Paper ID: 40990
student

SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations (IP)

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AI OPTIMIZED ROBOTIC DESIGN FOR THE ARCHITECTURAL CONSTRUCTION OF A LUNAR HABITAT

Abstract

The Moon is considered to be an optimal site for both manned and unmanned missions to fulfill various goals such as astronomical observations, interplanetary spacecraft missions, space colonies and space industrial development. A long-term objective regarding human settlement on the Moon is self-reliance, and as such, tele-operated robotic equipment should be transported to the Lunar base. In order to make the mission time and cost effective, one should endeavor to minimize the payload mass. A key way of achieving this would be to take advantage of Lunar in-situ resourcing and on-site manufacturing.

This project's aim is to propose a breakthrough robot design optimized through AI with pioneering capabilities for Lunar constructions. This shall be a well-designed robot with the capabilities to construct both simple and complex architectural forms on the Moon and survive the extreme Lunar environmental conditions. Lunar construction would be achieved by autonomous robotic operations, the overarching concept being a grouped set of mini-robots to work concurrently. An optimal mix of different free-form manufacturing techniques would be essential, as different aspects of the structure may require different construction methods.

The designed robot would take advantage of the latest technologies humans currently have on Earth. The robot is designed to be highly articulated in both locomotion and dexterity, which would assist in overcoming the difficulties of transport on the thin Lunar regolith, and climbing the rocky terrains. The payload consists of a 3D additive manufacturing machine, and a plasma digging laser. These two technologies are the most beneficial systems for creating Lunar architecture and utilizing the in-situ resources. The structure is being optimized by the use of latest additive manufacturing technology, to create a more efficient, lightweight and stronger structure. The material chosen has a high resistance against the extreme Lunar environment and is at the forefront of latest nanotechnology in the field of material science. The autonomous control system would incorporate a self-learning AI brain and would be provided with sufficient initial data. Following this, the AI would learn to evolve independently and hence be more efficient with subsequent tasks.

The knowledge, research and results to be gained from the aforementioned Lunar developed technologies will assist humans in activities concerning other celestial bodies exploration and habitations, as well as providing potential useful solutions to planet Earth.