GNG 1103

Project Plan and Cost Estimate

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Table of Contents

List of Figures

List of Tables

1. Introduction

1.1 Background of the Report

Our team has been working for the past two months on designing an innovative jig for prepping a wood door for flush bolt installation for Ambico windows and doors. At this point in the design process, we have created a conceptual design, on which we received client feedback and made appropriate adjustments. The next step of the process is to begin the prototyping and testing process.

1.2 Scope of the Report

This report provides a detailed project plan and cost estimations for the GNG1103 design project.

This encompasses:

- A refined design concept for the jig chosen in Deliverable D
- A strategic plan for prototyping and testing the jig
- A project cost spreadsheet (bill of materials)
- A list of the necessary equipment for prototyping
- A prototype testing plan for prototype 1

2. Detailed Design Drawing

To best understand all the components needed for our design a detailed model was created. Below is the 3D representation of our chosen concept (Figure 1).

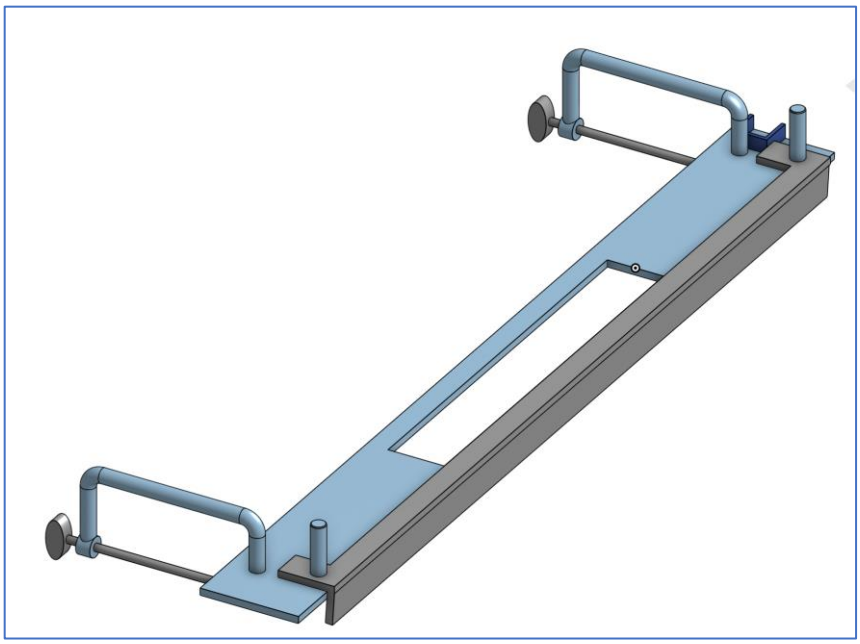

Figure 1: 3D design of jig with smallest back set guide attached

The following link can be used to view the design in an interactive virtual space:

https://cad.onshape.com/documents/f37a87d5d396557a22428a47/w/98aa5fb214b218f11b5ee07e/e/b455f52fd452ecc7671e4d7a?renderMode=0&uiState=65ca98bc86aa66337efd0edb

This 3D model was used to generate the detailed drawings in Figure 2.

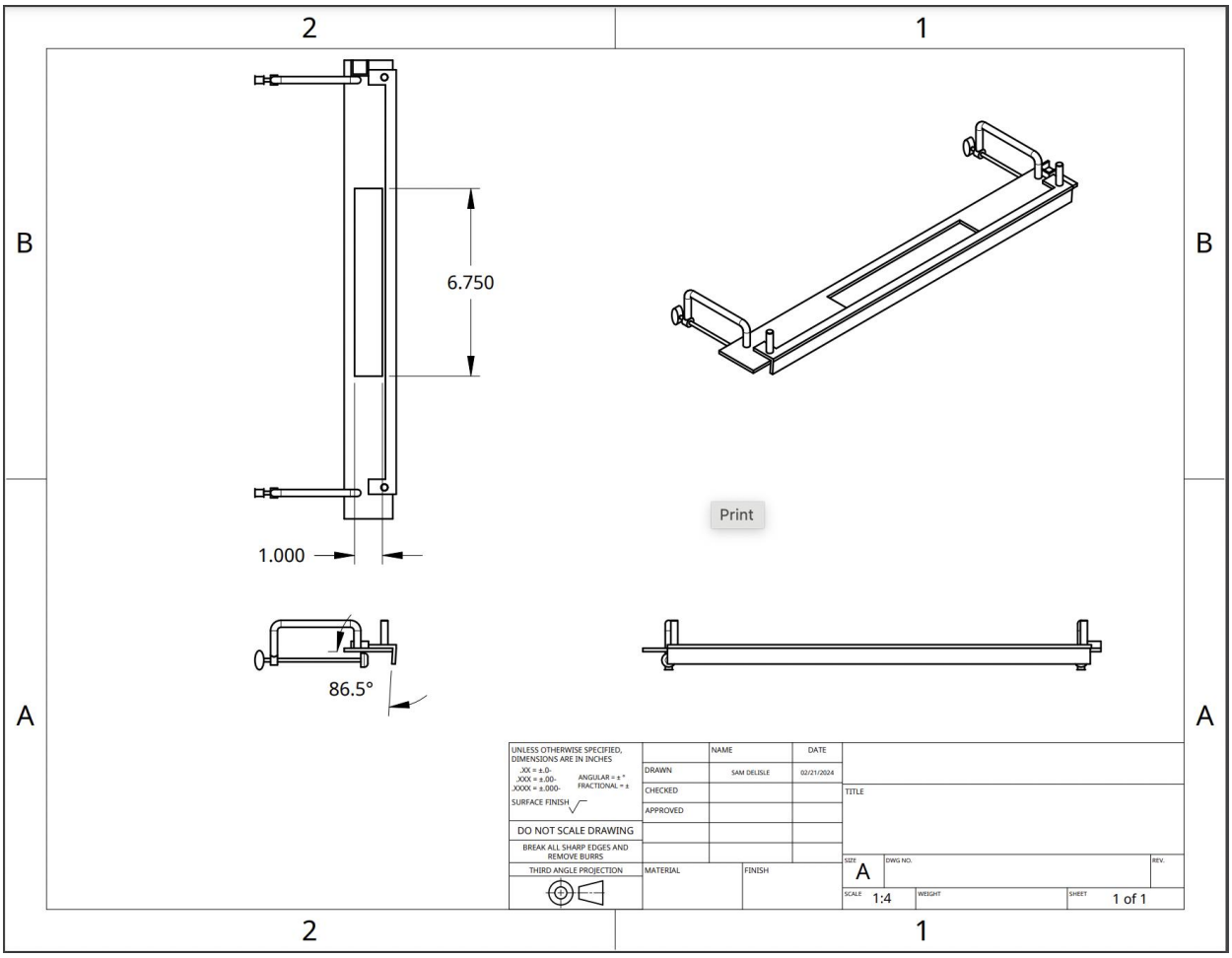

Figure 2: Detailed Drawing

The join between the clamp and baseplate is intended to be welded, and a thin layer of felt, rubber, or vinyl will be applied to all points of contact with the door.

3. Schedule for Prototyping and Testing Solution

This section will first discuss the plan for prototyping and testing the solution and then will discuss some of the contingency plans for the project's risks.

3.1. Plan Outline

To stay organized a detailed plan has been made (Table 1). The plan includes a list of all the tasks to be completed, the estimated time for each task, and the people responsible for each task.

Table 1: Prototyping and Testing Schedule

Objective	Estimated Time	Assigned to
Detailed Design - CAD	Completed	Sam
Prototype 1: Proof of concept	5 days: Feb 26-Mar 2	Team
Prototype 2: Main subsystem (Focused prototype)	5 days: Mar 4 - 9	Team
Prototype 3: Comprehensive Physical Prototype	12 days: Mar 11-23	Team
Testing and Iteration	Initial testing: 3 hours in lab on Mar 6 Further testing: 2 three-hour sessions during the weeks of the other prototypes	Team

Final Design Refinement	Final 1-hour meeting with the team the week of the last prototype.	Team
Documentation	As needed	Rachel, Sam
Quality Control Checks	As needed	Team
Project Review	Final 1-hour meeting with the team the week of the last prototype.	Team

3.2. Significant Project Risks and Contingency Plans

Below are some potential risks associated with this project as well as the contingency plans put in place to eliminate or minimize the risk:

- **Budget Overrun Risk**:
  - **Risk**: Exceeding budget due to unexpected expenses.
  - **Contingency Plan**: Regularly monitor expenses, allocate a contingency fund.

- **Schedule Delays Risk**:
  - **Risk**: Unforeseen delays in design or manufacturing.
  - **Contingency Plan**: A detailed schedule with buffers, shown above will be adjusted if needed.

- **Material Risk**:
  - **Risk**: Integrity of the chosen material
  - **Contingency Plan**: Testing and iteration.

- **Design Complexity Risk**:
  - **Risk**: Complex design
  - **Contingency Plan**: Testing and iteration after designing a prototype.

- **Safety Risk**:
  - **Risk**: Design flaws leading to safety hazards.
  - **Contingency Plan**: safety measures, testing, and provide an overview on how to use the tool.

4. Bill of Materials

To estimate the product costs and project where the budget will be spent, a Bill of Materials (or BOM) has been created. As seen in Table 2, the projected costs for this project total to CAN$49.25 without tax. This is an acceptable seeing as the given budget was CAN$50.

Table 2: A Projected Bill of Materials

Bill of Materials					
Item #	**Item Description**	**Product Link***	**Quantity**	**Unit Price**	**Amount**
1	1/8 x 3/4 x 36-inch Steel Flat	https://www.homedepot.ca/	1	$9.15	$9.15
2	6 x 24-inch 16 Gauge Steel Sheet	https://www.homedepot.ca/	1	$15.76	$15.76
3	1/4" x 1" #5 Zinc Plated Coarse Hex Bolt	https://www.homehardware.ca/	2	$0.39	$0.78
4	Track Clamps (2 Pack)	https://www.amazon.ca/	1	$23.56	$23.56
5	2’ x 2’, 0.08-in Vinyl fabric	N/A	1	$0.00	$0.00
				Total	**$49.25**

Note. all prices are in Canadian Dollars.

*Product link name shortened. Please click on link directly to view product details.

5. A list of Equipment

For prototype I (proof of concept)

- Cardboard
- Scissors
- Hot glue or tape
- Wooden dowels

For prototypes II and III (made of similar materials to the jig itself)

- Sheet metal (from the scrap bin or the maker store at CEED)
- The following equipment in the makerspace:
    - Sheet metal brake: bend and shape the sheet metal to the appropriate angles, used for the back set guides.
    - Corner notcher: Create precise, straight cuts in the metal sheets.
    - Spot welder: Join metal components securely to create strong connections.
    - Hand tools: Clamps, hammers, screwdrivers, wrenches, etc. to assemble the created parts. Clamps can be used to secure parts before spot welding, and hammers can help make minor adjustments to alignment. Nuts and bolts used are fastened with wrenches.

6. Prototyping Test Plan

Table 3: Tests and Objectives for Prototype I: Proof of Concept

Test ID	Test Objective (Why)	Prototype used and Basic Test Method (What)	Description of Results to be Recorded and how these results will be used (How)	Estimated Test duration and planned start date (When)
1	Communication between team members: Clear consensus on the conceptual design.	Using the CAD comprehensive prototype, discuss among team members to ensure that everyone agrees on the design which is moving forward to prototyping.	Thoughts of each member will be recorded to confirm that the whole team agrees.	During the 30 minute team meeting on Feb 26.

2	Feedback from client on design concept.	Using a physical, comprehensive prototype, and asking the client for feedback	Record what the client likes, and what they may be concerned about. These results will be used to modify the design.	During Client meet 3 (5 minutes on teams), March 4
3	Verifying feasibility: Budget	Using an analytical, comprehensive prototype (CAD), analyze the dimensions of each material required.	Record the dimensions and volume of each material. This will be used to calculate the cost of materials as well as the total mass of the design.	Brief analysis of the On Shape file already created (20 minutes). Planned start date Feb 26.
4	Ease of use: The jig can change back sets with ease.	Using the basic prototype slide various backsets in and out to ensure this is an easy process for the user.	If this is an easy process use this design for adjusting backsets otherwise discuss as a group some alternative ways to adjust the backset.	Should take 10-15minutes. Planned date March 6.
5	Ease of use: ensure that the jig does not affect the drill path.	Using a ruler ensure that at least a 6-1/2 inch radius on the face of the jig is clear so that the jig does not affect the drill path.	If the path is not cleared create larger jig. If the path is cleared the jig created is acceptable.	Should take 10-15minutes. Planned date March 6.
6	Ease of use: ensure the jig can self-centre.	Using a door place the basic prototype on side of doorframe. Ensure that the jig can self-centre.	If the jig is unable to self-centre, consider adjusting the angle which the jig is at. If the jig can self-centre, it is acceptable.	Should take 10-15minutes. Planned date March 6.

The goal of these tests is to have an end product that is functional and does not damage the door when used. The following criteria are to be met by the end of the testing period.

- The drill can be used to make cut out (jig doesn't affect the drill path).
- Jig is able to change back sets with ease.
- Jig can self-centre.
- Jig is not bulky and can be easily stored.

7. Conclusion

This project plan will allow us to create three prototypes in the coming weeks, as follows:

- Prototype I: Basic proof of concept (comprehensive, physical) made of scraps or household materials. The testing plan for this prototype was laid out in table 3.
- Prototype II: Physical, focused prototype of a main subsection. This subsection will be identified when the testing plan is made for the prototype next week.
- Prototype III: Physical, comprehensive prototype (possibly building onto prototype II) which can demonstrate the complete function of the jig, including being made from similar materials.

Each prototype will begin with a testing plan (as seen in this report for prototype I), then be constructed, and finally be presented to the client for feedback. This iterative process will allow the design to be refined at each step, to converge to an ideal jig which meets all the client needs in an effective and innovative way.