

Project Deliverable G Report

Prototype II and Customer Feedback

Course: GNG1103–Engineering Design

Team Name: Five Alive

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Team Members: Sam Stano, Owen Kaine, Aidin Moradi, Ziyi Wang

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1. Introduction

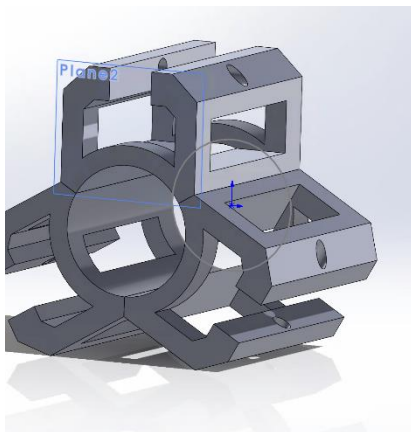
In this deliverable we will take feedback from client meeting 3 as well as earlier feedback to further our design. We will test various systems of our design and use AutoCAD to visualize these parts.

2. Client Feedback on Prototype I

The client said that the exact knife used for our prototype 1 scraping device would not be strong enough to scrape the steel of the pipe. He suggested using something stronger like a chisel which has more support.

3. Prototype II development

Our second prototype focuses on the key parts of our system as isolated features. We plan to make high fidelity prototypes and test to see if our idea will work. Our 3 parts are the wheel mount and wheel design, a collection design with more in-depth lid, and a functioning scraping device that can successfully remove material from the piping. Our goal is to make all our prototypes work but in the scenario that something does not, we plan to change the product as efficiently as possible to make it work. In this section we have included CAD designs and hand sketches of the focused parts. In the wheel mount design, we have changed it so that there are now 3 contact points instead of two, giving our tool more stability and accuracy.



4. Prototype II

In the pictures below, we have included images of the three main components that our team has built. The first component is the scraping tool, which will be used for our testing to ensure it efficiently removes debris from the pipe's interior surfaces. The second component is the collection system, designed to securely gather and store the debris scraped off during the testing process. The third component is the wheel mount and wheel design which will be used to stabilize and facilitate smooth movement of the prototype through various environments.

4.1 Scarping Tool

To make the Scarping tool our team decided to attach the chisel end on a long shaft that would run through the main tube of our tool. On one end of the shaft would be a handle and on the other end would be the chisel. The handle and chisel would be perfectly aligned and to scrap the operating would perform a back and forward motion using the handle and the chisel would be on the other end of the shaft scraping in a circumferential motion along the wall of the pipe. To actuate the chisel once 15ft down the pipe the operation would be a small lever that would be attached to a mechanical arm that is attached to the shaft. This mechanical arm would orient the chisels angle so that it contacts the tool wall before scraping.

4.2 Collection System

The design for the collection system is still not decided on as problems were encountered in figuring out how to have a closable lid that would block the sample particles falling into the collection box. Various lid designs will be drawn first on paper, discussed, and then a visual prototype or two will be drawn on Onshape to verify that our lid would function.

4.3 Wheel Mount and Wheel Design

To design our wheel mounts, we created detailed designs using CAD software (Figure 1). Our team used 3D printing for rapid prototyping, allowing easy adjustments based on testing results. design will be tested to verify its durability and appropriate sizing.

5. Analysis of Critical Components for Prototype II

Component/System	Function	Risks
Scraping system	Move circumferentially across the inner wall of the pipe. This prototype will include an actual scraping device that should be able to remove material.	Moderate risk because we must purchase the chisel and hope that it is strong enough to remove material.
Collection device	The collection device will be a CAD prototype this time with hopefully a more in-depth lid design.	Still very little risk as it will be CAD and 3D printed which won't cost us anything.

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

6. Prototype II Analysis and Test results

Number	Test Description	Results
1	1 or 2 chisels or metal blade bits will be attached to the end of a curtain rod and scraping scrap steel to see if they are strong enough to collect a small sample. (Physical Prototype)	The chisels successfully collected small steel samples when attached to the curtain rod. The sample size was within an acceptable range of the estimated size. The scraping method can be used for the final

		prototype.
2	One of the model wheel mounts will be 3d printed to ensure it is the proper durability and size (Physical Prototype)	The 3D printed wheel mount showed proper durability and fit, with no issues regarding strength during testing. The size will have to be modified as the dimensions were incorrect, but the proportions were valid.
3	Various design prototypes for the collection container will be designed and drawn with CAD to ensure they would work with the vertical and horizontal orientations (Visual Prototype)	The various container designs worked well in both vertical and horizontal orientations. The designs met the requirements for being able to collect sample.
4	Magnets will be tested to make sure small metal sample bits will fall into the collection container and not attach to the magnets themselves. Various distances will be tested to ensure the dimensions of the box will be enough for the sample to be collected properly. The goal is to have weak enough magnets that can seal our sample container by not attracting bits of sample. (Analytical Prototype)	The magnets' attraction varied with different metal shavings. Some were less attracted. It seemed the magnets had to be within 1cm or less to attach to the metal shavings we had. There used properly the magnets can be implemented into our design to close the container without interfering with the collection of the sample. With additional research it was also noted that most steel is non-magnetic so so from this test we conclude that magnets can be implemented to seal the collection container.

6.1 Updated Bill of Materials

Material	Amount	Cost (CAD with tax included)	Source
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	60 pack	7	Amazon
Metal sheet for testing	1	TBD	TBD
Metal bits for testing weight and magnet	NA	Already in possession	NA
Total	<p>The development of the prototype II was a key step in the progress of our project. We incorporated valuable feedback from customers and users, and the test results provided insights that guided the final prototype. Our updated task plan and BOM reflect the necessary adjustments.</p> <p>49.38 for all currently determined prices + 20-40 in undetermined costs</p>		

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7. Prototyping Test Plan III

Test ID	Test Objective	Description of Prototype used and of Basic Test Method	Tasks On Hold or Canceled	Estimated Task Duration
1	The strength of the tool is ensured by attaching the chisel to the curtain rod and testing its ability to collect small samples from the waste.	Attach a chisel to the end of the curtain rod to simulate the process of collecting a small sample of scrap metal. Evaluate the strength and applicability of the tool by observing the effectiveness of the sample collection.	None	2 Weeks
2	Verify the size and durability of the model wheel bracket to ensure that its design meets the requirements.	Durability and dimensional tests on the wheel holders are carried out using 3D-printed physical prototypes. The stability of the holders is tested under different pressures to ensure they are suitable for long-term use.	None	2 Weeks
3	Test the design of the collection containers to ensure their vertical and horizontal	Using a visual prototype designed with CAD, sketch designs for multiple collection containers to ensure that they can be used normally in	None	2 Weeks

	compatibility.	different orientations. Check whether the containers meet the functional requirements through virtual models.		
4	Test the strength of the magnets to ensure that they can effectively collect metal samples .	Use a functional prototype to test magnets of different strengths. Test the magnet's ability to attract metal samples at different distances.	None	2 Weeks

8. Trello Task Board Update:

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

		CAD design for wheel mount and 3D print prototypes of it.		
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9. Conclusion:

The development of the prototype II was a key step in the progress of our project. We incorporated valuable feedback from customers and users, and the test results provided insights that guided the final prototype. Our updated task plan and BOM reflect the necessary adjustments.

Figure 1

