Stargate: Digital Twin Engine

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Company Background:

Lunar Outpost is an industry leader in lunar surface mobility, commercial space robotics, and space resources. From our terrestrial product lines revolutionizing the air quality sector on Earth to the creation of oxygen on Mars, our impact spans the solar system. Lunar Outpost's exploration class rover, the Mobile Autonomous Prospecting Platform (MAPP), will be the first commercial rover on the Moon and the first rover in history to explore the lunar South Pole.

Since our founding in 2017, Lunar Outpost has raised Venture Capital from top-tier investors and continues to attract strong investment partners as we continue to prove the opportunity that advanced mobility, robotics and autonomy provides to the new space economy and here on Earth. In 2021, Lunar Outpost announced that our commercially funded MAPP rover—including payload mass allocations for MIT and Nokia — was scheduled for delivery by an Intuitive Machines lander to the lunar South Pole. Lunar Outpost has since secured two additional contracted lunar surface missions, one of which is fully commercial and the other a NASA funded science exploration rover. In addition to the three missions above, Lunar Outpost has also won a contract with the Australian Space Agency to design and develop a lunar rover for Australia's first mission to the Moon as part of the Trailblazer program. In 2024, Lunar Outpost was awarded a Lunar Terrain Vehicle Services (LTVS) contract by NASA to develop a human-rated Moon rover as part of the Artemis campaign.

With over a dozen active contracts across commercial, defense and civil space, Lunar Outpost is The Next Leap that will enable humanity to become interplanetary.

Description of Work to Be Done:

The Digital Twin Engine will be a feature of the Stargate Lunar Outpost mission control platform, designed to enable operator decisions in real time. This visualization tool will offer 3D models of various spacecraft, such as rovers, landers, satellites, and other robotic systems, enabling detailed inspection from any angle. It also incorporates live data to provide immediate health and status updates, ensuring operators have the necessary information for quick, informed visualizations. This tool will be utilized by mission operators during our LV1 and LV2 missions to the moon.
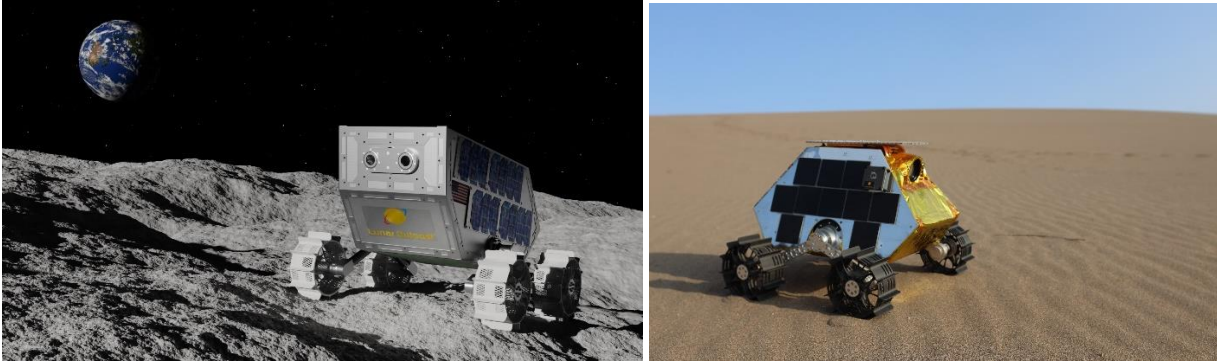
Figure 1: M1 MAPP rover and MAPP being tested at the Great Sand Dunes.

Students will focus their efforts on four specific areas:

1. 3D Visualization: Using toolchains such as three js, develop capabilities to render accurate 3D models of spacecraft, ensuring operators can view areas of interest and understand the spacecrafts health in a visual way
2. Operational Alerts: Integrate color coded limits/alerts into spacecraft components based on their operational thresholds.
3. UI Development: Utilize React.JS to create an intuitive UI and wrapping the threejs platform
4. Integration with Live Data: Ensure the engine can create insights on live spacecraft data, ensuring operators see insights as soon as they are available

Reach goal:

- Full integration into the Stargate platform

The students will be involved in every phase of the project 'from design through implementation'. During the design phase the students will interact with Lunar Outpost engineers to see what will provide value for operation. From there, the project overview will be created, and the work divided into tasks.

Desired Skills for Students:

- ReactJS
- Typescript
- Cloud/AWS Experience
- ThreeJS Experience
- Simulation Experience

We understand not all the students in the group might have the desired technical skills. However, if they can problem solve and have a willingness to learn, they can excel in this project with the help of our talented engineers.

Preferred Team Size: 3-4 students

Given the scope of this project a group of 4 students is preferred but 3 students could also excel given they are willing to problem solve and learn.

Internships at the End of the Course:

We are happy to consider offering internships at the end of the course.

Location Where Work Would Be Performed:

We have offices in Arvada, CO. This office is less than a 15-minute drive from CSM campus and should provide a convenient location for the students to meet. We also provide free beverages and snacks to keep the team fueled throughout the day.