Autonomous Multiple Cycle Farming in Space

Dominic Allard, Philip Bernhard, Joshua Calhoun, Courtney Cline, Giampiero Corsbie, Timothy Frazier, Kali Jenson, Bryce Johnson, & Christopher Millsap

Faculty Advisor(s): Dr. Elisabeth Kames, Dept. of Mechanical Engineering, & Dr. Philip Chan, Dept. of Computer Science, Florida Institute of Technology

MOTIVATION

- Space exploration expanding rapidly and the need to accommodate life beyond Earth.
- To grow food autonomously in space that can support humans reliably, without compromising valuable time, or energy, from other missions.

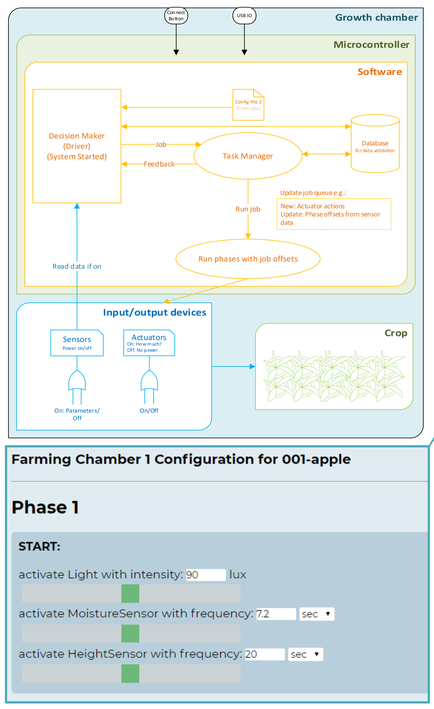
PROJECT GOAL

- To build an Autonomous Multiple Cycle Farming Chamber that seeds, grows, and notifies crew that crop is ready for harvest.
- Streamline the Growth Chamber configuration for multiple farming cycles by creating a web application user station.

FARMING CHAMBER & USER STATION

- Growth Chamber **runs autonomously** based on botanist and astronaut configurations and the
- User Station allows users to **manually control**, **update configurations**, and **view reports**(not shown)

Chamber



User station

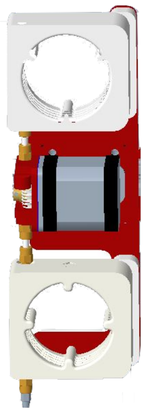
GROWTH CHAMBER DESIGN

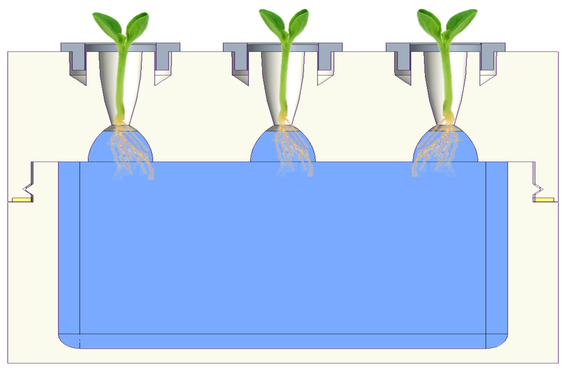
WATER DELIVERY

- Comprised of an aluminum tank, that controls the intake and outflow of water nutrient solution with a linear actuated plunger while solenoid valves control the direction of the water through commands of the software.

SEEDING SYSTEM

- The End Effector is capable of planting seeds in microgravity by forcing seeds out with filament driven by a stepper motor. The seeds are precisely placed into their respective tray hole.





TESTING & VALIDATION

- Multiple iterations of the tray were tested through growth cycles, in order to achieve the requirement of 70% harvest.
- Circuitry and software was also successfully tested over several weeks, proving the autonomous capabilities of the system.

COST ANALYSIS

Component	Cost
Planting System & End Effector	$560.21
Water Delivery & Tray	$329.16
Lighting & Electrical	$83.95
Miscellaneous & Case	$341.74
Total	$1315.06

FUTURE PLANS

It is with great pleasure to announce that we have already submitted the Autonomous Multiple Cycle Farming System concept to two different NASA programs: “Technology Advancement Utilizing Suborbital Flight Opportunities ‘Tech Flights’,“ as well as “Student Payload Opportunity with Citizen Science (SPOCS)” at Johnson Space Center.

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