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Abstract

For this deliverable, we will show the plan for the creation of the second prototype of our template based on the customer feedback we received from the first prototype. To do this, we will go over the customer feedback and how we will fix the problems of the first prototype. Finally, this document will show how the second prototype will be useful for testing and finding the requirements for the final prototype.

Customer Feedback

Overall, the customer liked our prototype. They liked the design and its simplicity. Their only complaint was the nozzles. We had not decided on the material of the nozzles because we wanted them to be durable but not expensive, this made the customer a little concerned, so we will address it in this delivery. We will also address how to replace the nozzles.

Results from Prototype I

The results of the first prototype were generally good, and there were also some design flaws that will need to be corrected in the next prototype. Overall, the shape and size of the first prototype were good. The prototype was made for the 5-inch hinge, although a model was also made for the 4.5-inch hinge. Since the prototype was the 5-inch hinge, it could be tested with the door frame at Ambico and the jig size is good. Another good quality of the prototype was that the offset lengths of the U-shape were very good as the longer side can easily hook into the door frame and the shorter side is out of the way. The handle is also a good quality of the jig as it can be easily pulled through the door with one hand. The design of the handle is simple, which makes it easy to use and understand, and may contribute to workers being more willing to use the jig. The nozzle shapes are also good, although there is a little fine-tuning to be done, as one Ambico employee noted while testing the jig in the warehouse. For the jig prototype, jig strength proved to be a problem because the jig had already broken with this prototype. Ideally, this would be resolved in the final design, as it would be made of metal or similar material. Another weakness of this design was that the sliding part was not strong and needed to be improved so that it would have a longer life cycle and would not break. Also the sliding part of the jig works well, but the tolerances had to be a bit larger because the sliding part works with a lot of friction, which is not ideal for our design. Also, the nozzles do not come off, which should be improved in the next design, as this is an aspect of our design that we want to implement to contribute to the long life cycle of the jig.

Prototyping Test Plan

In prototype 1 we tested it and saw some problems that could arise. The main problem was the nozzles and the wear and tear that occurs with excessive use. The friction of the drill and tapper slowly eroded the walls over time and created a weak point. The way we chose to solve this problem is by implementing removable nozzles and having the nozzles made of steel or having a steel metal sleeve inside. We have been deciding which would be the best and most cost effective way. The other problem we had with the first prototype was that the parts that the top piece (clamp) slides over were not strong enough to withstand the force of pulling the jig up and hooking it into the door. The way we solved this problem was by increasing the size of the sliders. Once we made the parts thicker and wider it was a noticeable change in the robustness of the jig. These were the two main problems we encountered with the first prototype.

Prototype II

We started implementing the changes we needed from the first prototype. We fixed the slide sizes and made the nozzles removable. We need to do more testing with this prototype to see if any other problems occur. We need to do research to see the best way to make this jig and have the problems fixed and for an affordable amount. We will 3D print it and see how they compare. We will also look into making the nozzles strong enough to withstand the friction of the drills and the tappers.

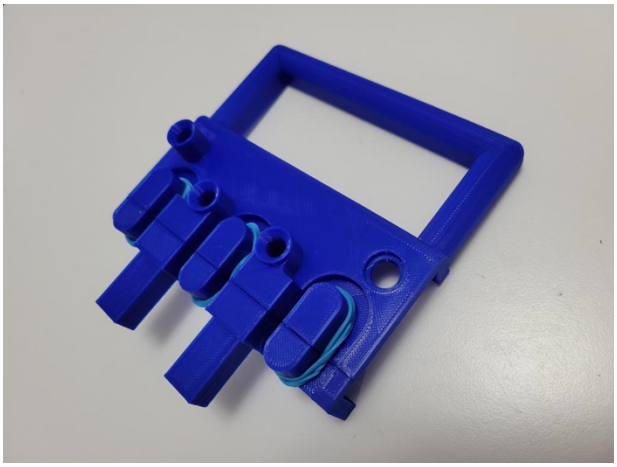

Figure 1 Removable nozzles prototype II

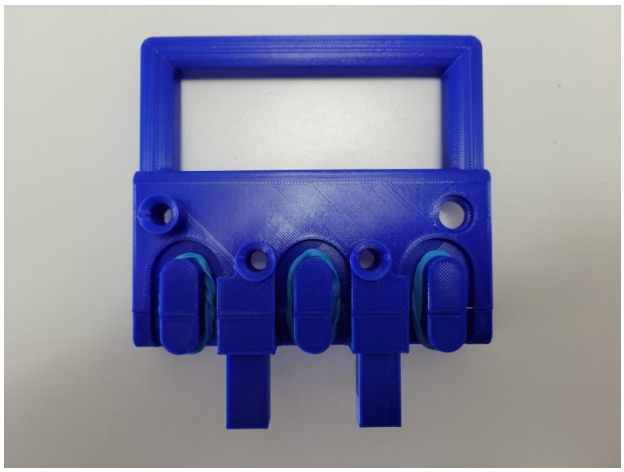

Figure 2 Rubber bands used for the sliding part

Experimental model

In view of the new features of the prototype model, there are two basic improvements, which focus on reducing abrasion and increasing the degree of firmness. In response to these two improvements, we use wear tests and tensile tests to simulate the actual use of the current prototype in order to better find undiscovered errors and insufficient factors in the future.

Costs of production

Table 1 Bill of materials

Item #	Item description	Quantity	Unit Price	Amount
1	Steel - 200g	1	$ 15,00	$ 15,00
2	3D filament - 150g	1	$ -	$ -
3	Glue	1	$ 1,00	$ 1,00
4	Alcantara Wrap	1	$ 10,00	$ 10,00
Total				**$ 26,00**

As stated in the BOM, the cost of the project is estimated to be $26.00. The main body will be constructed out of steel while the handle will be wrapped in alcantara to ensure a comfortable premium feeling grip. Please note that the 3D Filament will be provided by the University of Ottawa - Makerspace thus being free of charge. The manufacturing will be done at University of Ottawa facilities such as the welding lab and makerspace.

Reflection

After analyzing the customer's comments, we identified the following areas of importance: the materials to be used for the nozzles and the updated bill of materials. The client advised us to improve the aforementioned aspects, so we introduced the necessary changes to make the nozzles more resistant and durable, in addition to correcting the errors we found in prototype I. As mentioned above, the preliminary design was well received by our customer, so we will focus on refining the product and applying corrections in case any problems arise.