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SELF-FEEDBACK SWARM ROBOT FOR THE FUTURE HABITAT CONSTRUCTION MISSION ON THE MOON SURFACE

Abstract

ABSTRACT While using a robot in advance to constrict a habitat before humans arrive on the Moon surface is safer and less complex than a mission with astronauts, the current robot system has limitations for controlling and solving against unpredictable problems. Moreover, the current 3D concrete printing machines that we see today on the Earth are too big and heavy to transport to the Moon. Undoubtedly, it costs a lot. This big machine may require a human to assemble in-situ. The contemporary robotic construction still has a lack of autonomy and the gap between the realm of design and of fabrication. It should be solved for a long-term goal of a higher responsiveness of autonomous capacity towards the quality of materials, environmental conditions such as solar radiation, temperature, gravity and material stresses, etc. Here, a question raised for this project : How can we minimize the logistical costs by reducing a scale of mechanical devices which is generally larger than the structure they build? Based on this question, this paper will present a current process of the autonomous swarm robot to construct on the remote environment. At this project, we aim only to the fabrication of 3m height of the wall on the remote environment. Given that this project is focused on its basic functions from design to fabrication, we are not going to treat subjects of the Moon, for instance, transportation, deployment, energy supporting on the Moon, etc. On this paper, the swarm robot project is only concentrated on to find an alternative method to the conventions of material(layer) deposition, computer-controlled construction technique (digital fabrication), robot design, operation and creating a closed-loop feedback system for a physical fabrication. It is my belief that my ambition of finding a solution to close a gap between the software of digital fabrication process and hardware of robotic physical fabrication will allow the construction more productive and economical in terms of the material utilization and construction period.We expect to build a prototype model for a test on the remote environment on Earth end of the year.