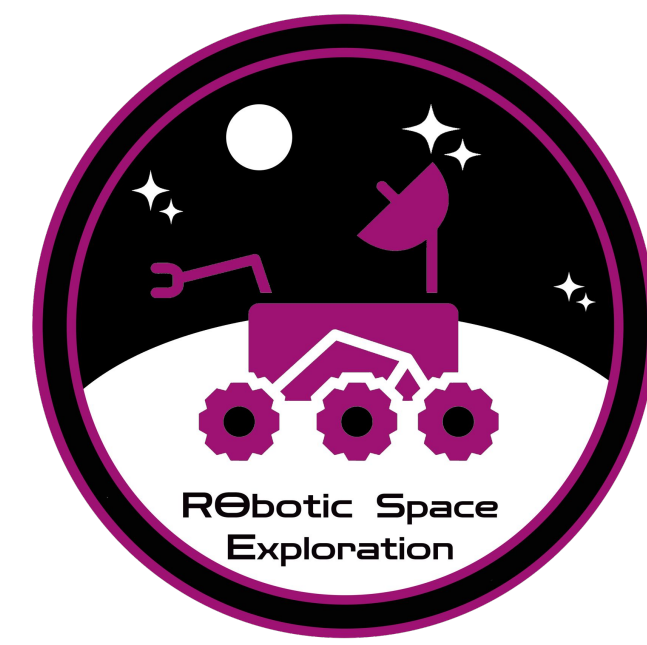




UNIVERSITY
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MĀNOA



Ground Station Development for Rover Operations

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Project Sponsor: Dr. Frances Zhu - Team RoSE
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INFORMATION & COMPUTER SCIENCES
UNIVERSITY of HAWAI'I at MĀNOA

Introduction

The University Rover Challenge (URC) is a competition where teams of university students design and build rovers capable of operating on Mars. The rover must be able to carry out various missions such as autonomous navigation and life detection. In order for the rover to accomplish these missions, a Ground Station User Interface must be developed to handle its tele-operations and data visualization.

Project Description

The Ground Station User Interface (GSUI) is a web application that must be capable of fulfilling the following requirements:

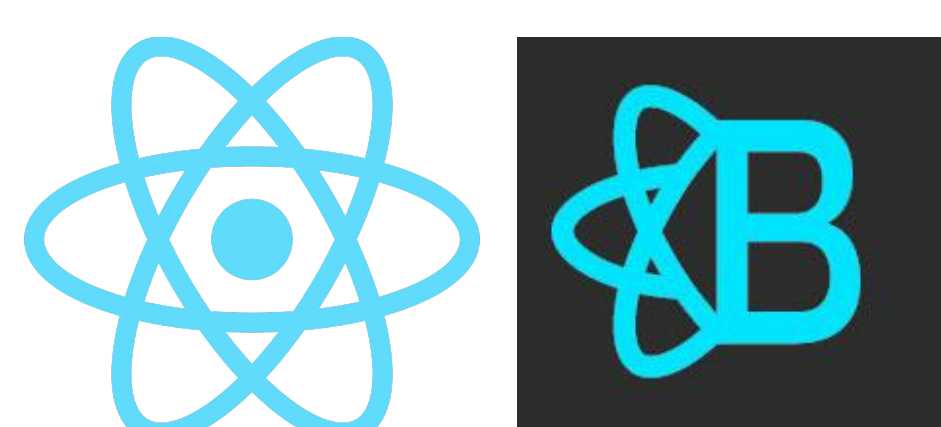
- display an indication of the state of the rover
- tele-operate the rover and the mechanical arm
- display camera feeds for various systems
- receive and transmit coordinates for autonomous navigation
- input and store data for scientific analysis

Methodology

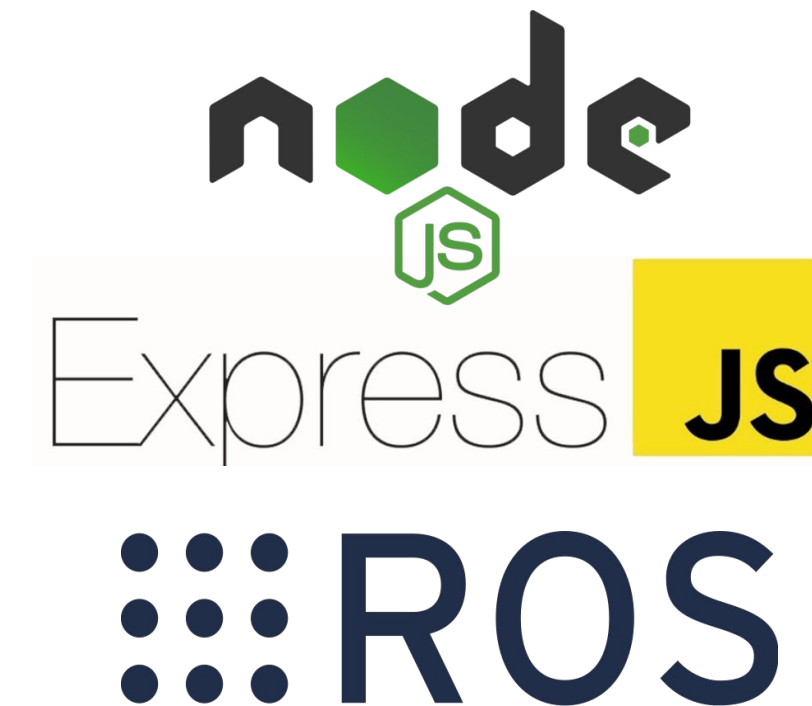
- **Agile Project Management** through sprint-based issue development facilitated using Jira
- **Weekly Meetings** held to provide progress updates, collect feedback, and establish milestones
- **Github** is utilized as a version control system to manage and source code and keep track of changes made to it over time.

Technology Stack

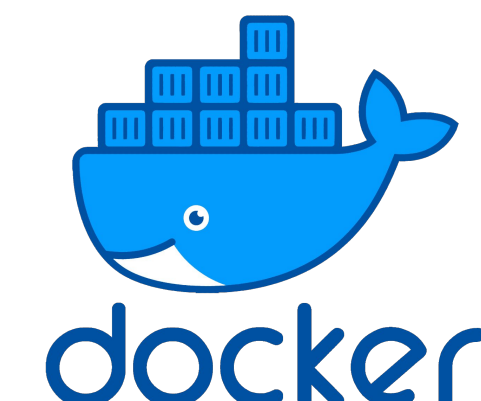
Front-End



Back-End

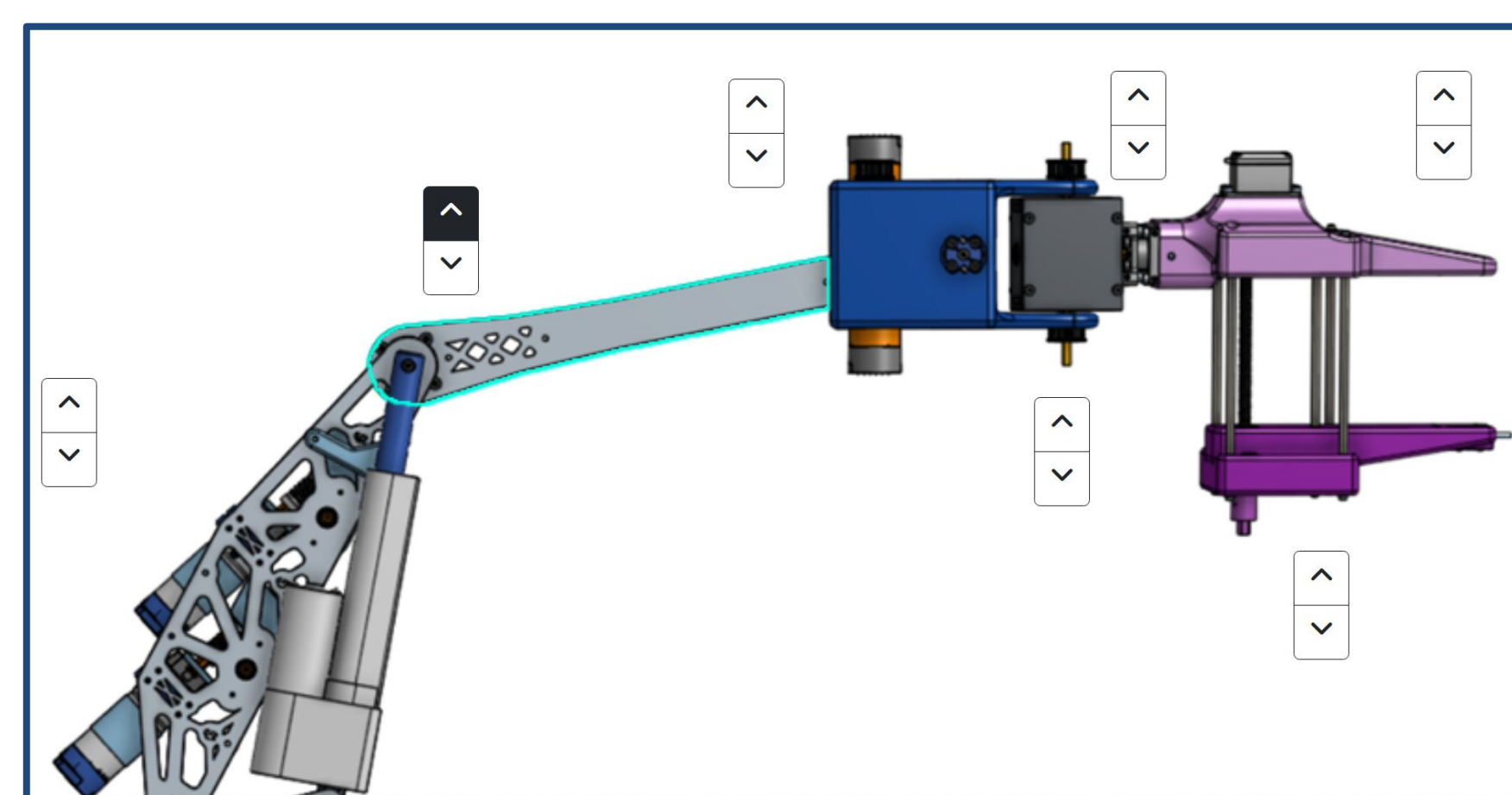


Containerization

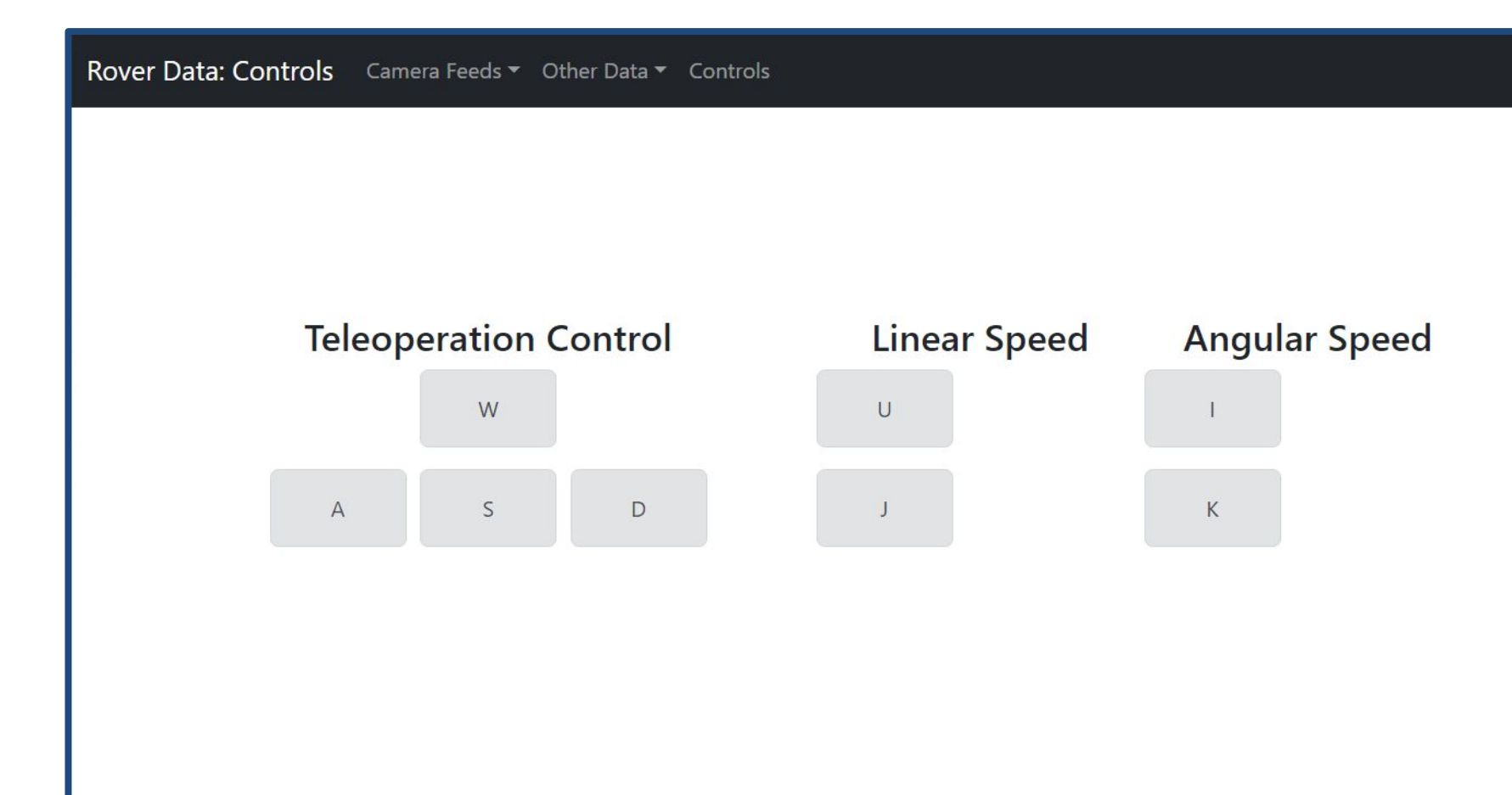


Accomplishments

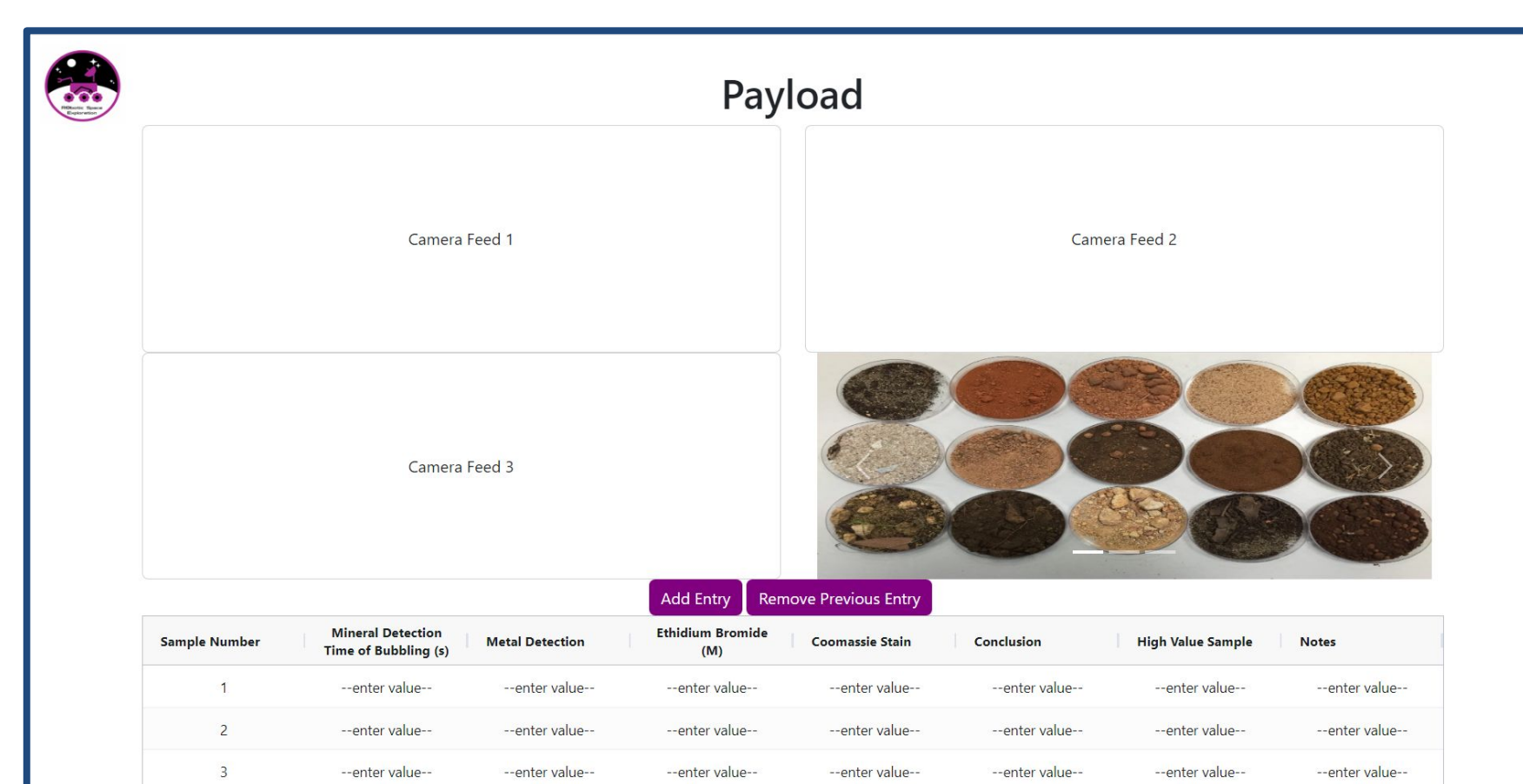
- **Simplistic User Interface Design**
 - Developed intuitive web pages designed specifically for each URC mission
- **Backend Server for Data Storage**
 - Developed RESTful APIs responsible for data handling
- **Tele-operation controls for rover and mechanical arm**
 - Created an interactive user interface with buttons that send ROS messages while highlighting the joint moving
- **Camera Feed Displays for tele-operation, arm control, and payload system**
 - Video streams from the rover are broadcasted utilizing rosbridge and displayed onto the GSUI
- **Data table for scientific analysis**
 - Users are able to input and modify rows of data, which is stored on backend server



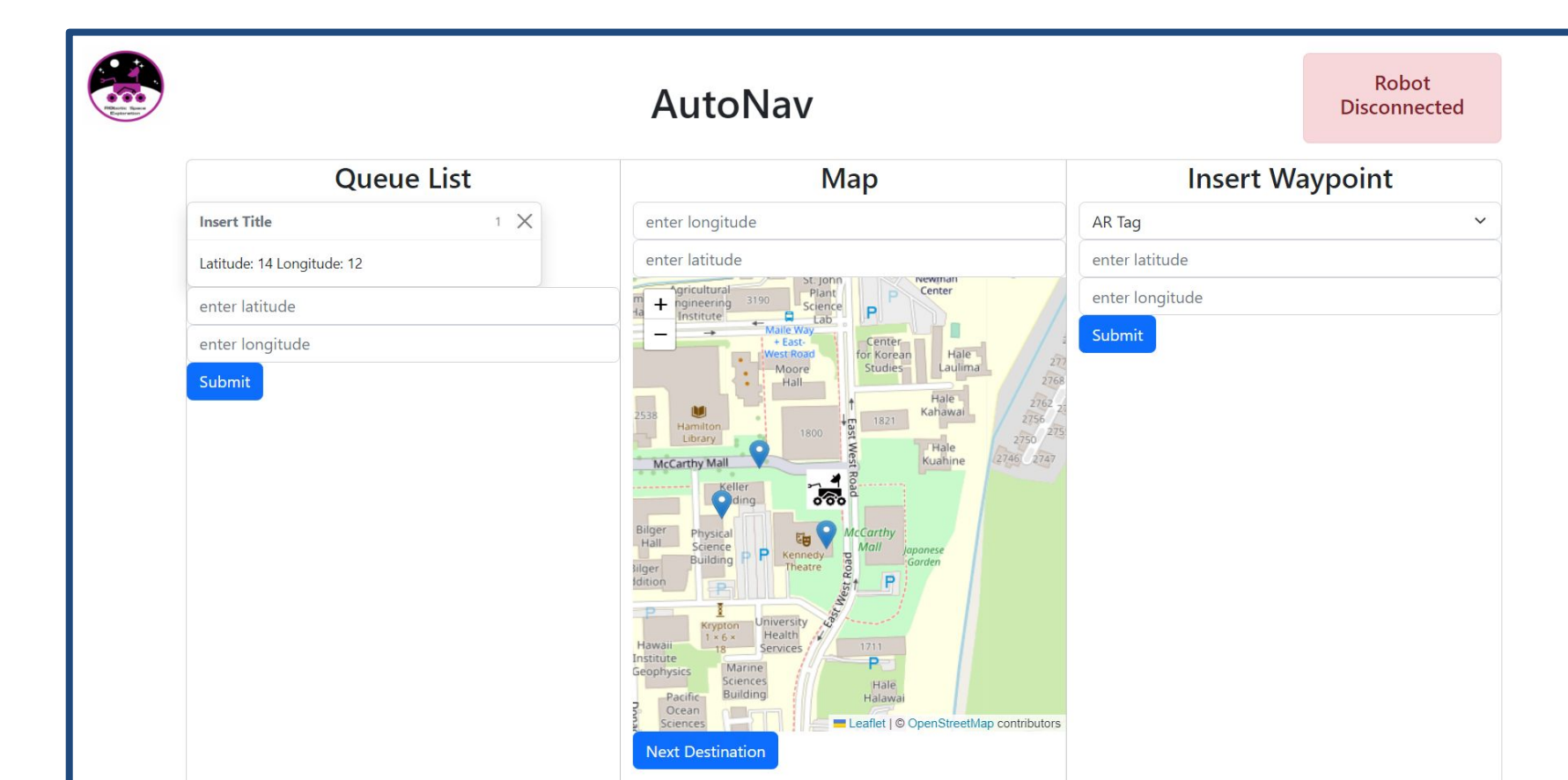
GSUI Arm Controls Page



GSUI Teleoperation Control Page



GSUI Payload Page



GSUI AutoNav Page

Reflections

- Adaptability is important when requirements tend to change continuously while working on a multifaceted project
- Tasks must be delegated accordingly
- Communication is vital for clarification and collaboration

Next Steps

- Implement GSUI with autonomous navigation process
- Implement real-time path tracking with map
- Implement Systems page displaying state of on-board components

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