



Robotic Arm and Rover for Future Low-Latency Telerobotic Assembly Experiments



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New Era of Space Exploration

- NASA's Mission

- Preparation future on-orbit missions
- Simulate operational environment



Image Credit: NASA

- Our Mission

- Quantify various constraints of teleoperating rovers
- Determine new ways to effectively and efficiently teleoperate rovers

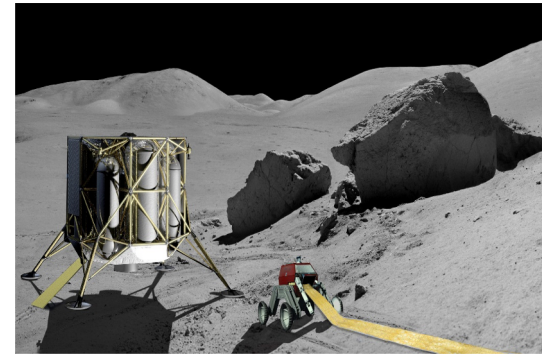


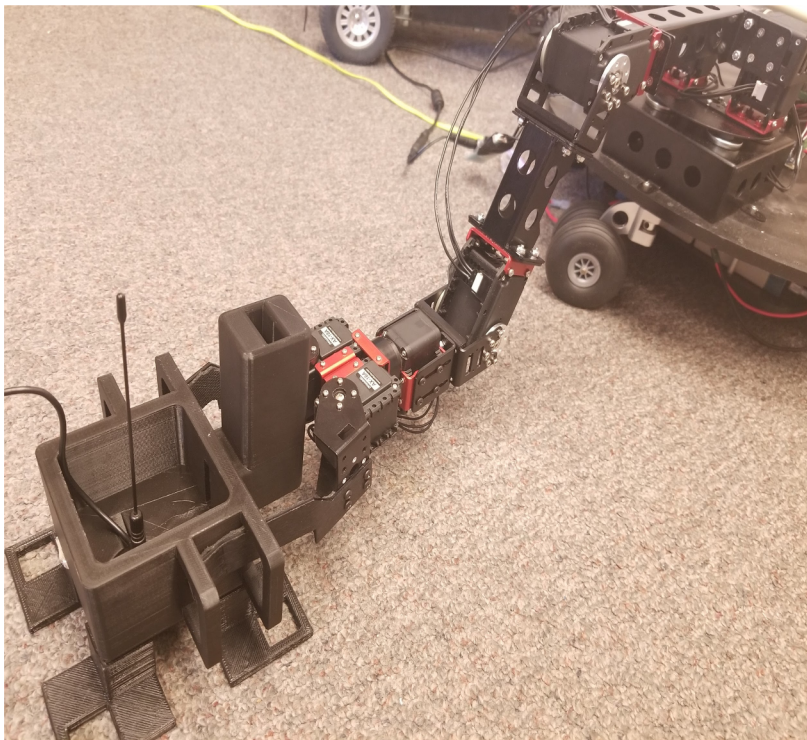
Image Credit: Jack Burns

Previous Work

- Low-Latency Surface Telerobotics
 - Quantified threshold video frame rate of 5 frames per second
 - Quantified effects of 2.6 second latency on real-time exploration
 - Human conducted geological teleoperated exploration



Current Work



- Radio Telescope Assembly
 - Construct a simple radio array telescope
 - Receive radio frequencies for data processing
 - Maximize situational awareness from video feedback
 - Robotic arm motion capabilities

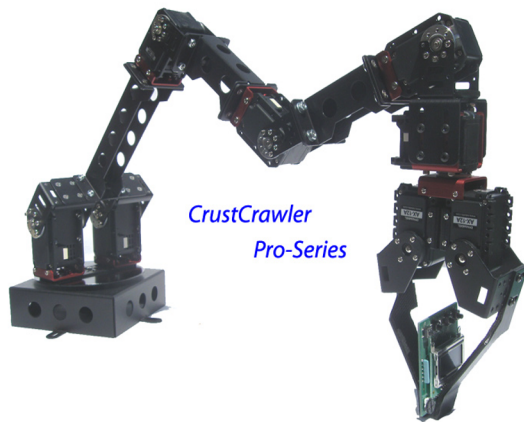
Assembly of Radio Telescope Elements

- Connect magnetic micro USB to power and transmit data from antenna
- Using 3D printed case and gripper to aid the robotic arm
- Demonstration of how a radio telescope could be assembled on the lunar farside



Robotic “Arm”strong Specifications

CrustCrawler Pro-Series Robotic Arm

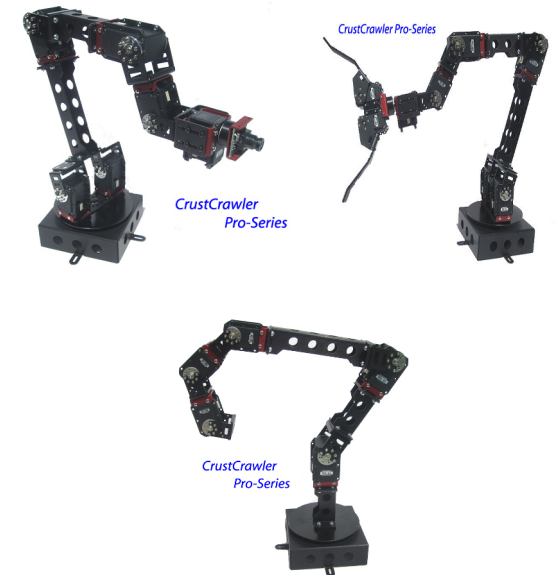


DYNAMIXEL Servos

- 5 MX-64, 2 AX-18, 1 AX-12
- 8 Servos = 6 Degree Freedom
- TTL 3 Wire Serial Connection (Daisy Chain)

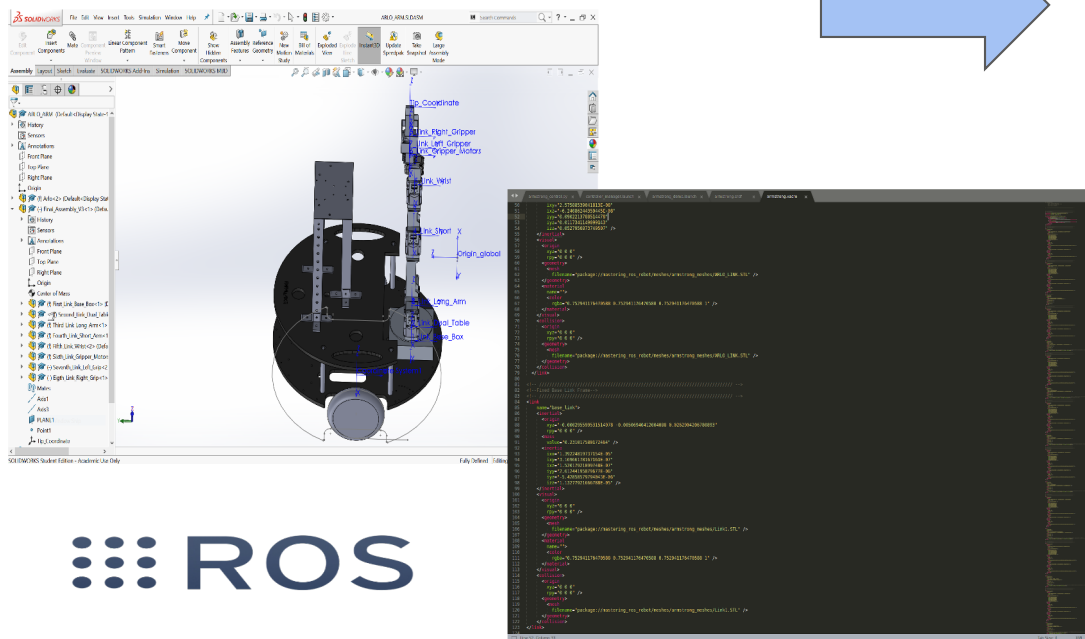


Adjustable Configuration

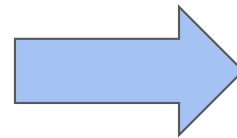


Robotic “Arm”strong Software

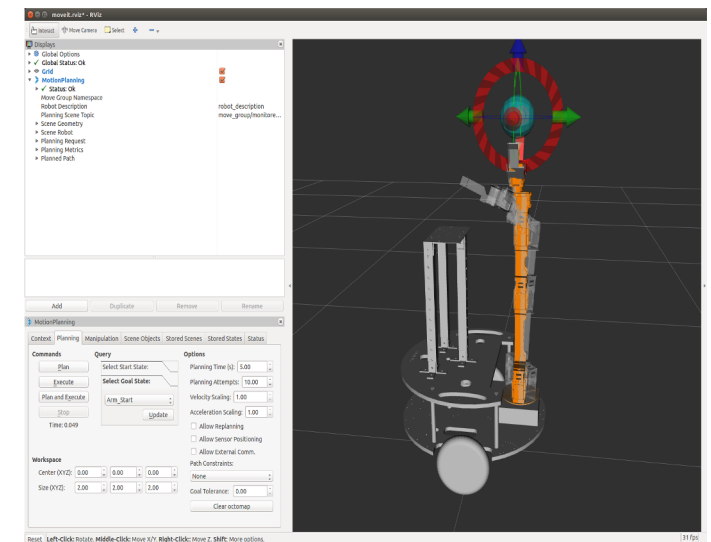
Robotic Operating System (ROS)



ROS

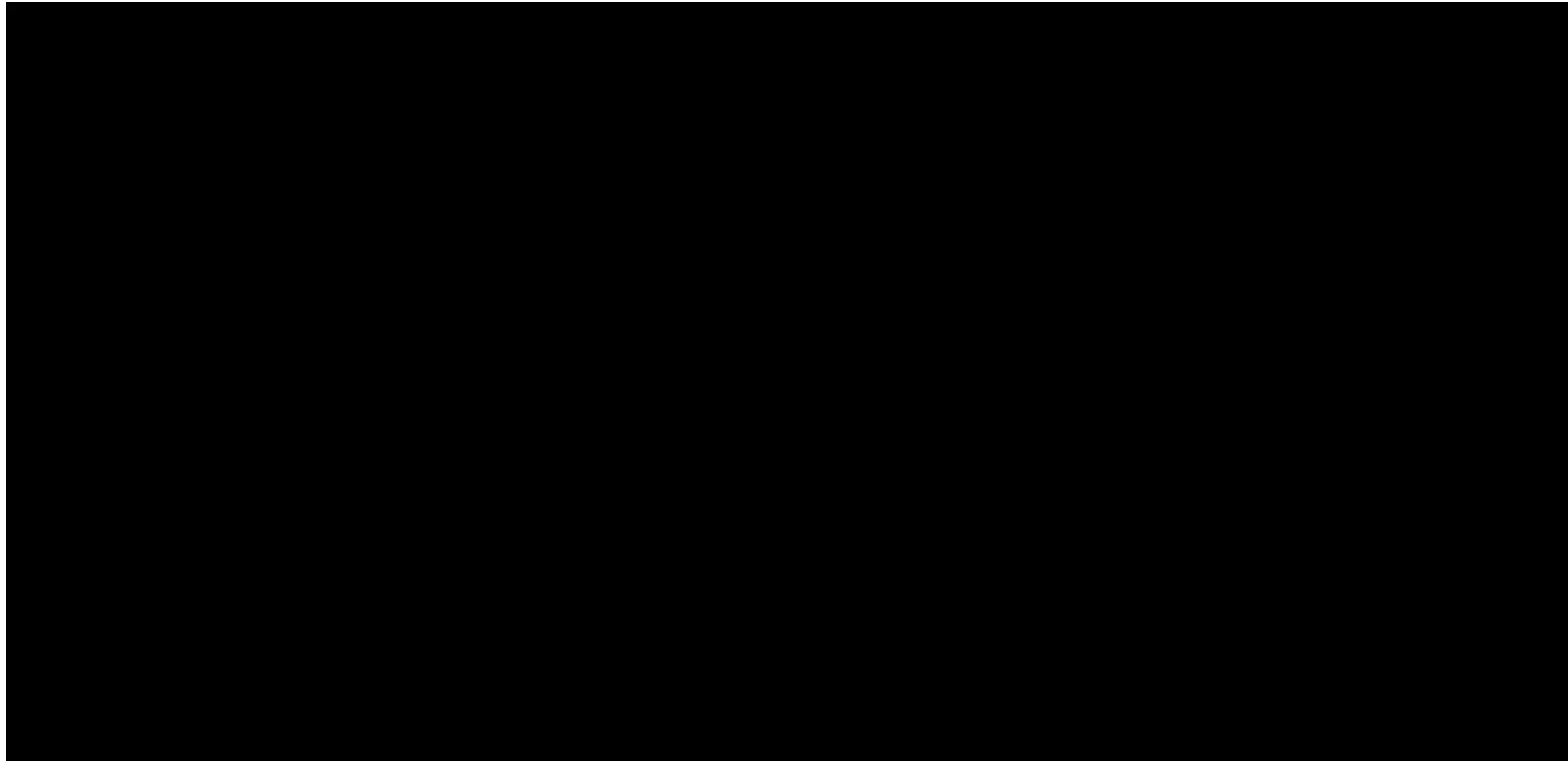


MoveIt! Open Source Motion Planning

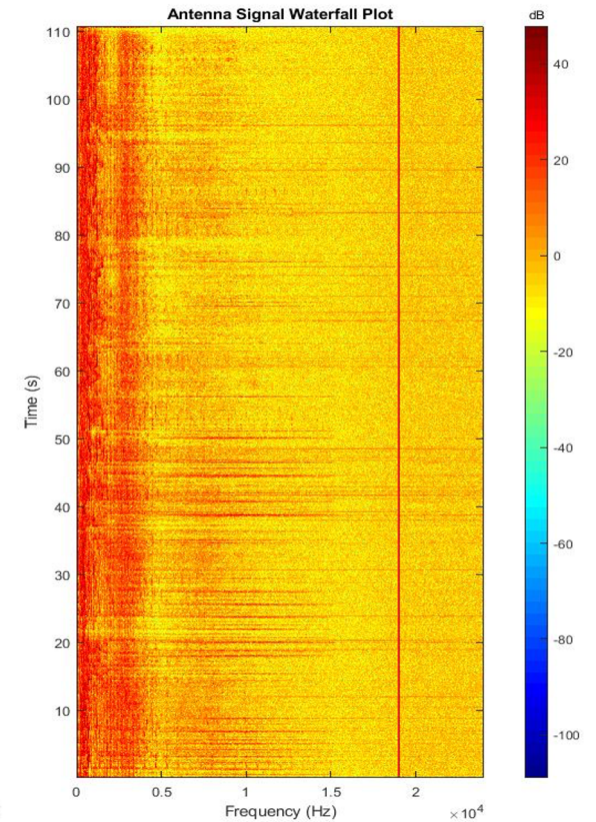
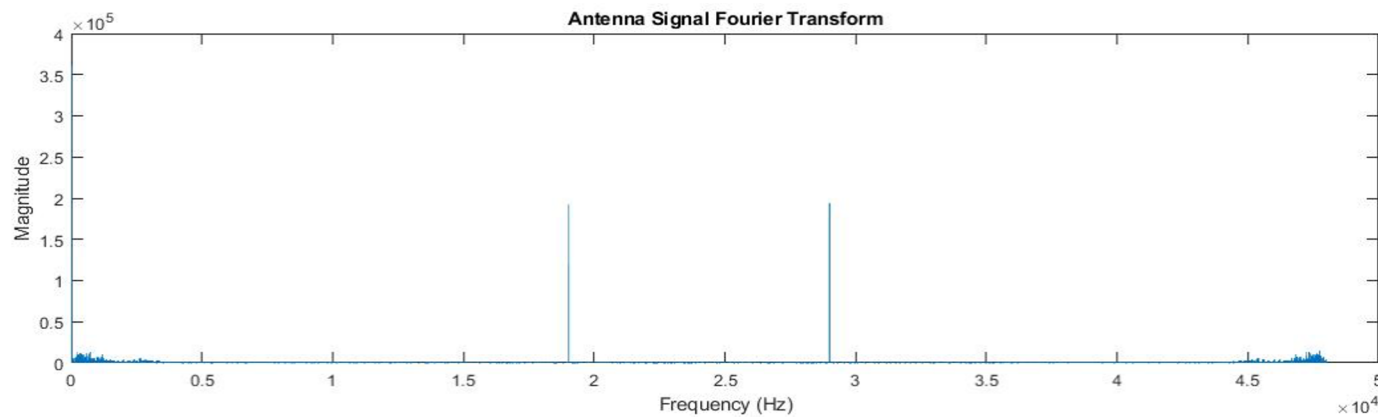
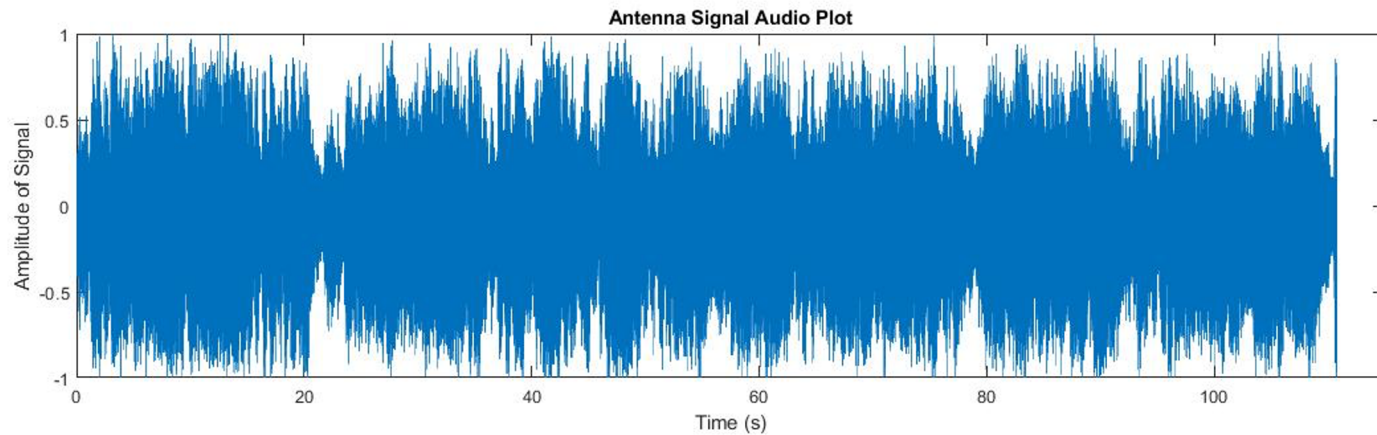


MoveIt!

Initial Results

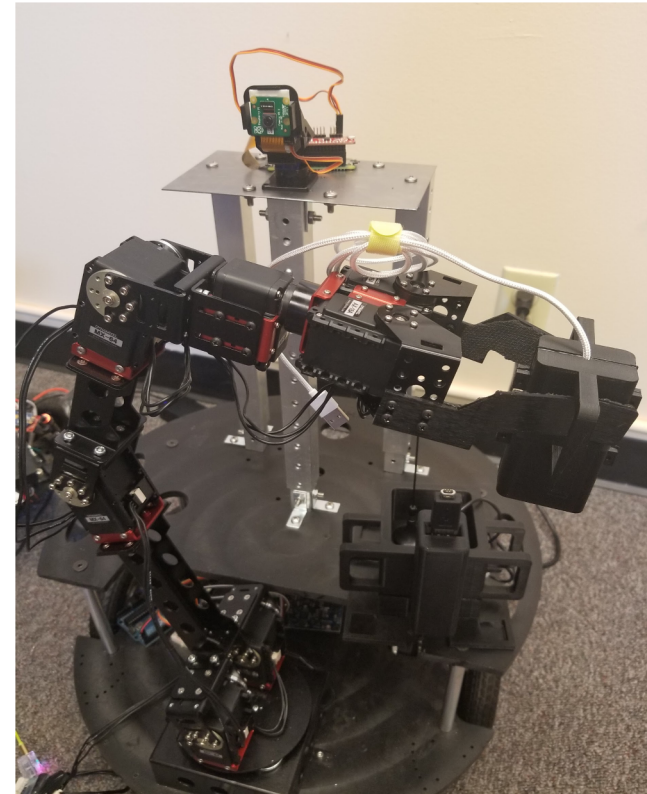


Signal Processing



Next Steps

- Add cameras to rover for video feedback
- Create user control interface
- Finalize 3D printed case and gripper
- Design experiment
 - Time to completion
 - Assembly errors
 - Operator situational awareness



Thank You and Questions

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