The Compost Professor – A Smart Composting System

Business Plan

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Executive Summary

The Compost Professor is a smart composting system that assists the average homeowner with creating compost. The Compost Professor uses analytics and artificial intelligence to makes decisions based on multiple factors, including temperature, moisture, weather, sunlight and historical trends.

Where possible, the system will act on the user's behalf to take corrective actions to advance the compost creation process. When human intervention is needed, the system tells the user what should be added to the compost, when the compost bin should be turned, and when compost is ready for use.

With proper use and activity, a user could create over 2500 pounds of compost every year.

The Problem

Per the EPA[1], food scraps and yard waste make up 20-30% of what we throw away. These materials could instead be composted – keeping waste out of landfills and reducing methane gas emissions.

According to the Environment Defense Fund[2], methane has a significant impact on our climate.

> "While methane doesn't linger as long in the atmosphere as carbon dioxide, it is initially far more devastating to the climate because of how effectively it absorbs heat. In the first two decades after its release, methane is 84 times more potent than carbon dioxide."

Unfortunately, most do not compost - typically due to ignorance on the benefits of composting, misunderstanding of what can be added to compost, and lack of desire to manage compost.

How the Compost Professor Can Help

The Compost Professor is designed to simplify the compost creation process. The system automates much of the compost creation process. When user interaction is needed, the system will tell the user:

- What to add
- When to turn the compost
- When to refill to the internal water reservoir
- When to replace or charge batteries
- When compost is ready for use.

The Compost Professor is made up of three units and four services.

[1] https://www.epa.gov/recycle/composting-home
[2] https://www.edf.org/methane-other-important-greenhouse-gas

Physical Units

1. **Compost Unit** - A Smart Compost bin contains temperature and moisture sensors that monitor the health of the compost. The bin will also take corrective actions as needed: automating air flow and compost hydration. The sensors are contained within an enclosed compost tumbler, reducing uncomfortable smells that disturb neighbors and attract rodents. The Compost Unit transmits data using radio packets and therefore can be positioned over 300 yards away from the Base Unit (which resides inside the home).

2. **Base Unit-** This unit relays data from the Compost Unit to the Compost Professor Cloud, which analyzes the data and makes recommendations on actions needed. This unit can be stored in a corner or under a desk.

3. **Kitchen Unit** – This is a small, chargeable, battery-powered touchscreen device that is meant to sit on the kitchen counter. The user can quickly check the state of the compost using the touchscreen. The unit will inform the user if any action is needed (e.g. turn the compost bin, add green materials, add brown materials, replace the batteries).

Services

1. **Compost Professor Dashboard** (release targeted for Dec 2016) – The dashboard is a web-based system that provides detailed records on your compost health. The user can review progress and compare his compost creation against other users.

2. **Compost Helper Alexa Skill** – This Alexa Skill tells users if a certain item can be composted.

3. **Compost Professor Skill (**release targeted for Nov 2016) – This Alexa skill can provide the same information as the Kitchen Unit. It will also be able to proactively notify the user when an action is needed.

4. **Subscription Service –** Each Compost Professor unit will come with a "starter kit" of Compost Activator and Sawdust Wood Pellets. Users will have the option of setting up an automatic replenishment of the activator and wood pellets**.**

Keys to Success

There are many reasons why we believe the Compost Professor can be a successful product.

1. **There are no comparable systems on the market**

   To date, there are no smart composting systems available for home use. We have found a few compost thermometers and moisture sensors; however, those systems are not integrated into an analysis and recommendation system. In addition, commercial systems are expensive and not built for home/urban use.

2. **Most Americans would compost if the process was "easy"**

   A 2014 study[3] shows that while 72% of Americans do not compost their food waste, 67% would if it was more convenient. The Compost Professor is designed to make composting as easy as possible, by telling the user what to compost, when the bin should be turned, and when the compost is ready. In addition, we provide organic materials to kick-start the composting process.

3. **Concerns about the environment are at an all-time high**

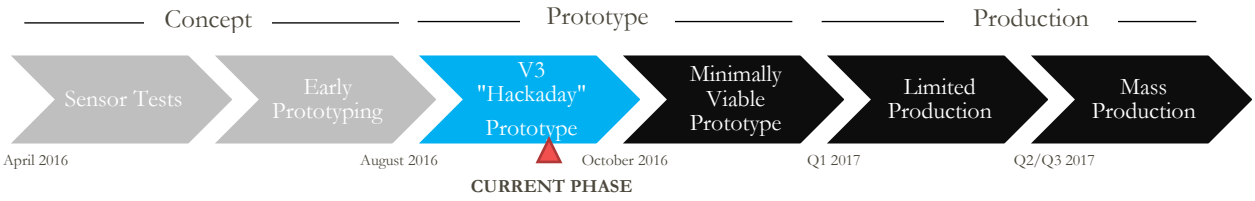
   Recent US policy decisions about environmental policies (specifically climate change) is renewing interest in recycling and environmentalism. Regardless of an individual's beliefs, it is universally accepted that composting can reduce the amount of trash thrown into landfills and reduce methane gas outputs.

Timeline and Highlights

Summary

The Compost Professor system has been in development since April 2016. Three major prototypes have been built during this time. Prototype 2 was judged by Intel professors and members of academia as part of the Us-China Young Makers Competition. The Compost Professor advanced to the 3rd round of the competition, and ultimately received an Excellence Award. Feedback from the panel of judges was incorporated into the Version 3 Prototype.

Project Phases



[3] https://www.prnewswire.com/news-releases/national-waste--recycling-association-survey-finds-most-americans-would-compost-if-it-was-more-convenient-in-their-community-239232261.html

Phase	Objectives	Successes	Learnings
Sensor tests	• Determine if sensors can be used to monitor compost	• Tests successful • Selected as Semi-Finalist Award in 2017 China-U.S. Young Maker Competition • Selected as Semi-Finalist in 2017 Hackaday Best Product Competition	• Initial moisture sensor was susceptible to corrosion
Early Prototyping	• Validate sensors can be built into robust product • Validate analysis algorithms • Develop User Notification System/GUI	• Prototype built and demoed at Young Maker Competition in Beijing, China • Advanced to 2nd round (26 out of 70 teams) • Won Excellence Award	• Judges Feedback - Product needed to be less "DIY" and more "out-of-the-box" • Battery challenges – convert to alternate microprocessor • Phone App not desirable; an easily accessible kitchen unit was considered a better option • Solar charging solution un-reliable for production
V3 ("Hackaday") Prototype	• Validate system can be built into an enclosed compost bin • Moved algorithm to AWS Cloud for scalability and • Build Kitchen Unit	• Prototypes for Compost Bin, Base Unit, and Kitchen Unit built • Validate Algorithm	• Adafruit Feather boards validate system can be run off 3.3V microprocessors • Battery challenges with Kitchen Model: need to – o convert from wifi to radio packet communication o incorporate larger battery o change TFT screen
Minimally Viable Prototype	• Design and manufacture PCBs for MVP • Design website and registration process • Manufacture custom compost bin with enclosures for sensors and water reservoir		
Limited Production Run	• Obtain funding • Manufacture limited number of units for sale and feedback • Incorporate Machine Learning into compost analysis algorithms		
Mass Production Run	• Apply feedback from Limited Production Run for Mass Production • Mass manufacture (location TBD) • Roll-out Replenishment Service		

Business Considerations

Product Tiers

The Compost Professor system has products that span hardware, analytics, and recurring sales. The products are grouped into 4 categories

Service Tier	Description	Products/Services	Cost Target
Hobbyist	The Hobbyist Tier provides free access to the Compost Processor Cloud.	• Limited API access to the Compost Professor Cloud to obtain recommendations on creating compost • Access to Alexa skill to get recommendations on what can be composted	Free (registration required)
Do It Yourself	A set of PCBs and sensors that can be assembled to monitor compost	• Free Tier • Sensors and PCBs to create a compost smart system	$75 – 100
Standard	A self-contained, fully assembled smart compost system that can be used out of the box	• Assembled Compost Bin, Base Unit, and Kitchen Unit • Full access to Compost Professor Cloud and Dashboard • Starter kit for Compost Activator, Sawdust Pellets, and Charcoal Filters • Access to Alexa skills to get specific recommendations for the user's compost	Target $150 - $200
Subscription	An additional subscription service that provides components to assist in compost creation	• Subscription service for Compost Activator, Sawdust Pellets, and Charcoal Filters	$25 every quarter

Competition and Pricing

Though there are no smart compost systems in the market, there are competing compost bins. Initial analysis prices compost tumblers as low as $60 (cheap, plastic) to almost $400 (metal, with a crank that rotates compost). Additional analysis is needed before a final price can be determined.