

**Guiding Cane**

GNG 2101

**Deliverable F**

Team B32

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# INTRODUCTION

The third client meeting information will p[rovide a guideline for the second prototype. This prototype will be designed based on the client’s feedback for the first prototype in order to meet the target specifications as well as the budget. The second prototype test will be conducted and documented. The target specifications will be compared to the second prototype test and design as well as analyzing and evaluating the prototype. The Bill of Materials(BOM) will be updated with respect to the prototype's 2 necessary parts that will reflect on the final prototype. The project plan outlined tasks to team members via wrike. The tasks were assigned according to the team members skills.

# TO TAKE AWAY FROM THE CLIENT MEETING

## 2.1 New Improvements to be Made

In this client meeting, the team was able to explain the most recent prototype plan. This plan included specific designs for the locking and unlocking of the telescopic components of the cane’s main body as well as getting rid of the arduino part of the cane design entirely. After explaining the design ideas to the client we were able to gain more insight on what needs to be improved upon based on her personal experiences. From the conversation with the client, the needs are basically the same as before with the exception of the removal of the signal for nearby hazards (arduino component) and a higher emphasis on the weatherproofing of the handle. The client still really likes the idea of changeable tips and handles, a folding joint/hinge in the middle, a fast assembly time (transition from the tip to the handle), a more durable material, and the telescopic main body.

## 2.2 Updated Client Needs

The following needs follow the same priority scale as the needs stated in deliverable B and D, on a scale of 1-5, 5 being a higher priority and 1 being a lower priority.

**Table 2.2.1 - Priority of Client Needs**

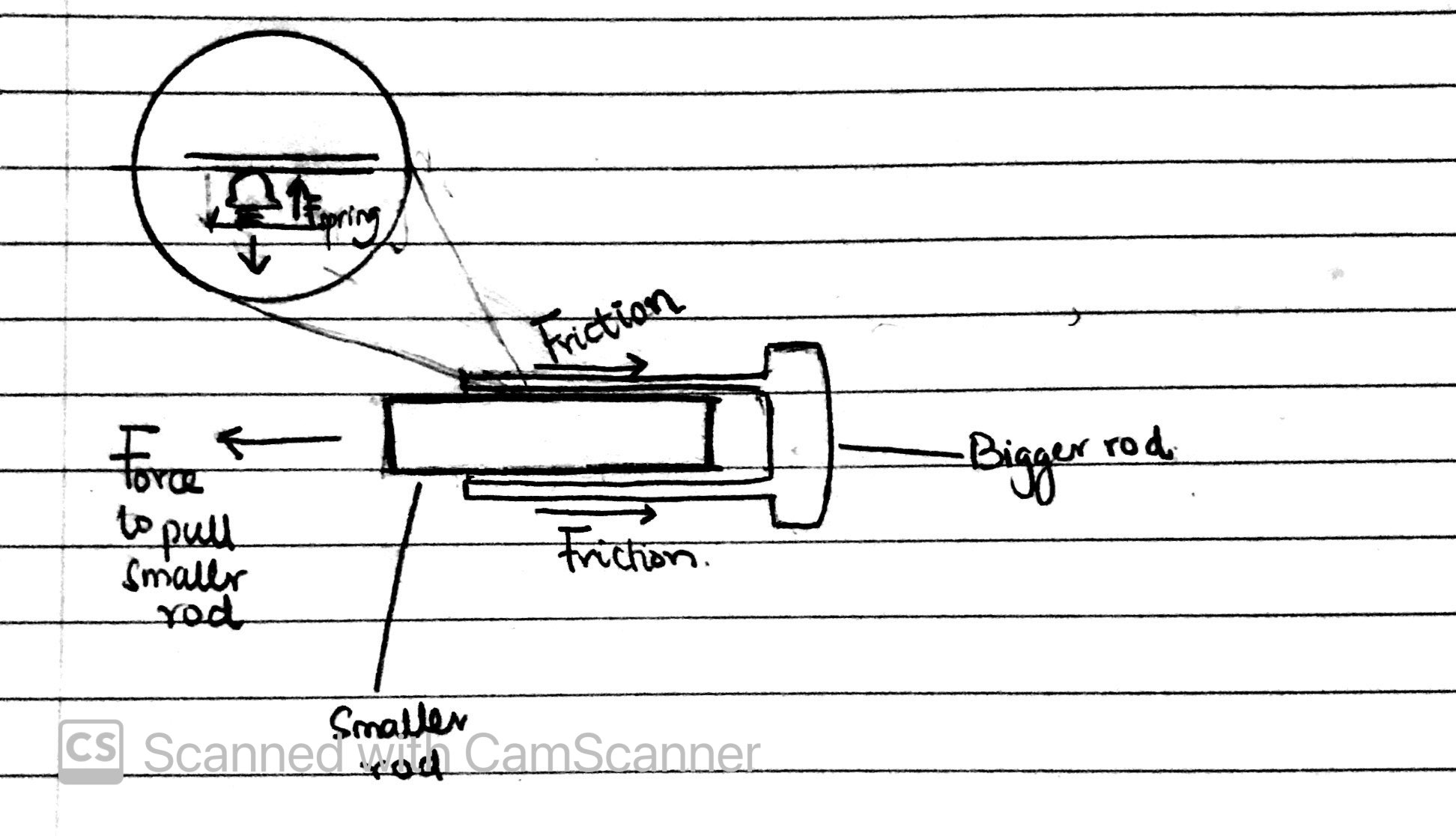
| **Customer Needs** | **Priority (1-5)** |
| --- | --- |
| Easily portable (small in size) | 4 |
| Lightweight | 5 |
| Easy to assemble and requires minimal assembly time | 4 |
| Durable materials for the cane, the tip, and the handles | 3 |
| Comfortable handles (to hold for long periods of time) | 2 |
| Flexible orientation of the cane and fits in narrow spaces | 2 |
| Allows user to maintain social distancing | 5 |
| Weatherproof | 2 |

# PROTOTYPE II

## 3.1 Detailed Design

The cane is intended to be a 2 in 1 cane and in order to successfully achieve this close attention was paid to the mechanism behind the cane’s ability to collapse and retract. The guiding cane has two main mechanical attributes that encourage the cane to meet customer’s needs. The two mechanical attributes of the cane are the spring enhanced locking system and the folding pivot joints. The spring enhanced locking system is focused on in this deliverable.

The following diagram gives a detailed FBD (Free Body Diagram) representation of how the locking mechanism of the cane is to work.



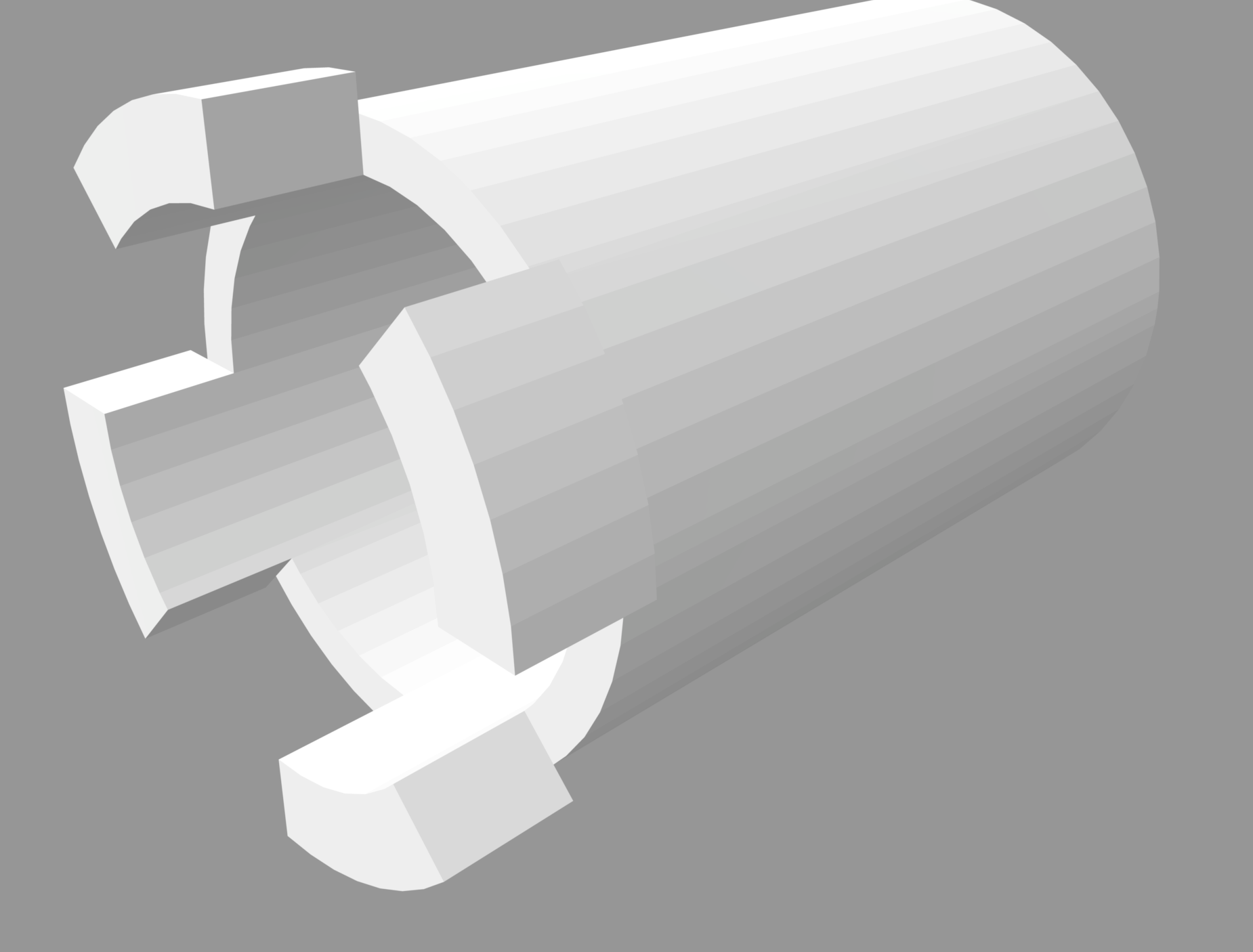
**Figure 1 - Locking mechanism FBD**

A spring and a button are used in the locking mechanism of the cane so that as the user pulls out the cane the force from the spring pushes the button from the smaller rod into the hole in the larger rod. This eventually locks both rods in place. Collapsing it is also easy. All that has to be done is to push the button into the hole and push the smaller rod into the larger rod.

## 3.2 Critical Product Assumptions

The cane must satisfy all the conditions set by the clients throughout the client meets. A suitable material such as carbon fiber tubing must be used to ensure durability while maintaining a light overall weight. The cane must be able to withstand daily use and abuse, we tested this by dropping it from 3 stories a few times until it fractured and a benchmark was made. A comfortable grip must be used to ensure ease of use over long periods of time. An attempt was made to create a locking mechanism and is predicted to be completely designed by the final prototype. Folding pivot joints are also being implemented to make sure it is foldable and compact.

## 3.3 Prototype Creation

The creation of this prototype was done so through solidworks. There were 3 parts created; the first part was a hollow cylindrical tube where a second tube would be inserted into it and thereafter extended through. To prevent the second tube from extending all the way; a hole was created where a small cylindrical piece was inserted into both pieces to prevent it from extending any further. The two pieces would therefore retract and extend in telescopic function smoothly. Solidworks theoretically proved this assembly was smooth and efficient through simulations. The CAD files were then 3D printed for prototype testing. Figure X is the CAD file for the small insert piece.

**Figure 2 - Small Cylindrical Piece**

## 3.4 Purpose and Function

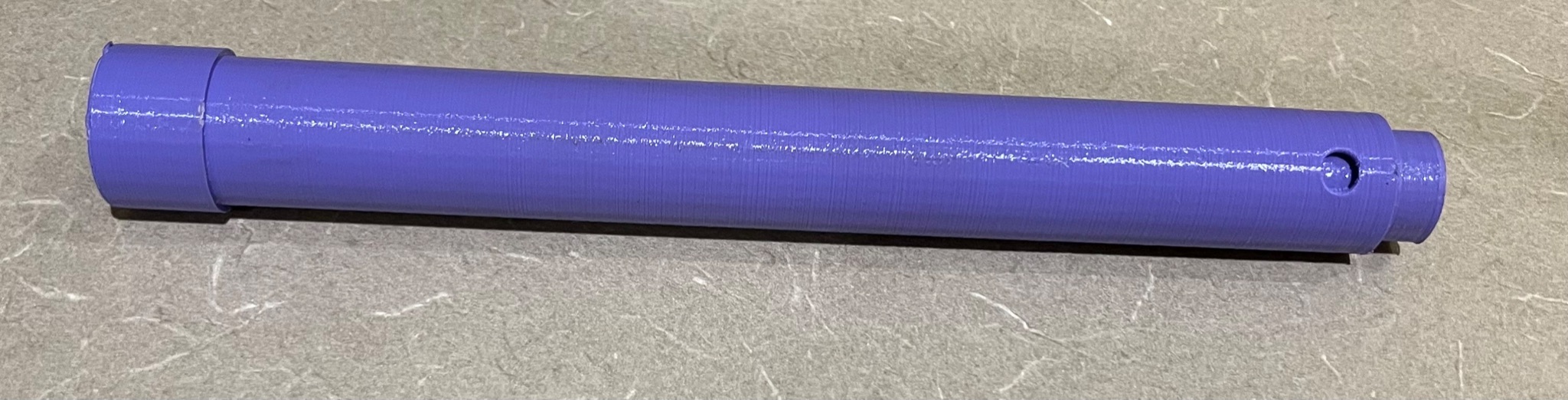
The purpose of this prototype was to design and test a simple locking mechanism for the cane similar to the design concept for the final product. This would test the concept for both functionality and ease of use. This prototype utilizes a small, spring-loaded linear slide which when mounted perpendicularly to the telescoping cane, would act as a lock and restrict the cane from retracting when extended. Thus ensuring the cane would be able to extend without collapsing during collisions.

## 3.5 Prototype Testing

The testing of the second prototype was to observe if the pieces would fit and extend in a telescopic motion. In Figure 3.5.1 it can be seen that the prototype extends but not beyond the end of the first pole. There are two holes in both connecting pieces where figure 3.5.3 is inserted to prevent the pieces from moving any further. Unfortunately these pieces didn’t fit the way it was intended too. Theoretically in the CAD files these parts fit and function smoothly. The second piece that extends through the first piece of the prototype had to be filed to completely fit and extend through the first piece. In figure 3.5.2 it is observed that the two pieces were able to retract successfully. This prototype allowed the team to analyze flaws in the design to be able to create a suitable final prototype. The inserts in figure 3.5.3 will have to be redesigned or replaced with a more efficient way to prevent the piece from extending further. The prototype was created using PLA material and was all 3D printed not to actual scale. The printer can only print to a certain scale and due to the prototype being 6 foot long it had to be printed half scale. The prototype testing was a success despite the pieces in figure 3.5.3 not fitting. The core extending pieces were a success because of how smooth it would slide and retract. This proof of concept prototype test results lead to analyzing key flaws and areas to improve for the final prototype.



**Figure 3 - Extending Guiding Cane**



**Figure 4 - Retracted Guiding Cane**



**Figure 5 -Insert pieces to prevent further extension.**

# 

# B.O.M.

**Table 4.1 - B.O.M. of Prototype II**

| **Materials** | **Amount Needed** | **Cost ($)** |
| --- | --- | --- |
| 3D printer | 1 | 0 |
| Solid Works software | 1 | 0 |
| PLA filament | 1 | 0 |
|  |  |  |
|  |  |  |

**Table 4.2 - B.O.M. of Final Cane**

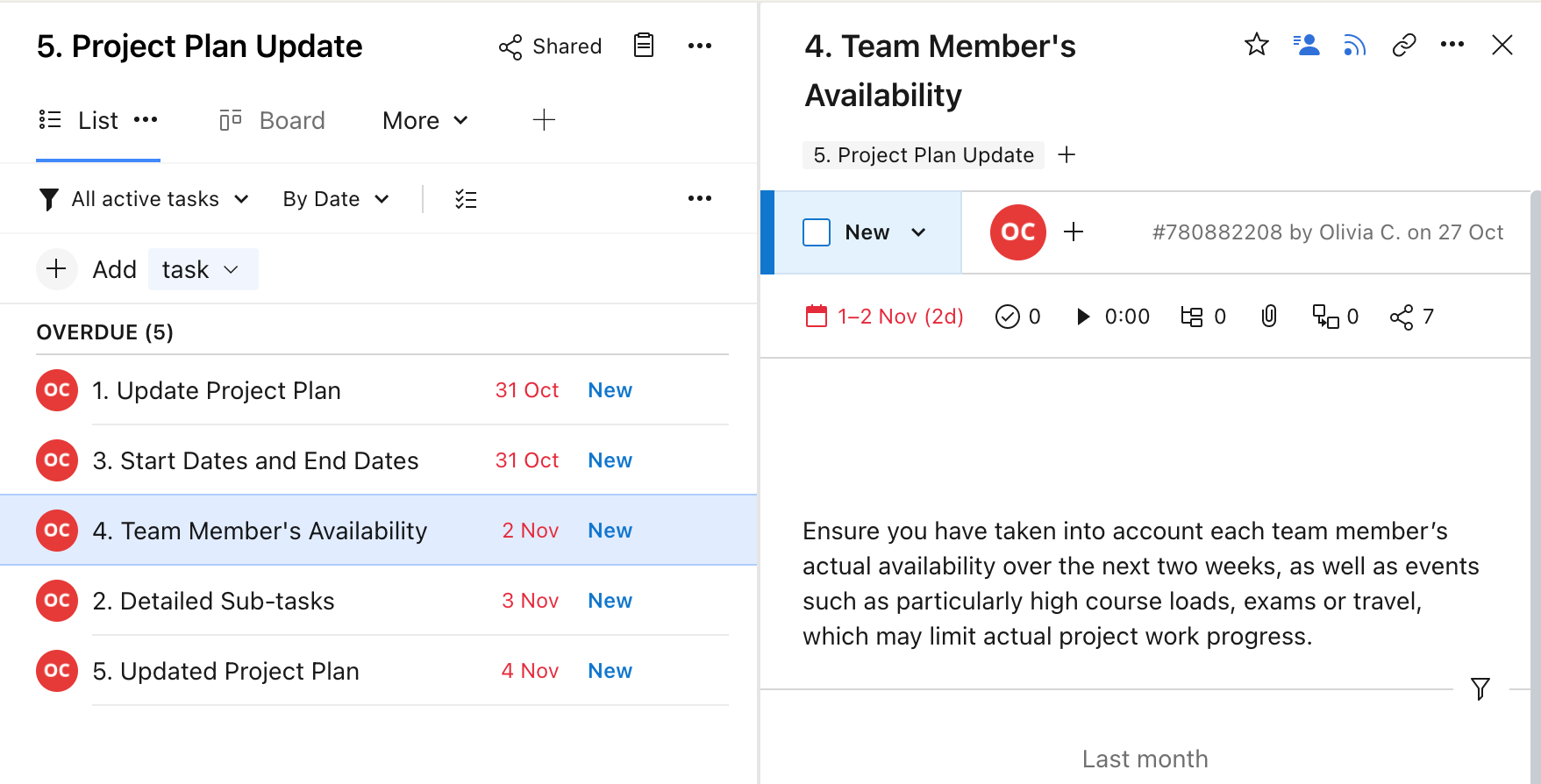
| **Materials** | **Amount Needed** | **Cost ($)** | **Link to Material** |
| --- | --- | --- | --- |
| Arduino | 1 | 16 |  |
| Carbon Fiber Tubing | 1 | 15 |  |
| Grip/Handle | 1 |  |  |
| Hinge | 1 |  |  |
| Workshop Session | 1 | 0 |  |
|  |  |  |  |
|  |  |  |  |

# PROJECT PLAN UPDATE

This section explains and shows all of the stages of planning that went into the creation of the wrike for this deliverable. The final wrike gantt chart for deliverable F can be found in section 5.4.

## 5.1 Detailed Sub-Tasks

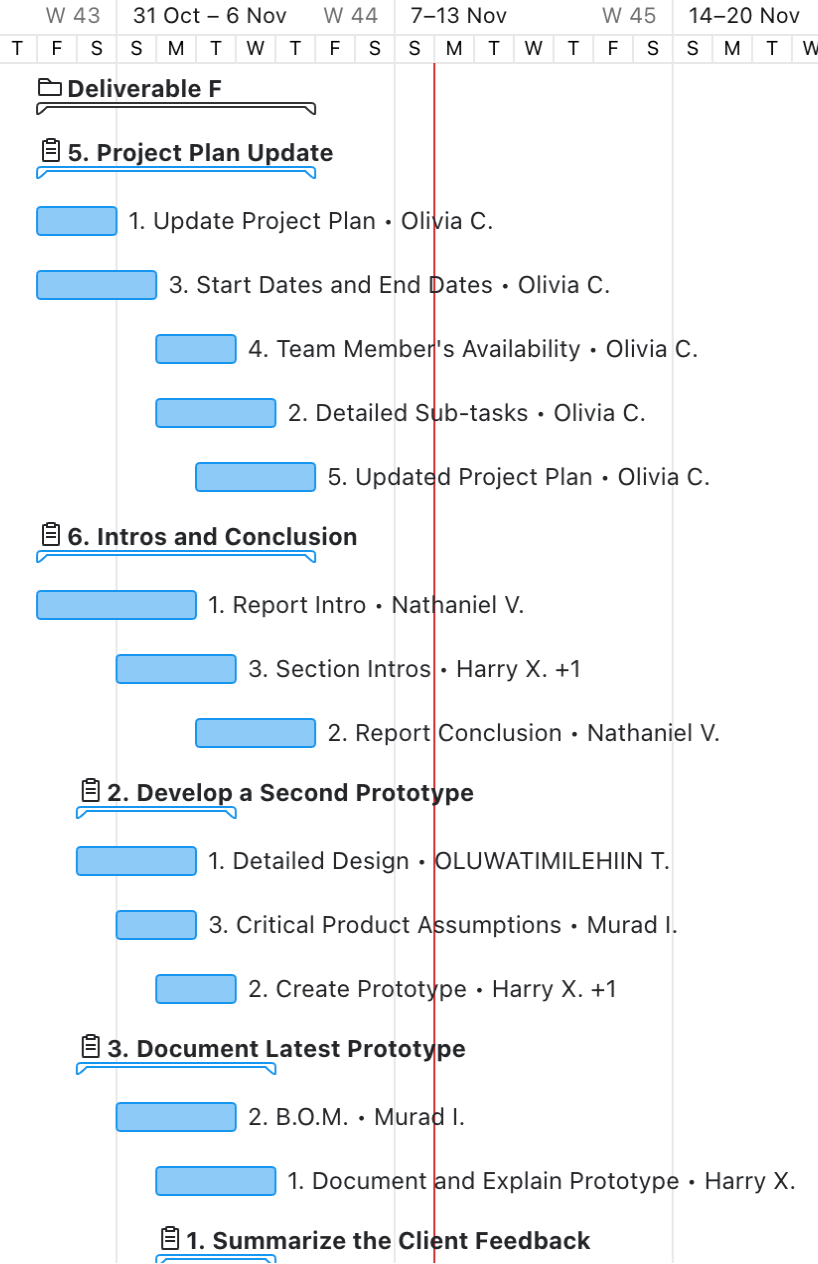
There were 6 main sections found to be in this deliverable that have been named: summarize the client Feedback, develop a second prototype, document latest prototype, prototype testing, project plan update, and intros and conclusions. Within these main sections are the corresponding sub-tasks. These sub-tasks are assigned to individual members of the team, given a time frame for completion, and are then explained in detail. The instructions on what is needed to be seen are clearly explained, however, there is still room for the individuals assigned to each task to interpret certain aspects. For example, in prototype testing, the information that is needed to be shown and discussed from the tests themselves is explained, but the way in which the tests should be conducted are up for interpretation. An example where the individual is told exactly what to do would be the tasks under project plan update. Every aspect of what is expected of these tasks is specifically explained.

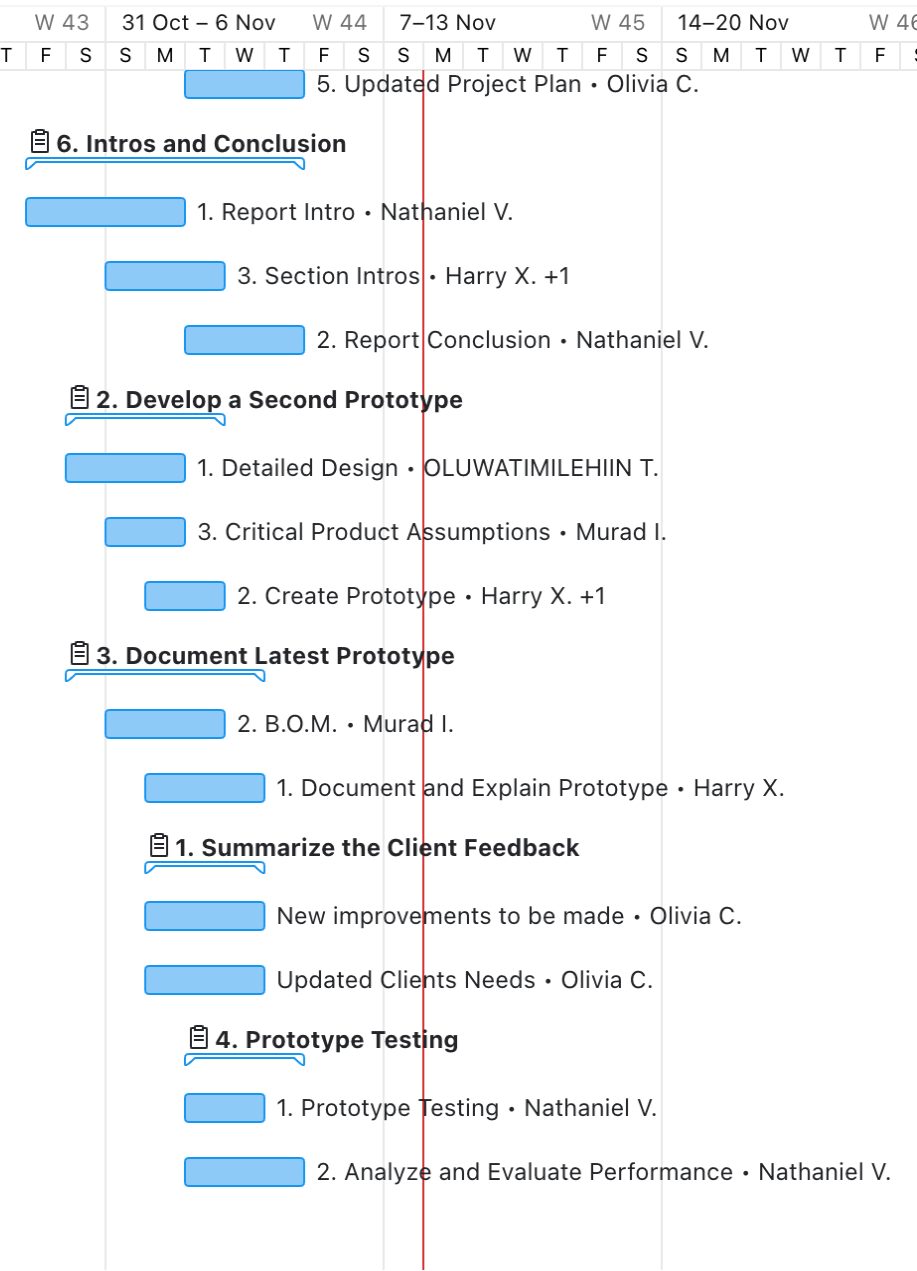


**Figure 6 - Individual task Example**

## 5.2 Start and End Dates

All dates were set in place for the original due date of November 4th for the deliverable as seen in the gantt chart below.





**Figure 7 - Deliverable F Gantt Chart**

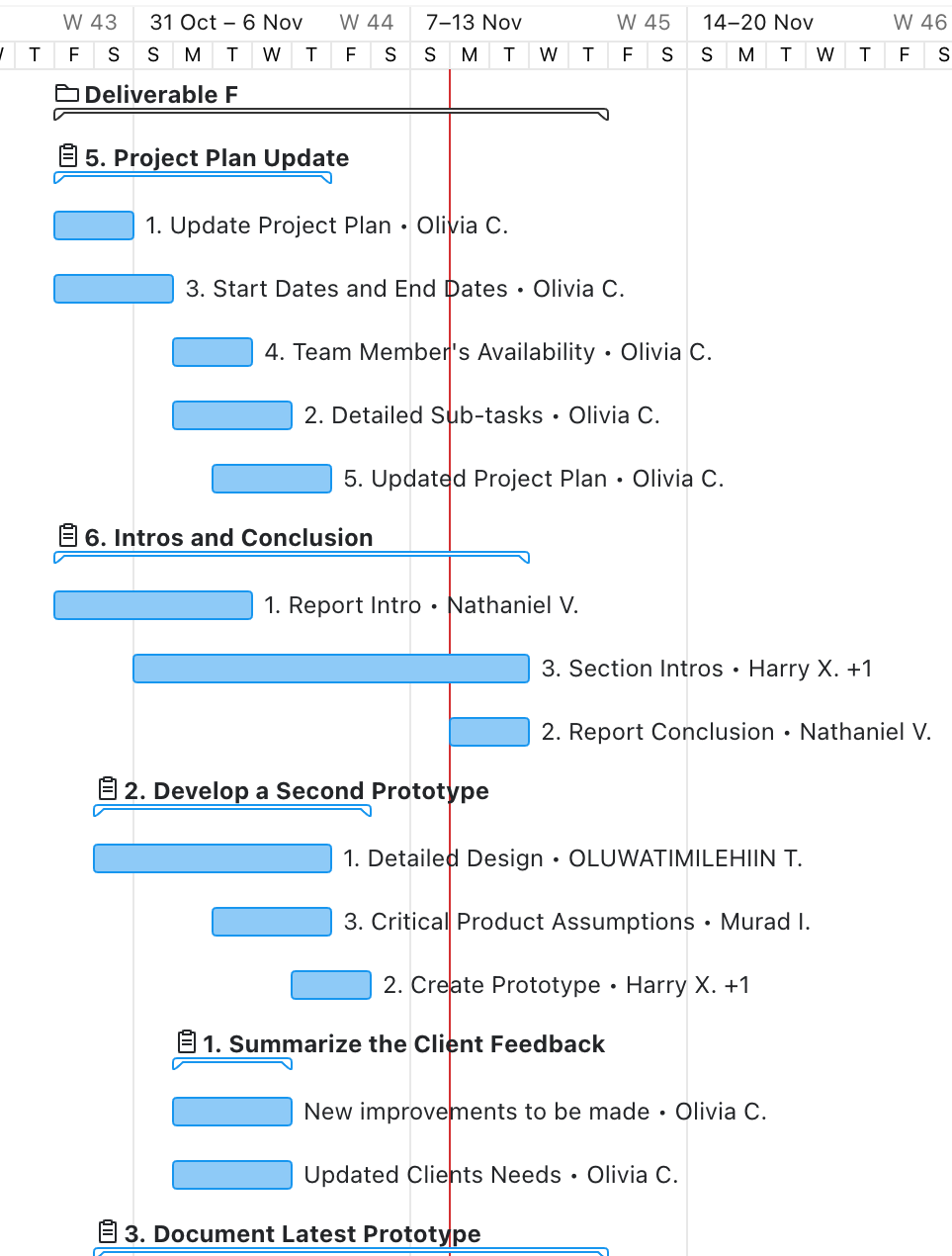
The due date was then pushed back a week to November 11th, so the dates of the project could then also be adjusted. This allowed for more time to complete the more difficult tasks without feeling too rushed. More time allotted meant that any issues could be discovered and fixed while still being able to show a functional prototype.

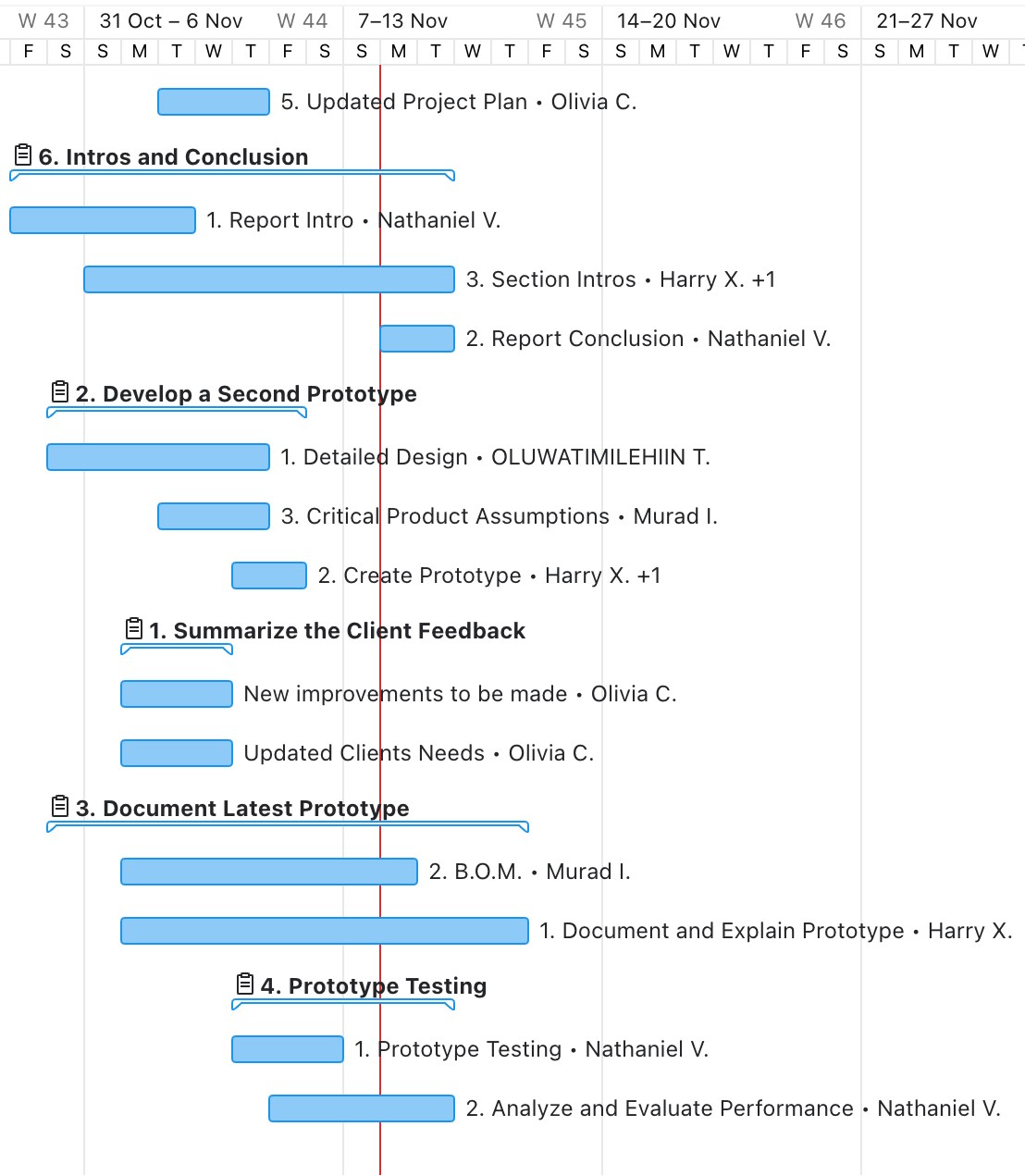
## 5.3 Team Member’s Availability

The timing was a little constrained at first, however, the availability of each team member was taken into consideration while designating tasks and task dates. When the due date was pushed back, the team was relieved because we were then able to focus on doing the best work possible rather than rushing to produce the fastest version of this prototype as possible. Tasks were not reasigned to individuals, however more time was allowed for the completion of certain tasks. This helped a lot with fitting in with the availability of the team members.

## 5.4 Updated Wrike

Shown below is the most updated version of the Wrike. This is the gantt chart followed for this deliverable. There arent any dependencies within the main sections, but there are sections that depend on other sections. Unfortunately, dependencies cannot actually be put on those folders, but the dependency is reflected in the due dates of the tasks (prototype design and prototype creation must be completed before prototype testing).





**Figure 8 - Updated Deliverable F Gantt Chart**

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# CONCLUSION

The client feedback helped in designing and redesigning the prototype to better the final prototype concept. The client meeting’s information laid a foundation for the second prototype’s design and test. The second prototype was created using CAD and free body diagrams and thereafter was 3D printed. This theoretical and practical creation of the second prototype was a success as both proved it was functional. The second prototype test was conducted successfully and presented flaws that will be corrected before the final prototype. The plan for the next deliverable has been outlined on wrike and the necessary tasks have been assigned to the team.