# NASA Lunabotics

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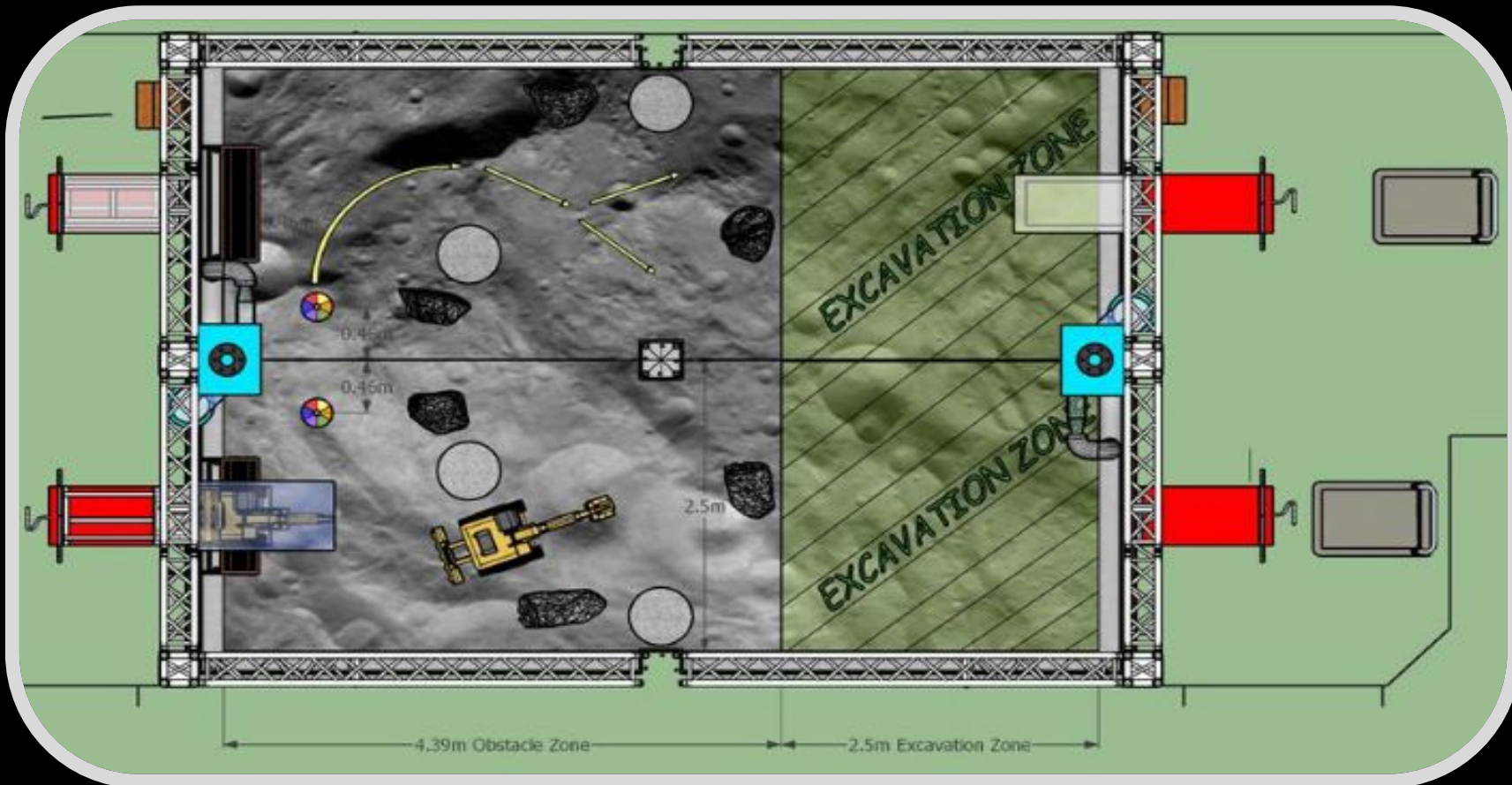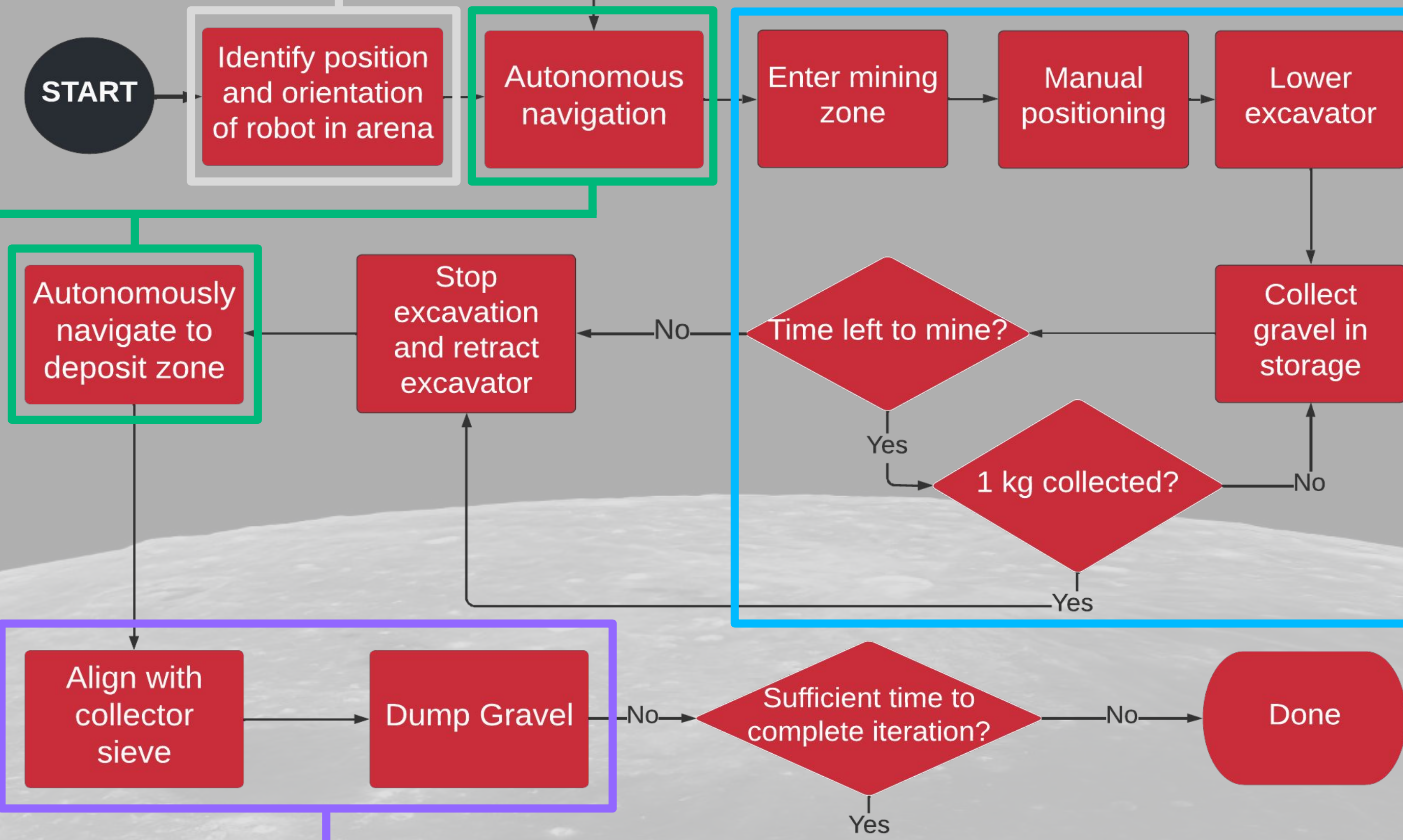
Abstract

The robot is designed to autonomously navigate rough terrain, mine icy regolith simulant, and deposit regolith into a collection sieve. At the conclusion of the project, the majority of the performance metrics were met by the robot.

Results

- Successful teleoperated navigation, mining, & depositing
- Max speed of 0.37 m/s achieved
- Autonomous navigation simulated
- 40.6 kg total robot mass
- >20 minute battery life
- IP50 dust protection
- Energy consumption <100 Watt-hours

Future Work

- Implement full autonomous operation
- Topology optimization for weight savings
- Add more dust protective features

Navigation

- Target speed of 0.23 m/s
- Rocker suspension traverses 40 cm obstacles (in height or depth) with four-wheel drive train
- Teleoperated navigation using cameras
- Autonomous navigation with crater/boulder avoidance simulated in ROS
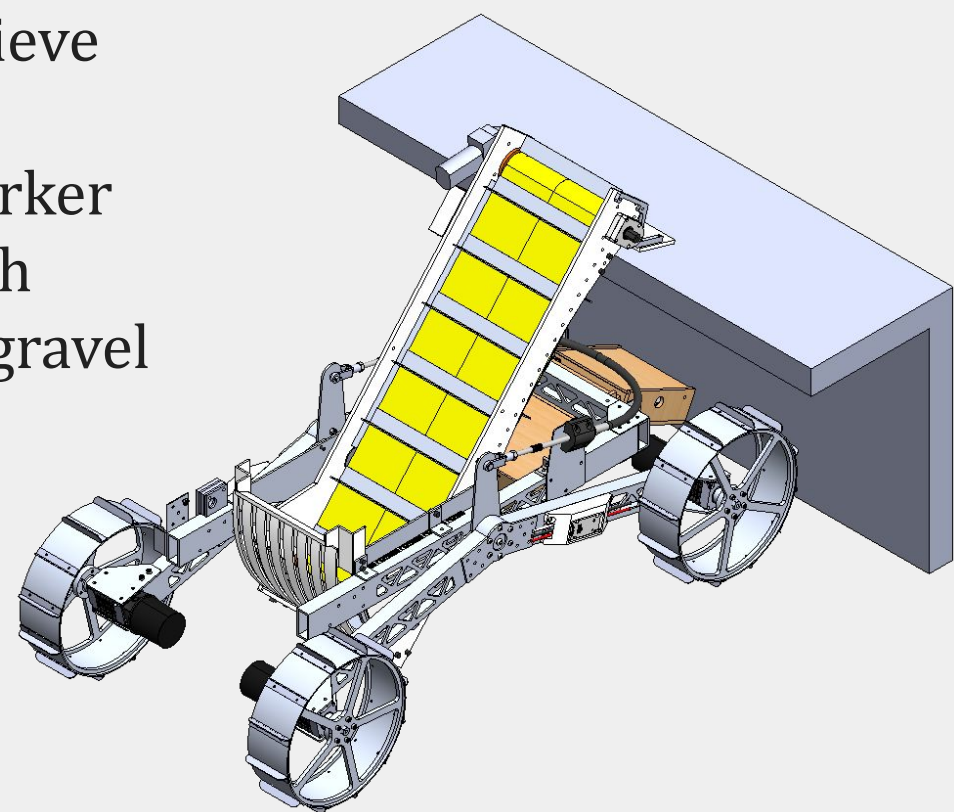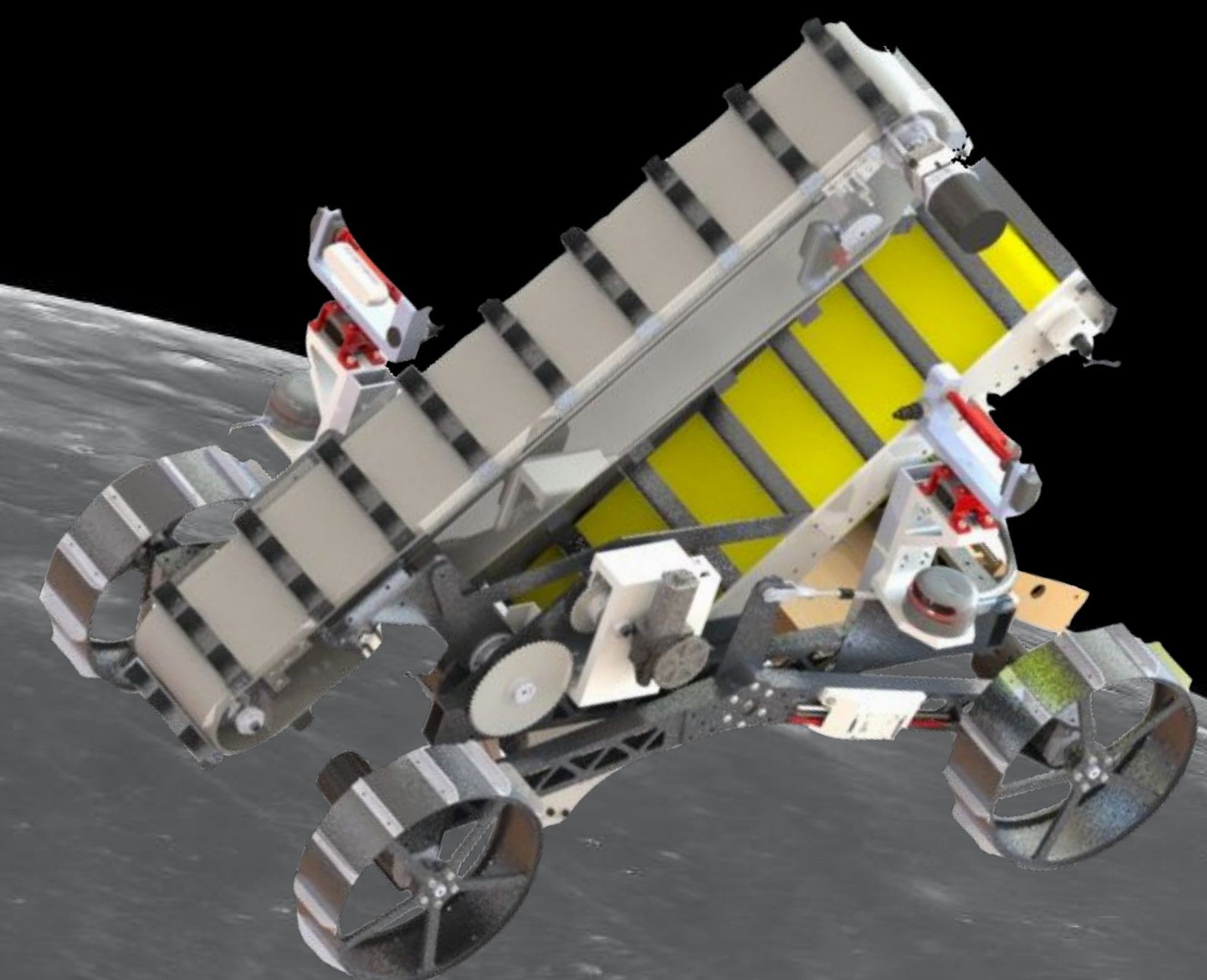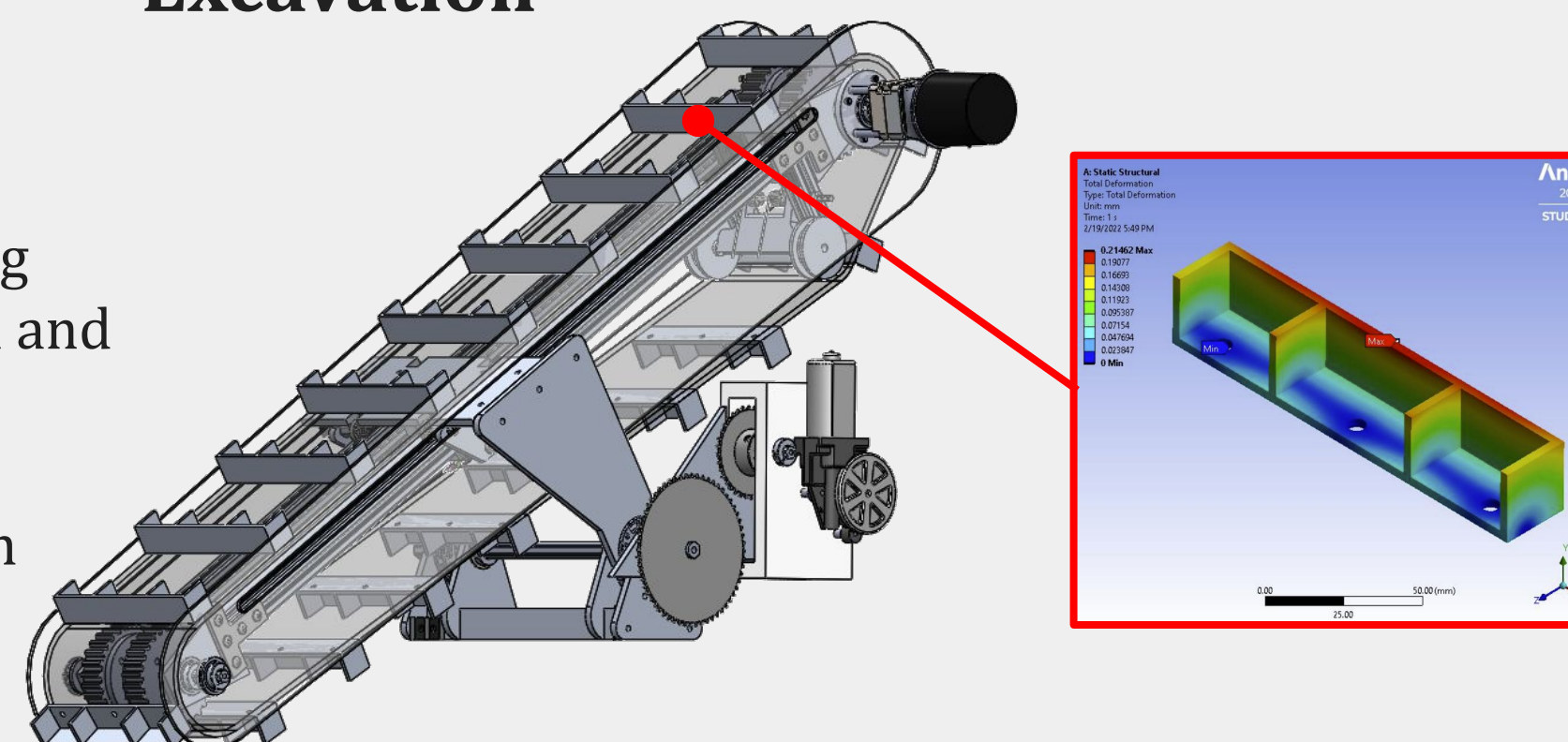

Depositing

- Align robot with sieve using cameras to identify ArUco marker
- Uses conveyor with grousers to carry gravel up and onto sieve
- Linkage connects excavator to depositing belt for rotation

Excavation

- Gravel below 30 cm of BP-1
- Excavator mines up to 40 cm deep
- Uses a conveyor with grousers to dig
- Lead screw structure to translate in and out of ground
- Chain & sprocket system to rotate between stored and mining position
- Internal brushes for dust protection

Flowchart

START → Identify position and orientation of robot in arena → Autonomous navigation → Enter mining zone → Manual positioning → Lower excavator → Collect gravel in storage → 1 kg collected? → (No) back to Collect gravel in storage; (Yes) → Time left to mine? → (Yes) → Stop excavation and retract excavator; (No) → Stop excavation and retract excavator → Autonomously navigate to deposit zone → Align with collector sieve → Dump Gravel → Sufficient time to complete iteration? → (No) Done; (Yes) back to Autonomous navigation

Acknowledgements