Computer Science & Computer Engineering

# NASA/ROBOTIC MINING COMPETITION ROVER

Team 5; Nicholas Beck, Cade Courtney, Levi Davis, Michael Ebbs, AnElizabeth Henry, Tristen Teague | Sponsor: Dr. Uche Wejinya

## Introduction

The objective of this project is to design a robot for NASA's 2022 Lunabotics Competition. Our capstone team has joined the computer science sub-team of Razorbotz and will be focusing on the computer systems of the robot. In the competition, our robot will receive two attempts to maneuver through the terrain to collect the maximum amount of rock/gravel material within the 15-minute time limit of the competition while operating remotely or through autonomous operations using ROS2 (Robot Operating System).

## Design Goals

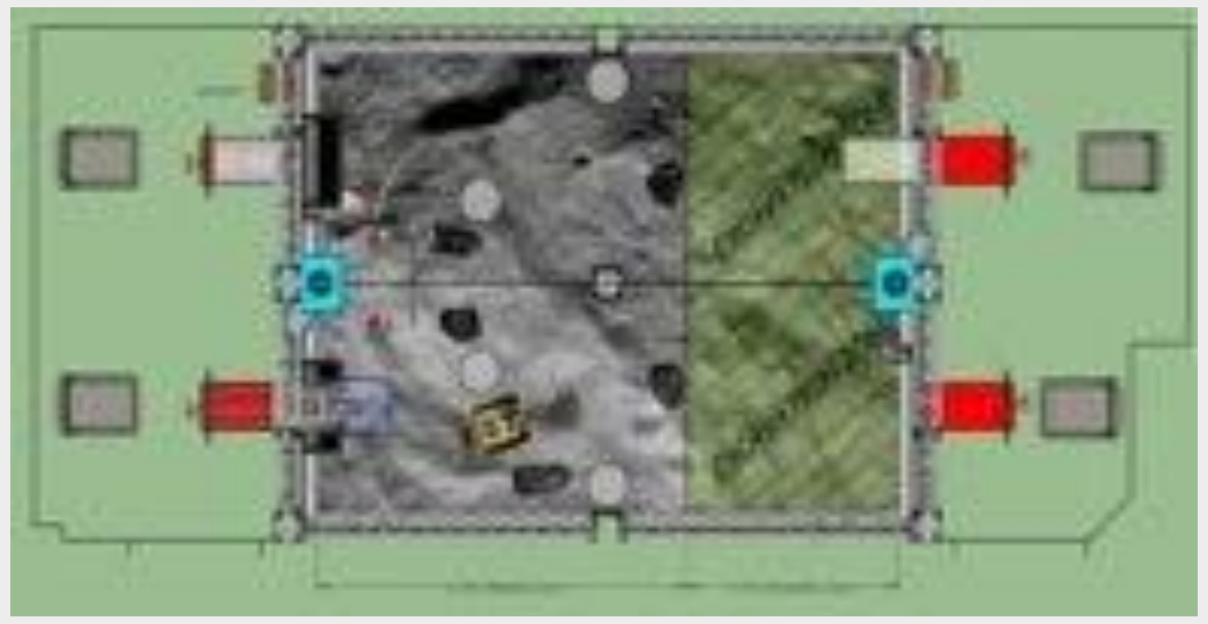
Complete autonomy:

- Arena navigation will require the rover to be able to detect the excavation zone and dumping zone.
- The rover must also be able to detect obstructions in its path.
- The Excavation which must start once the rover reaches the excavation zone.
- The dumbing process must return the robot to the starting area and then find the dump bin to deposit its contents

Update and Standardize documentation:

- We will create new documentation and update old documentation using the tool Doxygen.

Replace the previous rover's talon motor functionality with the new rover's REV motors.



## ROS Node Architecture

<u>Communication:</u>

Takes topics from the Talons, power, and motor speed and publishes its information

<u>Excavation</u>:

Utilizes ODrive motors SDK to use the excavation device

<u>Logic:</u>

Publishes Zed and Communication info into topics

<u>Power Distribution Panel:</u>

Publishes power measurements to other nodes

<u>Talon:</u>

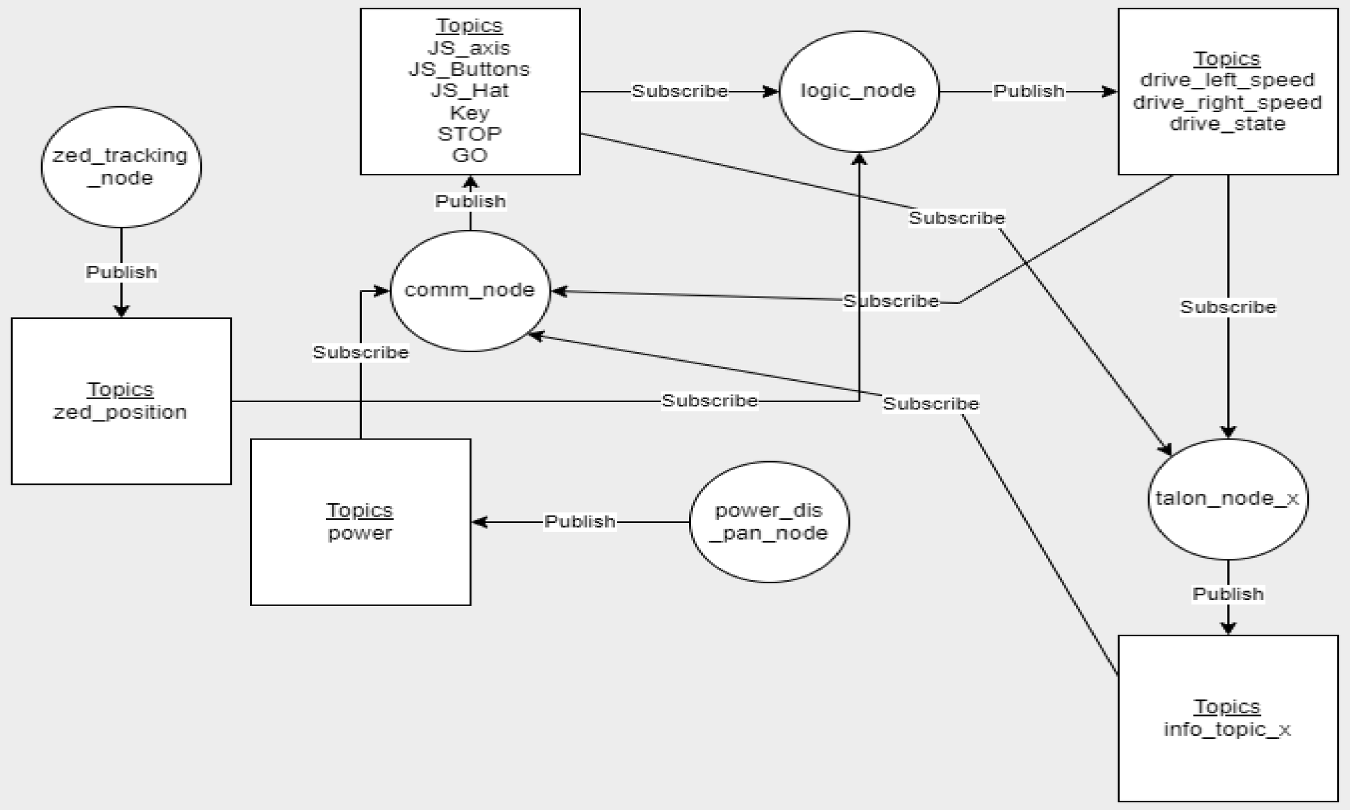
Utilizes Talon SDK to control the linear actuator.

<u>REV NEO:</u>

Controls the speed of the motor.

<u>Zed:</u>

Uses Zed SDK to detect a known marker for point of reference




## Future Work

- More thorough documentation of the code that is used for manual and autonomous operation to allow the level of understanding that an individual must have to understand the code is lower
- Further implementation of Navigational Autonomy can be completed so that the robot can navigate through the arena more efficiently

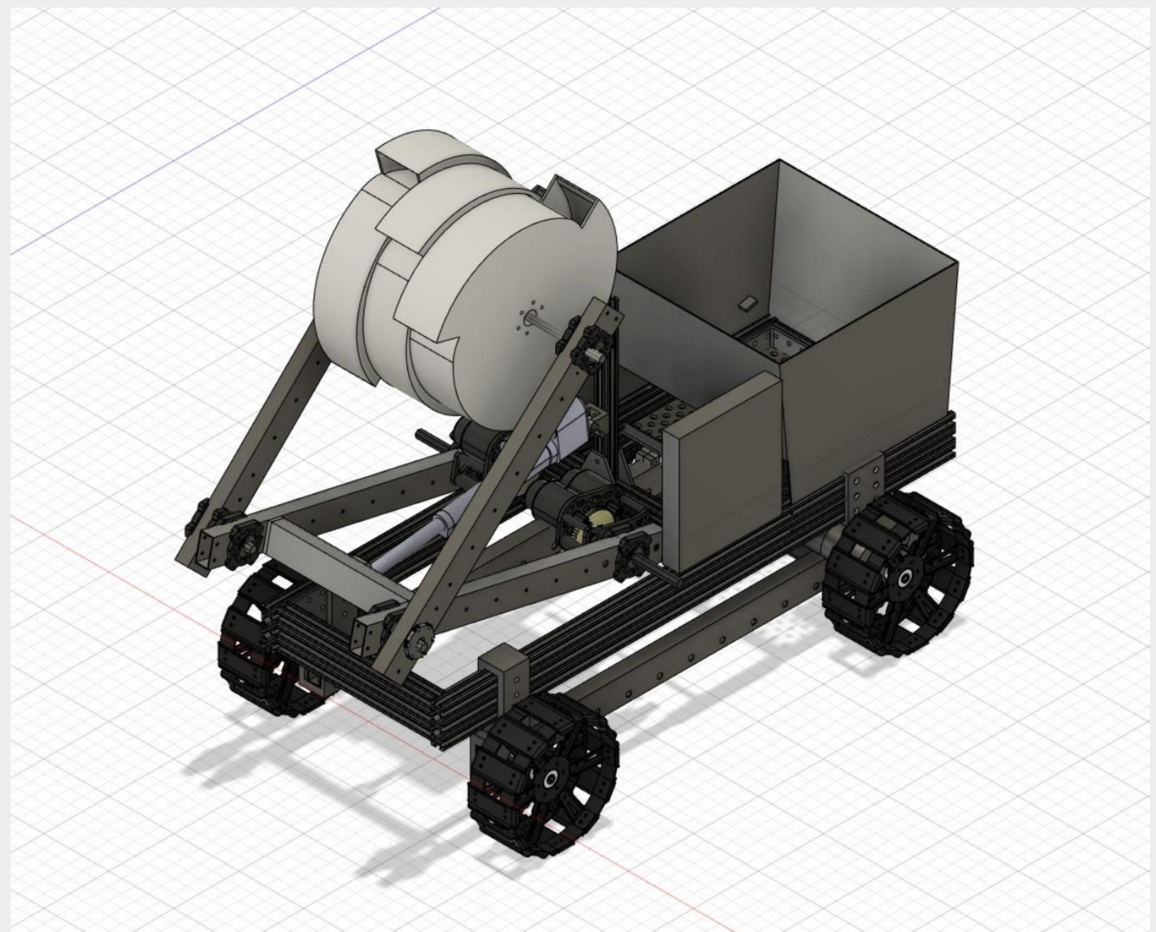
## Hardware

<u>Chassis:</u> 3D printed wheels along with 39.4"x12" aluminum t-slotted extrusion frame.

<u>Drive:</u> 2 REV Brushless motors mounted to rear wheels along with a belt drive through extrusions enable all wheel drive.

<u>Excavation:</u> 2 ODrive motors drive excavation drum via in-extrusion belt drive Extends and retracts via linear actuator

<u>Microcontroller:</u> Powered by NVIDIA Jetson NANO and designed specifically for AI applications.



## Challenges

- Working with different sub-teams on the Razorbotz team presented communication-related challenges, because of the number of diverse students we include on our team.
- Difference in design expectations between sub-teams caused some sub-teams to have re-design the robot during the spring semester.
- Post COVID-19 related obstacles were still present during the development of our project as the virus continues to develop into multiple variants.
- There is a large amount of background information needed by every individual on the Razorbotz team to understand and contribute work to the project