GNG 1103

Deliverable F: Prototype I and Customer Feedback

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1. Introduction

Our team has been working hard for 2 months now to complete the flush bolt jig for AMBICO. Currently, we are working on prototyping and testing our ideas. This report includes our first prototype (a basic proof of concept), prototype test results, the customer's feedback, and the test plan for prototype II.

2. Prototype I: A Basic Proof of Concept

The proof of concept of our jig includes a CAD model, and a physical prototype.

The CAD model initially presented to the client in client meeting 1 was modified based on their feedback, which included lengthening the baseplate to allow 3 ½ inches of clearance for the router and changing the angle of the back set guide from 90 degrees to 86.5 degrees to accommodate the bevel in the door.

Figure 1 shows an image of the CAD model, and figure 2 the physical construction. The physical model was constructed from recycled cardboard, wood, and plastic, and serves as a way to better visualize the design without wasting materials.

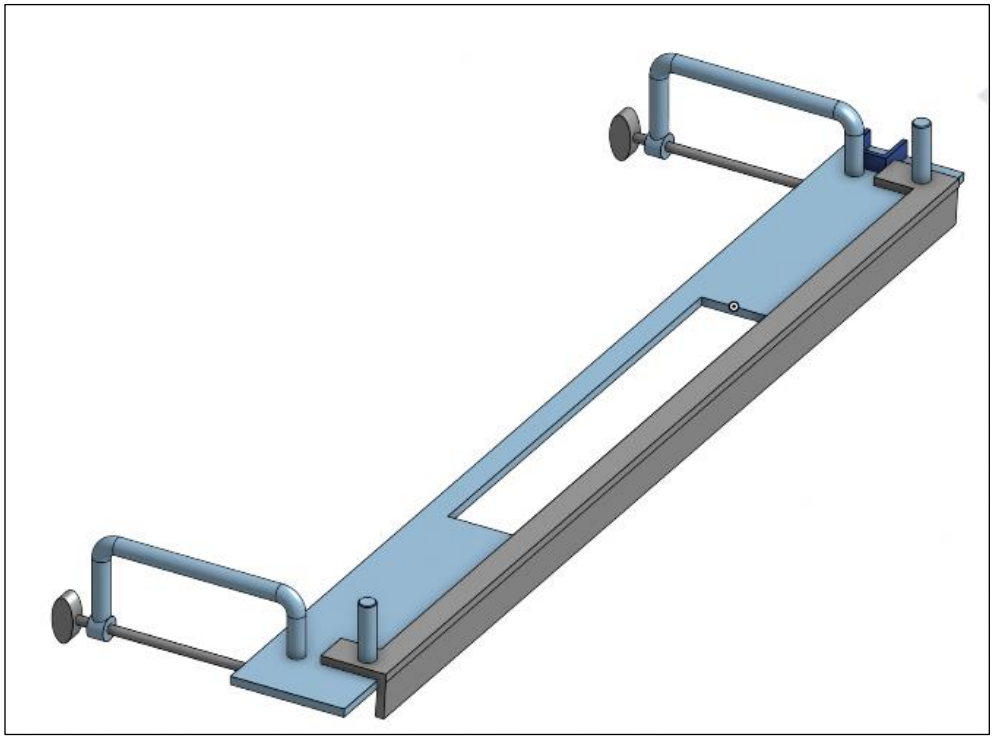

Figure 1 - A Digital Prototype for the Basic Proof of Concept

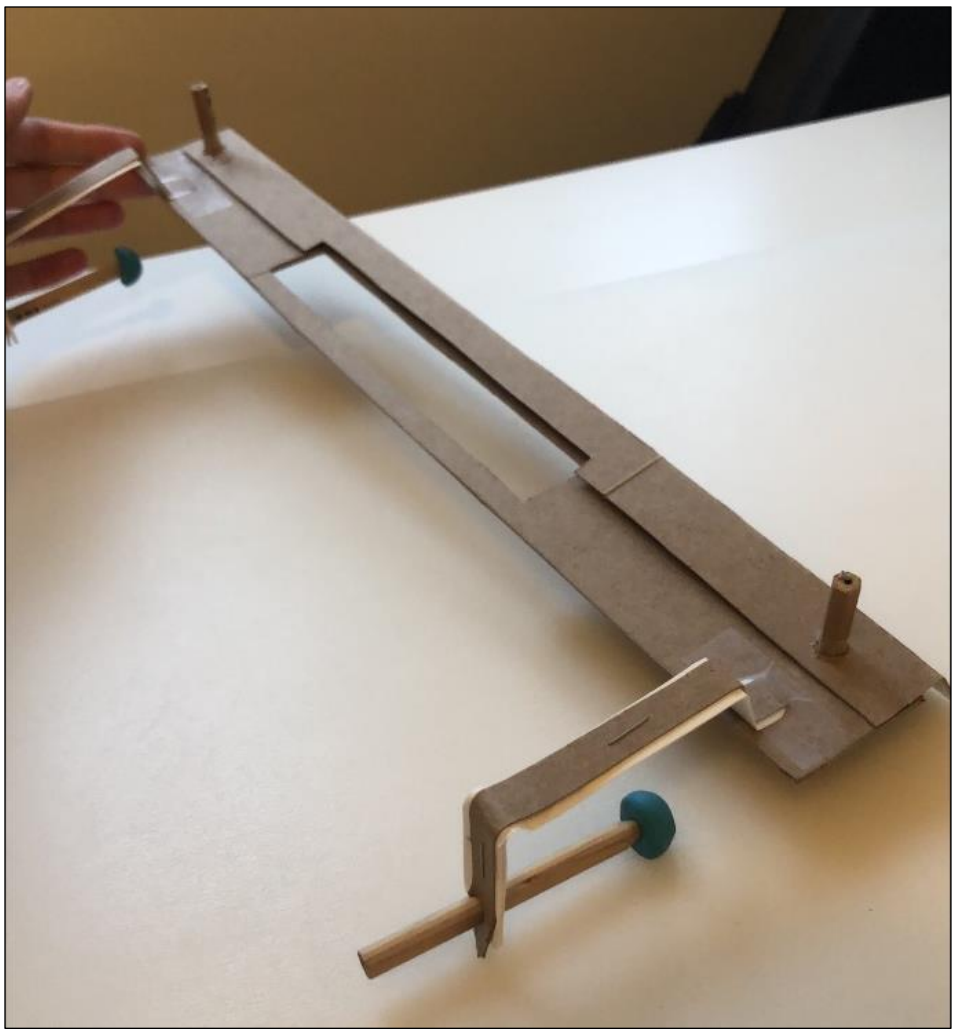

Figure 2 - A Physical Prototype for the Basic Proof of Concept

3. Analysis of Critical Components

Critical components for this project are:

- Baseplate
- Clamps
- Back set guide
- Magnetic guide
- Damage-preventing lining

The goal of all materials chosen is to be sturdy and inflexible, except for the damage-preventing lining which should be elastic enough to prevent damage to any part of the door once the jig is clamped on. This material will cover all points of contact with the wood door.

An analysis of the materials used will be performed in the construction and testing of prototypes II and III, which will be made of similar materials to the final jig. This analysis will include choosing a material, calculating critical values, or performing tests, and evaluating whether this material is suitable.

These analyses are summarized in table 1 below:

Table 1 - Summary of Analyses to be performed for material selection.

Critical component	Material for first iteration	Value/property to be analyzed	Equations/parameters/tests needed
Baseplate	Sheet metal	Mass	Density of sheet metal, dimensions of base plate, $m = \rho V$
Clamps	Aluminium	Mass	Balance (clamps will be pre-made)
		Stress while clamping, any distortion	Force balance and analysis of system, testing of clamp subsystem (destructive test?)
Backset guide	Sheet metal	Mass	Density of sheet metal, dimensions of backset guides, $m = \rho V$
Magnetic guide	Magnet, sheet metal	Strength of magnet	Testing of applied force to remove magnet
		Mass	Balance (for magnet) Density of sheet metal, dimensions of guide, $m = \rho V$
Damage-preventing lining	Vinyl	Compressibility	Testing of dimensions under various applied forces.

4. Testing for Prototype I

Once the physical and analytical models for prototype I were created several tests were done to validate the design and check for any potential design issues. Table 2 shows the test plan, analysis, and results for each of the tests.

Table 2 2 - Test Results for Prototype I

Test ID	Description of test method and materials needed	Results
1	Using the CAD comprehensive prototype, discuss among team members to ensure that everyone agrees on the design which is moving forward to prototyping. All team members must be present and have feedback.	Team members came to a unanimous conclusion that the design will move forward to the prototype stage.
2	Using an analytical, comprehensive prototype (CAD), analyze the dimensions of each material required.	Base plate area (including clamps): 66.737 in^2 Back set 1: 34.714 in^2 Back set 2: 29.248 in^2
3	Using the basic prototype slide various back sets in and out to ensure this is an easy process for the user.	This doesn't slide on as easily as hoped, however this is due to the flimsy material of the prototype. When the proper materials are used this should be an easy process.
4	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 router path.	There is adequate space around the cut-out for the radius of the face of the router path to not be hindered.
5	Using a door place the basic prototype on side of doorframe. Ensure that the jig can self-centre.	The jig can self-centre when placed on the door. Again because of the materials of the prototype it must be held in place rather than properly clamped, but this will be resolved with the proper materials.
6	Using a physical, comprehensive prototype, and asking a relevant party for feedback	The prototype was shown to previous semester's winning team. The were overall very impressed with our model but suggested that we find a way to reduce the size of the clamps.

5. Client Feedback

During our testing of the jig design, we were unable to present our prototype to the client yet. However, we had the opportunity to discuss our design with a member of the previous semester's winning team. In our conversation, they expressed appreciation for the simplicity and sleekness of our Jig design, as well as its adjustability to the back set using clamps and metal parts. They

recommended exploring ways to reduce the size of the clamp holders. Overall, the member was favorable towards our design.

6. Test Plan for Prototype II

The second prototype will be a focused prototype for the backsets and the base plate. These two pieces are crucial to our design and will need to be tested before we create a final comprehensive prototype. Table 3 outlines the test plan for prototype II which we will use to verify if our design works and see where improvements could be made.

Table 3 3 - Tests and Objectives for Prototype II

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	System integration	Use prototype I and attach the different backsets from prototype II to the baseplate.	Ensure that each of the backset smoothly align with the flush bolt cutout. Record the measurements for any misalignments	Test will take about 10 min and can start on March 6th
2	Ease of use: attaching backset to baseplate	Use prototype I and attach the different backsets from prototype II to the baseplate.	Rate the ease of the attachment process for each backset on a scale from 1 to 10 (1=difficult & 10=very easy) and make any notes about what made the process difficult.	Test will take about 5 min and can start on March 6th
3	Verify precision: ensure backsets are securely attached	Use prototype I and attach the different backsets from prototype II to the baseplate.	Use a ruler to measure the gap between the pin on the baseplate and the hole in the backset. Record the distance of the gap.	Test will take about 5 min. Start on March 8th
4	Verify precision: ensure the backset is 86°	Use each of the backsets for prototype II	Use protractor to measure the angle the backset makes. Measure the angle at several points and record the angles.	Test will take about 10 minutes. Start on March 8th

7. Conclusion

This project plan allowed for us to create a prototype, test the prototype and gather feedback. With the first prototype constructed the team was able to discuss the feasibility of our current jig to be later presented to the client for further feedback. Based on the current materials used it was difficult to attain accurate test results. When the second prototype is created further testing will be done to ensure all needs are met. The second prototype will be created, and the current prototype will be presented to the client to gain further understanding of adjustments which need to be made.