Autonomous Greenhouse with Swarm robots for Mars Exploration

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Abstract: Bhoomi is a swarm robotics platform to build Habitats. Each robot in the swarm is independent and completes functional requirements autonomously. Multiple robots collaborate to complete a complex task. Robots consist of Rover(UGV), Quadcopter(UAV/), Humanoid(Digital twin). VR map model is generated by the Habitat Monitor system for real time visualization and tracking progress of robots. Each robot has a fallback position, for human operators to intervene for complex task processes.

The system will generate layouts for Habitat modules and provide Assistance and monitoring to Martial explorers. Fresh and locally grown food is necessary for Sustenance and survival of crew members. The system will monitor the green house and provide information to Mission specialists.

For the Habitat's Greenhouse Module. Below tools have to be 3D printed

- Metal Cutter/Shearer : To repurpose landing gear shell for walls and compartments
- Exercise Equipment : Weight + Dumbbells
- Photo Frames : Mental Health and sense of belonging to mission and life
- Rubber/Soft Mallet : Bend materials into shape for building compartment
- Wires - Thick filaments to hold items into places
- Cutlery/Garden Tools : Scissors, knife, Screwdriver - Standard head

Process

- 3D printer - Print the items based on Prioritised order received from the Habitat Control System
- Rover to pick the items from the 3D printer and to stack it at the sub-module location.
- Astronaut build the module with logistic support of Rover

Modules retrofitted from I-HAB segment

- Crew Systems: Galley for warming food and dining and Personal Crew Compartments providing private area for sleeping
- Crew Health Performance Subsystem: Environmental monitoring, Exercise area and Medical care
- Docking ports: Two axial ports for attachment to the Gateway, Two ports radially for vehicles
- Phenotype plant growth and requirements by growing in Simulated environment on Earth.

Schedule

- Weekly harvest - Per person requirements calculation
- Sow / Re-planting order and time consumed
- Batches of seeds - Initial usage and seeds creations for long term
- Print - Pots and containers for schedules

Demo - https://mangala.earth