

Intelligent Multi Agents for Exploration and Settlement in Unknown and Unexplored Areas

Project manager

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R&D institutions

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Summary of the project

The project acknowledges the limitations and risks associated with relying solely on high-precision measurement and control by a few large robots. To overcome these challenges, alternative solutions are being sought, focusing on decentralized and self-organizing AI robot technology. The objective is to develop robots capable of long-term survival and operation in high-risk and unfamiliar natural environments with unpredictable conditions. This entails studying how the collective can evolve through updating and expanding shared functions and introducing new robot units. Furthermore, the project aims to create an advanced system that utilizes swarm intelligence to construct activity bases, where multiple robots collaborate to transport and deploy robot base containers, functioning as operational hubs. By combining these approaches, the goal is to achieve the establishment of lunar activity bases through the evolution of swarm intelligence by the year 2050.

In addition, developed technologies can be applicable to the earth such as natural disasters and etc.

Milestone by year 2030

The goal is to establish and demonstrate a technology that enables the self-organization and control of a swarm of low-functionality small robots through advanced strategic intelligence called "network intelligence," which is distributed among each robot. This technology will allow us to conduct exploration of the interior of lunar lava tubes, investigate suitable habitats, and transport spherical robot containers, among other tasks. By achieving this, we will contribute to international lunar development and robotic operations in hazardous and unknown environments, as well as outer space exploration.

Milestone by year 2025

The goal is to develop a technology in which a swarm of low-functionality small robots collaborates and evolves together using the initial stage of shared distributed intelligence, shown as "network intelligence." This technology enables the robots to perform continuous operations in demanding and unfamiliar terrains. Moreover, by coordinating with immobile spherical robot containers, the swarm robots can broaden their range of applications. This advancement paves the way for their utilization in real-world situations, where they can take over specific tasks traditionally performed by humans and work alongside them in diverse industries.

R&D theme structure of the project

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R&D Theme-1 : Evolutionary Network Intelligence System

- 1-1. Control scheme and Behavior for Evolving swarm robots, and Integration of Network intelligence
- 1-2. Analysis of Collective information from Network intelligence and Swarm robots
- 1-3. Design and Implementation of Decentralized and Self-organized Network intelligence with Co-evolutionary capabilities

R&D Theme-2 : Individual and Collective Evolutionary Functions

- 2-1. Flexible functionality of Evolving control system with Low-consumption and High-speed processing
- 2-2. Parallel processing architecture on flexible structural control device with Low-consumption and High-speed
- 2-3. Design of architecture of Data flow control in Lager-size task-module, and its Implementation with Evolving mechanism
- 2-4. Design and Implementation of Task-module sharing architecture in Inter-swarm network

R&D Theme-3 : Network Intelligence RT Platform

- 3-1. Design and Integration of RT-platform with Exploration, Transportation, and Habitation capabilities
- 3-2. Design and Implementation of Small-size RT hopping mechanism and Robot
- 3-3. Design and Implementation of Small-size RT surface mobility and Robot