Down to Earth (DTE):

The Electric Food Composter

Senior Design 2021/2022

Team LANCE

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DR2.2 Specification Status

03/16/22

As you work on your project, you continually make progress towards meeting more and more of your specifications. The specifications status table will contain a summary of the status of your project in meeting all of your specifications.

TABLE FORMAT

The specification status table will be organized such that each specification (or sub-specification if specifications contain multiple parts) has a separate row. Please include only Shall/Will specs for DR 2.2. Please follow the format in the example shown below.

Spec ID	Specification	Status	DR2.2 Justification	Plans to meet full specs
UF001	**There will be an operation handbook included with our electric composter**.	Not met, but currently in development	This shows how the user can best use the product and how they can remain safe while doing so	Once the project is complete, we will have better understanding of the users input and the functions to operate the machine
UF002	**Our electric composter shall not require expert maintenance work more often than 1 time per 12-month period if user operation guidelines are followed properly. Our composter should not require expert maintenance more often than 1 time per 24-month period if user operation guidelines are followed properly**.	This spec at this time is met but not tested as we will not be able to run tests for that long of a period of time	This spec shows our commitment to autonomy in the product and the hope that it will not cause more work to the buyer than is necessary	Our analysis of this spec is encompassed by our bill of materials as we have been very selective of materials that will hold up to the heat and repeated use for long periods of time

S001	**Our electric composter will be equipped with some form of an emergency stop button in case our composter malfunctions**.	Designed to meet this, but in spring quarter	Postponed to spring quarter	By putting a big button on the exterior of the housing, the user can easily reach for the button to stop the cycle
S002	**Electric composter will be equipped with a safety latch on the input and output doors, so that when opened, power will be unable to flow to electrical components.**	Designed to meet this, but in spring quarter	Postponed to spring quarter	We can use some kind of switch and put it on the input and output doors, so when either of these doors are opened, it will cause the cycle to be put on hold.
S003	**Emissions shall be less than or equal to 15,000 ppm (parts per million) and should be less than or equal to 5,000 ppm.**	Designed to meet this, in spring quarter.	Shows we aren't emitting a significant amount of methane gas during a heating cycle.	Use methanometer to measure possible methane production for all food variations at least 2-3 times when heating.
S004	**The device will be labelled with clearly visible warning signs.**	Not met, but planned and will be easily met soon	With safety being our utmost priority, we want to make sure our users stay safe and are aware of potential hazards	To meet this spec, we have looked at printing our own or buying pre-made caution stickers that we will place strategically around the final product

R001	**Our heating chamber will be tested with food waste of all kinds, except large bones**.	Designed to meet this, but in spring quarter	Shows the system can properly process a variety of foods	Multiple tests of the heating cycle with a variety of foods groups individually then combined.
R002	**Our blending chamber will be tested with our dehydrated food waste**.	Designed to meet this, but in spring quarter	Ensures that the blender will be able to be properly utilized to blend our food waste into final product	Multiple tests of the heating cycle with a variety of foods groups individually then combined.
R003	**The design will include an air flow mechanism to filter air into the system**.	Currently incorporated 2 filters in ductwork.	Having a system to vent out harmful emissions and circulate air is integral to the safety of our system.	Placing the methanometer at the end of ductwork opposite the fan will indicate how well we are able to introduce air into our system
R004	**All exposed materials will be able to withstand the heat created by our heating chamber**.	Based on our initial tests, sheet metal can withstand heat	Ensures the material can properly work during a heating cycle without being compromised.	Test with agitator assembled and sealant applied to heating chamber
D001	**The lifespan of the**	Theoretically met but not	We want our device to be	Similar to UF 002 this spec is

	device shall be at minimum 2 years. The lifespan of the device should be at minimum 5 years.	testable within our time frame	worth the investment to the consumer so we want to ensure that it will work properly for a long time without issue	measured primarily by the type of materials we have bought and the life expectancy of those materials plus our add-ons
E001	**One cycle of operating our electric composter shall be accomplished in less than 24 hours and should be accomplished in less than 20 hours.**	Designed to meet this, but in spring quarter	Postponed to spring quarter	With the help of a timer, heating subsystem's components and the insulation, we'll do more tests to ensure the efficiency of the product
E002	**The processed food waste shall have a mass reduction of at least 50% and should have a mass reduction of at least 70%.**	Designed to meet this, but in spring quarter	Ensures final product is successful in extracting water from food waste during heating cycle	Multiple tests of the heating cycle with a variety of foods groups individually then combined.
E003	**The processed food particle size shall be 3 millimeters or less and should be 1 millimeter or less after one cycle of operating our electric**	Designed to meet this, but in spring quarter	Ensures we have a final product able to be directly incorporated into soil	Multiple tests of the heating cycle with a variety of foods groups individually, then combined.
E004	**The processed food particle size shall be 1.5 centimeter or less and should be 1 centimeter or less after one cycle**	Designed to meet this, but in spring	Ensures we have a final product able to be directly incorporated into soil	Multiple tests of the heating cycle with a variety of foods groups individually, then

	of operating our electric composter.	quarter		combined.
E005	**The heating chamber subsystem shall operate for at most 12 hours which is an ample amount of time for our food waste to completely dehydrate at our specified temperature. The subsystem should operate for at most 8 hours for our food waste to completely dehydrate.**	Designed to meet this, but in spring quarter	Postponed to spring quarter	By creating a countdown timer in the arduino, we can use it to control both the dehydration process and the grinding process.
E006	**The agitator and ceramic heating component for the heating chamber will operate at the same time during the heating period.**	The fan, motor and heater are working and programmed to operate at the same time	We did a test to see whether the heating chamber is working or not. In that test, we were able to see that the motor, fan, and the heater operates at the same time.	Once these components are permanently installed on the heating chamber, we will do some more tests to make sure that they are working properly.
E007	**The inner heating chamber will have a maximum and minimum fill line to indicate the range of food waste the heater will be able to accommodate**.	The stabilizing structure acts as a natural maximum fill line.	Having a range of capacity allows us to safely and effectively operate our system allowing for even heating and preventing overflowing of the blending chamber.	Continue to test to justify max fill line. May need to change value to the height of agitator to allow for all food to be displaced.

PC001	**The power consumption of the device shall be in the range of 0.5 kWh to 2 kWh and should be in the range of 0.9 kWh and 1.4 kWh.**	Based on our current design and progress, the heater would take the most power out of all of the electrical components (1kW). Thus, the range that we have would be sufficient.	Based on the program that we uploaded into the arduino, the heating chamber would only be activated when the internal temperature is below our lower temperature threshold. Thus, it's possible to lower the power consumed by the heater as it's not going to be activated for the whole process.	We'll do more power calculation in the next quarter and we'll also examine our system just in case we can make it more efficient
PC002	**The heating chamber subsystem shall be able to generate and keep an internal temperature of 120°F-175°F and should be able to generate and keep an internal temperature of 150°F-160°F.**	In one of our tests, we found that after a time the heater would lose its capability to generate, resulting in a failure to reach the temperature threshold.	This could potentially happen to us receiving a faulty product. On our first test, the heater is performing as desired. However, after taking a few tests in a row, the heater isn't generating much heat.	We plan to do more tests to see the behavior of the heater. However, if the problem persists, we would possibly get another heater so that we can generate enough heat to dehydrate the food.
C001	**The total cost of the electrical food composter shall not exceed $1,000 and**	We are on track to meet the shall portion of this spec but we have already	We want to keep the cost of the product low to, A: turn a profit for sales, and	We have been keeping a tight budget and using donation parts whenever

	should not exceed $500.	exceeded the should in our budget	B: make our product accessible to many people not just the rich	possible, continuously monitoring the budget should keep us within the spec range
SW001	**The dimensions of the entire system shall not exceed 47,520 volumetric cubic inches and should not exceed 26,448 volumetric cubic inches.**	On track to meet but not yet met	We wanted to keep the final project small enough to fit into someone's house easily or into a kitchen without interference	When we build the remaining housing, we will be sure to keep the dimensions within the given parameters
SW002	**The device length shall not exceed 28 inches and should not exceed 20 inches**.	Met the shall statement but not the should and tested (for the heater housing)	We want to keep the product small enough to fit into a home but large enough to contain all the internal components	As we build the blending housing, we will be sure to keep the dimensions within the parameters given, same as the heating chamber
SW003	**The device width shall not exceed 19 inches and should not exceed 15 inches**.	Met the shall did not meet the should and tested (for heater housing)	Again, we wanted to keep the project small for use in home kitchens or small restaurants	As we build the blending housing, we will continuously measure to stay within the spec parameters
SW004	**The device height shall not exceed 40 inches and should not exceed 35 inches**.	Not yet met but on track and planned to meet	This dimension is more about user-friendliness than fitting into a room, we don't want it too short so people must bend over to use it, or too tall that	Again, as we build the blending chamber, we will be making sure it doesn't go over the height parameters, with the current height of the heating

			someone might need a step to use	chamber we should be well within the limits
SW005	**The weight of the entire system shall not exceed 150lbs without any food waste and should not exceed 100lbs without any food waste.**	Not yet met but sure we will meet it by the end of the year	This spec is more for maneuverability, we want people to be able to easily reposition and move the product around the room as needed	We have been weighing the box periodically as we build and right now are well under the weight parameters so we are confident the final product will be too