Team 8: Smart Composter

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GVSU SUSTAINABLE AGRICULTURE PROJECT

GRAND VALLEY STATE UNIVERSITY

Project Purpose: The Smart Composter was an interdisciplinary project among Engineering, Computing, and Environmental Science Schools with the goal of increasing the sustainability of GVSU's small scale farm called the Sustainable Agriculture Project (SAP). It is designed to actively measure the temperature, humidity, and oxygen levels inside the composter and regulate to maintain an aerobic environment to create food safe compost. Previously, the SAP's composter had to be aerated and watered by hand which is physically intensive and would not guarantee food-safe compost.

The smart features of the project are the remote monitoring of the internal climate and automatic controls to maintain temperature and humidity. In the future the goal is to have the parameters be adjustable through the web based app.

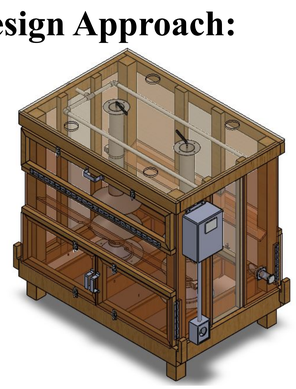
Key Specifications:

- Indicate internal temperature from 0 - 180°F
- Maintain internal temperature from 131 - 159°F
- Indicate external temperature from -20 - 170°F
- Indicate internal humidity from 0 - 100% RH
- Maintain internal humidity >40% RH
- Temperature resistant from -20 - 170°F

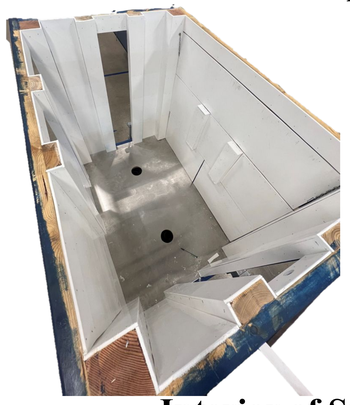
Notable Challenges:

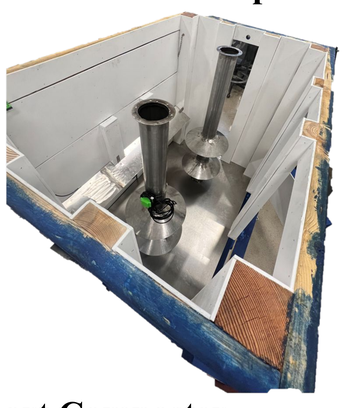
- Designing a solution to aerate the compost without manually turning the pile.
- Fabricating and welding with stainless steel.
- Finding blowers to move air through the compost.
- Selecting food grade materials to prevent leaching.
- Building it to withstand the hoop house's climate.
- Designing a PCB to only allow one AC utility to turn on at a time.

Design Approach:

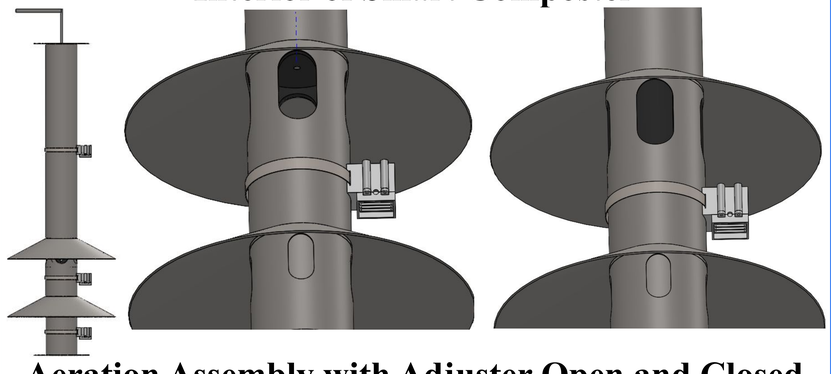


CAD Model vs Completed Smart Composter

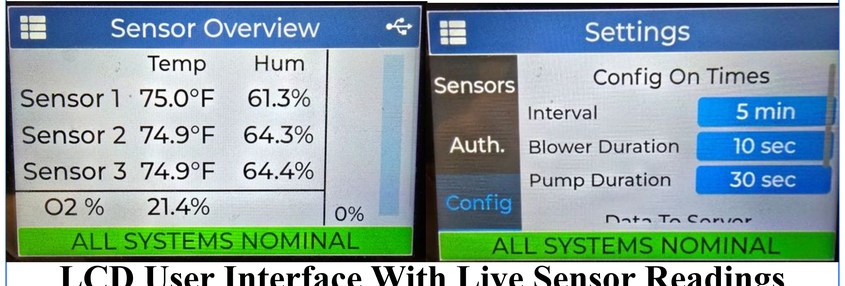




Interior of Smart Composter

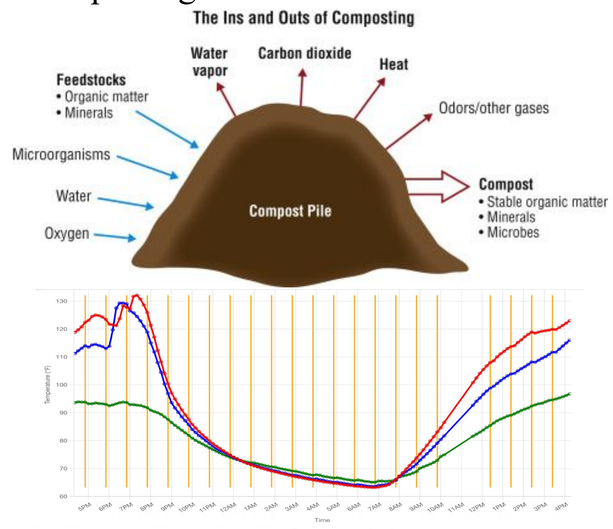


Aeration Assembly with Adjuster Open and Closed



LCD User Interface With Live Sensor Readings

Performance Results: The Smart Composter successfully transmits the climate data to the web based app for remote viewing. It is maintaining the minimum humidity levels, and we are waiting for microbial breakdown of organic matter to generate enough heat to sustain the target temperature of 131° F, which is necessary to eliminate pathogens and have efficient composting.



Temperature Over 24 Hours

Impact of Project: The SAP can now produce food grade compost, and a research tool with the ability of remote data collection and climate adjustability. The composter will also serve an educational purpose for all visitors, including young children, adults, and other small-scale farmers, by teaching them about the process and benefits of composting.

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