COMMAND-AND-CONTROL SUBSYSTEM FOR REGOLITH MINING ROBOT

Requirements

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Requirements Document

1. REQUIREMENTS

1.1 Subsystem

1.1.1 OPERATIONAL PHASES - The C2C subsystem shall have the following main phases throughout operation:

- Idle
- Testing
- Initialization
- ForwardTransport
- LoadCollection
- ReturnTransport
- LoadDeposit

1.1.2 POWER USAGE - The C2C subsystem shall have the capability to measure the power consumption of ARES.

1.1.3 KILLSWITCH - ARES shall have the capability to halt all operations and shut off power upon receiving a kill command from the ground-station.

1.1.4 VERSION CONTROL – All ARES software will be hosted on a Github repository for version history and simplified collaboration.

2.2 Movement

2.2.1 FORWARD – The C2C subsystem shall enable ARES to move forward using its motors.

2.2.2 BACKWARD – The C2C subsystem shall enable ARES to move backward using its motors.

2.2.3 TURN CW – The C2C subsystem shall enable ARES to turn clockwise.

2.2.4 TURN CCW – The C2C subsystem shall enable ARES to turn counter-clockwise.

2.2.5 RAISE MINING GEAR – The C2C subsystem shall enable ARES to raise the mining subsystem assembly

2.2.6 LOWER MINING GEAR – The C2C subsystem shall enable ARES to lower the mining subsystem assembly

2.2.7 MINING – The C2C subsystem shall enable ARES to raise the spin the mining mechanism forward resulting in the collection of lunar soil simulant.

2.2.8 DEPOSITION – The C2C subsystem shall enable ARES to raise the spin the mining mechanism in reverse resulting in the release of held lunar soil simulant.

2.3 Communications

2.3.1 CS UPLINK – ARES shall be able to communicate with the Control Station with the NASA-provided Ethernet connection.

2.3.2 OPERATOR CONTROL – As a baseline, all of ARES' electromechanical functions shall be controllable by a human operator from the Control Station.

2.3.3 ROBOT TO CS – ARES shall be able to send data to the Control Station.

2.3.4 CS TO ROBOT – The Control Station shall be able to send data to ARES.

2.3.5 ROBOT FUNCTIONS – ARES shall be able to be controlled by key presses on the Control Station computer.

2.3.6 CHANNEL SWITCHING – The wireless communication hardware shall have the capability to change channels in order to minimize interference and to comply with the competition rules.

2.4 Program Phases

2.4.1 IDLE– ARES shall be able to maintain a connection with the control station even if there's no control activity going on at the moment.

2.4.2 TESTING– ARES shall be able to ensure its components and communications links are available and responsive during this phase.

2.4.2 INITIALIZATION– ARES shall determine its relative position inside the arena along with its orientation.

2.4.2 FORWARD TRANSPORT– ARES shall not be mining during this phase in which it shall be making its way towards the mining zone.

2.4.2 LOAD COLLECTION– ARES shall be using its mining equipment to collect regolith during this phase.

2.4.2 RETURN TRANSPORT– ARES shall no longer be mining during this phase and be moving towards the regolith collection bin.

2.4.2 LOAD DEPOSIT– ARES shall release the regolith held inside the mining assembly during this phase, which shall only happen.

2.5 Control Station

2.5.1 CONTROL STATION– The control station shall be a commercial-off-the-shelf portable computer.

2.5.2 GUI– The control station shall include a graphical user interface with which to view incoming ARES data.

2.5.3 INPUT– The control station shall be able to control ARES functions using keyboard keystrokes or input from a hand-held controller.

2.5.3 LATENCY– Input-to-response latency shall not exceed three hundred milliseconds in order to achieve responsive robot control.