Interim Report

Project Title: Exploring the Moon with VEX Robotics

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1. Definition of the Problem

The problem we aim to address is the need for an efficient and autonomous robotic exploration of the Moon's surface. The Moon's challenging terrain includes craters, fine dust that can interfere with machinery, and extreme temperature fluctuations. These conditions make exploration and data collection difficult but essential for future lunar missions. Our project focuses on designing a VEX-based robot capable of navigating this terrain to collect critical data on surface materials, potential water sources, and areas suitable for human habitation (1, 2).

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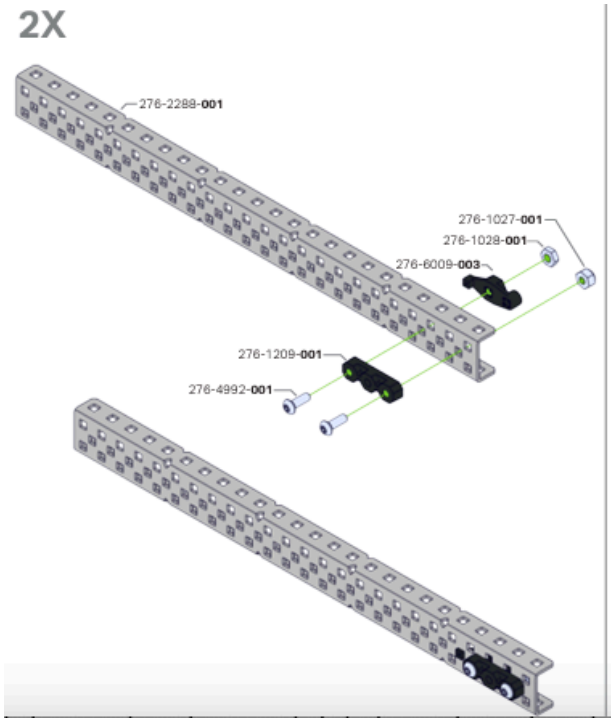
2. Plan for Solving the Problem Computationally

We are employing a systematic approach to solving the problem:

1. **Design and Build**: Using VEX robotics kits, we are creating a modular robot equipped with sensors such as ultrasonic range finders, gyroscopes, and cameras for obstacle detection and navigation.

   In this exciting project, we are building **VEX robots** designed to explore and navigate the surface of **Mars**! Using innovative engineering and robotics skills, we are creating robots that can overcome challenges like rough terrain, obstacles, and exploration tasks, simulating a real Mars mission. These robots represent our first steps toward understanding how robotic technology can assist future Mars missions. Throughout this process, we will learn about design, programming, and problem-solving, preparing us for real-world applications in science and engineering. We will also be sharing pictures of our progress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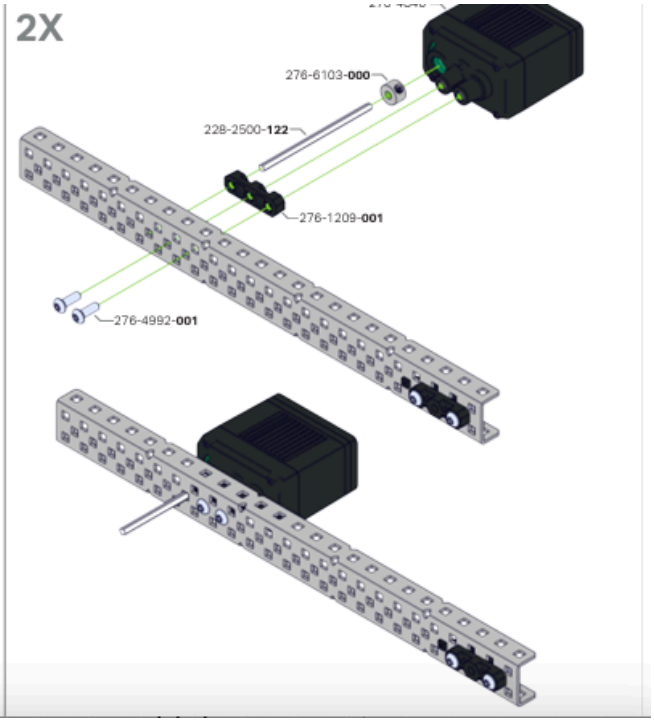
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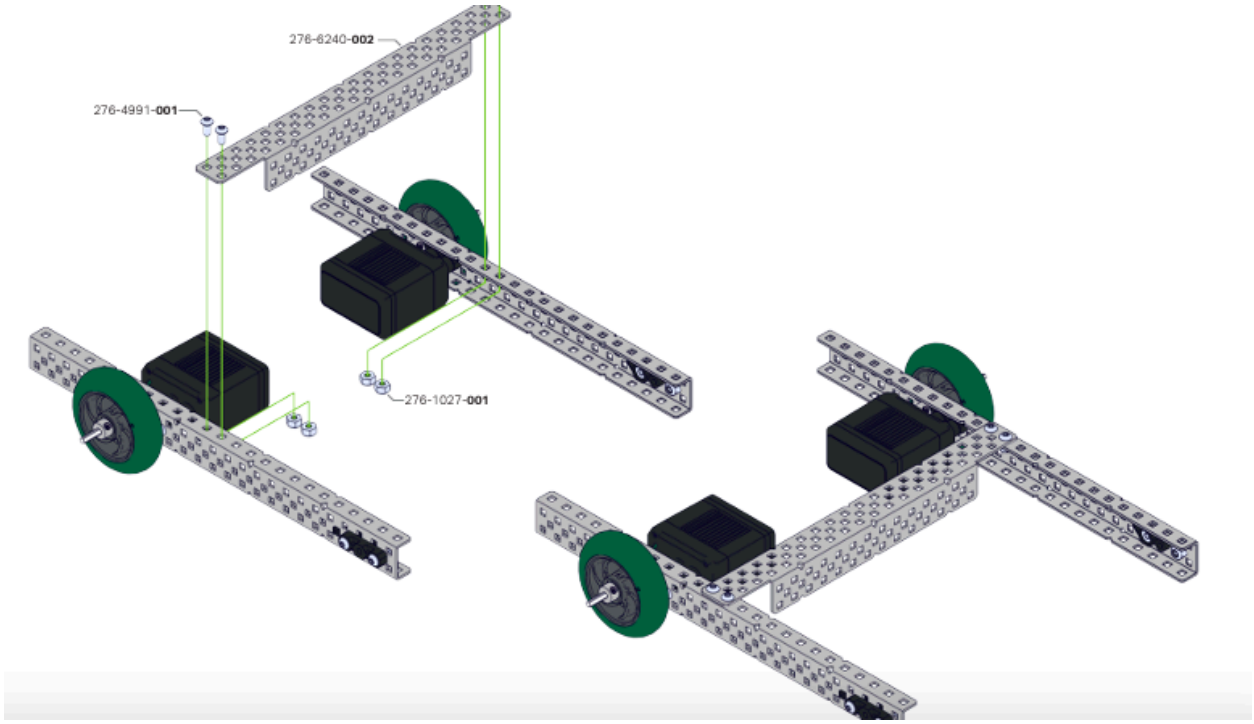
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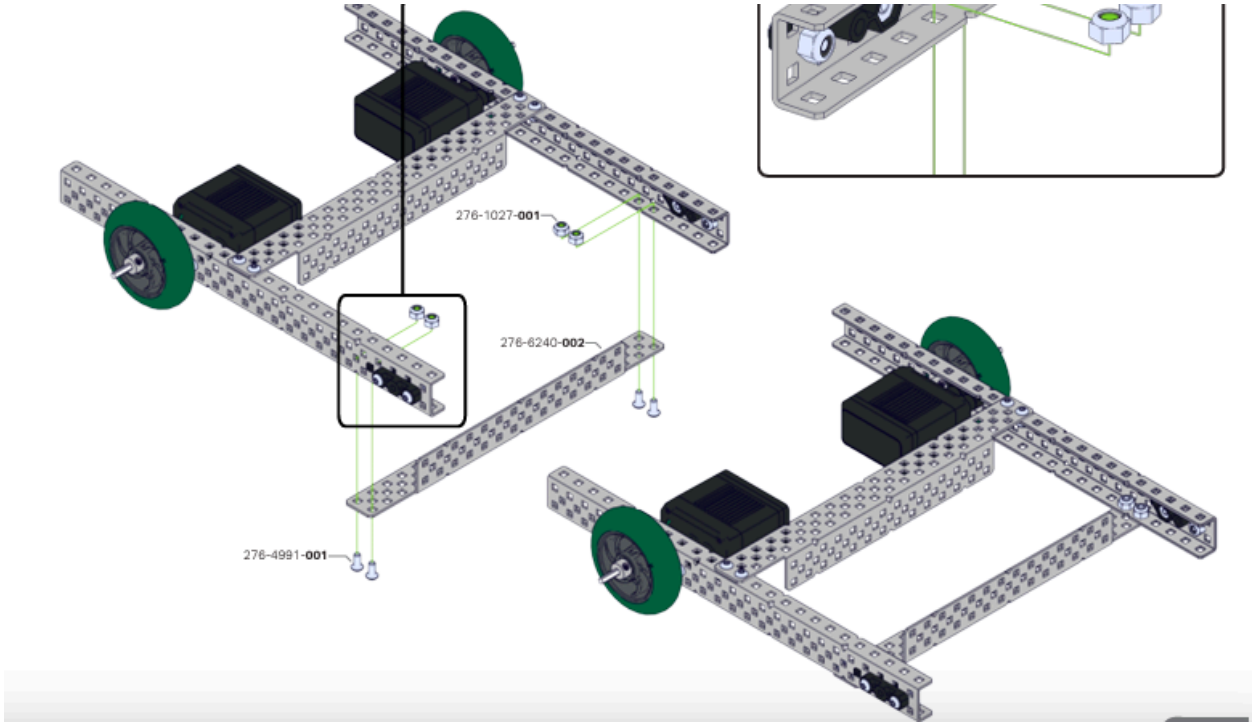
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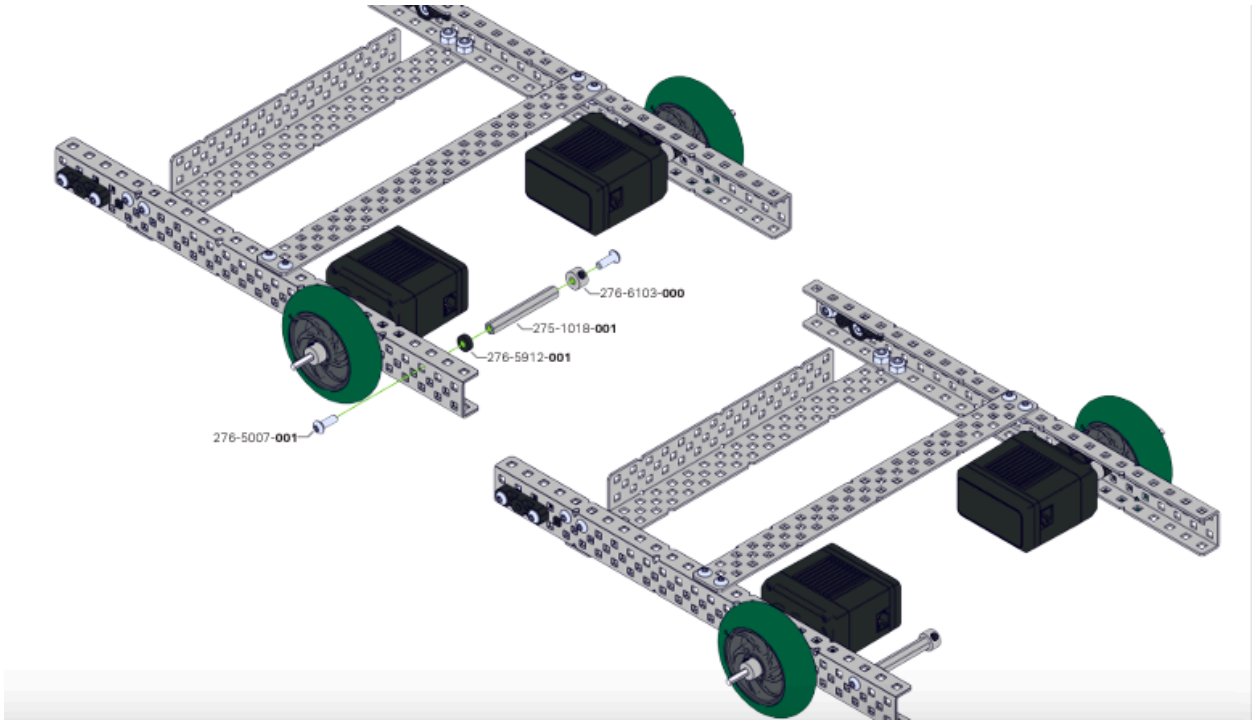
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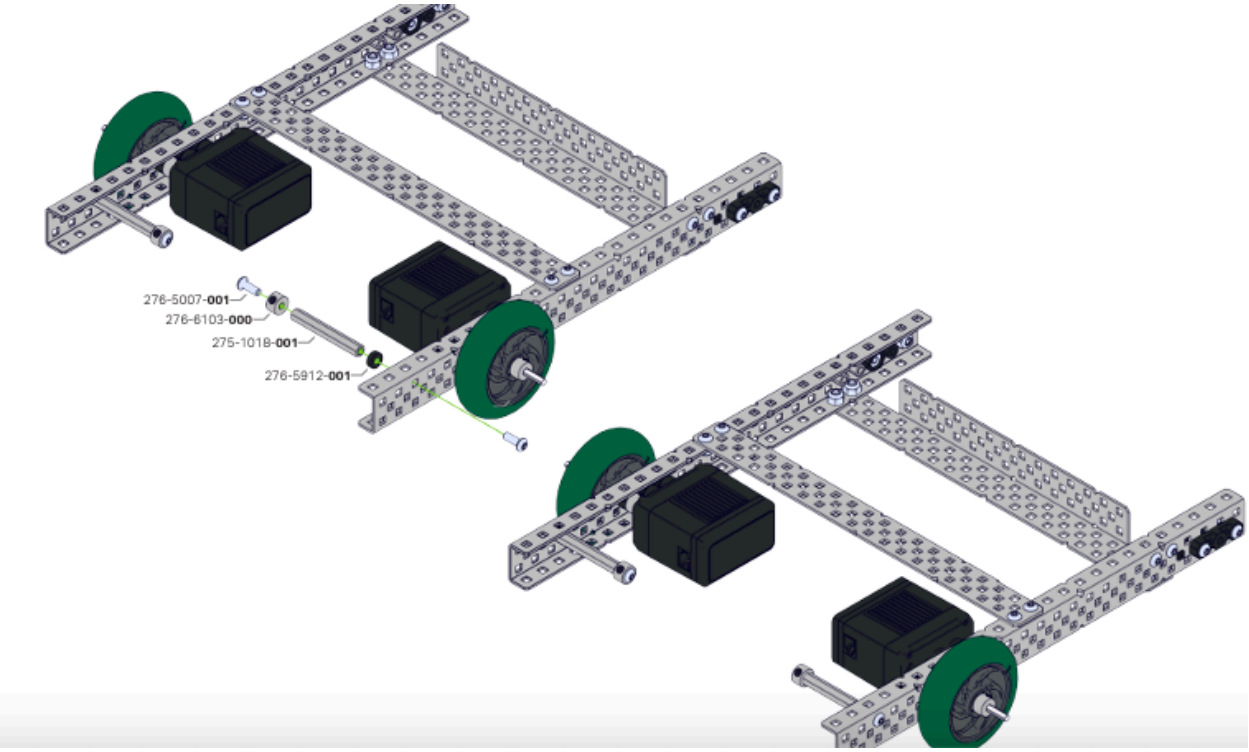

2. **Algorithm Development**: The robot will use computational algorithms to autonomously explore the simulated lunar environment. These include pathfinding algorithms (e.g., A*) and data processing techniques to identify and prioritize areas of interest (3).
3. **Simulation and Testing**: A simulated lunar environment is being developed to test the robot's ability to navigate craters, avoid obstacles, and operate under varying simulated temperature conditions.
4. **Data Collection and Transmission**: The robot will be programmed to collect data on soil composition and temperature and identify potential water sources. This data will then be transmitted back to a central system for analysis (4, 5).

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3. Description of the Progress Made to Date

- **Robot Design**: Completed the initial design using VEX kits, integrating sensors and actuators. The robot's frame has been tested for durability in simulated rough terrain.
- **Programming**: Implemented the first iteration of navigation and obstacle avoidance algorithms, including basic functionality for terrain mapping and safe zone identification

- **Simulation Environment**: Developed a controlled testing environment mimicking lunar terrain, complete with craters and uneven surfaces. The robot has successfully performed basic navigation in this setting.
- **Collaboration**: Engaged with mentors and experts in robotics and lunar geology to refine the computational model and improve the robot's data collection capabilities .

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4. Expected Results

- Deliver a fully functional robotic system capable of autonomous navigation and data collection in a simulated lunar environment.
- Collect data on surface materials, temperature variations, and potential water sources that can be used for future scientific studies.
- Demonstrate the feasibility of using VEX robotics for advanced space exploration, providing a scalable and cost-effective solution for future lunar missions.

5. References

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3. Modeling and Simulation for Mission Operations Work System Design. Retrieved from https://www.jstor.org/stable/40398607
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