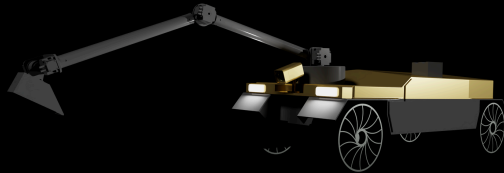


softserve

L-REX: SOFTSERVE'S LUNAR ROBOTIC EXCAVATOR

OPERATE AUTONOMOUSLY | EXTRACT EFFICIENTLY



Meet L-REX, SoftServe's simulation of a lunar robotic excavator developed to expedite lunar resource extraction. The L-REX simulation provides a comprehensive virtual environment to test and optimize excavation techniques for frozen, oxygen-rich regolith. By simulating the challenges of the Moon's environment, L-REX supports the long-term goals of establishing a lunar base and advancing space exploration.

GOALS AND CHALLENGES

Extracting resources from icy regolith deposits on the Moon's surface presents unique challenges:



Hostile environment

The hostile lunar environment requires machinery endurance and operational stability.



Autonomous operation

Reliable systems are needed for remote operation with minimal human intervention.



Energy management

Optimizing control systems and energy use is crucial due to limited power availability.



Efficient extraction

Preventing machinery depletion while ensuring continuous operation is critical.

SOLUTION

The L-REX project minimizes human intervention and reduces operational costs by simulating autonomous robotic operations in the design phase by using:

- **Multi-body dynamics** simulate the complex movements and forces acting on the robotic systems.
- **Terramechanics modeling** assesses the interaction between the robot and lunar soil for optimized performance.
- **AI-driven robotic perception algorithms** enhance environmental interpretation and robotics responses with a multispectral imager.
- **Energy optimization algorithms** maximize the efficiency of excavation operations for prolonged operational capability.
- **Advanced mechatronics** test a vibratory mechanism to enhance digging capability in icy regolith and to reduce energy consumption.

POTENTIAL BENEFITS



Enhanced Mission Planning

Detailed mission planning and energy optimization through advanced simulation techniques.



Efficient Resource Management

Efficient extraction and resource management to support in-situ resource utilization (ISRU).



Performance Optimization

Fine-tunes robotic operations for maximum efficiency and minimal energy consumption.



Feed-forward to terrestrial industries

The solution is amenable to terrestrial mining and agricultural applications, as well as soil cutting in general.

TECH STACK

- **ROS 2 middleware:** Seamless communication between robotic components, real-time decision-making, and interactions with custom robots.
- **NVIDIA Isaac Sim™:** Realistic, high-fidelity simulation environments for testing and co-simulating robotic operations.
- **WarpPackage in NVIDIA Omniverse:** Multi-body dynamics and precise modeling of soil interactions.
- **Modelica:** Terramechanics physics modeling and simulation.
- **FMU/FMI coupling:** Terramechanics physics integration with the simulation environment.
- **NVIDIA PhysX® engine:** Real-time calculation of draft forces during scooping motions.

ACCELERATORS



Terramechanics modeling: Pre-configured models of soil interactions enable accurate prediction of excavation forces and digging techniques optimization.



Moon-like co-simulation environment: High-fidelity physics models with general-purpose robotic simulators enable testing and optimization of robotic operations.



Multi-spectral vision system: Pre-built simulation modules for visualizing and identifying icy particles within the soil mass, enhancing resource mapping and extraction accuracy.



Energy optimization framework: Algorithms for energy-optimized digging and real-time adjustments to prepare the planning and execution of energy-efficient missions.

BUSINESS VALUE

COST REDUCTIONS

Reduce mission planning and operating costs with simulation-based digital twin technologies for lunar mining robotics.

FUTURE-READY SOLUTIONS

Accelerate your organization's entry into commercial lunar activities with advanced simulation tools, preparing for the next era of space exploration.

TERRESTRIAL INDUSTRY APPLICATIONS

Adapt the space solutions, such as simulation and software development, to Earth industries like mining, construction, and more.

ACCELERATE TIME-TO-MARKET

Speed up time-to-market with our pre-built accelerators.

MISSION SAFETY

Increased mission safety due to the ability to simulate edge cases.

PARTNERS



WHY SOFTSERVE

STABILITY

31 YEARS

Award-winning service, across multiple industries

EXPERTISE

Sc.D. & Ph.D.

30% of the team are Sc.D. & Ph.D. holders in robotics & advanced automation

EXPERIENCE

20+ YEARS

Our team's total experience in space projects

TRUST

14 YEARS

Longest space mission with our experts involved

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