Umbrella Holder Documentation

Overview

Introduction

M is a student at Clovis North High School who lives with brittle bone disease. One of the things she thought would be useful is an umbrella holder that can attach to her wheelchair and hold an umbrella without her needing to carry it herself. This way her hands can be free and she can carry more things. The team brainstormed various designs, and we iteratively 3D printed prototypes and tested them.

Co-Designer Needs

- M's wheelchair cannot be out in the rain for too long, because it is not waterproof
- M would like an umbrella holder so she doesn't have to carry as many things
- M would like to be able to use the umbrella independently

Product Requirements

- Allows the umbrella to cover the entire wheelchair
- Easy to attach/remove
- Lightweight and strong

Brainstorming Process

Questions/Concerns

- Can she comfortably reach the back of her chair?
- Does she need to store it with her?
- Where are we going to place the umbrella holder?
    - Will we use the "notch at the back of her chair to attach the umbrella holder?
- Should we build it by ourselves or buy an existing solution?
- We should communicate with the cup holder team so that AT has a "common design"
- Should we add a net? If so, how big should it be?

Ideas

- A solid metal bar that slides through the latch
    - Umbrella Clamp
        - *Fits on 0.47-1.2 inches metal handle*
    - Umbrella Clamp 2
        - *Fits on 0.85-1.45 inch oval frames*
    - Oversized Umbrella (68 in)
      Oversized Umbrella (72 in)
        - Measure the length of M's wheelchair

Prototype 1

Objectives

What is the goal you want to achieve with this particular prototype?

- Testing the strength and reliability of holding an umbrella
- Testing the feasibility of the part

Materials

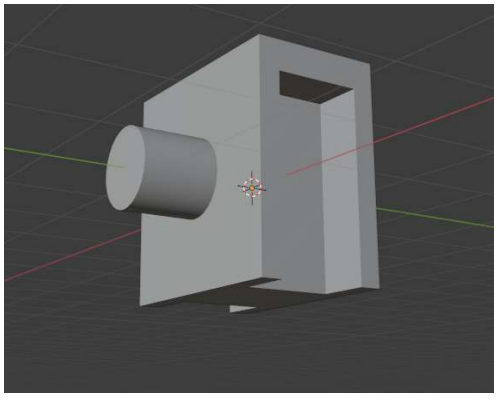
What are the materials needed to build this particular prototype?

- 3D Printed
    - PLA Plastic

"Technical Drawing"

Pictures, a Sketch, CAD model, etc.

Note: Make area of the circle part of the model larger, extrude it out more



Needed measurements to take

Red: 0.179 in
Purple: 0.1545 in
Green: 1.8175 in
Yellow: 0.9480 in

Test Plan

How effective is this prototype? What aspects of the prototype do you want to test (durability, strength, etc.)?

Concerns

- Strength
    - Hang weight to see the maximum strength the part can withstand
    - Test if the part will become dislodged easily
    - Test if the part is heat resistant
- Accessibility
    - Test how easy it is to reach the back
        - Have M reach back and touch the part 3-5 times
    - Does it work with different size umbrellas
    - If we just leave the part in there will it interfere with anything?
        - Can we use the “screw thing” on the side

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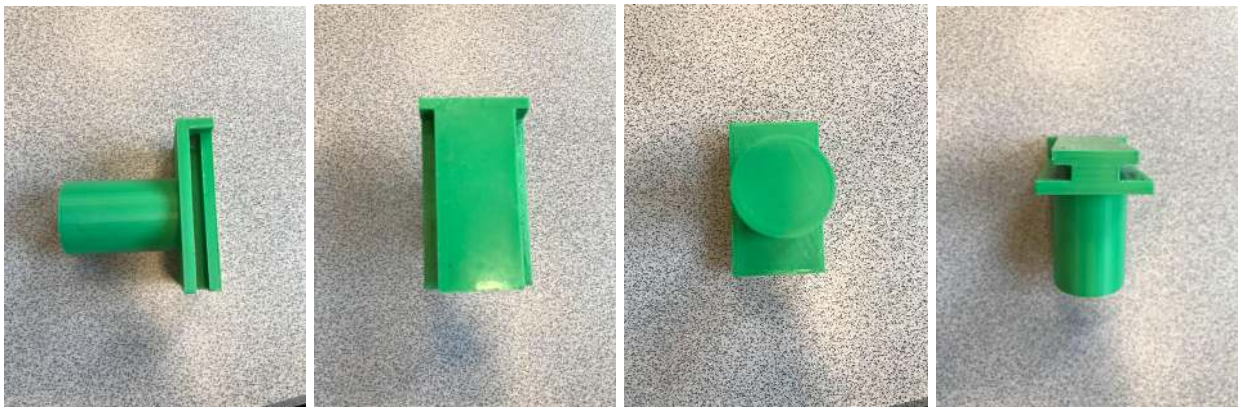
- Aesthetics
    - How do you like the look of it?
        - We can add stickers, paint it, etc.

1/27/22

- Received umbrella
    - Umbrella Clamp
- Pros
    - Is adjustable in length, can graph most umbrellas
    - The base is relatively stable
- Cons
    - It may be difficult to place umbrella inside the holder
    - Lots of cheap parts can easily lose bolts, screws, and plastic pieces
    - Sometimes it's very hard to tighten/loosen the screws, may not be accessible for M

Various sides and angles of the first prototype



Pictures of the first test prototype


- Updates
    - The gap is too narrow for the piece to slide onto the back of M's wheelchair. Cannot slide all the way, need to make it wider.
    - The umbrella holder is a bit inaccessible for M to reach, with the current state, she'll need additional help putting the umbrella on and tightening the holder
- Issues
    - The umbrella holder attachment is too tight

Prototype 2

Various sides and angles of the second prototype




Pictures of the second prototype

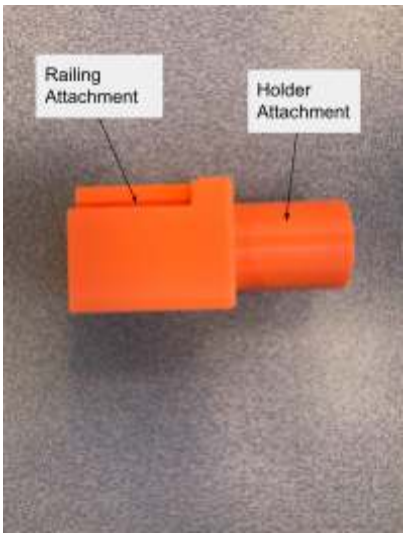


- Updates
    - Increased gap to .25 inches, fit very well despite some warping due to a fault in the print
- Issues
    - When attached to the back umbrella holder is still hard to access for M
    - The angle at which the umbrella holder rests hardly covers M, need to change the angle so that it will cover her
        - Even with the largest umbrella we had, it still hardly covered M
- Future Improvements
    - Change the angle at which the umbrella holder rests at so that it will be able to properly cover M

Prototype 3

Various sides and angles of the prototype
Top, Bottom, Side





Front, Back, and how it attaches to the wheelchair

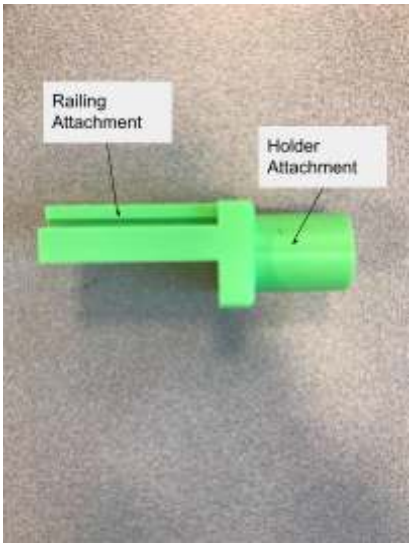



- The umbrella holder in action!
- Updates
    - We adjusted the 3rd prototype to attach to the railing under M's left armrest
    - Umbrella holder is much more accessible than when it was in the back
    - Umbrella is able to cover her much more than when it was attached to the back of her chair
        - Large umbrellas (like the black one) can cover her entire body
        - Smaller umbrellas (like the pink one), which M has, can cover most of her body but her right arm and feet aren't covered that well
            - Additionally, the control panel (the joystick and buttons to control her wheelchair) on her right side isn't covered either
- Issues
    - The portion of the mounting bracket that slides into the wheelchair's railing is not flushed to the end
    - The mounting bracket slides very easily, but that means it can also slide out quite easily as well
        - Want to add more material to make the mounting bracket slide in more snuggly
- Future Improvements
    - Increasing the length of the mounting side of the bracket so it is flushed to the end of the railing on the right armrest

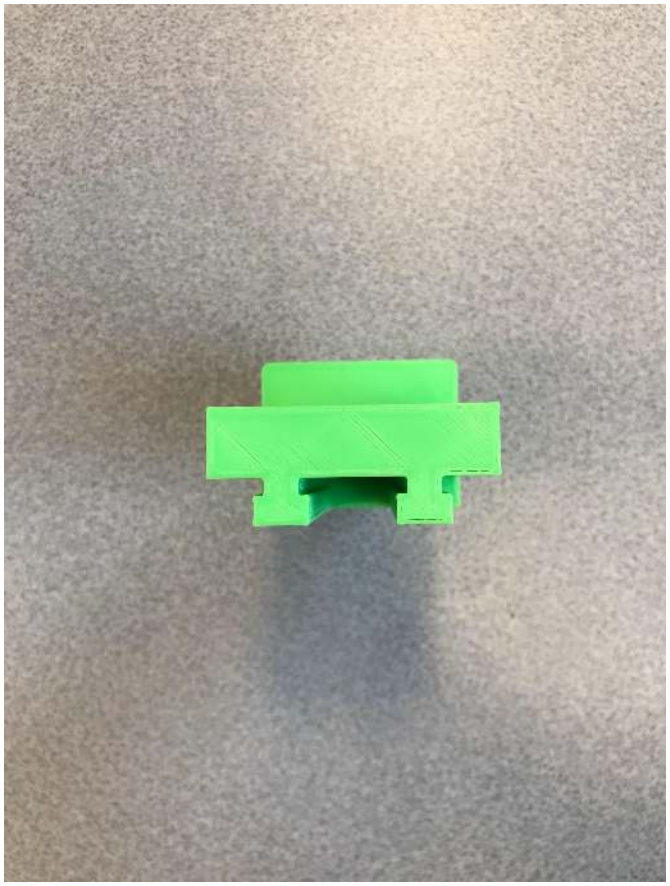
Prototype 4

Various sides and angles of the prototype

Top, Bottom, Side

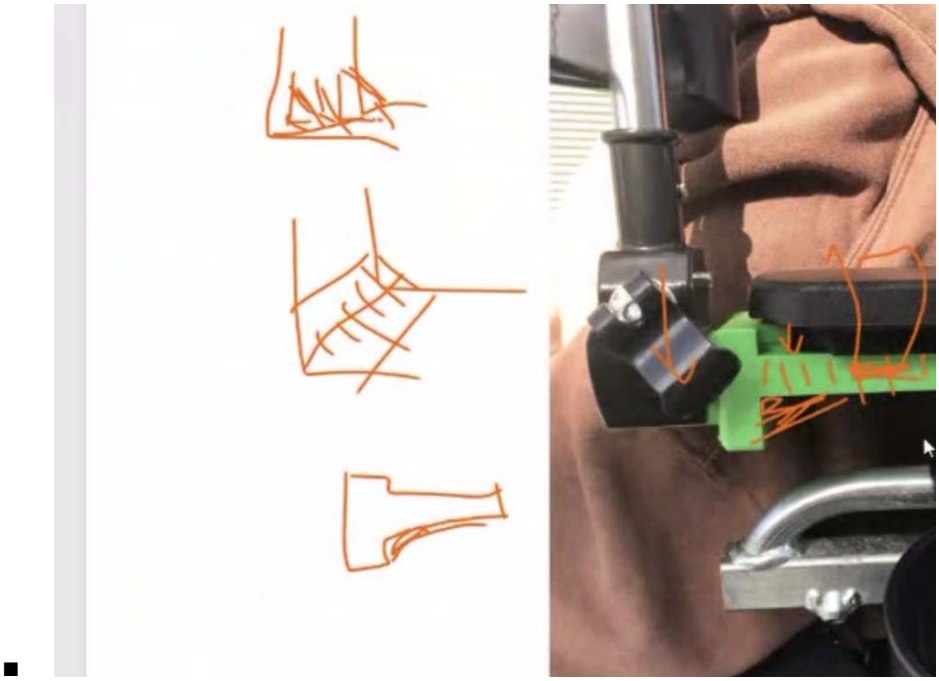


Front, Back



- Updates
    - Removed unnecessary printed material from the previous prototype
    - Increased the length of the portion that would attach to the railing of the wheelchair's armrest
    - The umbrella holder on the holder attachment can be angled, so that the umbrella can cover the right side of M.
- Issues
    - The prototype is a bit too long now, will decrease by ¼" for the next prototype
    - The layers of the prototype and the force applied on the prototype are parallel to one another, thus there is a concern that the structural integrity of the prototype.
        - The 90-degree angle where the railing attachment meets the holder attachment poses a concern about the structural integrity of the holder
    - The railing attachment is slightly loose as it attaches to the railing of the armrest, would like to make it more snug by increasing the width of the railing attachment
- Future Improvements
    - Shorten the length of the railing attachment by ¼"

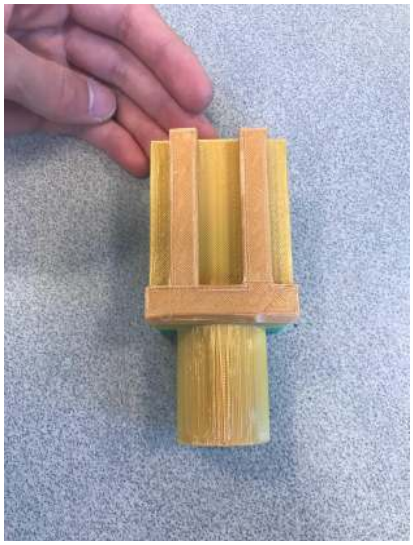
- Add ribs where the railing attachment meets the holder attachment to improve structural integrity

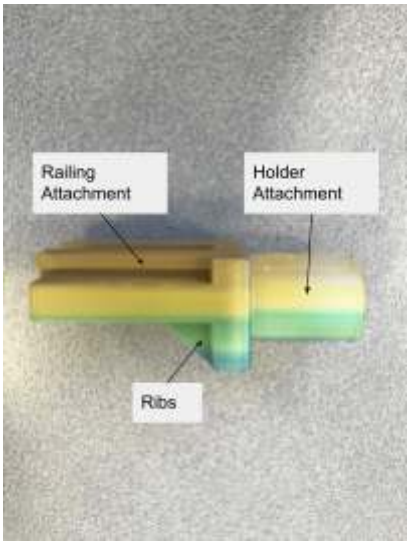


Prototype 5

Various sides and angles of the prototype

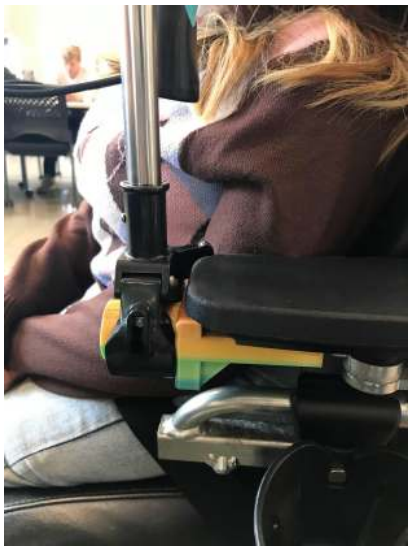
Top, Bottom, Side





Front, Back, Isometric



- Finalized prototype!
- Updates
    - Added ribs where the railing attachment and the holder attachment meet
    - Shortened the length and increased the width of the railing attachment for a better fit
    - Added a drawing of a smiley face to the front and back of the prototype :-)
    - After some practice, M was able to independently use the umbrella holder
        - This includes...
            - Putting and adjusting the umbrella holder on the 3D printed part
            - Attaching and removing the umbrella to the umbrella holder
            - Storing and carrying the umbrella holder and 3D printed part