Deliverable F – Prototype I and Customer Feedback

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Abstract

This document includes our prototyping plan, system analysis and updated specifications, design, and bill of materials, chosen after the first client meeting. A plan is then listed for tasks which will need to be completed in the design process This is followed by a prototyping schedule, with a list of tests scheduled for the following weeks until the final concept must be shown to the client. This schedule also includes stopping criterion and the objectives of tests. Additionally, three screenshots of the Trello task plan are included at the end of this document.

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1 Introduction

This document presents a detailed prototyping plan and cost estimate for the proposed design, incorporating insights from the client meeting. It outlines the key phases of development, updates to our design, and a structured prototyping schedule. By providing a clear roadmap, this document ensures that the team can efficiently execute the project.

2 Feedback Reflection

After our meeting with the client our design underwent some changes. The client was concerned about our wheels slipping upon entering the pipe, which would make calculating the proper distance travelled difficult. As a result, we decided to add a tether which is exactly 15 feet so the sampler cannot overshoot and doubles as a failsafe method. We also used his feedback to finalize some of our concepts which we would include in our final design.

3 System Analysis

Drive:

The drive system for our design includes wheels which allow the device to move further into the pipe when the pipe is oriented horizontally. There will be 3 motors which spin the front wheels the desired direction and 3 rollers to line up with each of the motors. When the pipe is oriented vertically the device will be lowered with the spool and will use gravity and the tether to reach the 15-foot target.

Collection:

For our collection system we will be using gravity and a hopper, once the sampling is completed the sample will fall into the hopper and be ready to be retrieved.

Feedback:

During each stage of the collection process the interface will update to show the current stage. This information will be displayed on a laptop and will be retrieved through a long chord which will run from the device to the laptop.

Sampling:

We will be using a scraper to collect our sample, we plan to have a motor raise when the 15-foot mark is reached. The scrapper will then go back down when sampling is completed. We are currently looking for a mechanical solution due to space constraints and will ask the client for opinons during our next client meeting.

Retrieval:

Once sampling is completed and the sample had been properly collected, the wheels will turn the opposite direction to allow the device to return to the opening of the pipe. If this system fails, the spool can also be used to manually retrieve the device. Once returned the whole device can be shipped for testing.

4 Prototype Testing

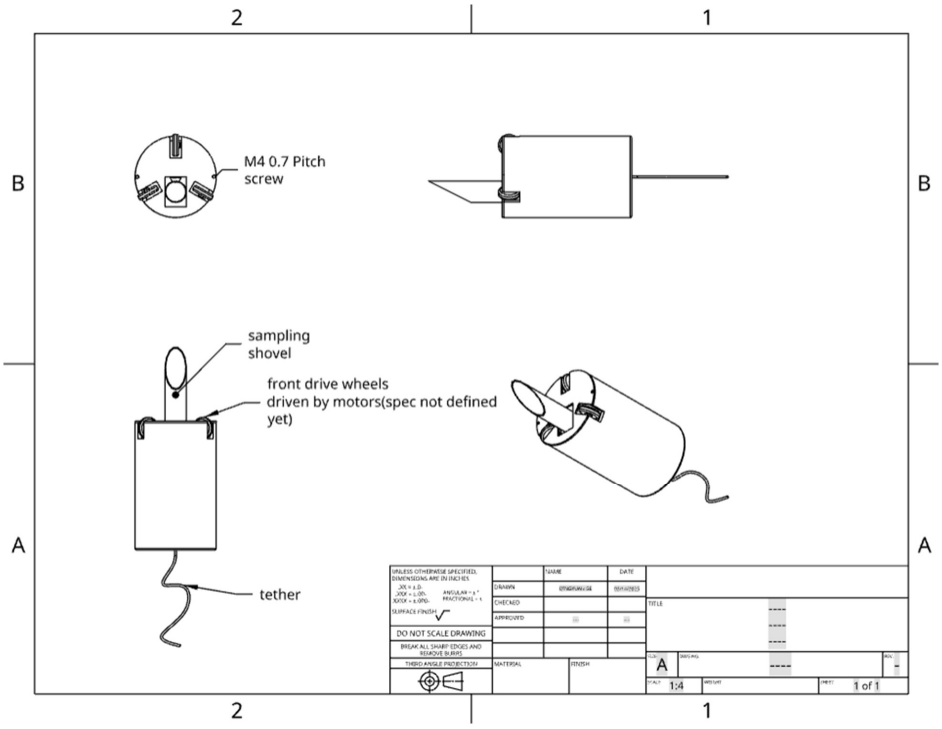
Prototype	Name	Date Finished	Result
1	Spool	March 1	Determined the spool handle was in an inconvenient position and remodel to put it on the outside. Parts all fit together well.
2	Interface	March 1	Decided to make the interface more visually appealing by adding a background. Was successfully able to make test motors move.

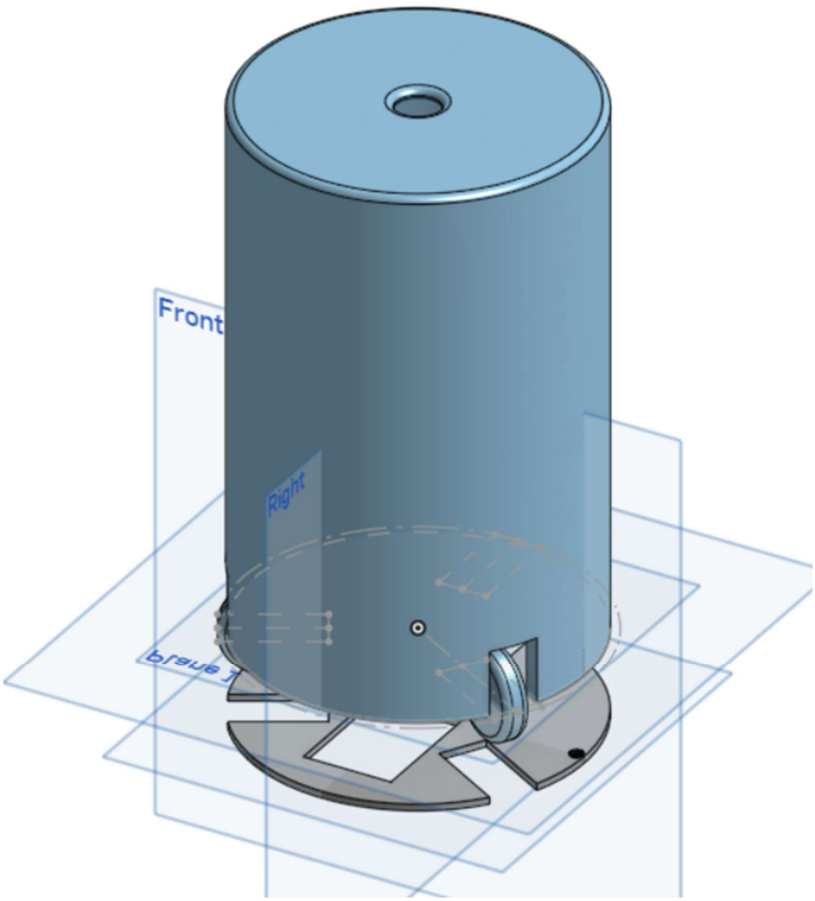
5 Feedback From Potential Clients

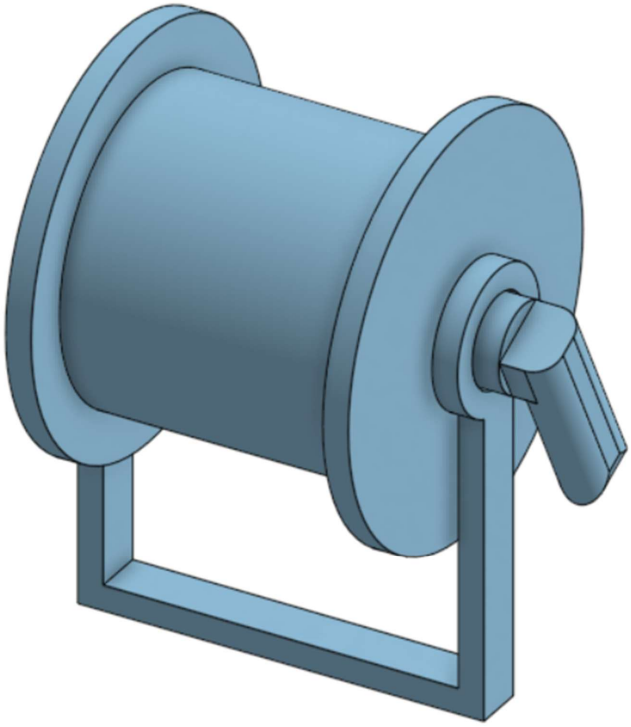
Some feedback which was found was that that samplers typically leave behind small pieces of missed samples which leads to buildup. We will try to find a way to minimize the number of debris left behind after sampling. One major problem potential client had with our spool prototype was that the 3D printed parts were not the same colours, when we Finnish our final design we are going to use the rocketry printers which use black filament. The feedback for our interface was positive, they enjoyed being able to control the device from a laptop.

6 Updated Design

The design has been changed after the client meeting to include a tether and a ui interface instead of just LEDs. After some prototyping, we discovered some issues with some of our designs and have had to rethink some aspects. The spool has been redesigned, and we are now looking for a mechanical solution for the sampling system. Our updated model will be reviewed and given feedback in our next client meeting, as a result updates are applicable to change.


2
1
B
A
M4 0.7 Pitch
screw
sampling
shovel
front drive wheels
driven by motors(spec not defined
yet)
tether
DO NOT SCALE DRAWING
BREAK ALL SHARP EDGES AND
REMOVE BURRS
THIRD ANGLE PROJECTION
MATERIAL
FINISH
DRAWN
CHECKED
APPROVED
DATE
TITLE
SIZE
A
SCALE
1:4
SHEET
1 of 1


Front
Right



7 Future Prototyping Testing Plan

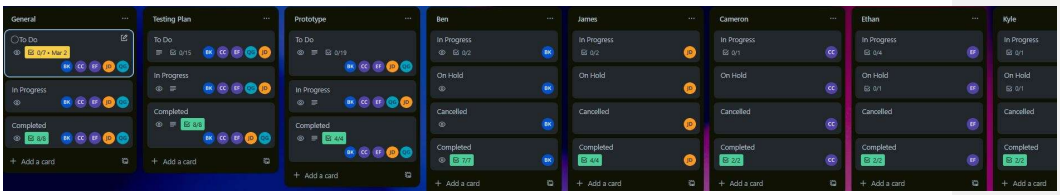
Prototype	Planned Date	Description
Drive System	March 3	Test the power of motors, ensure controllers work and ensure the scraper material can scratch the pipe.
Updated Spool	Mar 4	How well drive system can move through pipe
Collection System	Mar 4 – Mar 8	Test the collection system and its accuracy.

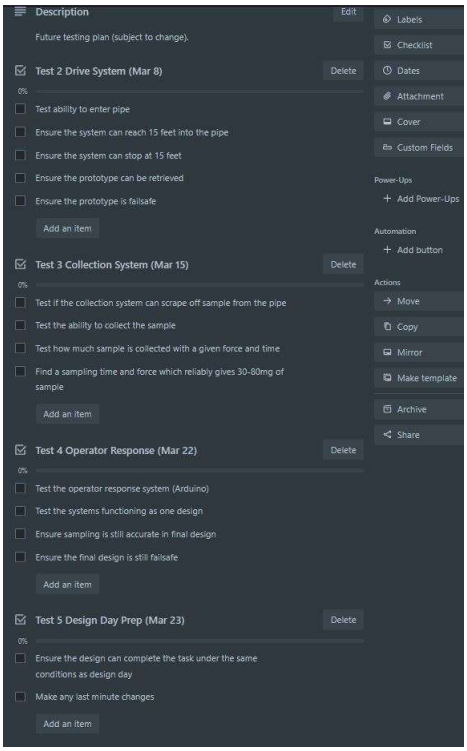
Operator Response	Mar 15	Test the operator response system combined with the rest of the prototype.
Full Device	Mar 23	Test the whole device to see if it can complete the task

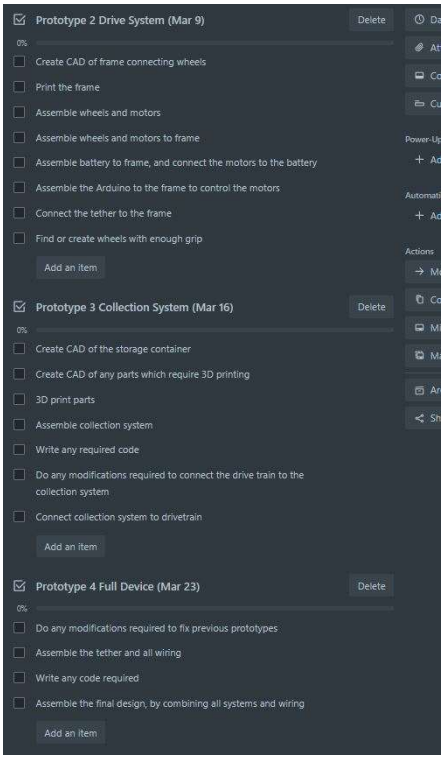
8 Conclusion

The updated project plan and cost estimate provide a structured approach to developing the proposed design, ensuring efficiency and feasibility. By identifying key milestones, potential risks, and contingency measures, the team can proactively address challenges and maintain project momentum. The scheduled prototype tests will validate the design's functionality, allowing for iterative improvements before the next presentation to the client.

9 Trello




Description
Edit
Future testing plan (subject to change).
Test 2 Drive System (Mar 8)
Delete
0%
Test ability to enter pipe
Ensure the system can reach 15 feet into the pipe
Ensure the system can stop at 15 feet
Ensure the prototype can be retrieved
Ensure the prototype is failsafe
Add an item
Test 3 Collection System (Mar 15)
Delete
0%
Test if the collection system can scrape off sample from the pipe
Test the ability to collect the sample
Test how much sample is collected with a given force and time
Find a sampling time and force which reliably gives 30-80mg of sample
Add an item
Test 4 Operator Response (Mar 22)
Delete
0%
Test the operator response system (Arduino)
Test the systems functioning as one design
Ensure sampling is still accurate in final design
Ensure the final design is still failsafe
Add an item
Test 5 Design Day Prep (Mar 23)
Delete
0%
Ensure the design can complete the task under the same conditions as design day
Make any last minute changes
Add an item
Labels
Checklist
Dates
Attachment
Cover
Custom Fields
Power-Ups
Add Power-Ups
Automation
Add button
Actions
Move
Copy
Mirror
Make template
Archive
Share


Prototype 2 Drive System (Mar 9)
Delete
0%
Create CAD of frame connecting wheels
Print the frame
Assemble wheels and motors
Assemble wheels and motors to frame
Assemble battery to frame, and connect the motors to the battery
Assemble the Arduino to the frame to control the motors
Connect the tether to the frame
Find or create wheels with enough grip
Add an item
Prototype 3 Collection System (Mar 16)
Delete
0%
Create CAD of the storage container
Create CAD of any parts which require 3D printing
3D print parts
Assemble collection system
Write any required code
Do any modifications required to connect the drive train to the collection system
Connect collection system to drivetrain
Add an item
Prototype 4 Full Device (Mar 23)
Delete
0%
Do any modifications required to fix previous prototypes
Assemble the tether and all wiring
Write any code required
Assemble the final design, by combining all systems and wiring
Add an item