

Observing the efficacy of the automation of small-scale farming in regolith and soil conditions

Emily Soucy, Tyler DeScenza, Anthony Digiovanni, Vivienne Nipar, Caitlyn Hubric, Indigo Boggs, Charlotte Aplin, Caitlin Rosinus

Faculty Advisor(s): Andrew G Palmer, Dept. of Ocean Engineering and Marine Sciences, Dept. of Biomedical and Chemical Engineering and Sciences, Florida Institute of Technology



Background

- In space conditions, the automation of farming offers a way to reduce the toll on several limited resources, particularly time, as well as increase crop monitoring.
- Farmbot Genesis v1.2 is equipped with tools for seeding, weeding, watering, and taking pictures.
- Farmbot can perform plant care sequences and track plant condition and age without human input.
- Open Farm provides crop information to Farmbot and relevant data can be automatically applied to plant care regimens



Figure 1: Farmbot Genesis v1.2 set up in a 10x5x1ft garden bed.

Preliminary Data

- The tools experience increasing resistance to motion in the more dense substrates (specifically regolith).
- Substrate compaction dramatically increased after watering.
- The weeding tool was unable to move through the watered unsifted and sifted regolith substrates, while maintaining connection to the active tool.



Figure 2: Weeder tool falling off the UTM due to unsifted regolith compaction, post watering.

- Tool pins and wiring have corroded over time and wear, needing replacement to regain functionality
- Dust buildup has occurred in wiring connections and tools, limiting their consistent functioning and requiring regular human upkeep
- The web interface is entirely reliant on a stable internet connection for Farmbot to be able to process commands and perform sequences



Figure 4: Side-by-side comparison of sifted regolith, unsifted regolith, and topsoil. The regolith is a mixture of MGS and perlite. The unsifted perlite limits compaction and provides a less dense growing substrate as compared to the sifted regolith



Figure 3: Visual observations of soil/regolith accumulation on the weeder tool, before and after watering substrate.

Research Goals

- Repair and rebuild Farmbot from its 2-year hiatus
- Troubleshoot mechanical issues
- Analyze hardware integrity and identify potential problem sources
- Fine tune software preferences and build usable sequences
- Test Farmbot's durability in regolith conditions with preliminary growth studies

Future Studies

- Grow the plants to maturity using Farmbot
- Perform a comparison of time use between traditional and automated farming
- Compare the collected biomass between traditional and automated farming

Acknowledgments

FarmBot
Kennedy Space Center