R&D Item

3. Network Intelligence RT Platform

Progress until FY2024

1. Outline of the project

This R&D Item is to develop the small moving robot mechanism and systems to behave autonomously, in addition, to develop the robot container that has the functions to support the robot's autonomous behavior.

The integration of these developments will achieve "Robot Technology Platform activating Network Intelligence".

The first problem is in the small moving robot. It is to raise the capability and stability of moving and hopping of the robot. To solve it, we will develop robots in the construction field on earth first. This achievement will develop a robot that will be able to explore the lunar lava tube, investigate suitable places and transport the construction materials. We will develop step by step from a robot individual to a small, big swarm. Technical Demonstration machine will be proofing the capability of rough ground rolling movement, hopping movement, exploring, investigating and transportation. These will achieve the mass production machine to be operated on the moon.

The second problem is with the robot container. It is to achieve the swarm cooperation function and the transportation function as a container. The swarm cooperation function will need the capability to relay the communication and the electricity. container's function will need the capability to envelope and protect the base construction materials, assist the passing of the rough ground with folding and membrane tensegrity, and deploy the container at the base construction with inflator. This each function will be developed and be being integrated as swarm cooperative robot container.

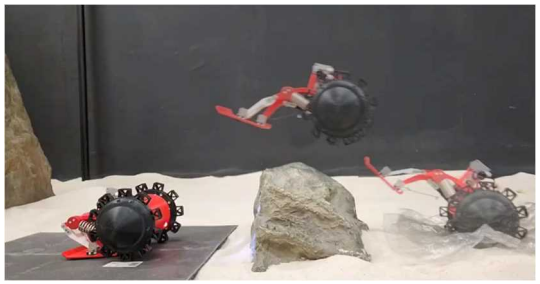
Eventually, we will integrate this R&D 3 with R&D 1 and 2, then swarm robots will achieve the autonomous exploration on the moon and construction of the activity base.

2. Outcome so far

We have improved the conventional small moving robot also as experimental machine for R&D1. Compared with previous robot, the hopping unit have been smaller, and the wheels have been modified to fit for rough ground. The robots have been able to pass the obstacles and undulations that have 15 % height of wheel diameter in the actual rolling experiment. Then, the robots have been tested step by step on various rough ground. In addition, we have gathered the critical data by testing in the actual lava tube in the earth assuming the lunar lava tubes.

Moreover, we have designed and tested the prototype functions of robot container that swarm robots would transport.

Based on these results, we have formed new design concept for robot and container.



3. Future plans

Based on these R&D results, we will be developing the surface moving function and the hopping function implemented in the small robots. These improved functions will be integrated, and we will develop the flight model to explore on the moon and the ground model to integrate tests. These will be developed assuming for the actual exploration for the lunar lava tubes, be tested for space specifications. The ground models will be switched to be made the mass production as swarm robots, and to be evaluated the cooperative behaviors.

In addition, we will develop the fundamental functions of the robot container transported by swarm robots. The functions will include the ability to envelope robots in throwing into the lunar lava tubes and to reduce the shock in landing to the moon surface. Moreover, the robot containers will be added to the functions to support the swarm robots.

The relaying function to deliver the data and electricity to the swarm robot and the inflatable structure function to deploy the containers as the robot activity base by gas expansion will be developed and be added. These small moving robots and robot containers will be assumed to explore in lunar gravity environment. We will plan the scenario to construct the activity base in the lunar lava tubes. we will develop the above all with the scenario.