GNG2101

PD I: Video and User Manual

TABLE TOP WITH RECESSED TABLET HOLDER

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Table 1: Acronyms.

Acronym	Definition
BOM	Bill of Materials
MDF	Medium Density Fibreboard

Table 2: Glossary.

Term	Definition
Flippy Bit	Part of the table that holds the tablet and moves.

1. Introduction

This project involves designing a table top for a wheelchair user that contains a recessed tablet holder. The problem is relevant because currently, many wheelchair users have to use multiple desks to go about their tasks. This table design will aim to accommodate most daily needs in one piece of furniture. The goal of this product is to have a tablet holder built into a table so that when the user is not using the tablet, it is out of the way and the table is fully functional for other uses. This user manual will go over all set-up and safety considerations of our team's product and how to use it and troubleshoot any issues you could encounter.

2. Overview

Figure 1: Table Top in closed and open positions.

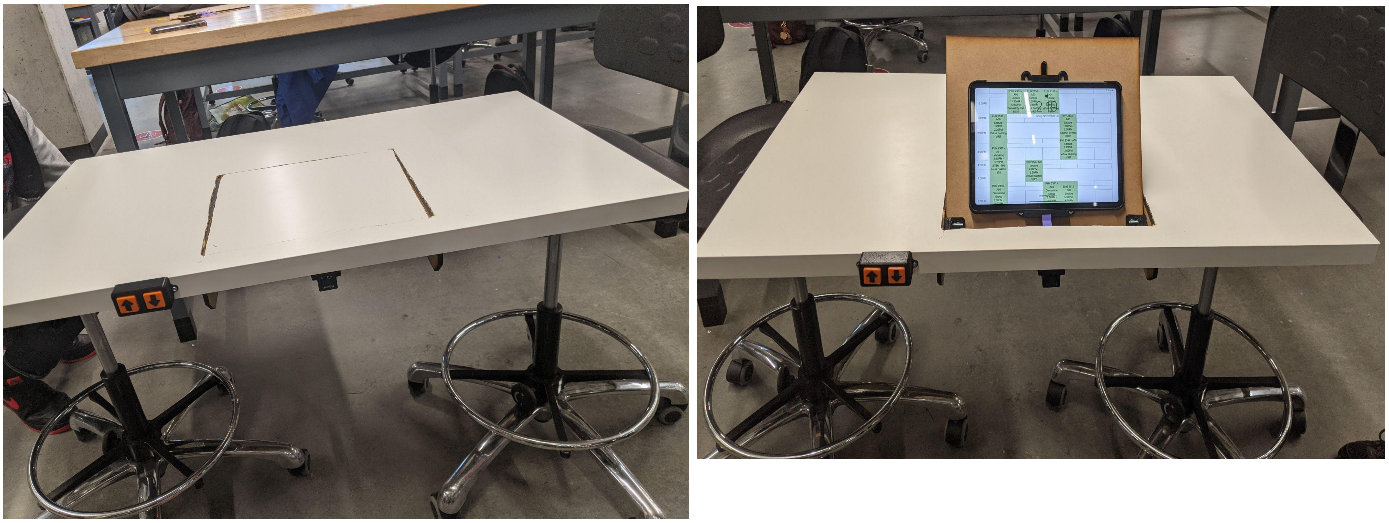
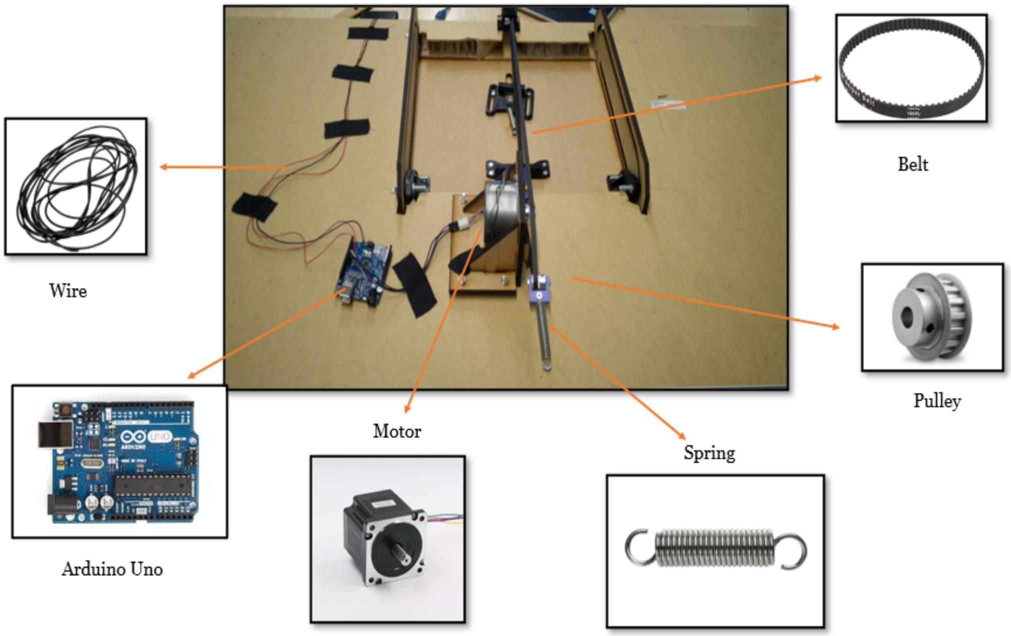


Figure 2: Underside of the table top.



To activate the system the user will press the UP arrow button which will activate the arduino and trigger the motor to rotate. The motor will rotate the pulley which will initiate the belt movement. The belt will start to pull on the tablet holder which will rotate it to the open position. To close the system the user will press the DOWN arrow button which will activate the arduino and trigger the motor to rotate the other direction. The motor will rotate the pulley which will initiate the belt movement. The belt will start to pull on the tablet holder which will rotate it to the recessed position. The belt and pulley system contains a spring mechanism to tension the system and make sure the belt stays tight and does not slip.

2.1 Cautions & Warnings

Do not place fingers or other appendages near the belt or the rails.

Do not sit or stand on the table.

3. Getting started

3.1 Set-up Considerations

As this is a piece of furniture, it will need a dedicated location in the room it will be used. In order to use the motorized functions, power needs to be supplied. Sufficient space should be left in front of the table so as to not obstruct access. The space below the table should be left empty.

3.2 User Access Considerations

There are no access restrictions.

3.3 Accessing the System

Physically approach the table.

3.4 System Organization & Navigation

1. After approaching the table, press the up button to raise the Flippy Bit.
2. Once in the open position, a tablet can be mounted or removed from the tablet holder.
3. Pressing the down button will then lower the Flippy Bit, storing the tablet.

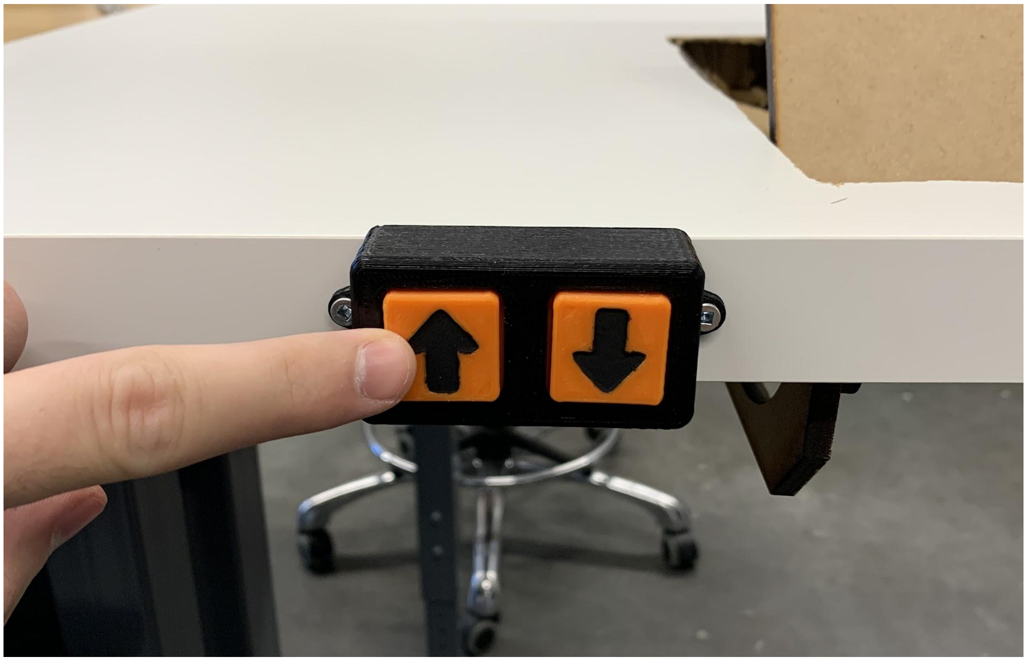
3.5 Exiting the System

Physically move away from the table.

4. Using the System

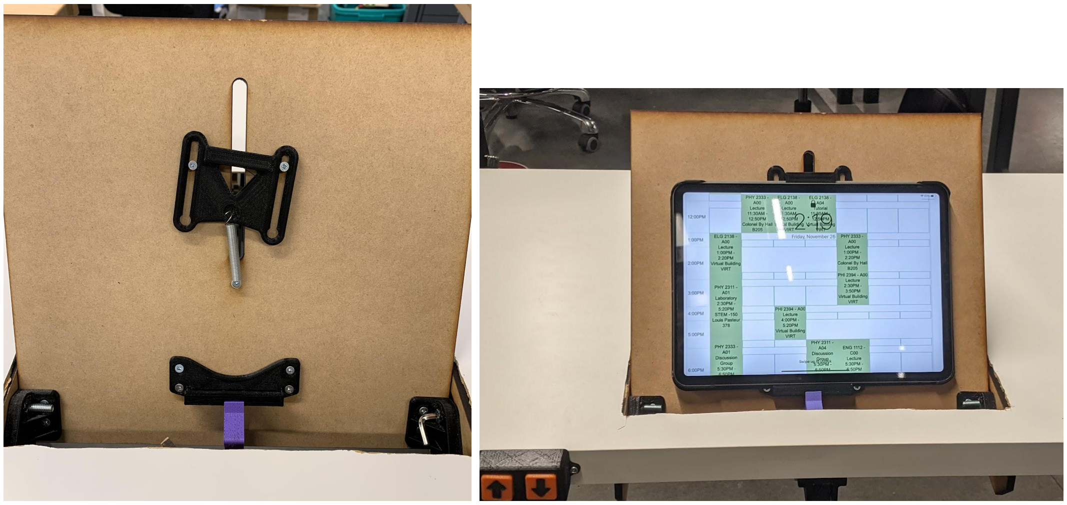
4.1 Opening the table

Figure 3: Press the UP button.



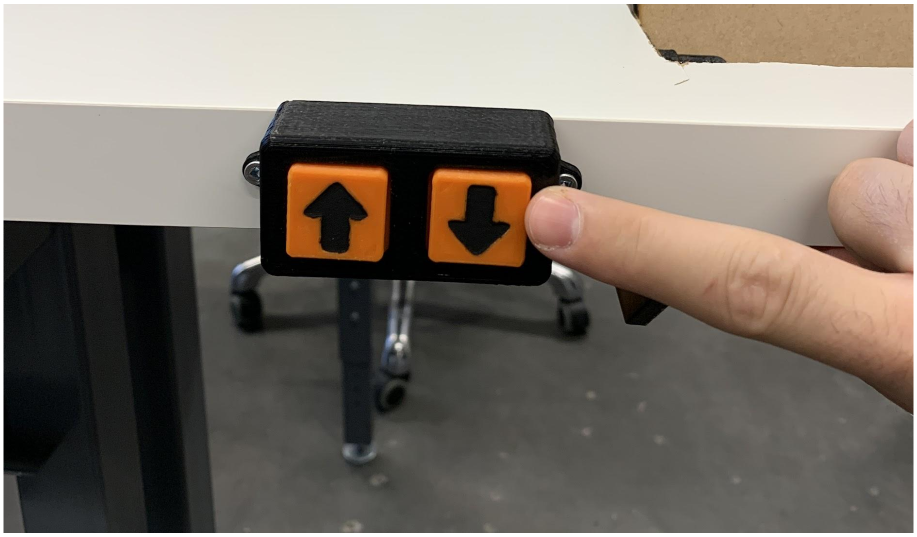
4.2 Placing/Removing a tablet

Figure 4: Slide the clamp up and place or remove the tablet.



4.1 Closing the table

Figure 5: Press the DOWN button.



5. Troubleshooting & Support

5.1 Troubleshooting

Table 3: Troubleshooting.

Issue	**Solution**
Belt has fallen off motor	Place belt back on motor pulley
Tension spring has fallen off the screw	Reattach the spring to the screw
Flippy Bit has gotten stuck part way through motion.	Manually move the Flippy Bit back to the closed position.
Table is on fire.	Put out fire with a C class fire extinguisher. Dispose of table.
Tablet jaw has fallen off Flippy Bit.	Align the guide screws with the holes in the jaw and replace.

5.2 Maintenance

Rails should be lubricated periodically to avoid seizure and excessive friction.

5.3 Support

If you are in any critical emergency situations please call the emergency phone number in your region. If you are encountered with any problems relating to the physical sliding, please contact us. We will reply within 24 years to help solve the problem you are experiencing.

Email: Support@flippytable.com
Phone: 1-800-FLIPOUT

6. Product Documentation

Due to the small budget, and large scope of the project, there were a lot of immediate sacrifices to the hardware and materials chosen. The pin-and-slot design for the rails was chosen for simplicity and the ability to 3D print and laser cut the majority of the components. Unfortunately that choice led to far more friction than was anticipated, which resulted in the product not functioning. Proper metal rails with ball bearings and grooves that prevent lateral movement would have eaten up a significant portion of the budget and been much more difficult to retrofit to the design. Similarly, adding a second belt and a long drive shaft to run them both from the same motor would have increased the price as well as the complexity, though the added stability likely would have aided with keeping the Flippy Bit balanced.

Because these fundamental choices were the core of the failure, we believe that there is very little value in the specifics of the production. Changing the rails and belt means there are no remaining measurements that would be relevant to the future design apart from the dimensions of the Flippy Bit itself, which were just arbitrarily chosen to be somewhat larger than the largest iPad. For that reason, the following directions should be taken more as guidelines than step-by-step instructions.

6.1 Physical System

6.1.1 BOM (Bill of Materials)

Table 4: BOM.

Material	Count	Price per unit ($)	Cost ($)	Source
Tabletop	1	9.99	9.99	IKEA (https://www.ikea.com/ca/en/p/linnmon-tabletop-white-00251135/)
Rails/Tablet Holder (Cut from MDF)	1	1	4	https://makerstore.ca/shop/ols/products/mdf
Arduino	1	20	20	https://edu-makerlab2021.odoo.com/shop/product/arduino-5#attr=5
Power Supply	1	28.70	28.70	https://www.amazon.ca/Adapter-Arduino-Exercise-Elliptical-Recumbent/dp/B06Y1LF8T5/ref=sr_1_5?dchild=1&keywords=arduino+uno+power+supply&qid=1634918663&sr=8-5
Wires (2.5ft)	2	1.25	2.50	https://edu-makerlab2021.odoo.com/shop/product/wire-5ft-45#attr=215,217
Button	2	0.20	0.40	https://edu-makerlab2021.odoo.com/shop/product/tactile-button-37#attr=39
Motor	1	11.10	11.10	https://edu-makerlab2021.odoo.com/shop/product/stepper-motor-63?search=motor#attr=77

Shield	1	15.50	15.50	https://edu-makerlab2021.odoo.com/shop/product/motor-shield-50?search=motor+shield#attr=
Sum			92.19	

6.1.2 Equipment List

- Materials in BOM
- 3D Printer
- Laser Cutter
- Drill
- Utility knife
- Soldering Iron

6.1.3 Instructions

1. Print out the 3D files, and cut the laser cutter template.
2. Cut a hole all the way through the table large enough to fit the Flippy Bit.
3. Cut holes through the bottom of the table to fit the rails.
4. Drill pilot holes for mounting the motor and button enclosure.
5. Install the 3D printed parts onto the Flippy Bit.
6. Connect the Flippy Bit to the rails.
7. Mount the motor onto the table.
8. Mount the rails and Flippy Bit to the table.
9. Solder the wires to the motor, arduino, and buttons.
10. Mount the arduino and buttons to the table.

6.2 Testing & Validation

Movement Prototype

After adding the string, the printed model was held level while the string was repeatedly pulled towards the front of the print, and then towards the back of the print. The moving portion followed the rails as expected when pulled to the front, but experienced too much friction when pulled towards the back. This friction is being caused by the layer lines of the print, and is not expected to be an issue with the final product. Lubricant and bearings could be added if friction does turn out to be an issue.

Table 5: Tablet Holder Movement Testing.

Test	Pass Condition	Result
Moves forward along rails when pulled by the string.	Yes	Pass
Moves backwards along rails when pulled by the string.	Yes	Fail

Button Enclosure Prototype

After assembling the switches into the button enclosure, it was seen that the switches fit correctly. The retaining bar held the buttons securely in place, allowing a press to activate the switch, while also leaving the pins accessible for the wires to be attached later. Using a scale, the switch activation was measured by slowly applying force until the activation occurred and noting the results.

Table 6: Button Enclosure Testing.

Test	Pass Condition	Result
Switches fit in the enclosure, and pins are accessible.	Yes	Pass

Buttons can be clicked with reasonable force.	<5 N	3 N Pass

Table 7: Tinkercad Circuit & Arduino Code Testing.

Test	Pass Condition	Result
Motor reacted as expected.	Yes	Pass
Program ran as expected.	Yes	Pass

7. Conclusions and Recommendations for Future Work

The first lesson learned is to not underestimate the amount of friction produced by substandard parts. As we had a very small budget for a project of this scale, we needed to compromise at every level from the table itself, to the rails, to the hardware. Ideally, the rails would be made using metal with bearings that are contained similar to a drawer rail to prevent lateral movement. This would have massively reduced the amount of force needed to move along the rails and prevented the Flippy Bit from getting out of alignment. Using two belts on each edge would further reduce the risk of the Flippy Bit becoming misaligned.

Apart from fixing the above issue to make the table functional, if more time and budget was available, we would have liked to have added wireless charging as well as a way to adjust the vertical placement of the tablet. To achieve the vertical adjustment, we had envisioned mounting the tablet clamp to a second rail system instead of directly to the Flippy Bit. Since the current product is only a table top, adding legs to the table would of course be desirable.

VIDEO LINK BELOW

https://youtu.be/Q-Cq3CXXiMc