









University of Portland Robotics Club

NASA Robotic Mining Competition 2018-19

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Outline

Introduction

- RMC
- Collaboration
- Goals

Design

- Mobility System
- Excavation System
- Deposition System
- Electrical Systems

Video Demo STEM Outreach Acknowledgements



NASA's Robotic Mining Competition





The competition itself:

 50 university/college teams from around the country work to "Design it", "Build it", & "Dig it"

Four ways to score points:

- 1. Slide Presentation and Demonstration
- 2. STEM Outreach Project and Report
- 3. Systems Engineering Paper
- 4. Mining Competition





Collaboration





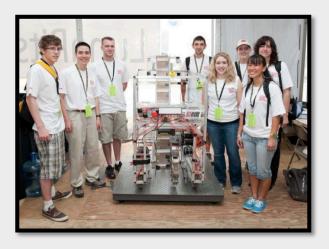
Performance Goals

Performance Goals:

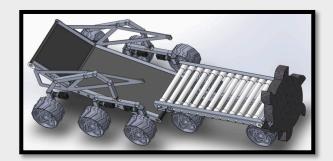
	Pre-Systems Engineering Goals
Mass	< 70 kg
Size	1.5m x 0.75m x 0.75m
Maximum Excavation Depth	45 cm (max pit depth)
Autonomous Operation	500 pts (fully autonomous)
Suspension Travel	30 cm
Excavation Speed	2250 cm ³ /min
Travel Time to Mining Area	< 1 minute

University of Portland's Rover Evolution

2010 - 2011



2013 - 2014



2011 - 2012



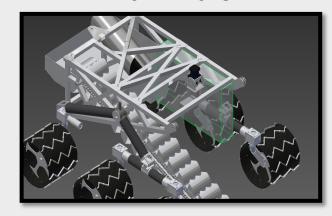
2014 - 2015



2012 - 2013



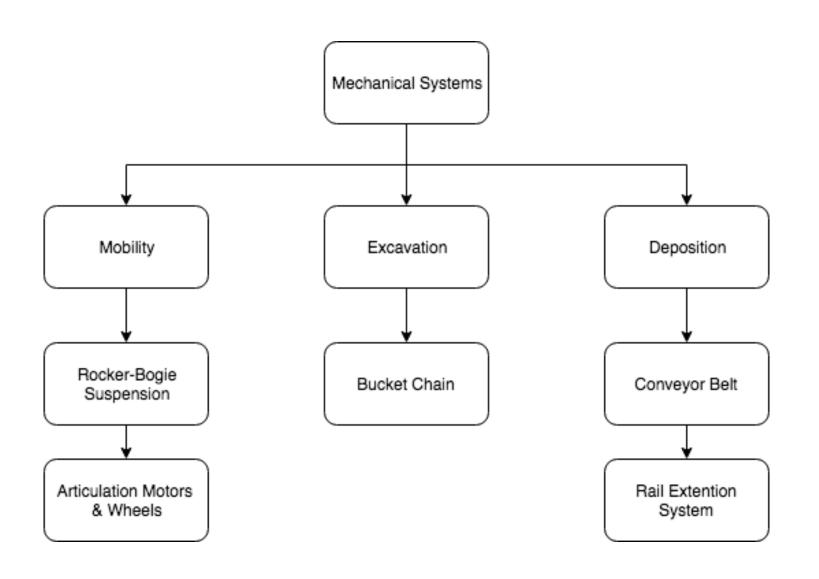
2017 - 2018





2018-2019

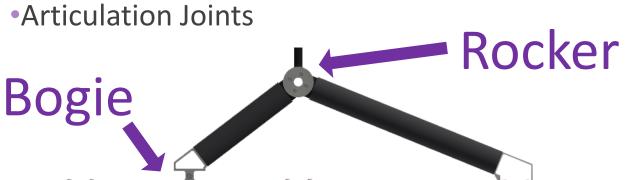
Design



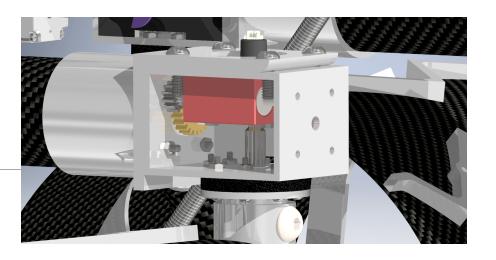
Physical Systems

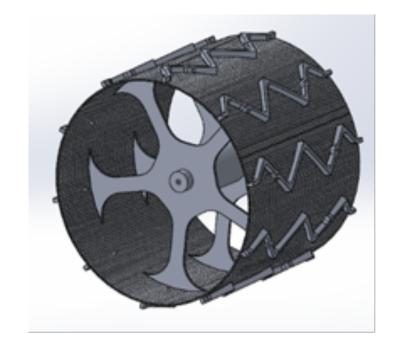
Mobility System

- Rocker Bogie Suspension System
- •Hybrid Carbon Fiber Aluminum Wheels & Treads





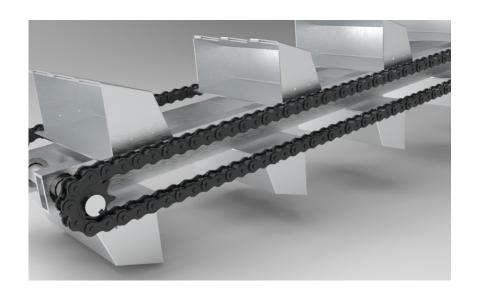








Excavation & Deposition System



Excavation System

Dual Z-Axis Motors



Chain Tensioning System

•High Torque Motor with Custom Gearbox

Benefit of continuous excavation



Deposition System

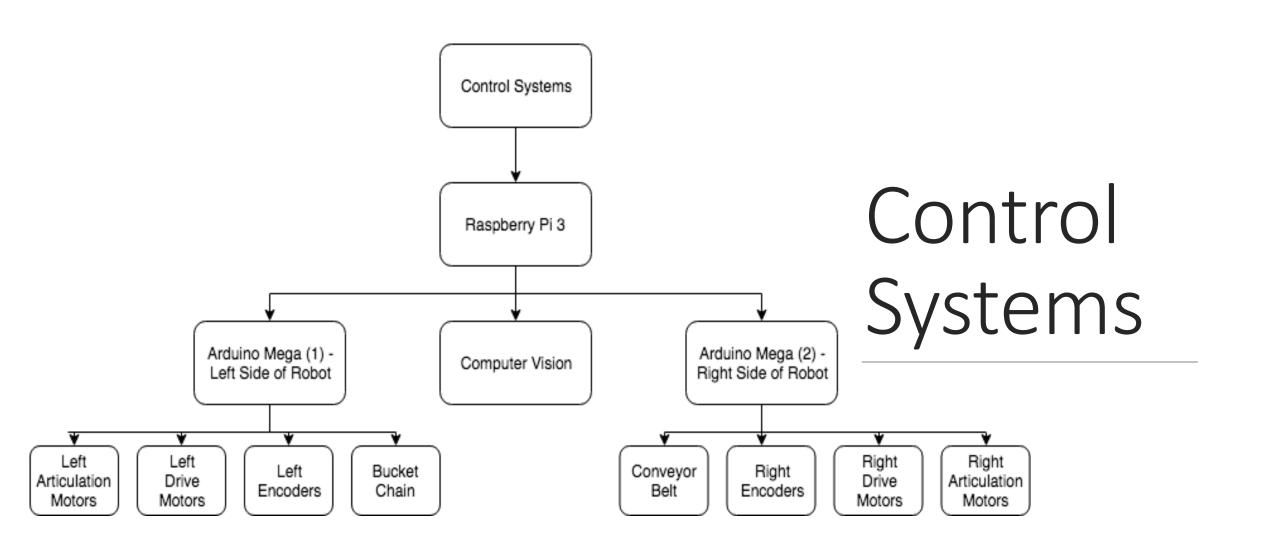
•Mesh BP-1 Filter Surface



Dual Internally-mounted Drive Motors

High-torque Lead Screw extension/retraction system

•20 kg Icy Regolith Load Capacity



command2ros package

ScanCommand

- + ros message
- + scan commands

ArduinoFeedback

- + ros message
- + error messages
- + ready to receive command

MovementCommand

- + ros message
- + driving commands
- + digging commands
- + dumping commands

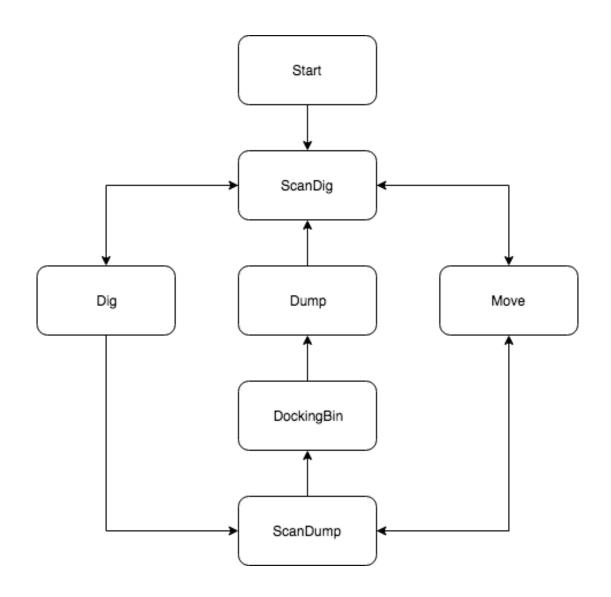
Arduino Mega

Arduino Program

- + subscribe MovementCommand
- + execute driving
- + execute digging & dumping
- + publish ArduinoFeedback

Raspberry Pi 3 **StateMachine** CurrentState + start ROS + perform state activities + start DataDistributor + set next command + start FeedbackHandler + manage states CommandRobot + sendData Feedback Handler + receiveData + subscribe ArduinoFeedback + setCommand + messageQueue **DataTransferProtocol** + sendData **DataServer** + receiveData + addCommand + commandQueue + publish DataDistributor MovementCommand + receiveData + subscribe ArduinoFeedback + sendData

Software Data Protocol



State Machine Flow Chart

Demonstration

Rover Testing



STEM Outreach

STEM Day on campus, fostering Space and STEM interests for future generations







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- •Dr. Ben Tribelhorn Professor of Engineering, Faculty Advisor
- •Jacob Amos and Jared Rees Shop Technicians
- Lisa Bassett Budget Coordinator, Shiley School of Engineering

