GNG 2101

Design Project User and Product Manual

Frisbee Bud

Submitted by:

Group A3.2

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Table of Contents

List of Figures

List of Tables

List of Acronyms and Glossary

Table 1. Acronyms

Acronym	Definition
BOM	Bill Of Materials
MDF	Medium Density Fiberboard
SVG	Scalable Vector Graphics

Table 2. Glossary

Term	Acronym	Definition
Laser Cutter	N/A	A device used to cut sheets of materials in the required shapes.

1 Introduction

This User and Product Manual (UPM) provides the information necessary for the client, Bethany Children's Health Center, and others who may use the Frisbee Bud to effectively set up and operate the device. Prototype documentation is also included for those who wish to recreate or continue working on this project. This document outlines background on the project, how to set up and use the Frisbee Bud, troubleshooting, the process used to build the Frisbee Bud, and all relevant files and information needed to recreate the Frisbee Bud. Recommendations for future work are also included.

2 Overview

The problem that we were faced with was to create a switch-operated device that will assist kids with restricted mobility in throwing a frisbee straight. This is important because of our client and their needs. Our client is a health center that focuses on children with disabilities. Projects like our frisbee thrower allow them to play adjusted games and sports like everyone else.

The following is a list of the most important fundamental needs of the user:

- The frisbee thrower connects to the minimal required pressure “red buttons”
- The frisbee thrower is easy to repair with common tools
- The frisbee thrower is easy to assemble and take apart
- The frisbee thrower is safe to have around kids
- The frisbee thrower does not wear-down the frisbee
- The frisbee thrower is able to throw a frisbee to its target

The key aspects of our project that differentiates it from others and makes our product better is that we were able to construct it extremely under budget, while others spent a lot of extra money to complete their design. Even though we were under budget, our design had a lot of the same features as the others and is able to throw the frisbee just as far, if not further. In addition, another key aspects that makes our product better than others is that we are able to disassemble the thrower in over 10 pieces to be easily shipped, while it is still very easy to put it back together.

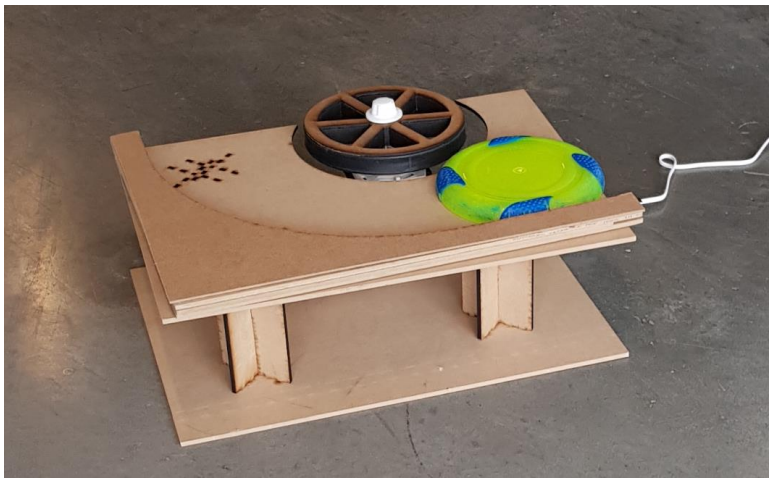


Figure 2.1. A picture of the final Frisbee Bud prototype

The only major function of our product is the motor spinning in a clockwise manner that allows the frisbee to be channeled around a corner and propelled outwards.

Our project is constructed out of MDF sheets that have been laser printed to fit the appropriate measurements. The MDF sheets act as the base of the product. Also, our product consists of a fan motor and rubber which acts as a surface to create friction for a frisbee that

allows it to propel further. Furthermore, the user access mode is by plugging in the fan motor, turning the motor on and placing the frisbee on top of the device, slowly pushing it into the motor cap.

2.1 Conventions

Action: To begin the loop of the frisbee thrower, the user must first plug in the motor and turn the ‘on’ switch to the desired speed.

Action: The user must then wait until the motor has reached its max speed and the desired power level. The user will then proceed by placing the frisbee on the device and slowly push it until it touches the motor cap.

2.2 Cautions & Warnings

While using the frisbee thrower, be sure to be cautious around it as it has no sensors that will prevent it from releasing the frisbee if there is an object and/or person in front of it. In addition, there is no cover on top of the motor. Users should be cautious when placing the frisbee on the device.

3 Getting started

The Frisbee Bud is designed to be easily assembled and disassembled without the use of tools. This section will provide instructions on how to assemble and disassemble the device and considerations while setting up the device.

3.1 Assembly

The Frisbee Bud contains 14 pieces which are listed and shown below and will be referred to by the listed names for the rest of the document. Ensure you have all listed parts before you start assembly. Additionally, a power outlet is needed to power the motor and a nine-inch frisbee is needed to use the device.

List of pieces:

- x1 Motor
- x1 Motor cap
- x1 Wheel
- x2 Side supports for motor
- x1 Back support for motor
- x6 Supports
- x1 Base
- x1 Top

Images of pieces:

Figure 3.1 Motor

Figure 3.2 Motor cap

Figure 3.3 Wheel

Figure 3.4 Side support for motor

Figure 3.5 Back support for motor

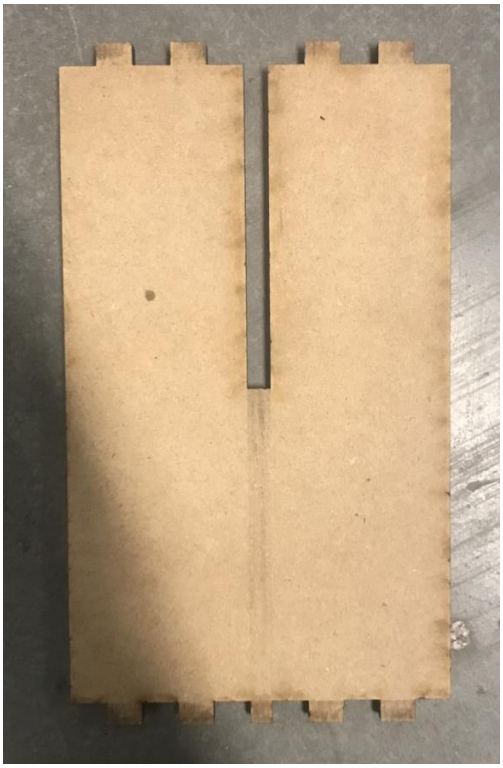


Figure 3.6 Support

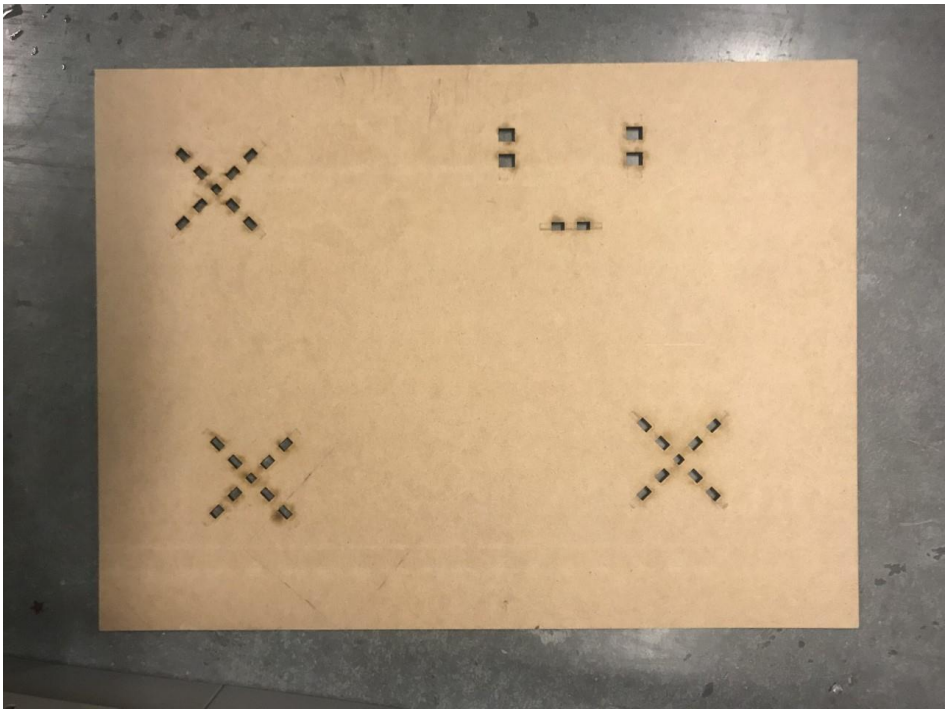


Figure 3.7 Bottom

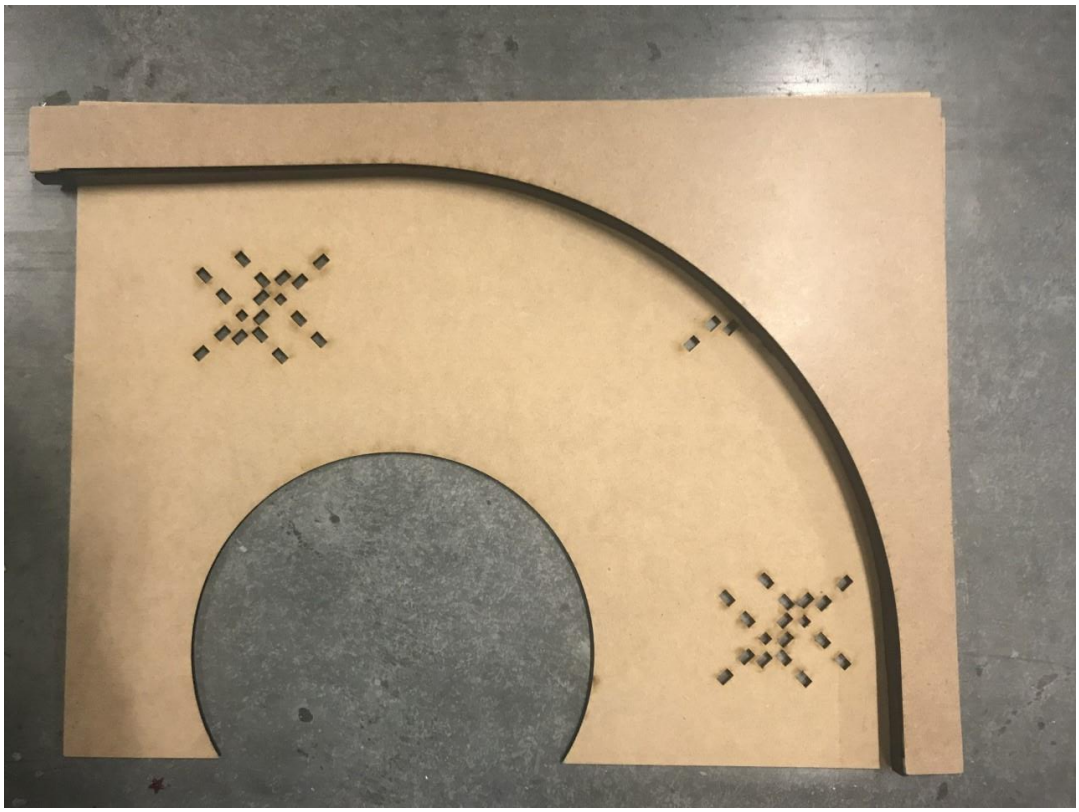


Figure 3.8 Top

Assembly Steps:

1. Place base on a flat surface
2. Locate the support pieces. These six support pieces will become three supports that will support the top piece.
3. Slide the long slit on one support piece into the long slit into another support piece. This will form an X shaped support shown below. Repeat with the other four support pieces to form three supports in total.

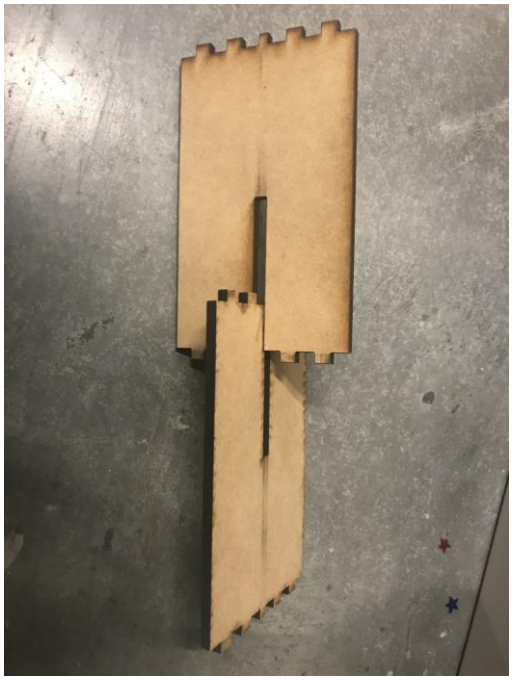


Figure 3.9 a) Supports being placed together b) Supports after being placed together

4. Place the supports into the holes on the base that form an X shape.
5. Locate the side supports and back support for the motor.
6. Place both side motor supports into the set of square holes on the base located across from each other. The Frisbee Bud should now look like the image below

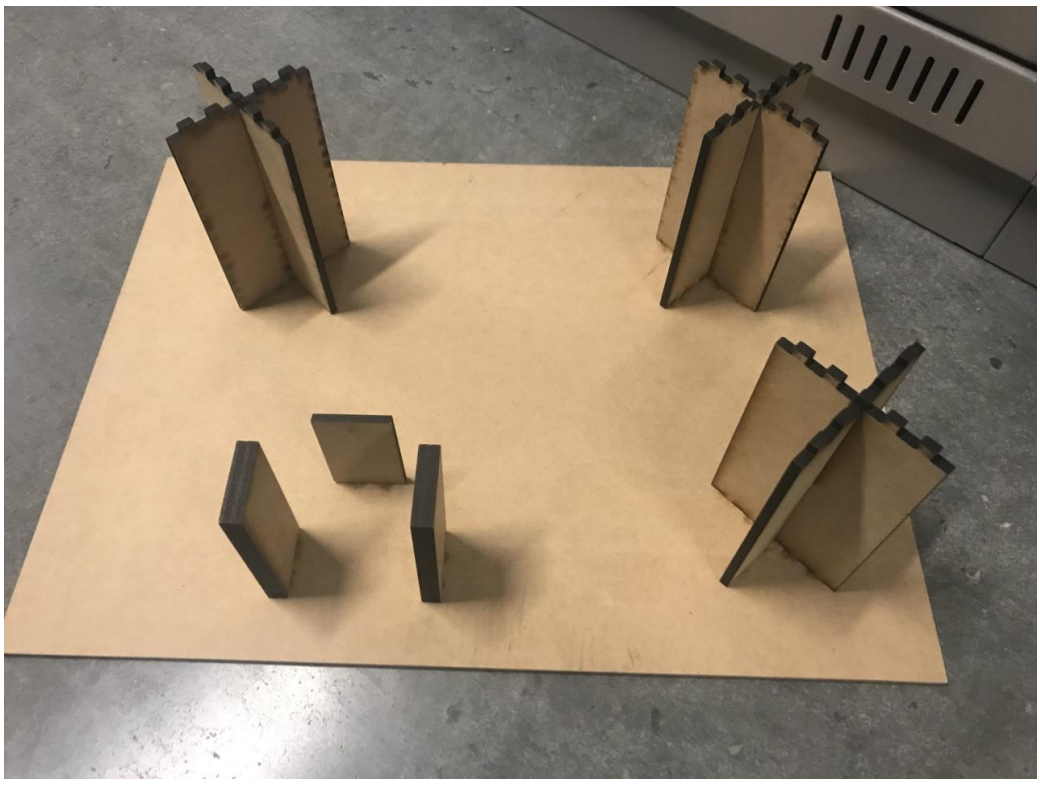


Figure 3.10 Base with all supports in place

7. Place the back motor support in the remaining set of holes on the base
8. Locate the motor, wheel, and wheel cap.
9. Slide the small hole in the middle of the wheel onto the motor rod with the smooth side facing up
10. The bottom of the wheel has small rectangles cut on both sides of the small hole in the middle. Ensure the small rod perpendicular to the motor rod sits within these holes.
11. Once the wheel is in the correct position, screw the motor cap onto the motor rod until the bottom of the motor cap is touching the wheel. There is no need to excessively tighten the motor cap. (Note: screw the motor cap by turning it counter clockwise)
12. place the motor on top of motor supports with the side of the motor with the cord facing the back motor support. The side motor supports will sit under the ridge on the side of the fan and the back motor support will sit between the oscillating mechanism and the main body of the motor. There should be a gap between the base and the bottom of the motor
13. Place top on the supports. Looking from the front of the frisbee thrower, the rightmost set of X shaped holes should line up with the supports. The top should be level, if it is not, ensure all the teeth of the supports are within the holes on the top. The wheel should be in the middle of the circle on the top, if it is not, use the other set of X shaped holes.
14. The final frisbee thrower should look like the image below

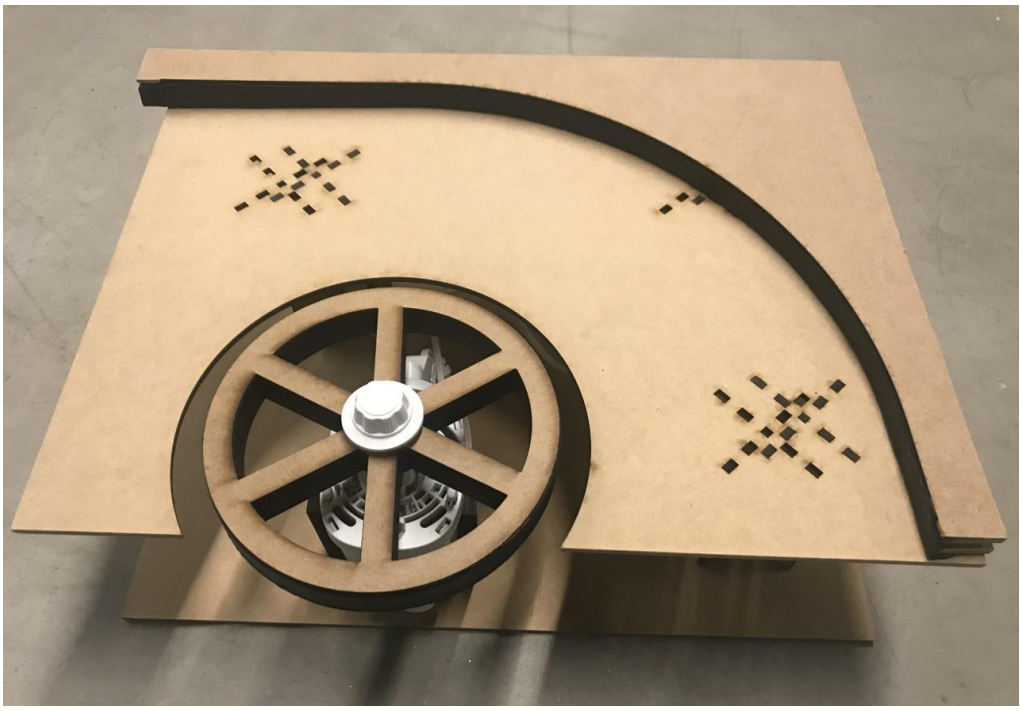


Figure 3.11 Fully assembled Frisbee Bud

3.2 Attaching a Switch

To make the Frisbee Bud accessible via an accessible switch, a PowerLink is needed. The motor can be plugged directly into the PowerLink and the Frisbee Bud motor can be controlled with a switch.

3.3 Turing on the Device

To turn on the Frisbee Bud, plug the motor into the outlet or the PowerLink and turn the dial on the motor away from 0. The recommended setting is 3 for maximum range, but the device can be used on settings 1 and 2 for decreased range.

After turning the motor on, it is recommended to wait five to ten seconds before loading a frisbee into the device. This allows the motor to get up to full speed.

3.4 Disassembly

The Frisbee Bud does not need to be disassembled every time it is not in use, and can be stored fully or partly assembled. If storing for long periods of time, it is recommended to remove the motor from the rest of the device to prevent unnecessary stress on the motor supports.

The Frisbee Bud can also be fully disassembled to take up less space when storing.

To fully disassemble the device:

1. Turn off the motor by turning the dial to 0
2. Unplug the motor from the outlet or Powerlink device
3. Remove motor from device
4. Unscrew motor cap from motor (Note: Turn motor cap clockwise to unscrew)
5. Slide wheel off of motor (Note: This may require a bit of force. Push down on the motor rod while pulling up on the wheel if you are having trouble)
6. Remove all three motor supports from the base
7. Remove top from supports
8. Remove all three supports from base
9. Separate each support into two pieces by pulling each piece in opposite directions

4 Using the System

The following sub-sections provide detailed, step-by-step instructions on how to use the various functions or features of the Frisbee Bud.

4.1 Adjusting the Range of the Frisbee Thrower

Frisbee Bud is a simple, yet powerful device and can be used to launch the frisbees over 15 feet away. However, if required, the range of the frisbee thrower can be adjusted. The frisbee thrower comes with a pair of wooden blocks (see Figure 4.1) that can be used to adjust the angle at which the frisbee is launched.

Figure 4.1. An image of a wood block that can be used to adjust the Frisbee Bud incline

There are no additional parts required for this function. Adjusting the angle of frisbee launch is as simple as placing the two blocks below the frisbee thrower base and running the device thereafter.

4.1.1 Maximum Range

For maximum range, the two blocks can be positioned under the laser cut holes on the base that are used to snap the support mechanism in place. The frisbee thrower together with the blocks needs to be placed on a raised level surface like a table. Placing the device directly on the ground might affect the range significantly.

4.1.2 Intermediate Range

For an intermediate range value, the blocks can be placed in the region between the laser cut holes and the edge of the base MDF sheet. The closer the blocks are to the edge, the lesser the range is. For the absolute minimum range, the blocks can be removed altogether and the frisbee thrower can be operated without an incline.

4.2 Adjusting the Motor Speed

The Frisbee Bud uses a speed adjustable motor with 3 speed levels (see Figure 4.2). It is recommended to operate the motor at maximum speed (level 3) for maximum performance and system stability.

Figure 4.2. An image showing the speed control knob on the motor

The motor can also be operated at level 2 for a quieter performance.

5 Troubleshooting & Support

Frisbee Bud is a mechanical device with little computing power, and therefore any operational error that might occur has to be detected by the user itself. Since the design of the device is quite straightforward, the errors are most likely to occur in two major areas:

1. Places where parts connect together
2. The motor itself

5.1 Error Behaviors

The following sections describe in detail the various error behaviors that can occur and how to deal with them.

5.1.1 Excessive Vibrations when Idle

Frisbee Bud is expected to vibrate under usual operating conditions, since its parts are mostly snapped into their positions like puzzle pieces. However, if the frisbee thrower appears to be excessively vibrating when running under no load, to the point that it seems unstable, there is most likely something wrong.

The following sequence of steps can be followed to troubleshoot the situation:

1. Set the motor to its lowest speed (level 1).
2. Observe the motion of the wheel attached to the motor. If the wheel appears to be unbalanced, turn off the device.
3. Unscrew the motor cap and remove the wheel.
4. Inspect the wheel for any abnormalities and fix them if needed.
5. Reseat the wheel on the motor shaft, and screw the motor cap.

If the above sequence of steps does not fix the problem, then the following sequence of steps can be followed:

1. Turn off the device and unplug its cable.
2. Remove the top MDF sheet of the frisbee thrower.
3. Check connections for all the parts that fit in the laser cut-outs on the base sheet.
4. Check if the motor is seated properly.
5. Replace the top MDF sheet and make sure all the connections for its laser cut-outs are okay.

5.1.2 Frisbee Thrower Power Appears to be Reduced

It is normal for the frisbee thrower power to reduce after prolonged usage. Since the components are mostly connected with simple puzzle-like joints, extended usage might make them come loose. The following sequence of steps can be followed if the issue is encountered:

1. Turn off the device and unplug its cable.
2. Remove the top MDF sheet of the frisbee thrower.
3. Reseat all the parts that fit in the laser cut-outs on the base MDF sheet.
4. Reseat the motor if needed.
5. Replace the top MDF sheet, making sure all the parts fit properly with its laser cut-outs.

5.2 Maintenance

Frisbee Bud is constructed from laser cut MDF parts that are prone to wear over time. The laser cut-outs where the parts connect might get worn-out over time and result in loose connections that affect the performance and stability of the overall device. Therefore, it is recommended to replace the worn-out parts with new laser cut ones as they get used up over time.

5.3 Support

In case of any additional questions about the device, our team members are reachable via their emails:

Kaiya Brereton	:	kbrer101@uottawa.ca
Adwitheya Benbi	:	abenb083@uottawa.ca
Harry Clark	:	hclar072@uottawa.ca
Saheel Mohammed	:	smoha266@uottawa.ca

This product was developed as a part of the GNG 2101 course with professor Dr. Rubina Lakhani. Therefore, in case of any emergencies related to the project, please contact her at rlakhani@uottawa.ca.

6 Product Documentation

Due to the simplicity of our device, which comprises of a fan motor that rotates clockwise to generate momentum in the chamber and move the fan forward, It only has one primary sub-system (Mechanical sub-system). So why a fan motor? We chose a fan since it was the least expensive option because this product was intended for a non-profit and we wanted to make sure that every dollar mattered. However, we first tested a DC motor, but it was insufficiently powerful to move the frisbee ahead. The base, walls, and wheels of our device came next, and we immediately chose MDF for these components because we knew it was a reliable and affordable choice. We considered using plastic, but it was too flimsy, or metal which was too expensive.

6.1 Mechanical Subsystem

6.1.1 BOM (Bill of Materials)

Item Name	Description	Quantity	Unit Cost	Extended cost	Source
Fan Motor	Hampton Bay 16-inch Pedestal Fan	1	$21.98	$21.98	Home Depot
Screws	1 inch phillips flathead wood screws	20	$0.10	$2.00	Makerlab
MDF	1/4 inch x 18 inch x 24 inch MDF Sheet	7	$4.00	$28.00	Makerstore
Rubber	2 inch x 36 inch x 0.187 inch	1	$9.86	$9.86	Amazon
MDF	1/8 inch 18 inch x 24 inch MDF Sheet	1	$3.00	$3.00	Makerstore

6.1.2 Equipment list

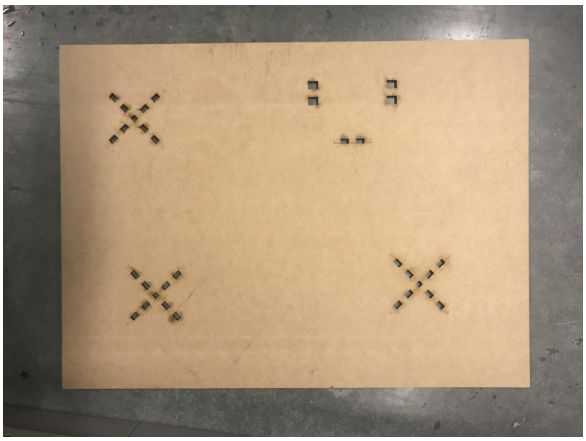
- laser cutter
- Wood Glue
- screwdriver
- hammer

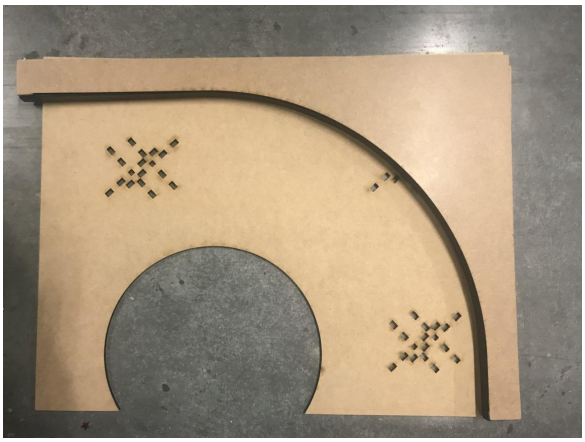
6.1.3 Instructions

Step 1
Start by taking apart the fan so that you only have the motor left live shown in the figure below

Step 2
Next prepare your 7 sheets of MDF for laser cutting (shown in the figures below)

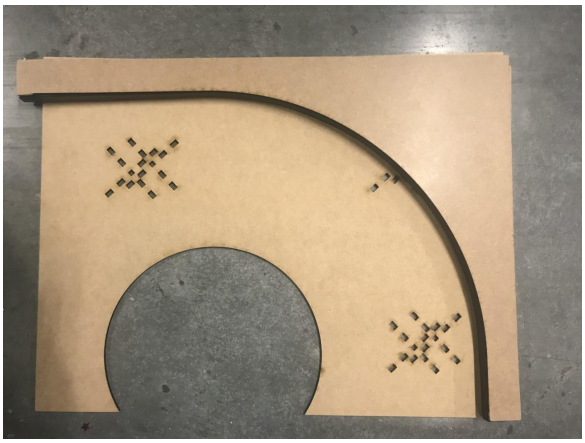


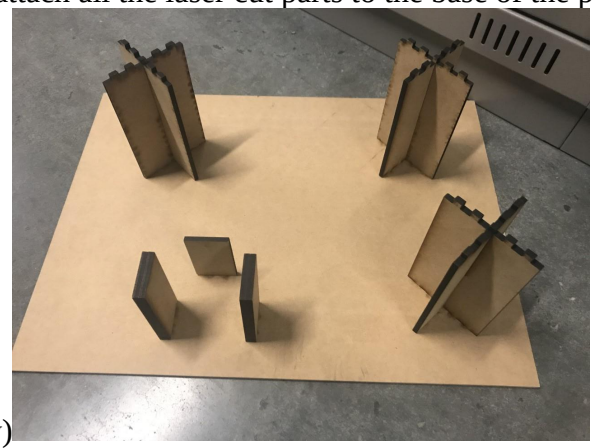


Step 3

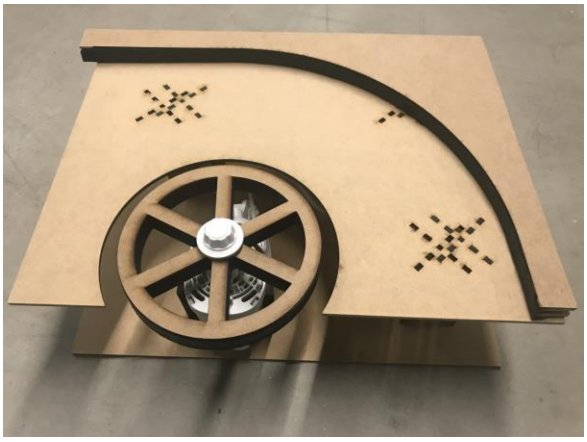
Stack all the curved wall pieces together to create a curved wall on the base (shown in the figures below)



Step 4
Next attach all the laser cut parts to the base of the product (like show in the figure below)



Step 5
Next attach the fan, wheel and the 2nd base with the curved wall on to the first base (like show in the figure below)



Step 6 (final step)
Plug in the fan and put it at your desired speed, and watch the fan go.

7 Conclusions and Recommendations for Future Work

After working on this project, as a group we have learned many lessons that would have been very beneficial to know before-hand. For states, we learned the importance of having a detailed outline of our project plan. This ensures that a task is never missed, and all tasks are finished thoroughly before deadlines. Also, we learned that having a weekly group meeting is essential. Weekly group meetings allow the group to take a few hours to work on tasks and give each other constructive criticism. Finally, another lesson that we learned this semester was that design decisions go a long way in influencing the overall accessibility of the final product.

As a whole, our group worked very hard and efficiently throughout the design of this project. Because of this, we were able to accomplish most goals and finished most aspects of the project. However, one aspect of our project that we did abandon that we would have liked to further the development of, was a switch device that automatically pushed the frisbee into the device. Not only would this have made it a much safer environment for the user, but it would have also been a great opportunity for our group to go above and beyond within the project.

APPENDICES

8 APPENDIX I: Design Files

All design files can be found on our MakerRepo (https://makerepo.com/kaiya/1291.gng2101a32frisbee-bud). These files are the .svg files used to laser cut all the MDF pieces in our project.

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Issuance Date
8thInchMDF-Wheel-GuardRail.svg	MakerRepo	December 11, 2022
Base.svg	MakerRepo	December 11, 2022
GuardRail-Supports.svg	MakerRepo	December 11, 2022
GuardRail-Wheel.svg	MakerRepo	December 11, 2022
GuardRail-Wheels-MotorSupports.svg	MakerRepo	December 11, 2022
Top.svg	MakerRepo	December 11, 2022