

Project Deliverable F Report

Prototype I and Customer Feedback

Course: GNG1103–Engineering Design

Team Name: Five Alive

Date: [2025.02.24]

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1. Introduction

This report aims to design and test the tools we have designed. The current stage is Prototype I. The focus of this stage is to develop a basic, low-cost concept validation prototype. Collect and analyze feedback from customers, develop detailed testing plans, and provide a basis for subsequent prototype improvements.

2. Client Feedback

For our concept designs we suggested the client with various designs such as the detachable structure and design with added extension rods, and there is a battery at the grip to power the collection device. There is a control system above the grip, and the staff can also clearly observe feedback here.

The client emphasized making the concept designs simple and suggested that we do not need to use the have a mass sensor on board the collection container. Additionally, the client said that having a way to stabilize the 15ft of tooling within the pipe would be a feature to consider. The client was also concerned about how the chisel would be in contact with the pipe wall. The client also suggested using an end mill rather than a drill bit as a scraping device. Finally, the client suggested finding a way to obtain a consistent sample amount without the use of an Arduino weight sensor to simplify the design.

3. Prototype I development

Material selection: Cardboard boxes, toilet paper rolls/paper towel rolls, markers, pencils, sketching compass, ruler/tape measure, glue/tape

Production process:

1. We have completed the sketch design and made modifications according to the customer's requirements.
2. Cut the cardboard panel or component according to the marked outline and fix the component together with glue or tape. Ensure that the joints are stable and aligned correctly. Use paper rolls as cylindrical supports or structural elements where needed.

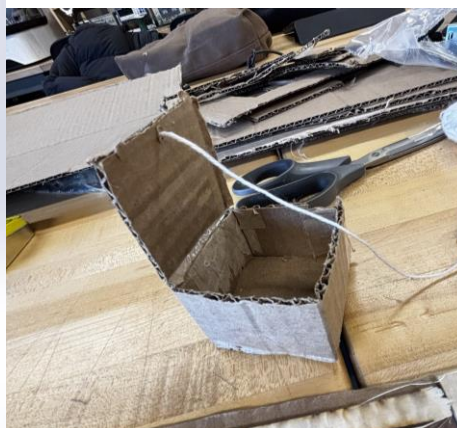
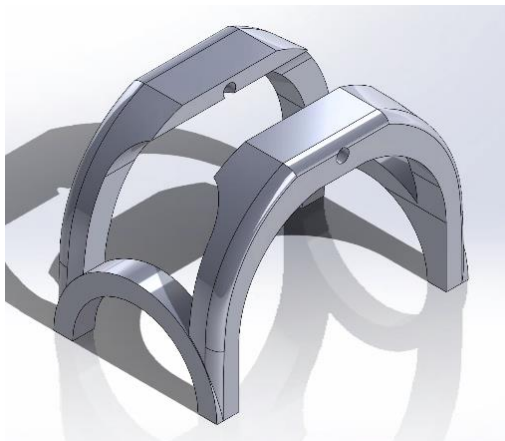
3. Add additional cardboard at the stress point. Wrap key joints or edges with tape to prevent tearing.
4. Carefully check the measurement results and confirm whether the assembled sample is consistent with the design drawing. Mark different parts of the sample for easier identification and discussion during presentations or feedback meetings'

4. Prototype I

The Prototype one was construed using the materials that were available at home with no extra cost. The material consisted mainly of cardboard which was used for making the box. The Prototype I is used to validate the functionality of our design using basic materials which allowed for easy modifications and adjustments.

The prototype consisted of **four main** components:

1. **The main body (tubes):** A set of tubes made from cardboard, cut and folded to create a housing for the mechanical components.
 - 1.1 **Wheels:** small wheels will be made of cardboard and plastic parts
2. **Collection System:** A small cardboard box with a closable lid that can be attached in the horizontal and vertical orientations.
3. **Scraping System:** A 1-meter-long thin cardboard rod can be cut out and a pencil will be attached to the end to simulate the scraping mechanism and test out function
4. **Feedback system:** along the cardboard tubes, different measurements will be written down in a way that supports various tool lengths and configurations.





5. Analysis of Critical Components for Prototype I

Component/System	Function	Risks
Scraping system:	Move circumferentially across inner wall of the pipe	Very little risk, we are using already owned materials and just testing how accurately it can be manipulated
Collection device:	Collect and temporarily store fragments that fall off during the scraping process to prevent them from reentering the pipeline or falling off	Very little risk, it will be made of cardboard and just do simple functions like opening and closing
Wheel and Mount:	Keep tube stable and centered and allow it to move smoothly through reactor pipe	Very little risk as it is a visual CAD drawing
Tubing with Measurements:	Body of tool and connects all parts of tool. Measures depth into the pipe from different orientations.	Very little risk as it is also made from cardboard and home materials.

6. Prototype Analysis and Test results

Number	Test Description	Results
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1	Build a small-scale replica of the full tool within 1-2 meters	A prototype approximately 1 meter in length was successfully built. It has the main structure of the tool, but some functions have been simplified. We only demonstrate the core functions.
2	Have modular sections on this replica	The prototype consists of three removable parts, each of which works well and is easy to assemble. But, when disassembling the parts repeatedly, slight misalignment is noticed.
3	Have feedback depth measurements written on the tubes of the replica	Depth marks are added every 5 cm. They can be clearly seen, but as our measuring method can lead to slight errors, additional calibration may be required to obtain precise data.
4	Have a rod system for scraping run through the tubes of the replica	The central rod with scraping device was inserted and tested. It performed well in removing the simulated debris.

Link to excel: [13_Prototype and Test Plan Template.xlsx](#)

7. Updated Bill of Materials

Material	Amount	Cost (CAD with tax included)	Source
Cardboard, tape, and other materials for prototype 1	NA	Already in possession	NA

Chisel	1	9.59	Rona
3d printing filament	Undetermined	0.15/g	Makerepo
10ft PVC pipes	2	21.45	Home Hardware
Female PVC couplings	3	6.07	Home Hardware
Male PVC couplings	3	6.07	Home Hardware
Hot glue gun	NA	Already in possession	NA
PVC glue	NA	Already in possession	NA
Magnets	12 pack	6.2	Michaels
Metal sheet for testing	1	TBD	TBD
Metal bits for testing weight and magnet	NA	Already in possession	NA
Total		49.38 for all currently determined prices + 20-40 in undetermined costs	

Link to excel: [Project Deliverable F \(Prototype\) - BOM.xlsx](#)

8. Prototyping Test Plan II

Test ID	Test Objective	Description of Prototype used and of Basic Test Method	Tasks On Hold or Canceled	Estimated Task Duration
1	Closable Lid for Container	How it is oriented on the tube horizontally and vertically and the lid can be closed from outside the tube.	None	1 Week
2	Magnet Strength Determination	The magnets that will be used to seal the lid of the collection	None	1 Week

		container will be glued to a surface and at various distances bits of metal will be dropped to see if the magnet catches them. The objective is to see how big the container must be so the sample will fall in and not attach to the magnet.		
3	Structural Integrity	Perform a drop test at a height of approximately 1 meter. Check whether the container has cracks, dents, or deformed lids after impact.	None	1 Week
4	Sealing System with Gasket	Immerse the container partially or completely in water for a short period of time (e.g. 30 seconds) to check if water has entered the interior of the container, which may affect its use.	None	1 Week
5	Wheel mount and wheel	Create CAD drawings of the wheels and wheel mounts and dimension them correctly to fit almost within the piping.	None	1 Week

9. Trello Task Board Update

Team Member	Tasks Completed Last Week	Current Tasks (In Progress)	Tasks On Hold or Canceled	Estimated task duration
Aidin	Deliverable E	Deal with any group issues or disagreements and develop strategies to help with conflicts.	None	2 Days
Owen	Deliverable E	Creating container and mechanism to close lid	None	2 Days
Ziyi	Deliverable E	Verify and update task start dates and consider everyone's availability over the next two weeks.	None	2 Days
Sam	Deliverable E	Create a new CAD design for wheel mount and 3D print prototypes of it.	None	2 Days

10. Conclusion:

The development and prototype testing in this stage have brought us returns. We have acquired useful information and identified areas for future improvement from customer feedback and test results. Next, we will focus on optimizing the key components and making the user experience more comfortable and convenient. And ensure the advancement of the overall project.