**Project Deliverable E- Project Schedule and Cost**

GNG1103 - Engineering Design

**Faculty of Engineering - University of Ottawa**

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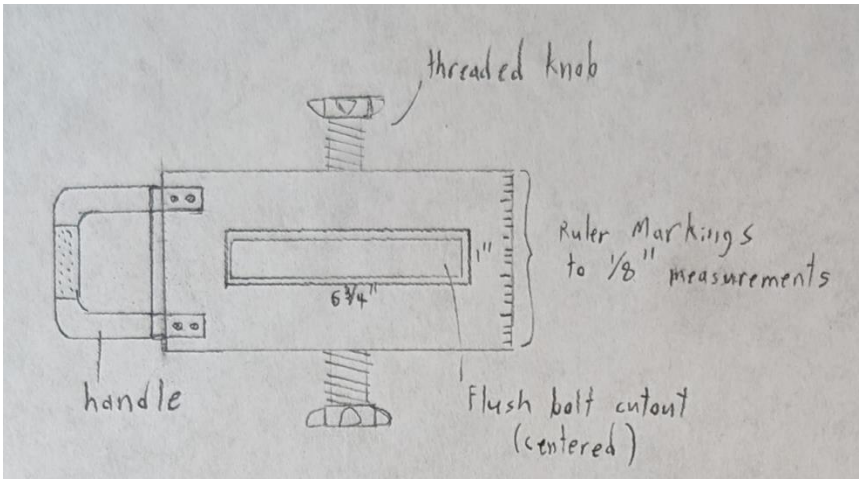
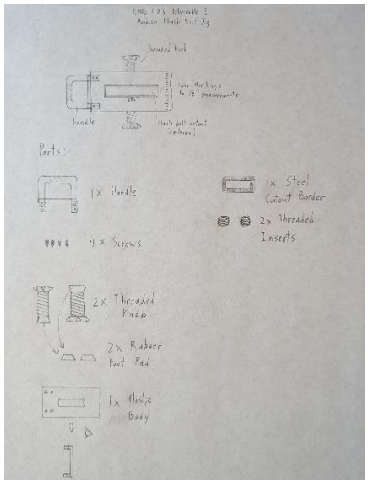
February 25, 2024

## 1.0 Introduction

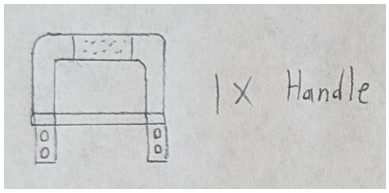
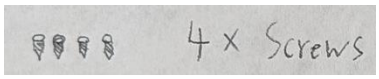
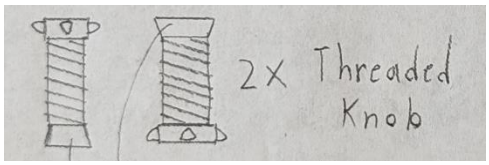
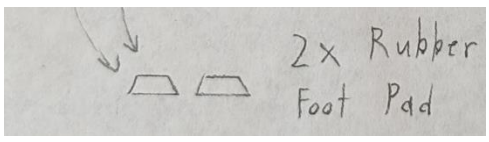
In this deliverable, our objective was to provide a detailed design drawing that summarized the final concept chosen for the flush bolt jig, outline a plan and schedule for prototyping as well as a list of all the equipment needed to build a prototype of our final design along with the estimated cost for each part.

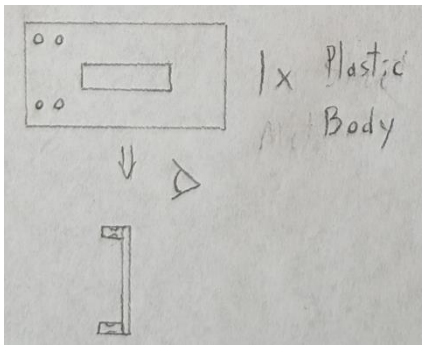
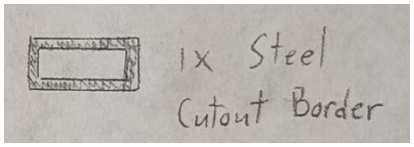
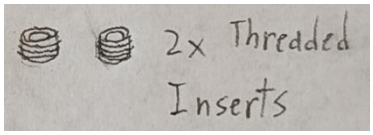
## 2.0 Detailed Design:



## 2.1 Design Parts

| Image | Description | Amount |
|---|---|---|
|   | Handle for carrying the jig. | 1 |
|   | Screws to hold the handle in place. | 4 |
|   | Threaded knob to clamp jig to door surface. | 2 |
|   | Rubber foot pads to prevent damage to the door when clamping. | 2 |

| | | |
|---|---|---|
|  | Lightweight plastic body with empty spaces for screws, jig cutout, and inserts for threaded rods. | 1 |
|  | Steel border around cutout to prevent damage to jig when cutting into wood. | 1 |
|  | Threaded insert/T-nut to hold threaded rods in place when adjusting. | 2 |

**3.0 BUDGET**

| **Bill of Materials** | | |
|---|---|---|
| **Material** | **Cost ($)** | **Description** |
| Handle | 0.00 | For carrying jig |
| Screws | 9.99 | For holding the handle in place |
| Threaded knob | 9.49 | For clamping he jig to door surface |
| Rubber foot pad | 5.99 | For preventing damage to door when clamping |
| Plastic body | 0.00 | Lightweight for the body of the jig |
| Steel cutout border | **13.99** | For preventing damage to jig when cutting into wood |
| Threaded inserts | 14.57 | For holding threaded rods in place |
| **TOTAL** | $54.03 | |

**4.0 List of Equipment**

| **List of Equipment** | | |
|---|---|---|
| **Material** | **Description** | **Type** |
| Router | For routing out cutouts | Hardware |
| Router Bit | Specialized for precise and clean cutouts | Hardware |
| Adjustable guides | Ensures precise positioning and alignment during the cutout process | Hardware |
| Jig Base | Sturdy base for mounting onto the door | Hardware |

| | | |
|---|---|---|
| Handles/Grips | Easy handling and manoeuvring during operation | Hardware |
| Level | Ensures perfect horizontal alignment with the door surface | Hardware |
| Allen Key/ Wrench | For adjusting and tightening screws or fasteners as needed | Hardware |
| Instruction Manual | Clear instructions for easy installation and usage | Documentation |
| Template | Universal for different door sizes and shapes, ensuring consistency and accuracy | Hardware |

**5.0 Project Risks and Contingency Plan:**

| **Significant Risks** | **Contingency plan** |
|---|---|
| Unforeseen costs can lead to exceeding the budget. | • Establish a contingency fund within the budget to address unforeseen expenses.<br>• Regularly review the project's financial status and adjust the budget if necessary. |
| Exceeding weight | • Use a lighter type of plastic and 3d printing throughout building rig.<br>• Use stainless steel screw<br>• It is cheap with the actual market price of 0.54 dollars per screw.<br>• Density of stainless steel only 8000 $KG/m^3$ |
| Grip | • Can slide if not tight around the plastic or slip off due to no adhesion from grip to handle.<br>• Do a rubber coating around it or apply a strong adhesive on the rubber to the handle. |
| Screw used to bind metal | • Could damage the metal with the pointy end.<br>• Use a screw with the greater surface area on the end and is flat.<br>• Put a more resilient rubber at the end for zero damage. |

**6.0 Prototyping Test Plan:**

| **Test ID:** | **Test Objective (Why)** | **Description of Prototype used and** | **Description of Results to be recorded and** | **Estimated duration of Test** |
|---|---|---|---|---|

| | | of Basic Test Method (What) | they will be used (How) | |
|---|---|---|---|---|
| 1 | Determine if the jig itself sits flush with the edge of the door. Must account for the slight bevel angle on the door. | A slab or thick piece of wood with the prescribed bevel edge will be used. We will observe if the jig sits smoothly onto the surface. | The results will be recorded as a success if the jig smoothly fits onto the surface. If it fails to or does not adequately fit; it will be recorded as a failure. | This test should take no more than 5 - 10 minutes. If failure is met, a possible sanding down of the built-in angle can be done to better adjust the jig. This could further add more time to this testing phase.<br><br>We hope to perform this test by March 4th.<br><br>Performed by: Sadeem Zahid |
| 2 | Determine if the screw knobs on the sides of the jig adjust well. Ensure that it screws in and out smoothly. | This will be tested by simply screwing in the screw knob through the threaded holes that were designated for it. | The results will be recorded as a success if the screw knob smoothly threads in and out of the hole. If it struggles to do so, it will be recorded as a failure. | This test should last under 5 minutes. If difficulty is met, we would try to continuously screw the knob in and out of the threaded hole. This will be done in hopes of grinding down the material for it to travel smoothly. Otherwise, a total redesign of the hole is required. |

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|---|---|---|---|---|
| | | | | We hope to perform this test by February 29, latest by March 4th.<br><br>Performed by: Matthew Chau |
| 3 | Determine the accuracy of the built-in measurements. Compare with other standard measurement tools. Ensures the accuracy and precision of the jig, crucial to its operation. | This will be tested simply by taking a standard 30cm ruler and comparing the marks on it with our built-in measurements. This is assuming the standard ruler is accurate to a degree. | The results will be recorded as a success if all or most marks on the ruler match with ours. Otherwise, it will be recorded as a failure. | This test should take less than 5 minutes. If the results show a considerable fail, the entire built-in measurement system will have to be redesigned.<br><br>We hope to perform this test by March 4th<br><br>Performed by: Ayaz Mohammad Saad Nayeck |
| 4 | Over tightening damage test with the clamps. We will intentionally over tighten the clamps around a test piece. This ensures no accidental damage can be caused to the work piece. | This will be tested by acquiring a test piece of wood, and simply placing our jig on top, tightening the clamps. The test piece will be inspected for any dents or scratches caused by the jig, if any. | The results will be recorded as a success if there are absolutely no scratches or dents from the over tightening. Otherwise, if any dent/scratch is noticed, the result will be recorded as a failure. | This test will be run 10 times, 2 minutes each. This way of testing ensures that there will be, with little doubt, conclusive results. If the test produces a negative result, new rubber padding or softening |

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|---|---|---|---|---|
| | | | | methods would have to be used.<br><br>We hope to perform this test by March 4th<br><br>Performed by: Oluwadamilola Olaifa |
| 5 | Practical use and work site condition testing. Ensures the capability of the jig is adequate and meets all stated design criteria goals. | This will be tested by using the jig as if it is a finished product. Every attempt at using the jig will be timed. This test will inquire about the feel, the ease of use, and most importantly usefulness of the jig. | The results will be recorded as a success if the time to set up and mark the flush bolt location is less than 5 minutes. If the timer exceeds this by 30s – 1 minute, it will still be recorded as a success. However, if the results exceed that by a significant margin, the results will be recorded as a failure. | This test should last approx. 20 minutes, there will 4 test runs; 5 minutes each. This way of testing ensures that there will be little inaccuracy in the results of the test. If during every test case there has been a failure, a complete re-evaluation of the final design will be done.<br><br>We hope to perform this test by March 4th<br><br>Performed by: Fiyin Eyenike |

**7.0 Conclusion**

In conclusion, the jig design project successfully integrates essential components for precision and efficiency in cutout routing. The budget, totalling $54.03, reflects the costs associated with materials and equipment. The comprehensive risk and contingency plan ensures preparedness for unforeseen challenges. The prototyping plan guarantees the functionality of the jig.