

3D Printed Laser Tag

By Tyler Edwards

Homemade Laser Tag Guns

Goal: Prototype and print a pair of laser tag guns that can be replicated, to simulate a game from home



Why?

Reasoning

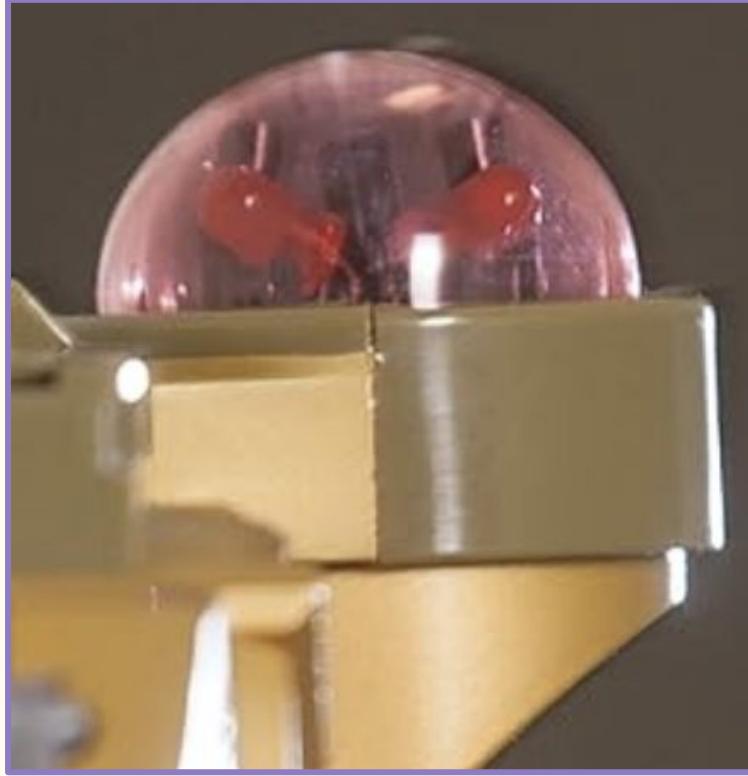
- Laser tag is fun
 - Paintball hurts
 - No cleanup, easy to play at home
- Nostalgia
 - Had these as a kid →
- Laser Quest closed :(
 - More accessible than going out to an arcade / laser tag arena
- Allows for use of programming, modelling, and working with circuit boards



Me as a kid until I left them out overnight in the sun



How do these
actually work?



Sensor attached to gun, w/ LEDs to indicate hits



Trigger to prompt system to fire



Lens + barrel to funnel and aim the laser

Other Features

(might implement later on)



Health bar



On / off switch



Reload button



← why?



Ammo indicator

Shield button
(?)

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Version 1

What hardware
do I have to work
with?

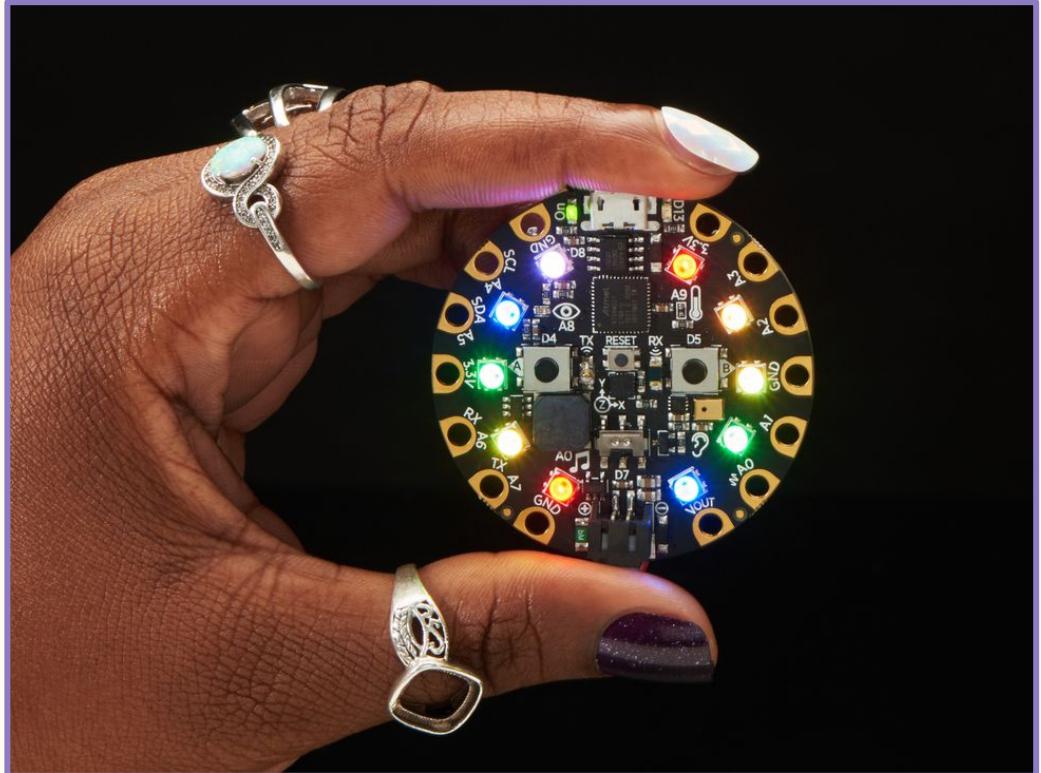
Circuit Playground Express

Main features I'm using:

- 10x NeoPixels to display different colors
- Push buttons
- Infrared receiver + transmitter

Used for:

- Sensor
- “Laser” transmitter
- Hit indicator
- Main circuit board



Credit: <https://learn.adafruit.com/circuit-playground-express-laser-tag>

Prusa MK4 w/ PLA Filament

For printing:

- Frame of the gun
- Trigger

Why PLA?

- Cheap and easy to work with
- Prototype doesn't NEED to be SUPER durable
- Allows for fun color customization



Other Misc. Parts



Button / Switch



AAA Battery
Pack



Alligator Clips



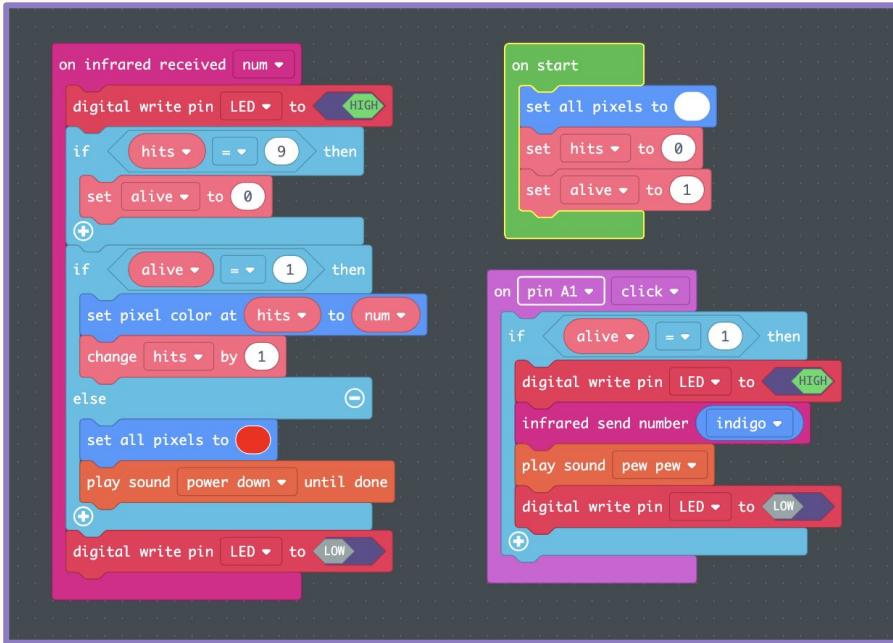
Velcro Strips



Magnet Strips

What software
can I use to code
this system?

Adafruit Makecode



Blocks

(using code below ↓)

<https://learn.adafruit.com/circuit-playground-express-laser-tag/code-the-laser-tag-game>

```
1 network.onInfraredReceivedNumber(function (num) {
2   pins.LED.digitalWrite(true)
3   if (hits == 9) {
4     alive = 0
5   }
6   if (alive == 1) {
7     light.setPixelColor(hits, num)
8     hits += 1
9   } else {
10    light.setAll(0xffff00)
11    music.powerDown.playUntilDone()
12  }
13  pins.LED.digitalWrite(false)
14 }
15
16 input.pinA1.onEvent(ButtonEvent.Click, function () {
17   if (alive == 1) {
18     pins.LED.digitalWrite(true)
19     network.infraredSendNumber(Colors.Indigo)
20     music.pewPew.play()
21     pins.LED.digitalWrite(false)
22   }
23 })
24
25 let alive = 0
26 let hits = 0
27 light.setAll(0xffffffff)
28 hits = 0
29 alive = 1
```

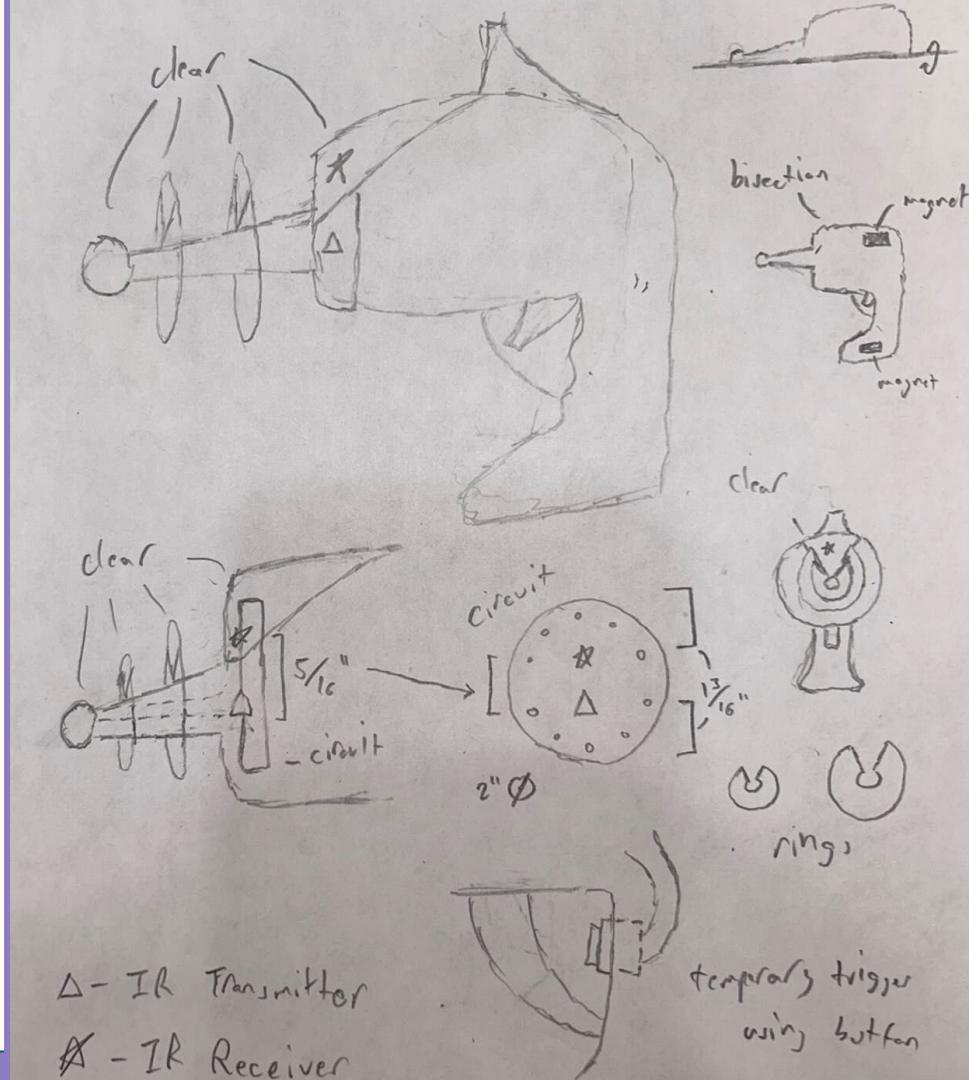
JavaScript

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Sketches & Design Ver. 1

Overall Design

(I did my best w/ the drawings)



△ - IR Transmitter

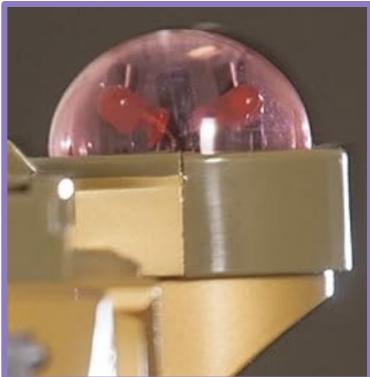
X - IR Receiver

temporal trigger
using button

Sensor

Reference

Clear plastic to allow IR beam to pass through



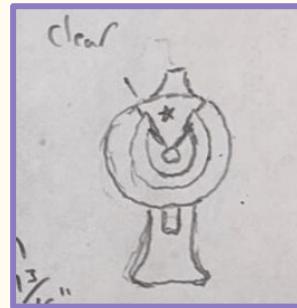
Multiple LEDs
for brighter
light indication

To the side of
the barrel

Colored
plastic to
make hit
obvious

IR light sensor

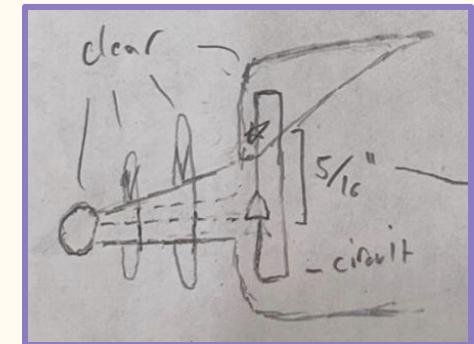
Lights flash
through clear top



Mine

Right above
the barrel

Clear casing to
protect sensors



Size
limitation of
the circuit

IR light sensor

Trigger

Reference

Enough space for finger to comfortably fit inside



Presses into the gun

Bright color makes it easy to locate

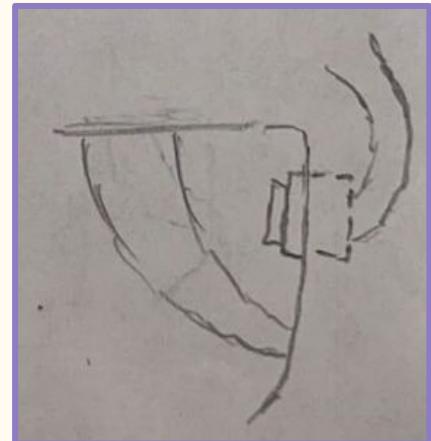
Easy to press and pushes back into start position

Mine

Enough space for finger to comfortably fit inside

Bright color makes it easy to locate

Temporary button in place of trigger



Lens + Barrel

Reference

Long, thin barrel to funnel and aim the IR beam



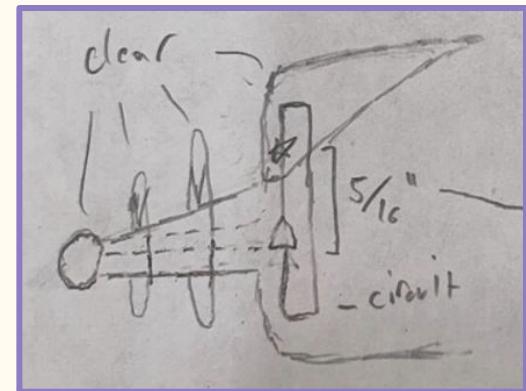
Clear lens to allow beam to easily pass through

Points straight ahead to aim

Ball at end is clear and works as lens

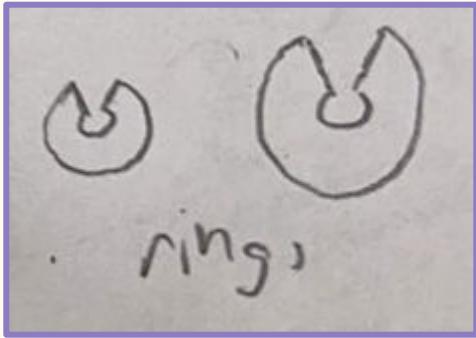
Mine

Long, thin barrel inside the one shape to funnel and aim the IR beam



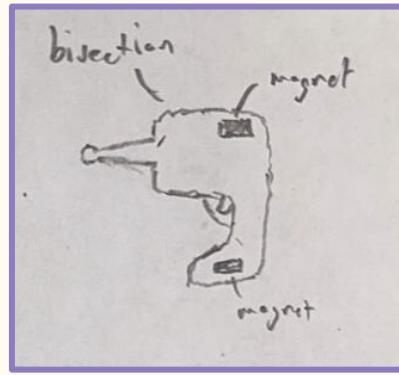
Has to be lower on the front to line up with transmitter

Other Sketch Aspects



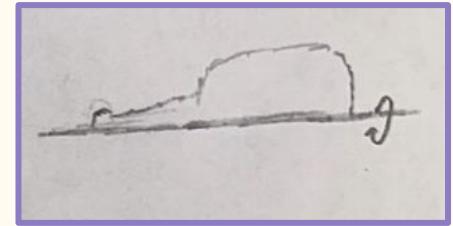
Rings

Goes around small barrel for design with empty space for sensor



Bisection

Will model it this way work on inside, make easier to print, and put magnets to keep two halves together



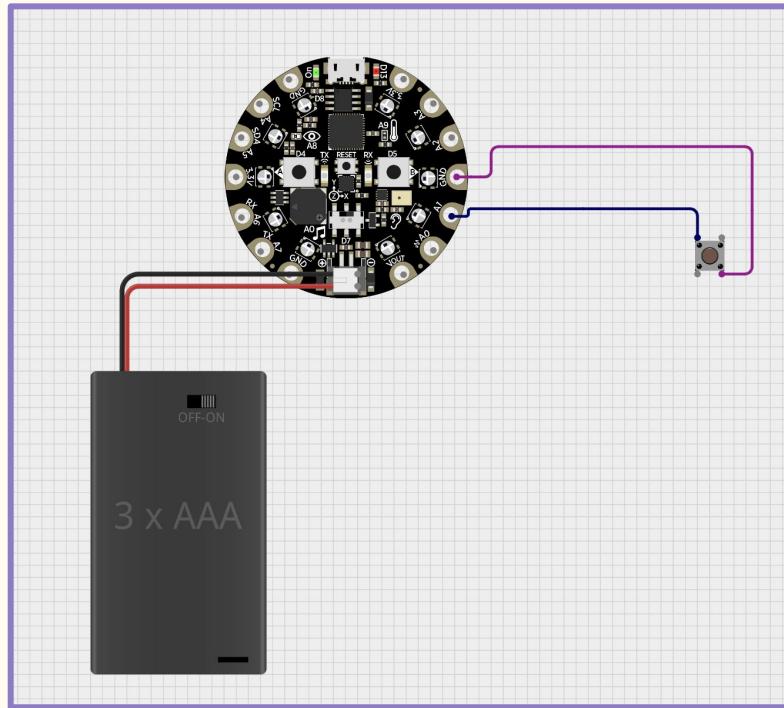
Revolution

General sketch to rotate around axis for the model

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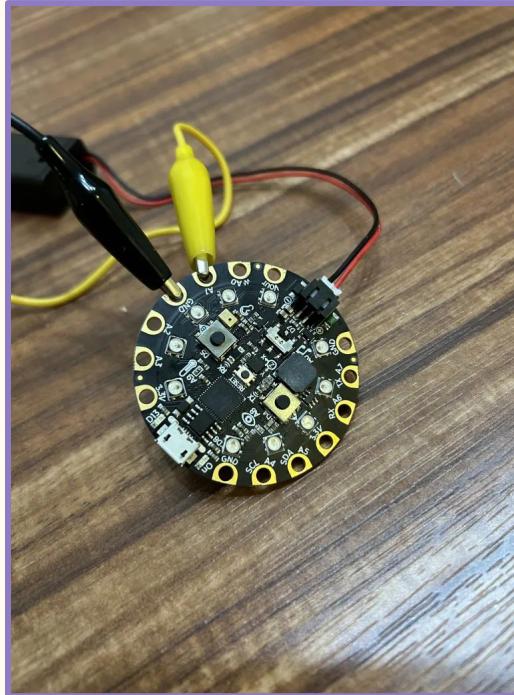
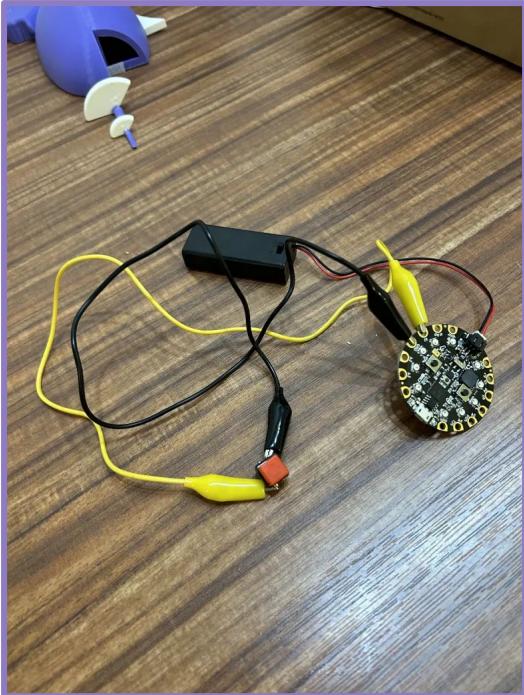
Hardware Ver. 1

Circuit Board Design

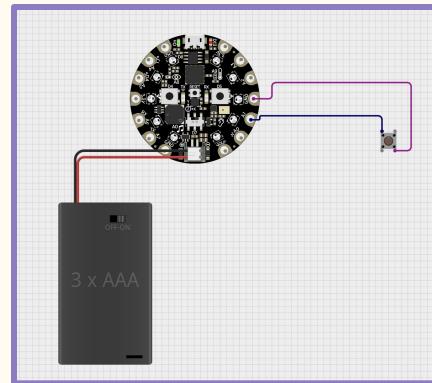
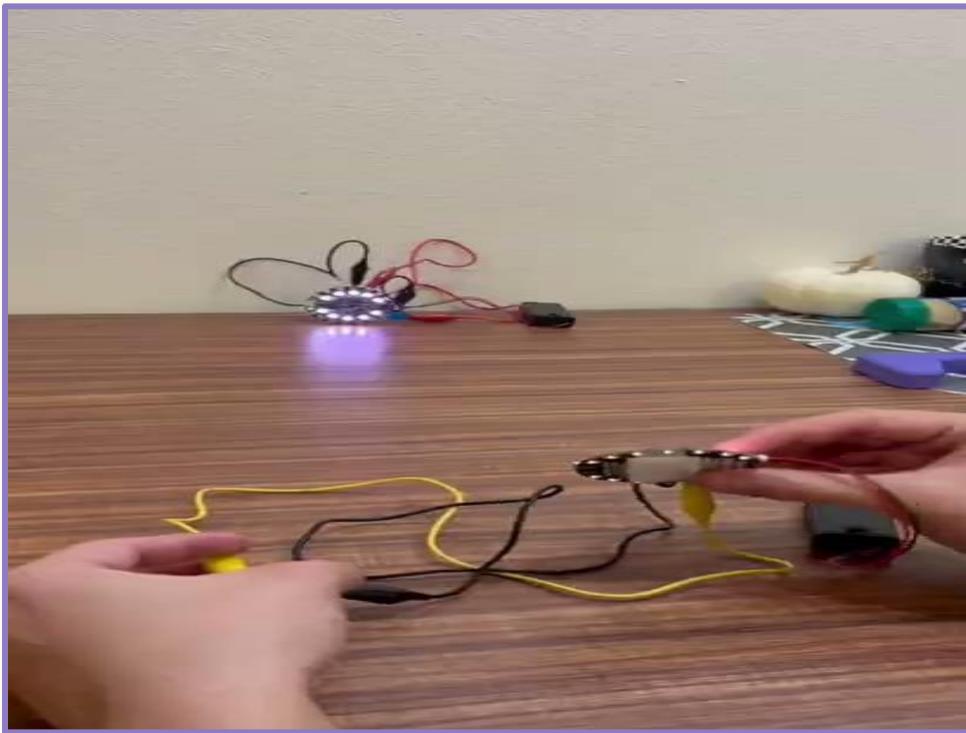


← I don't
know how to
connect a JST
please help

Full Circuit Board



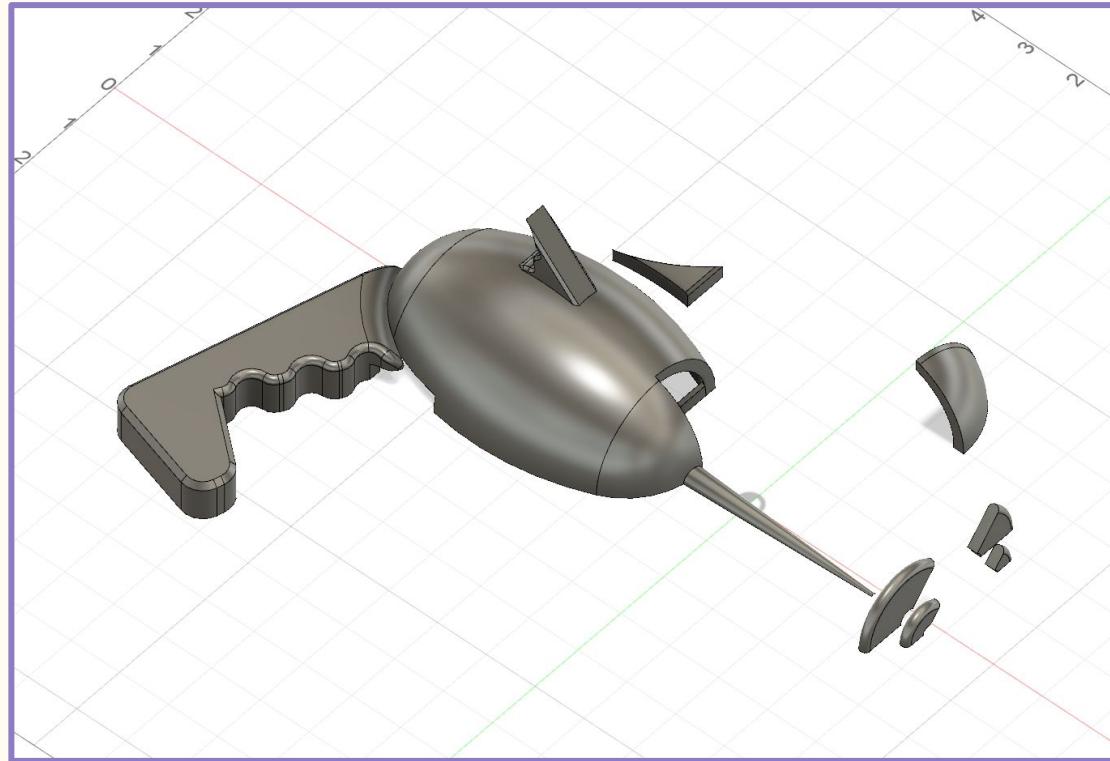
Full Circuit Board



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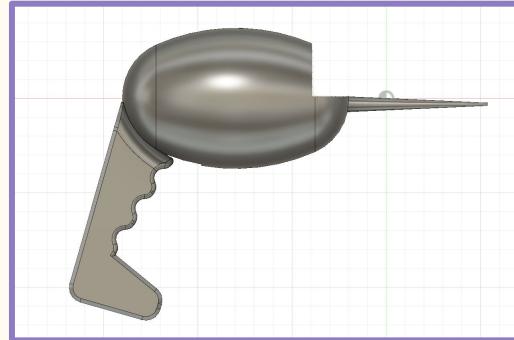
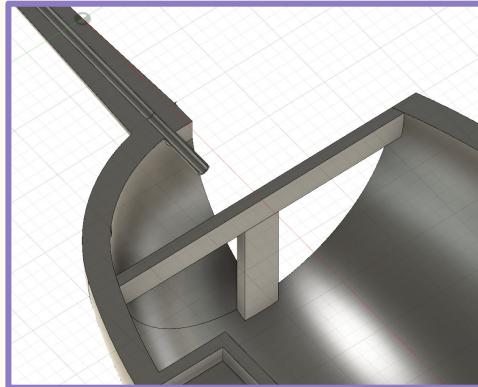
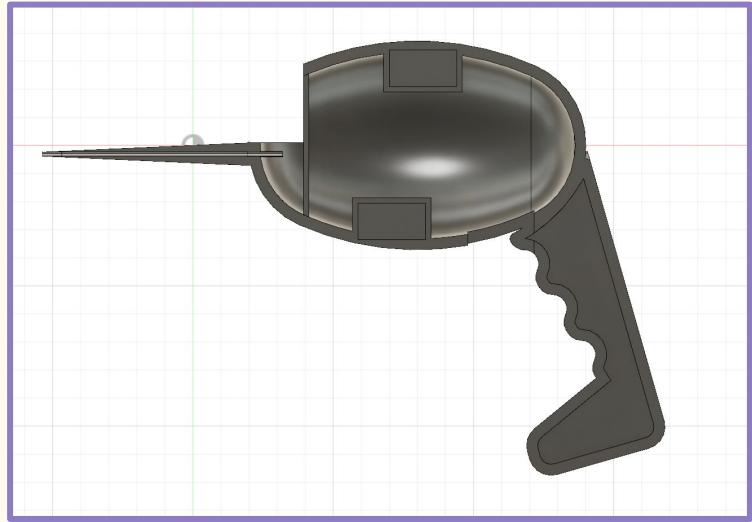
3D Model Ver. 1

Overall 3D Model



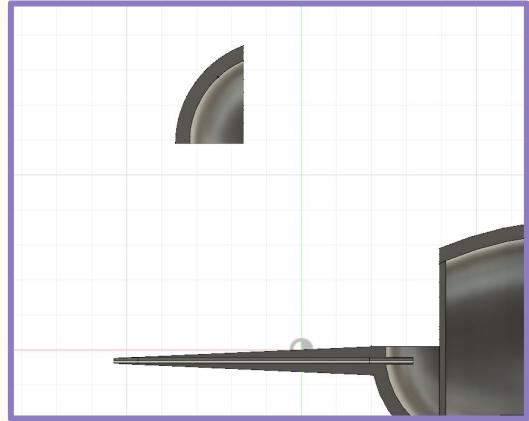
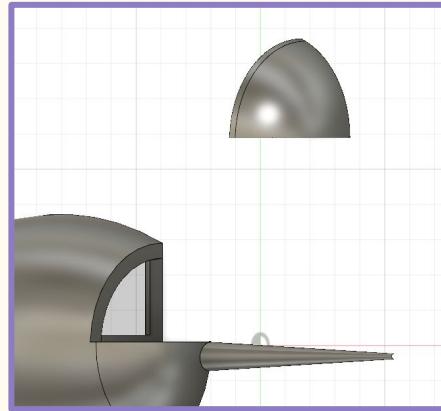
Main Body

- Added an extra spot for magnets in the main part of the frame
- Added a small cross to support the circuit board since the design is more rounded
- Made a small pipe so that the transmitter would carry into the barrel



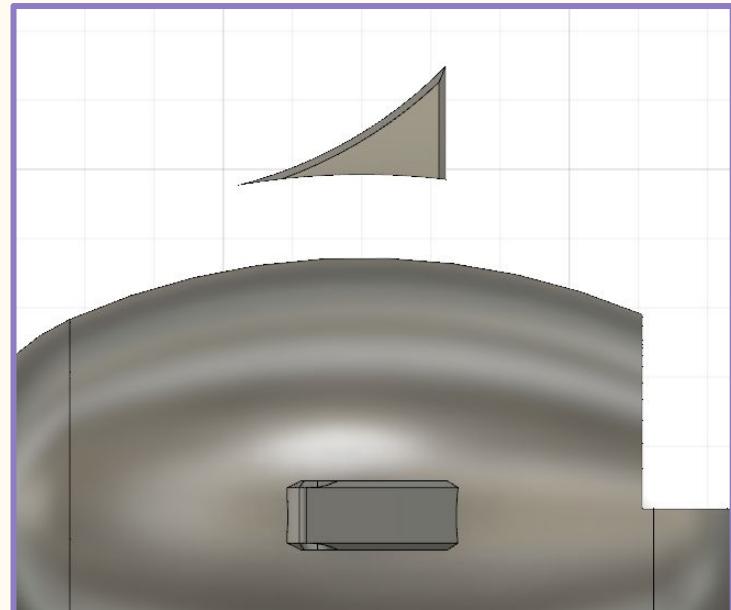
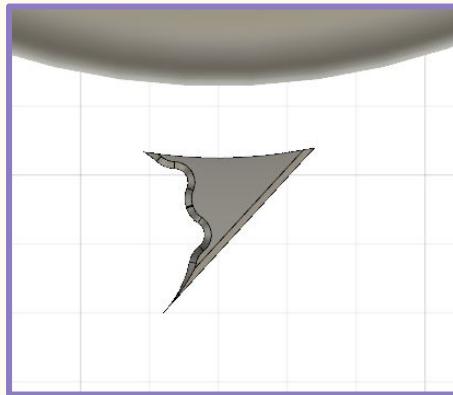
Lid

- Cut it out of the main body
- To be printed in clear
- Worried depending on the material that the IR beam may not go through it



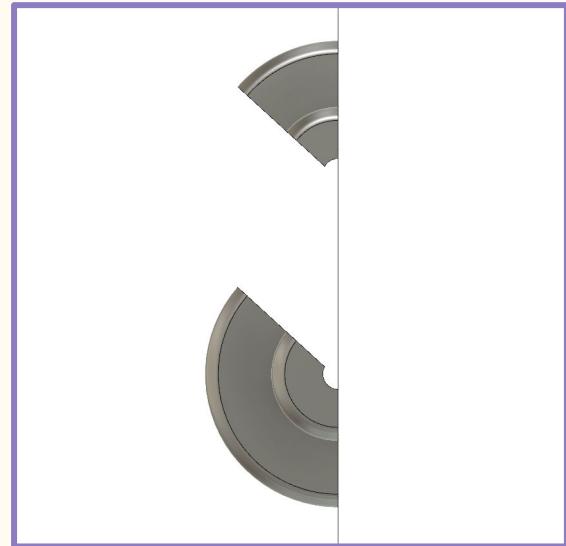
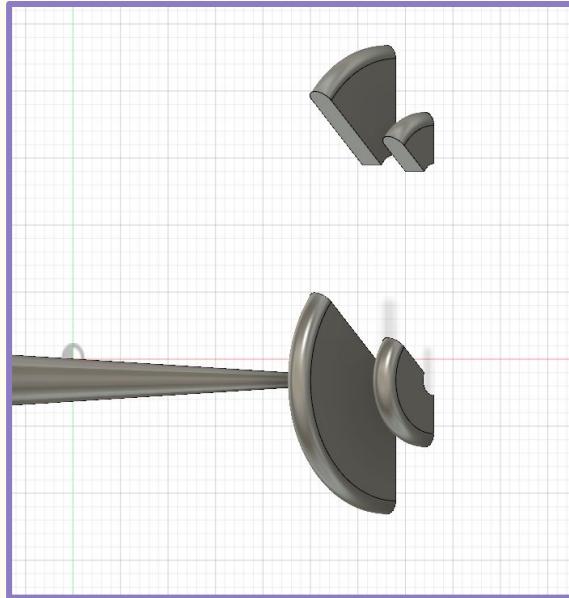
“Scope” and “Fin”

- For design purpose
- Printed in a different color than the main body to accent it



Rings

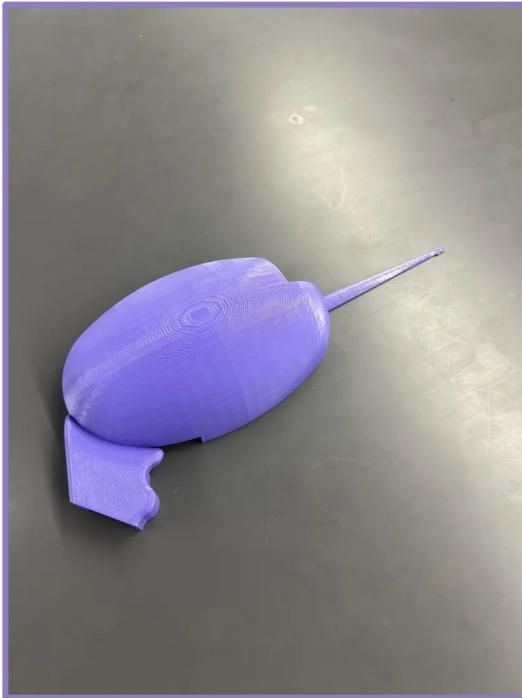
- Once again for design purposes
- Main portion of the ring printed in the same accent color
- Smaller portions are made out of the same clear as the lid



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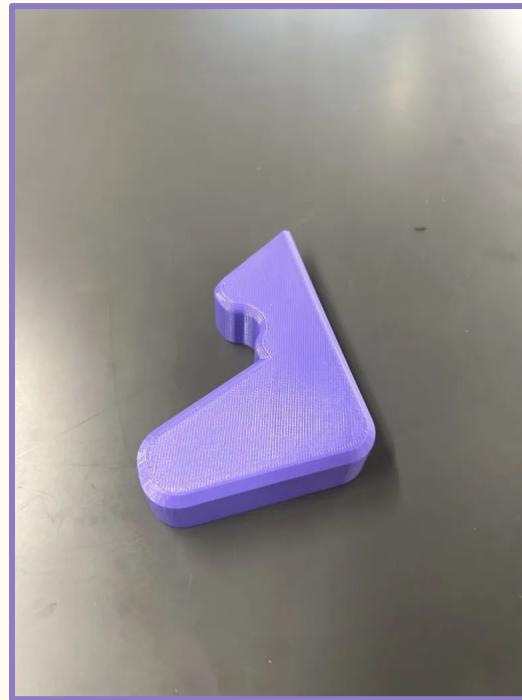
Printed Parts Ver. 1

Main Frame



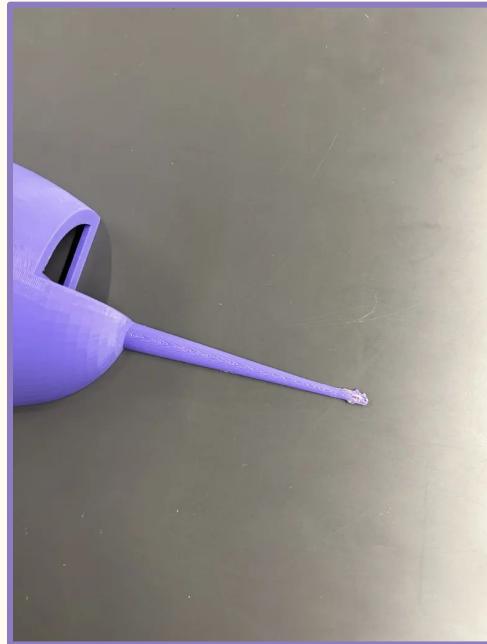
(cut off small half pipe cause it was flimsy and in the way)

Handle



Barrel Issues

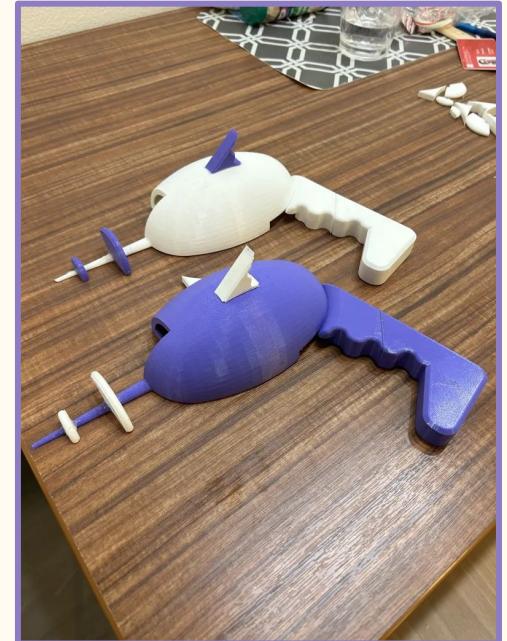
- Printer couldn't handle the super thin tip of the barrel, leading it to melt together and clog up from moving to a new layer before the last is set
 - Ended up cutting off the tip of both



Design Aspects



Putting a Half Together



(rings and scope on top didn't line up)

Handle Issues

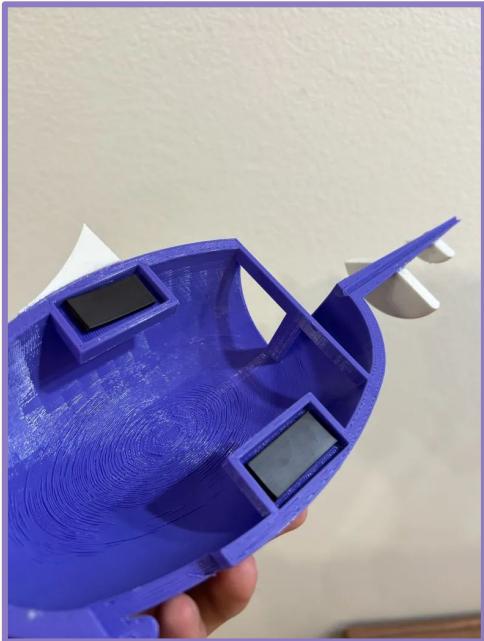


1 Day



(the epoxy glue did NOT stay)

Magnet Strip Issues



10 secs



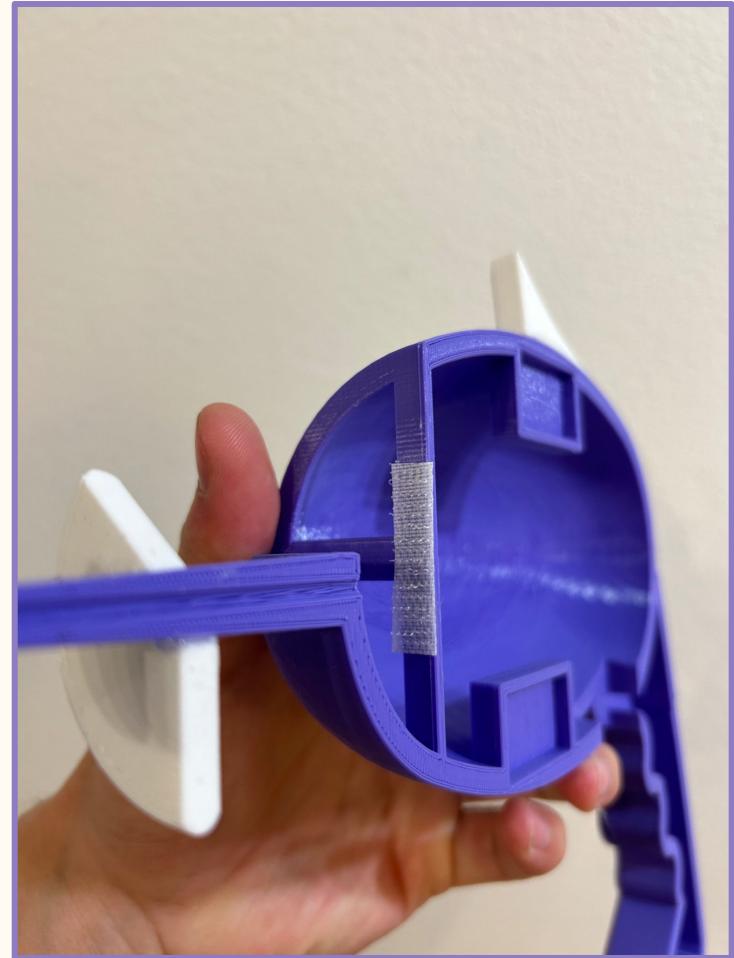
(the magnets were NOT strong enough)

Velcro Strip Temporary Fix



(stacked magnets for another velcro)

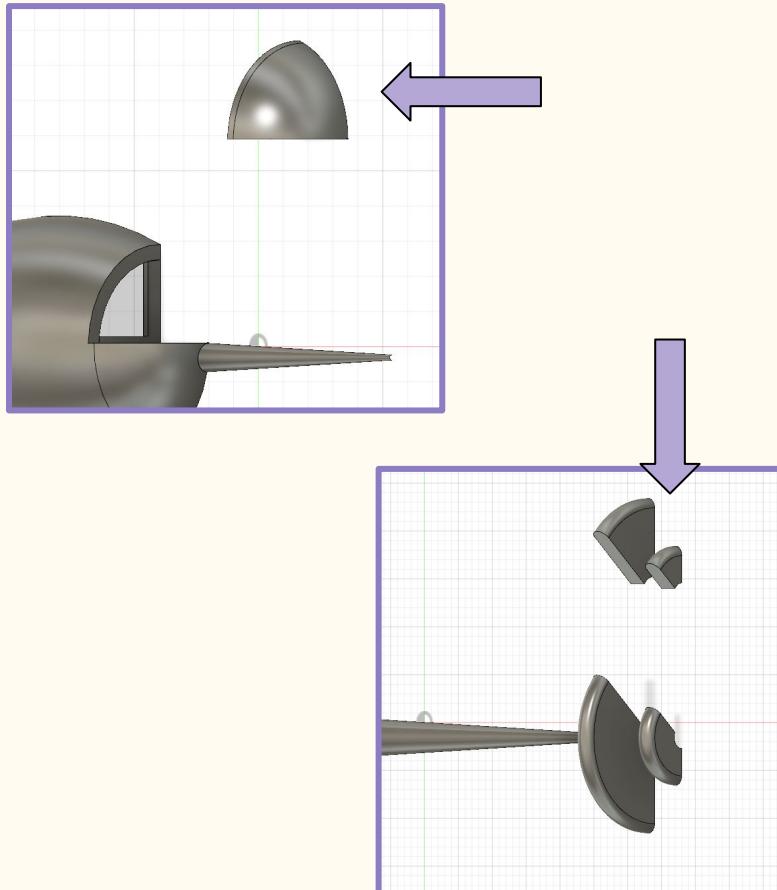
Velcro Strip for Circuit



Putting Halves Together

- Design aspects, back of the handle, and barrel don't line up perfectly with one another
 - Hard to line up with the transmitter





Unused Clear Parts

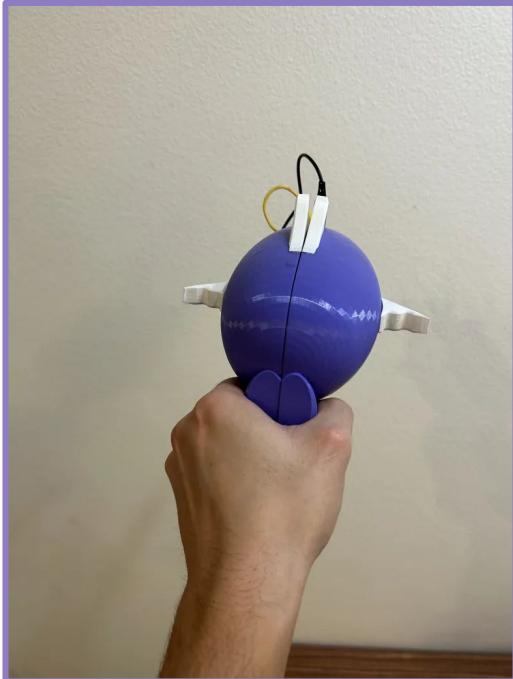
(realized it might cause problems
with the already dicey receiver)

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Complete Prototype Ver. 1

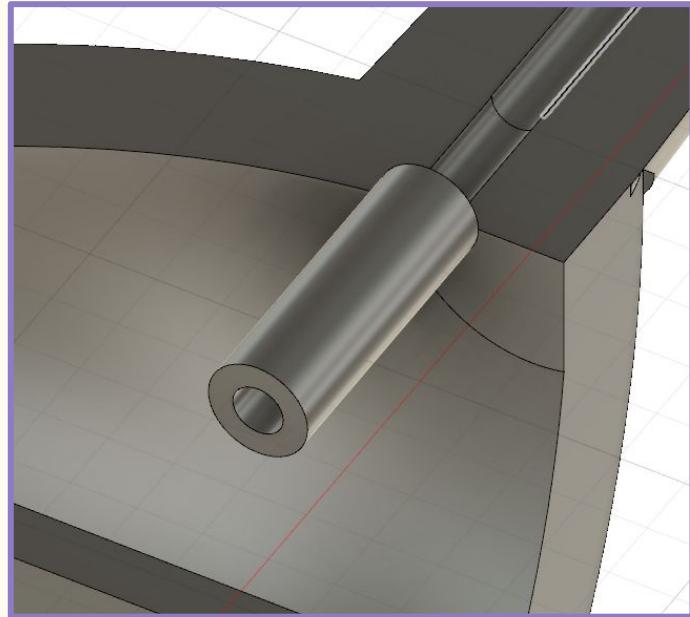
Yay! :)

Everything Put Together



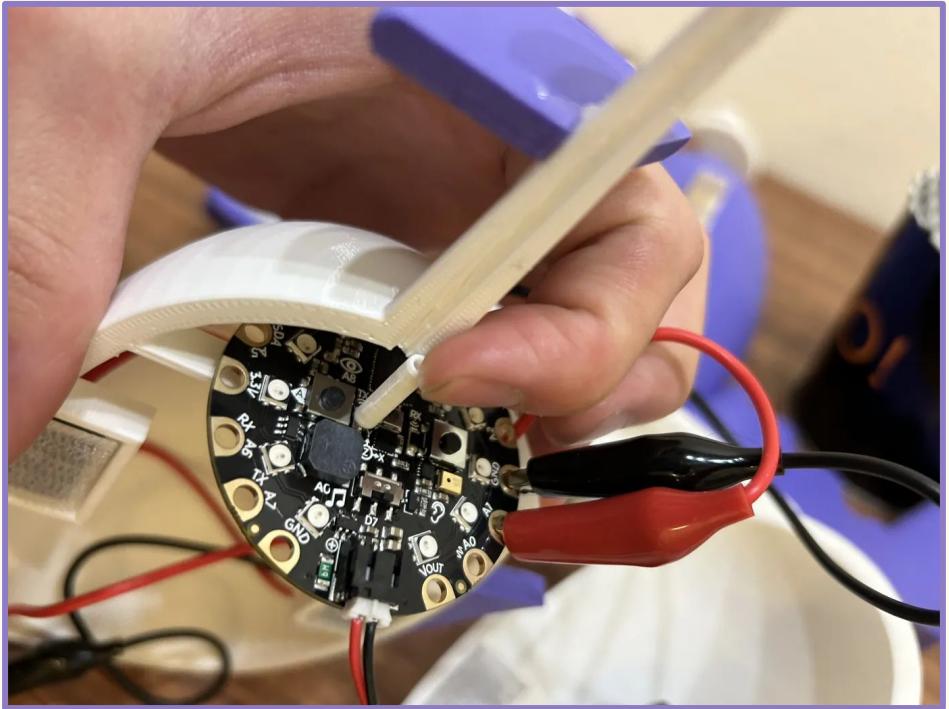
Transmitter to Barrel Issue

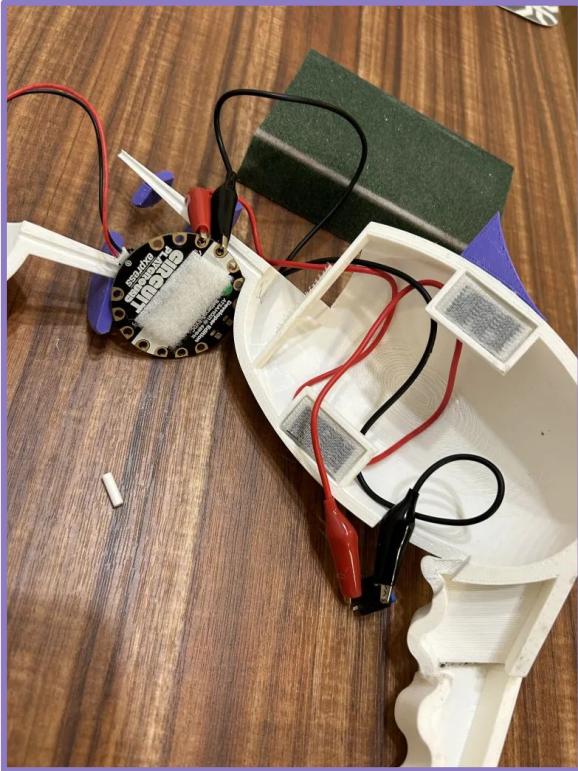
- Since the circuit isn't flush against the front of the gun, the space allows the IR transmitter to either miss or not line up properly with the barrel
- Solution:
 - Built a small, reinforced pipe to add into the preexisting model in hopes of fixing the issues of getting the transmitter to the barrel



First Pipe Issues

(didn't fit with, since I did not
take the velcro into consideration)



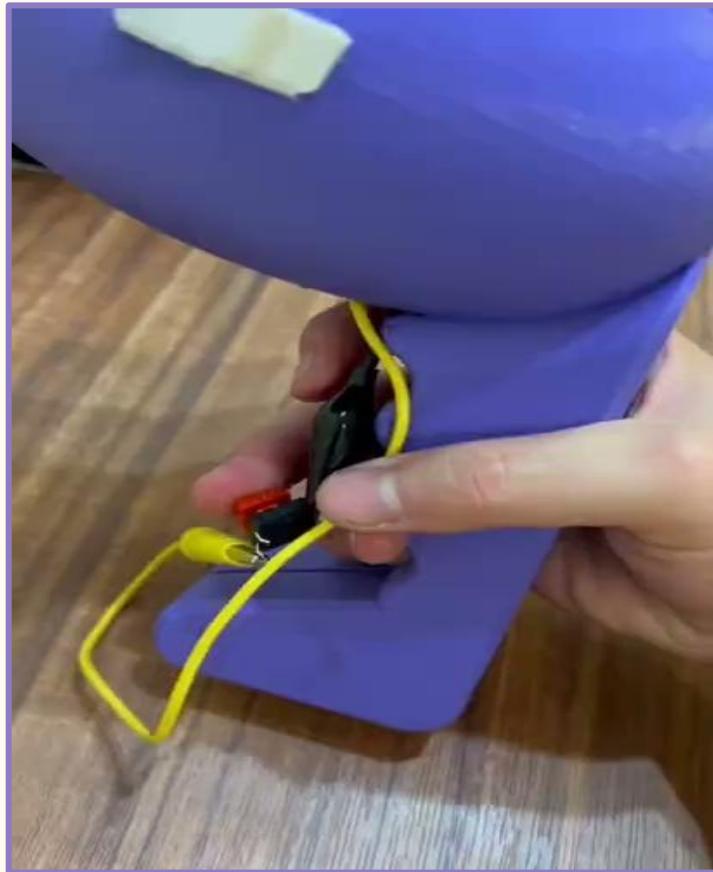


Second Pipe Issues

(epoxy would not hold the piece in place)

Button Issues

(would register at weird times,
when not really pressed down)



Now...

What went well?

Successes

- Hardware and circuits function (mostly) as intended
- Design works well in casing all the hardware parts
- Easily distinguishable between the pair
- Able to work through some of the issues
- Model and all the pieces printed well for the most part
- Doing the 3D model in Fusion did not end up being difficult

MOST OF ALL:

Lot the issues that arose are very clear and can be easily fixed in later versions of the design

What could've
gone better?

Failures

- A LOT
- Hard to access the inputs due to the placement of the support cross
- Gap between barrel and the transmitter made it very hard to line up
- End of barrels didn't print well and covered up the exit
- Button didn't function as I had intended it to
- Two halves didn't line up properly
- Design aspects had no indicators on where they were meant to go, forcing me to eye their locations
- Epoxy and magnet strips both failed me respectively

Dec. 2023

Future Versions

Overall Improvements & Changes

- To Add
 - Trigger mechanism
 - On and off switch
 - More visual design aspects
- To Change
 - Design the inside of the frame to hold the circuits better
 - Make a technical drawing of it to clearly specify measurements
 - Better way to hold the two sides together
 - Instead of two halves maybe a window into the side?
 - Adjust the size and shape of the barrel*
 - For the design parts add a little notch to make sure they line up together*

Having four of the circuits would be nice, since the receiver and the sensor are so close each other

What I Essentially Made:



+



Did this prototype work?

Yes, and No.
(in parts, but not together)
(very clear issues though)

Despite everything, I'm
happy with how Ver. 1
turned out.

:)

Let's go next!

<https://www.thingiverse.com/thing:579088>



Mass produced ornaments for my family while I was designing

Merry Christmas!

Dec. 2023

End of Ver. 1
