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ARMONY: A STATE-OF-THE-ART HEXAPOD EXPLORATION ROVER FOR LUNAR AND MARTIAN COLONIZATION AND BASE PLANNING FOR FUTURE SPACE COLONIES.

Abstract

Moon exploration has always been highly restrictive. Space exploration programs, such as the Artemis Program and SpaceX's colonization program, along with ongoing and planned missions, demand a systematic and efficient approach for in-situ preparation and exploration. Conventional rovers are constrained by uneven lunar terrain, lander deployment issues, sunlight dependency, and other factors.

The proposed work introduces a state-of-the-art hexapod exploration rover, strongly powered by AI. Its development, design, engineered mechanisms, systems, and algorithms address all the aforementioned constraints and beyond for space exploration.

The rover features specialized instrumentation for collecting valuable in-situ data from highly restrictive terrain, extra-planetary caves, and extreme environmental conditions. Novel tools have also been developed for regolith analysis.

Outstanding features of the rover include pressure-sensing locomotion, self-integrity diagnosis, and a refined self-repairing mechanism. Additional features include energy-harvesting gait cycles, specialized tools, object detection, 3D generation algorithms and techniques, and optimized performance for limited computational resources. The developed rover has a modular and adaptable design to fit any mission's needs. It includes removable and attachable limbs, behavioral instructions, specialized ports for datasets, AI algorithms, and more. Additionally, there is room for specialized instrumentation, small robots, and mission equipment.

Armony offers solid and reliable solutions to address trending issues in space exploration and closes the gap for restrictive extra-planetary exploration. Additionally, the 3D generation software offers optimized and efficient solutions for future settlements, outposts, and structure planning, which are fundamental aspects of space agency programs.