

Self-Evolving AI Robot System for Lunar Exploration and Human Outpost Construction

Project manager

(selected in 2022)

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Leader's institution

Tohoku University

R&D institutions

Osaka Institute of Technology

Kyoto University

Tokyo University of Science

National Institute of Advanced Industrial Science and Technology

Tohoku University

Summary of the project

This project aims to develop a self-evolving AI robot system for lunar exploration and human outpost construction. Core technologies will be established that effectively utilize the components deployed to the Moon, enabling modules to be reconfigured according to lunar conditions and mission tasks. By 2050, exploration and resource utilization on the Moon will be promoted to realize sustainable outposts for human presence in space. In addition, developed technologies can be applicable to the Earth, such as natural disasters, etc.

Image of a lunar base with AI robots in 2050.



Milestone by year 2030

We develop space flight models of "modular AI robots" that can function under the special environment of the Moon's surface and conduct an initial demonstration mission on the Moon to realize a lunar base using AI robots.

Milestone by year 2025

The robot module can be attached, detached, and replaced by itself or another robot, the module can be reassembled to accomplish the mission by selecting the appropriate movement style and form according to the movement environment, and multiple robots can cooperatively transport large objects on uneven terrain with obstacles, and deploy and assemble structures. The ground-based demonstration will include the ability to cooperatively transport large objects over rough terrain with obstacles and to deploy and assemble structures using multiple robots.

Project structure

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R&D Item 1 : Realization of Modular Multi-Agent Robot System

- 1: Design, prototyping, and functional analysis of modular robots
- 2: Distributed AI system by hierarchical reinforcement learning

PI: Fumitoshi Matsuno (Osaka Inst. of Tech), Jun Morimoto (Kyoto University)



R&D Item 2: Realization of a Lunar Base Using AI Robots

- 1: Integrated control system for assembling and construction by multiple robots
- 2: Human outpost construction using inflatable structures
- 3: Simulations and machine learning for robotic control of inflatable structures

PI: Kazuya Yoshida (Tohoku University), Shinichi Kimura (Tokyo University of Science), Natsuki Yamanobe (AIST)



