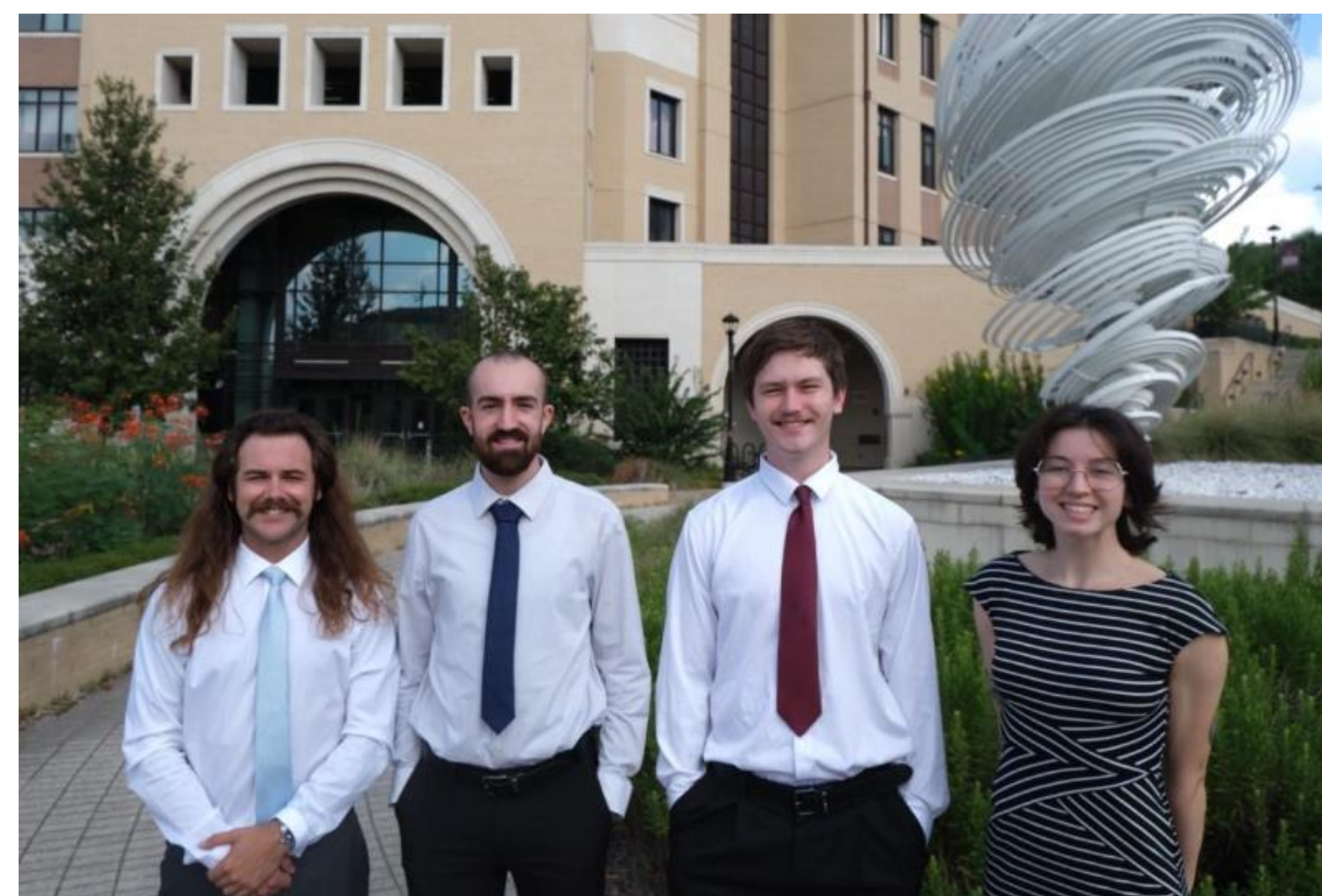
- Operates in zero visibility.
- Maps terrain to 3D point cloud.

Hazard Detection - Raspberry Pi analyzes point cloud frames to perform real-time classification.

Interface - Live display for hazard visualization and algorithm tuning.

Modularity - Designed is a drop-in peripheral for the Integrated Camera & Lighting System (ICLS).

Meet the Team

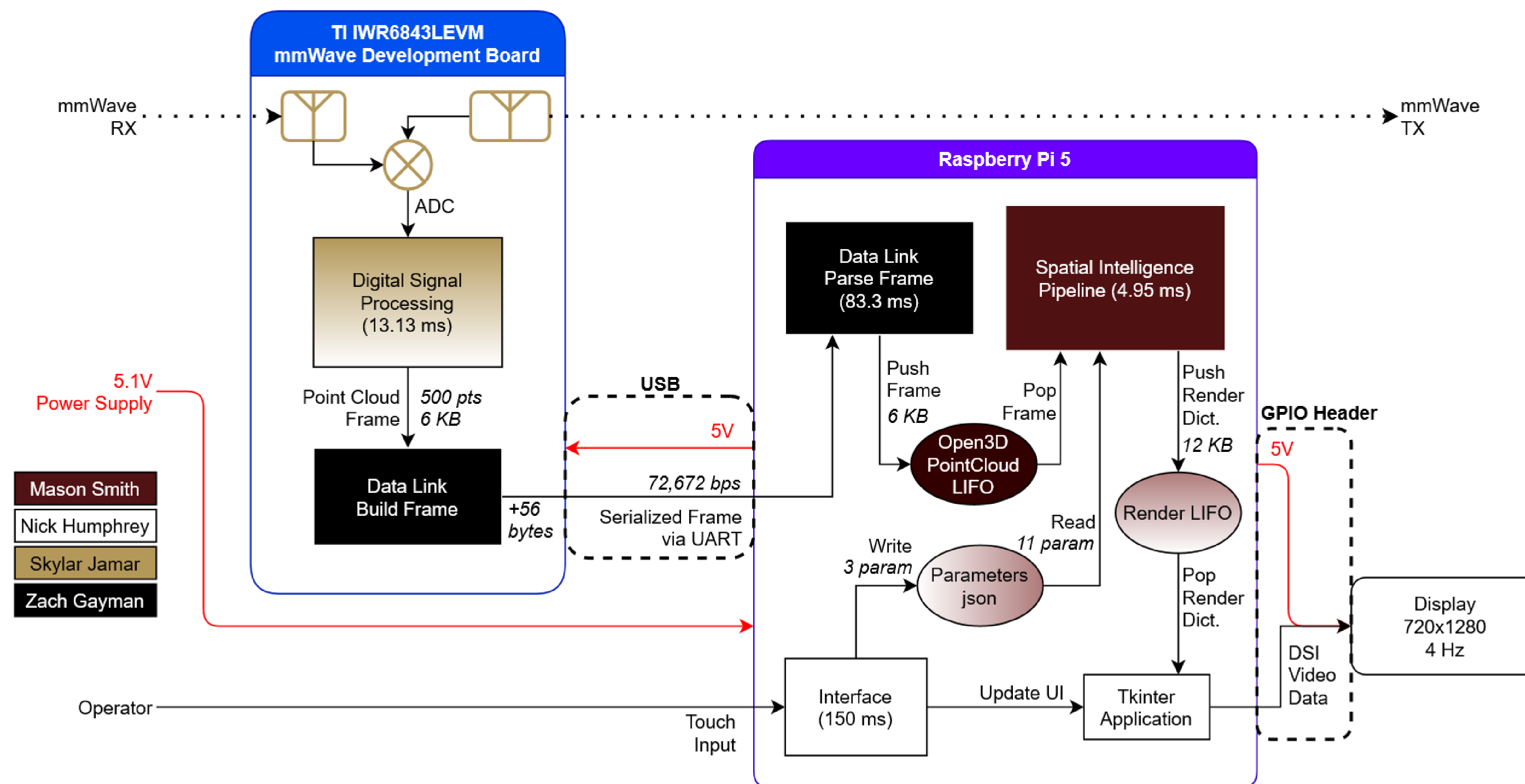


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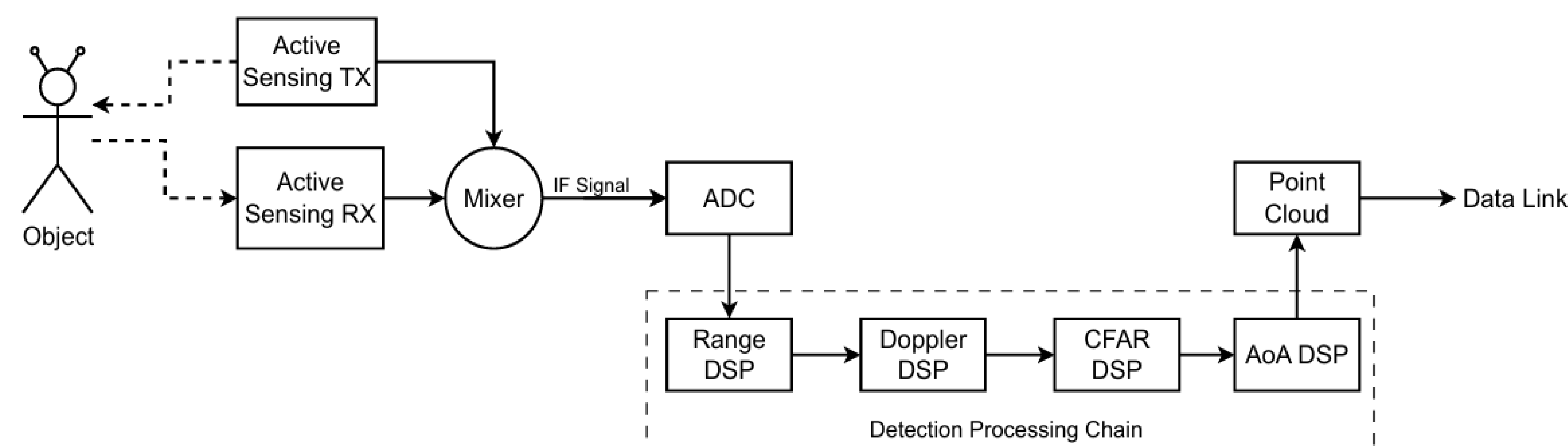
Acknowledgements

Faculty Advisor: Dr. Marcelo Carvalho
NASA Sponsor: Ms. Toni Clark
Student Mentors: Collin Peters, Erika Griffin, Jonah Hartley
Instructors: Mr. Welker, Mr. Stevens

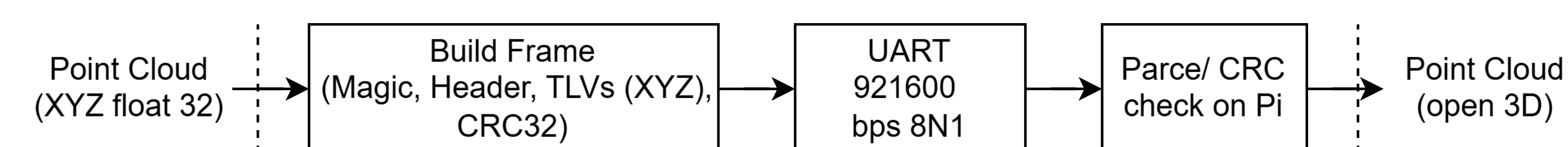
Top Level Block Diagram



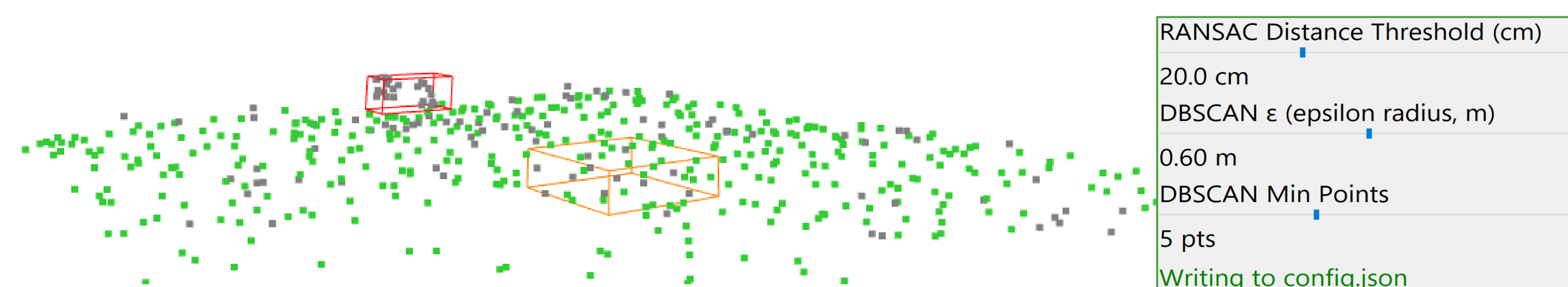
Digital Signal Processing



Data Link



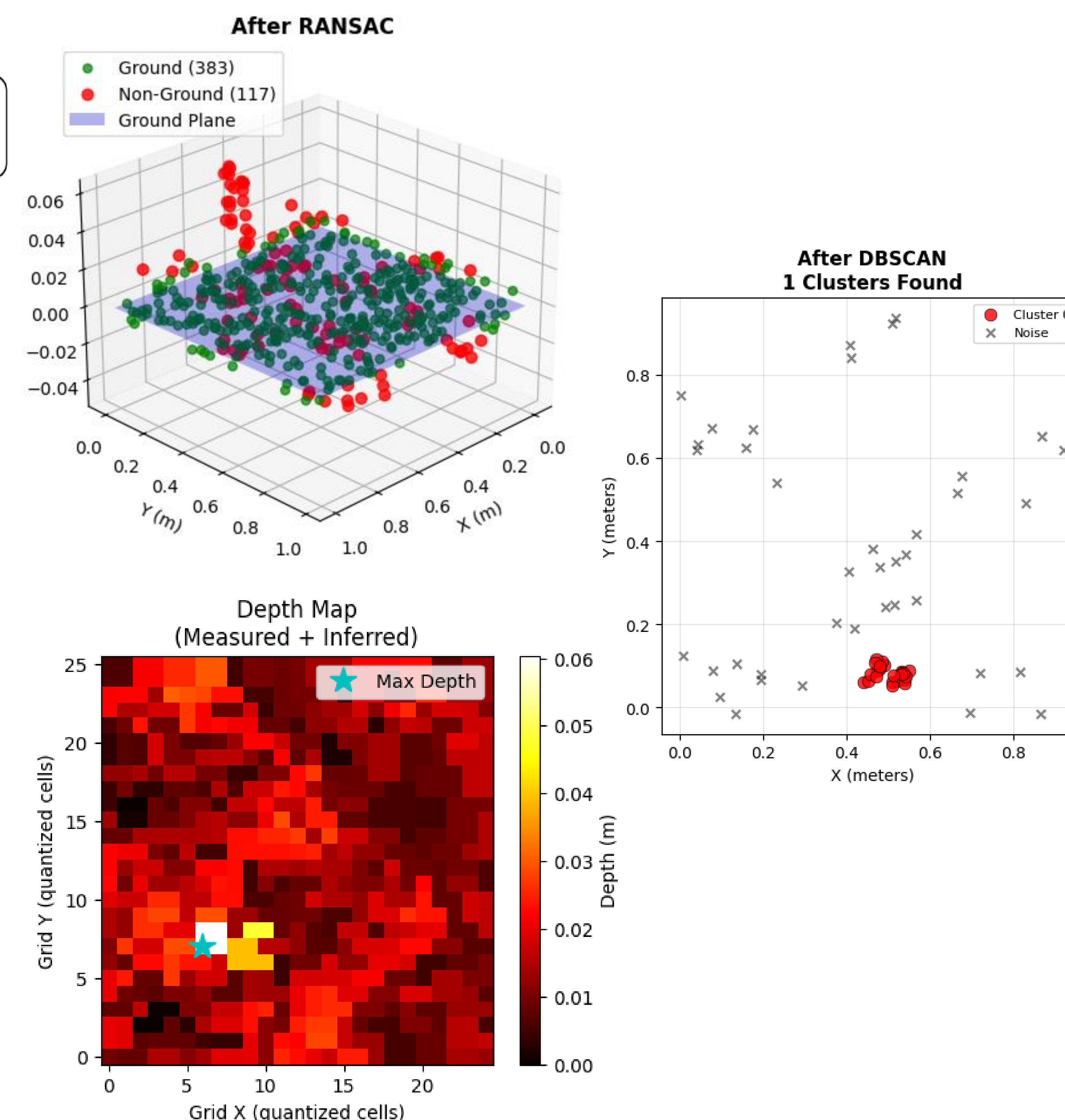
Interface Display



Power Budget

Budget Category	Wattage	Margin Details
PSU & cable loss	1.5 W	6% overhead
Raspberry Pi 5 Touch Display 2 (5")	4 W	800mA at 5V
TI IWR6843LEVM	8 W	1.6A at 5V
Raspberry Pi 5 core & peripherals	12 W	CPU, GPU, memory, GPIO/USB
Total	27 W	Supplied to the Raspberry Pi 5

Spatial Intelligence



Design 2 Goals

Bandwidth Optimization - Target Data Link bottleneck.

Full System Integration - Combine all subsystems, test and validate, augment existing ICLS.