Kent Denver Innovative Scholars Program
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Institute of Technology and Design
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Streamlining the Composting Experience

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Problem Statement

Over 33% of the world's landfills are filled with organic, compostable material. When not composted, this releases billions of tons of CO_2 per year. Many households view composting as inconvenient and difficult. This is simply not true, and I aim to streamline and simplify the composting process and promote compost education in order to bring this environment-saving methodology to everyone.

Research

At the beginning of the semester, I strove to educate myself on the internal mechanisms of composting. Below are some highlights and interesting facts:

- Compost should not have an unpleasant odor.
- Reactions within compost are extremely exothermic, often reaching up to 150˚F,
- A 65 gallon composter can save up to 132 pounds of carbon, roughly equivalent to the emissions of an average US household over the course of a month.

FIGURE 1: An image of active compost.

This fundamental understanding of the composting process allowed me to isolate two variables that can be used to detect issues and map progress over time: moisture and temperature.

Skills Learned

This semester was largely dedicated to developing my mechanical design skills to aid the development of an eventual product to combat the barrier between the average household and composting.

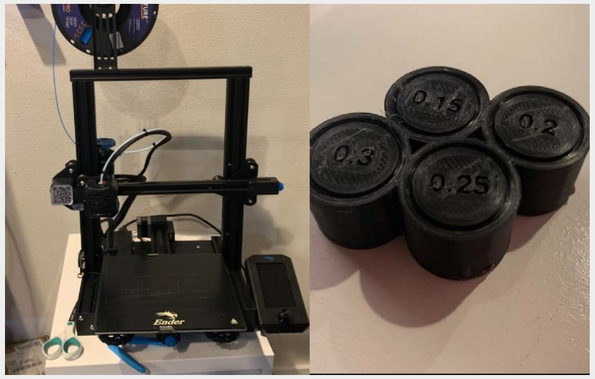

FIGURE 2: A 3D printer and a tolerance test, demonstrating an accuracy of ±0.25mm.

Throughout the period of my independent study, I chose to mainly focus on the mechanisms of 3D design and printing. This includes understanding print-in place joints, snap-fit joints, and printer tolerances.

I also began to dive into the world of prototyping with basic code through the Arduino IDE. I encountered unexpected complexity with this portion of the project..

Finally, I spent time improving my physical prototyping skills, mainly soldering wire connections and using a breadboard to test circuits.

These skill sets will serve me well into the future as I continue to develop this product.

Implementations

I focused most of my efforts on the development of a basic case for the Teensy 4.1, a microcontroller that will likely drive the operations of a compost sensor. In short, this device will use moisture and temperature readings to determine the state of the decomposition.

This polished design at right includes notable design features, such as:

- Snap-fit joints
- A friction-fit seal that is extremely water resistant
- A shelled and fileted case
- 50µm layer thickness, achieved using an SLA printer

FIGURE 3: A prototyped microcontroller case.

While these points of progress in the compost sensor itself are somewhat basic, it lays a strong foundation of technical and physical skills that will be necessary for a successful development process in the future.

FIGURE 4: A compost bin installation within the Kent Denver community.

In addition to prototyping my own compost sensor, I also looked towards my local community to make an impact on food waste.

I worked with a national non-profit, called Earth Guardians, to create a branch of the organization in the Englewood area. Our goal is to educate the general public about the benefits of composting, and provide a service to help households begin the composting process.

Shown at left is our first non-profit compost bin installation, assembled and installed only at the cost of parts.

Through the summer, our organization plans to install 50 of these bins throughout our local community, effectively preventing over 6,500 pounds of carbon from being released in landfills.

Looking Forward

Over the summer and coming fall semester, I plan to move into more intensive development of the compost sensor, and integrate it with the non-profit compost bin installations. This integration of technology and design skills with philanthropy and business will ultimately further my exposure to the world of engineering and its implementations in the environmental sector. I hope to complete this project by creating a cost-effective, manufacturable, and environmentally friendly "all in one" compost bin that can be easily installed and used by anyone.