Deliverable -F-

Prototype I & Customer Feedback

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1 Client feedback

1.1 What we do have right

- Priority list
- Size assumption
- General concept
- Dishwasher style is wanted functionally
- Chemicals will not change from what they are currently using
- Filtering the and reusing the water is possible

1.2 What we have learned

- Assume users will be careless (Strengthen durability)
- They are a lot more focused on automation than shortening labour time
- Cycle time is not a huge factor
- They are happy if the user can “Press and go”
- Being unable to move is not necessary
- If possible, to “Fold up” would be very beneficial
- Needs to be accessible to all heights
- I am willing to employ multiple if they are compactable
- Cost is not super important, based on ROI (Return on investment)
- They have tried different water treatments to avoid algae growth
- Unlikely to change the current water treatment process
- Easily repaired is helpful (Swappable parts)
- Water usage is not a concern (We can use extra water)
- Power consumption should not be a limiting factor
- If our product can be controlled remotely that would be beneficial, but not necessary

1.3 What was “reinforced”

- Users are unexperienced
- Size is massively important
- Automation is very strongly recommended
- They have a very narrowed view on a dishwasher type

- Longevity is important (Rural areas/Lack of professionals)
- Most of the work is remotely controlled (air temperature, humidity, air quality)

2 Prototype

2.1 Updated BOM

THENORTHDESIGN

BILL OF MATERIALS 05/11/2022

(1/2)

ID	Component	Feature	Unit price	Qty.	Price	Source
1	Brushed DC Motor	electrical	$ 15.81	1	$ 15.81	Store
2	Scrubber Brush	electrical	$ 5.62	1	$ 5.62	Store
3	Push button	electrical	$ -	1	$ -	Scratch
4	24V Battery	electrical	$ -	1	$ -	Scratch
5	Drilling Machine	assembly	$ -	1	$ -	Scratch
6	Drill Bits	assembly	$ -	1	$ -	Scratch
7	Other Drill Accessories	assembly	$ -	1	$ -	Scratch
8	Plastic tupperware	assembly	$ 4.00	1	$ 4.00	Store
9	Epoxy Plastic Weld	assembly	$ -	1	$ -	Scratch
10	Wiring	electrical	$ -	1	$ -	Scratch
11	Dish Detergent	testing	$ -	1	$ -	Scratch
12	Cutter	assembly	$ -	1	$ -	Scratch
13	Plastic Plate	testing	$ -	1	$ -	Scratch

Total = $ 25.43

(2/2)

Item ID	Link
1	https://www.hotecmotor.com/worm-gear-motor/ht-wog34b.html
2	https://www.walmart.ca/en/ip/scotch-brite-little-handy-scrubber-505p-8-ca-non-scratch-white/600007583890
3	/
4	/
5	/
6	/
7	/
8	https://www.dollarama.com/en-CA/p-cliplock-food-container/3033713
9	/
10	/
11	/
12	/
13	/

2.2 Prototype Development

Based on our previous work and deliverables, we have selected the following:

- Plastic box instead of wood in order to ensure waterproofing and avoid water leaks or damage.
- Rubber string or sealant inside the box lid for no permeability.
- A 24V battery with a high torque motor, maximizing both the efficiency and cleaning speed.
- Epoxy glue, tape, etc. to limit the access of the apparatus to the water.
- The brush is selected to be smooth and big to ensure good results.
- On & off switch connected to the wiring for automation and control.

Since the prototype is a smaller targeted objective, it is set to strictly follow two measurable criteria: cleaning efficiency, and automation level.

Pictures of the configuration and the set up are displayed in the following subsection.

2.3 Prototype set up & Analysis

2.4 Critical Component Analysis

Both the set up and analysis are shown in 2.3 as a multitude of pictures and snapshots from videos. The analysis is for the cleaning efficiency which is measurable by the % of efficiency by comparing the leftover residue area with the total dirty area through a simple ratio. In other words, we need to measure the % of removal based on how good our system works.

As shown in the picture, the brush is drilled then glued to the motor, which in turn is fixed in a tight hole within the containers lid. The circuit is to work outside of the box which ensures both safety and compliance.

The motor was firstly tested in the set up as a preliminary testing. First a 9V battery is hooked, which gives a somewhat fast and steady rotation speed. The trial is next done with a 18V battery resulting in a higher speed and visually a better torque, which enhances both the rotational capacity of the brush, resisting its weight, and the cleaning efficiency. Then a 24V battery is used as a maximum possible voltage. This however has led to a heating of the wires, and a burn out of the rotor as it stopped working/spinning, and small fumes exited the electrical device.

The manufacturer has ensured the ability of the motor to withstand such voltage. This is an expected contingency in our project, but since the guaranteed range of power is respected, an exchange of product or refund is to be expected.

The objective of measuring the cleaning efficiency was through putting a dirty dish inside and testing. However, since the rotor stopped working, the analysis is stopped.

The on and off switch on the other hand worked well. The pushing was easy and took barely a second, which as an outcome ensures reducing labour time and maximizing the efficiency of the prototype.

2.5 Final Outcomes

- Motor died – critical flaw.
- Push button & circuitry worked well – Ease of use.
- General functioning of the prototype was good, further testing must be done for the next prototype and the motor is to be replaced.
- The selected concept is simple yet good.

2.6 Potential Users & Feedback

- ***Alexis Truax: Former Retail Worker***

From the Retail worker standpoint, it is crucial that the product is capable of being simple and able to stay in the machine after cleaning, as it is extremely easy to become distracted or drawn away by customers while completing tasks. Making it vital that the machine can withhold having a cleaned raft past cycle completion.

- ***Nick Pho: Former Restaurant Dishwasher:***

Inside a kitchen it is quite common for various levels of adherence of grime on the plates, bowls, etc. It is especially important that the machine can pull off the hard stuck grime. An annoyance

with dishwashers is once the cycle is complete, but the plates are still dirty. This forces handwashing or a second cycle.

- ***Owen Hauck: Plumbing Apprentice:***

When working with water it is quite common for it to get into the areas you do not want it to. I would suggest making correct sealing and water control as a main priority as it is quite common for damage to occur due to a lack of prioritization of sealant.

3 Prototyping test plan

3.1 Test Objectives

1- Cleaning efficiency – Low fidelity + focused
   - Ensure mechanical cleaning is effective using a cleaned area by original dirty area ratio.
   - Test could be made many times for results accuracy.
   - Test aims for over 90% efficiency as a success criterion.

2- Automation – Low fidelity + focused
   - Improve automation and ease of use.
   - Qualitatively and subjectively evaluate the system and the push button.

3- Feasibility – Comprehensive + Analytical
   - Measure feasibility using available resources like cost and time.
   - Also could be measured by ergonomics and allowed space (box has to fit within a certain limited space).

4- Sealing & waterproofing – Low fidelity + focused
   - Ability of the box to retain water and not get the circuitry and other component wet.
   - Measurable using the leaking or exiting volume of water by placed water volume ratio.
   - Ideally this test aims for 100% waterproofness.

3.2 General Objectives

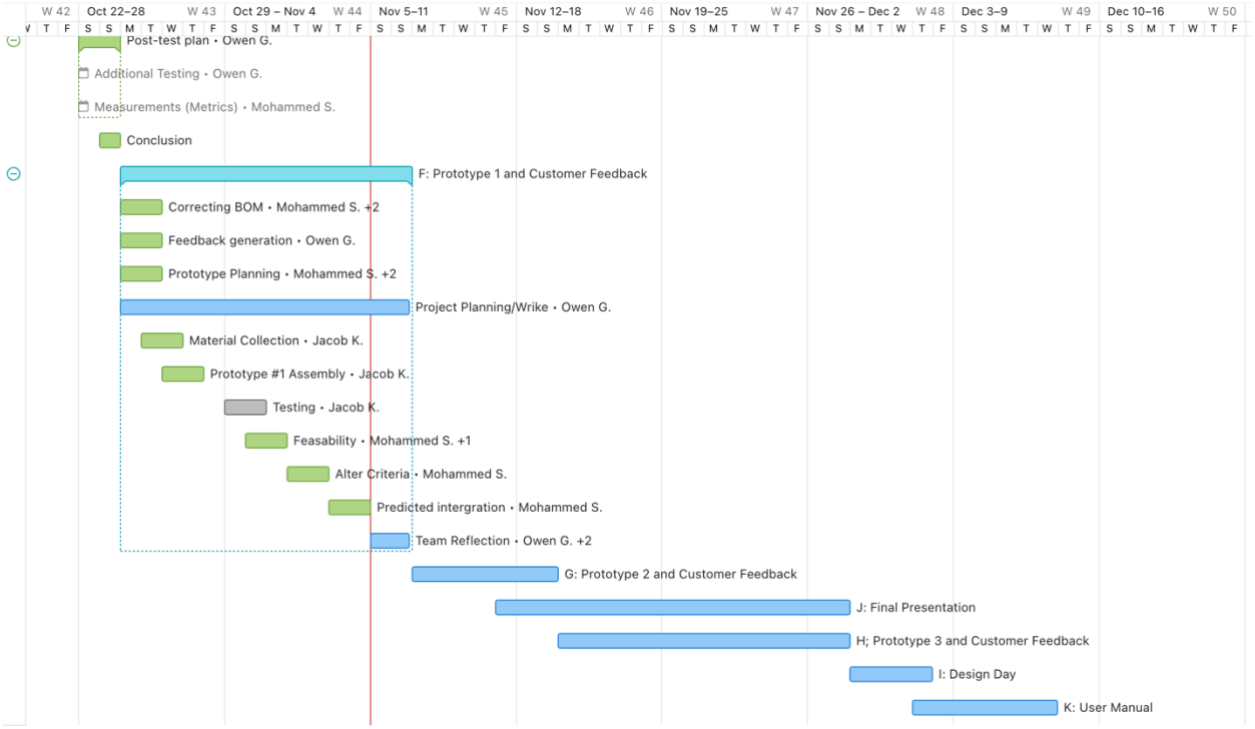
- Receive feedback on the prototype
- Analyze and interpret the meaning and goal of the feedback
- Produce potential conceptual changes to meet the feedback

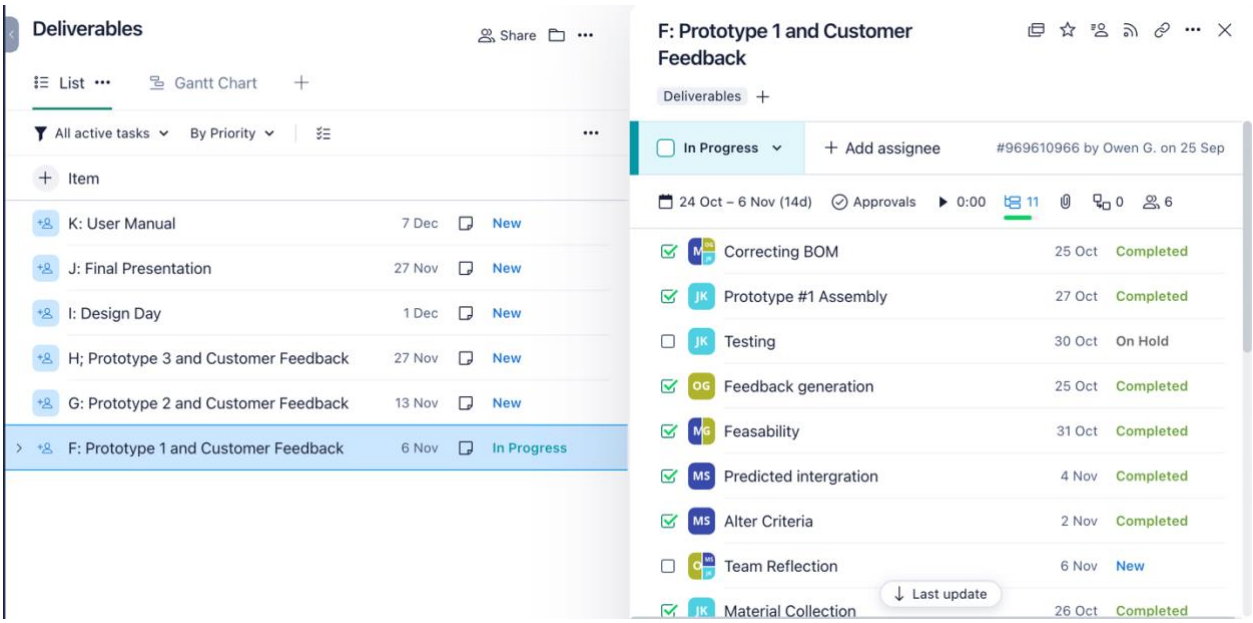
- Restart the concept selection process (Redesign, Reiterate, Brainstorm)
- Choose most feasible and “best” concept
- Begin implementing this concept into the overall design
- Prepare potential risks/uncertainties of this new concept
- Minimize the risks/uncertainties that the new concept presents
- Finish implementing the concept into the product
- Prepare test plan for implementation of product

4 Project Management

Throughout this week a lot of time is being spent separately, while doing the “planning process” together. With many different subtasks occurring all at once such as the prototype building, project management/planning and reconstruction of financial aspects of the prototype (BOM (Bill of Materials)). Each individual team member was assigned some tasks to complete so that the team may move forward. Although much of the project was done separately, a especially important portion of the project is done collaboratively as we complete the planning process of the products' future and current prototypes. This week will be similar to next, as much of it will be based on prototype 2, elevating the importance of this week's planning and preparation. Including the quick client presentation that we are delivering Tuesday.

(Please refer to Wrike for more detail)


W 42
Oct 22–28
W 43
Oct 29 – Nov 4
W 44
Nov 5–11
W 45
Nov 12–18
W 46
Nov 19–25
W 47
Nov 26 – Dec 2
W 48
Dec 3–9
W 49
Dec 10–16
W 50
Post-test plan • Owen G.
Additional Testing • Owen G.
Measurements (Metrics) • Mohammed S.
Conclusion
F: Prototype 1 and Customer Feedback
Correcting BOM • Mohammed S. +2
Feedback generation • Owen G.
Prototype Planning • Mohammed S. +2
Project Planning/Wrike • Owen G.
Material Collection • Jacob K.
Prototype #1 Assembly • Jacob K.
Testing • Jacob K.
Feasability • Mohammed S. +1
Alter Criteria • Mohammed S.
Predicted intergration • Mohammed S.
Team Reflection • Owen G. +2
G: Prototype 2 and Customer Feedback
J: Final Presentation
H; Prototype 3 and Customer Feedback
I: Design Day
K: User Manual


Deliverables
Share
List
Gantt Chart
All active tasks
By Priority
Item
K: User Manual 7 Dec New
J: Final Presentation 27 Nov New
I: Design Day 1 Dec New
H; Prototype 3 and Customer Feedback 27 Nov New
G: Prototype 2 and Customer Feedback 13 Nov New
F: Prototype 1 and Customer Feedback 6 Nov In Progress
F: Prototype 1 and Customer Feedback
Deliverables
In Progress
Add assignee
#969610966 by Owen G. on 25 Sep
24 Oct – 6 Nov (14d)
Approvals
0:00
11
0
6
Correcting BOM 25 Oct Completed
Prototype #1 Assembly 27 Oct Completed
Testing 30 Oct On Hold
Feedback generation 25 Oct Completed
Feasability 31 Oct Completed
Predicted intergration 4 Nov Completed
Alter Criteria 2 Nov Completed
Team Reflection 6 Nov New
Last update
Material Collection 26 Oct Completed

5 References

Jason Foster. 2019. “GNG 1103 – Engineering Design Lecture Notes” uOttawa.

Makerepo staff. 2021. “Professional development/Design thinking/Design for manufacturing - CEED Wiki.” Accessed November 6, 2022. https://en.wiki.makerepo.com/wiki/Professional_development/Design_thinking/Design_for_manufacturing.