Cuff-Link™

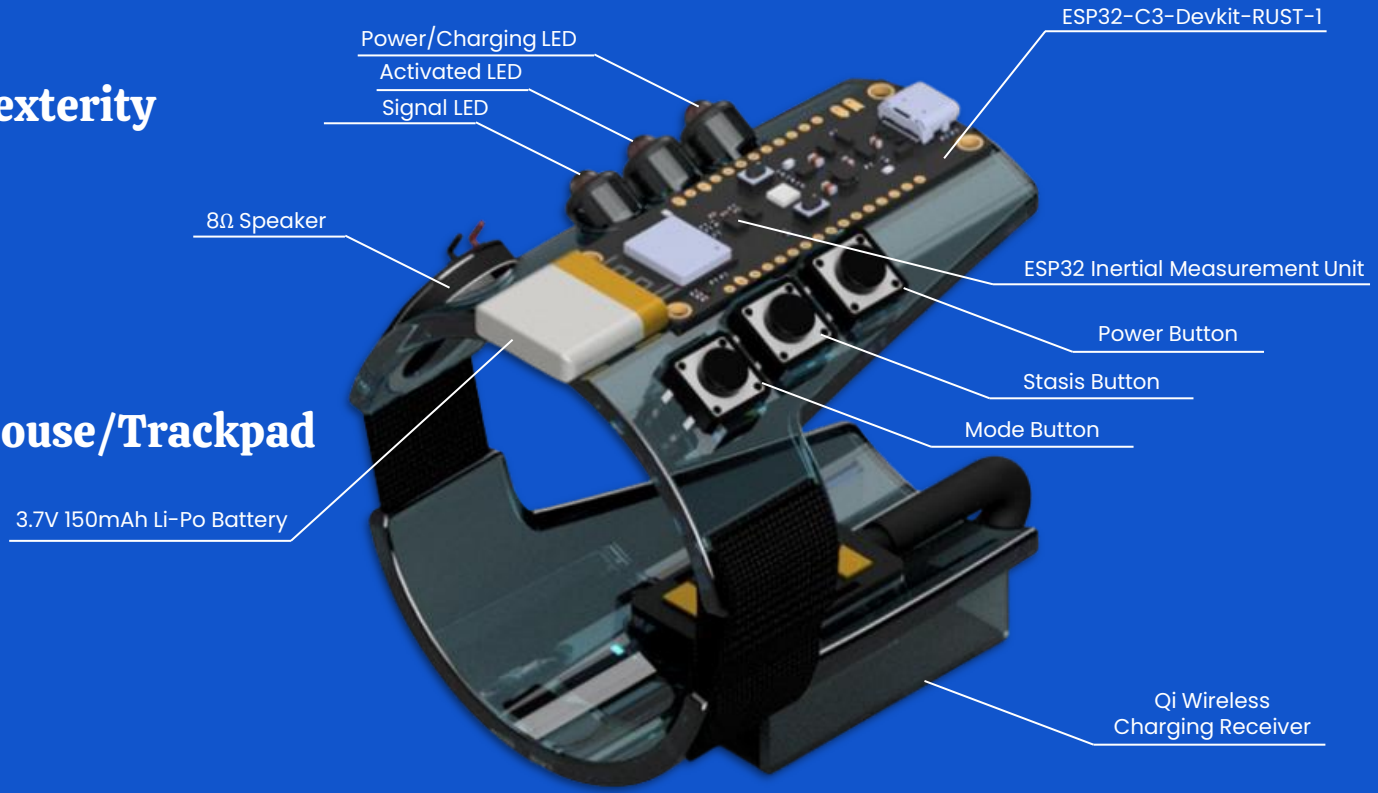
Milestone 6
Blue Team ‘24

Problem Statement

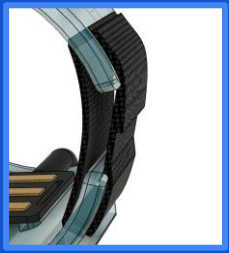
In North America, 58 million people experience limited hand mobility[1], obstructing access to most consumer technologies[2].

The Cuff-Link

- ➔ **Designed for Low Dexterity**
- ➔ **Wide Market**
- ➔ **Affordable Pricing**
- ➔ **Competitive with Mouse/Trackpad**



User Interaction Storyboard

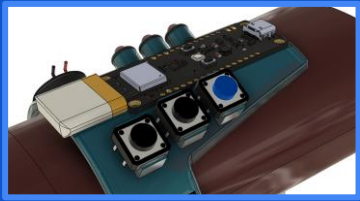


Unhook adjustable velcro strap

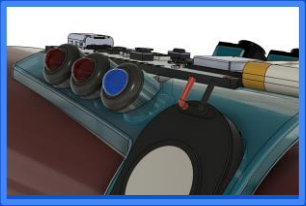
Loosen Cuff-Link to fit around wrist

Place Cuff-Link around wrist

Tighten velcro straps and ensure EMG is flush with skin



Select Power button to connect to Bluetooth



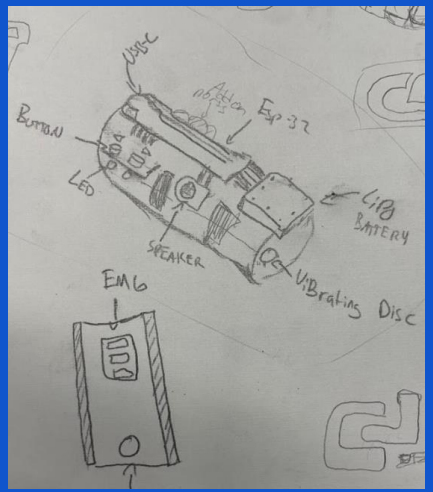
Ensure signal LED is turned on when selected

Development Progress

Our design shifted greatly over time to include:

1. **A ring module for more accurate IMU performance**
2. **Modified velcro and elastic for accessibility and electrode contact**
3. **BLE integration**
4. **Flex PCB (next slide)**

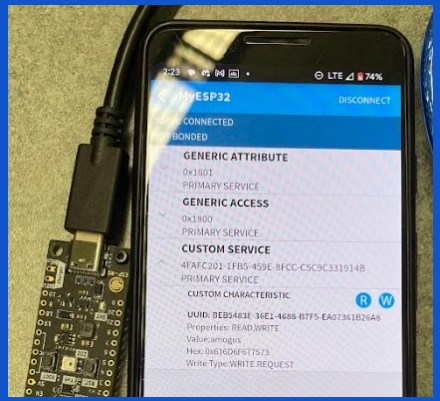
Our original concept



1 - Ring module

2 - Accessible velcro & elastic

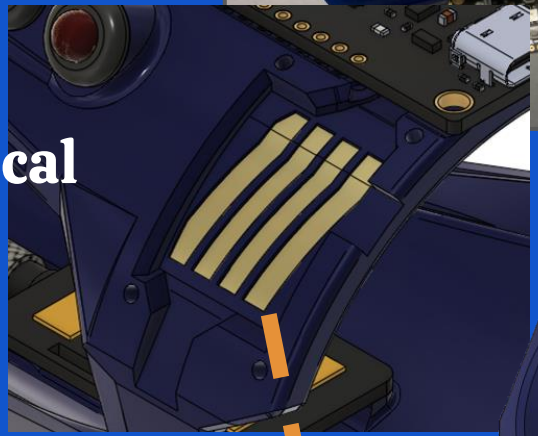
3 - Bluetooth Low Energy



Electronic Design

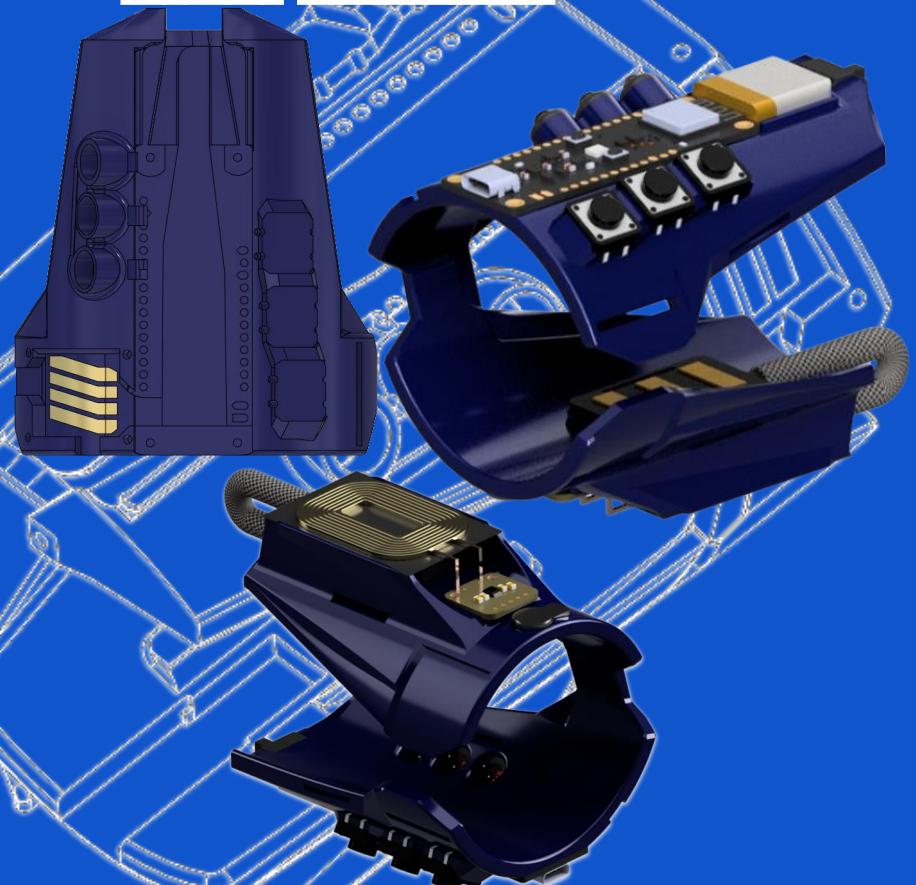
Instead of using bulky cabling, we opted for a multi-layered PCB integrated into the Cuff-Link using copper and electrical tape.

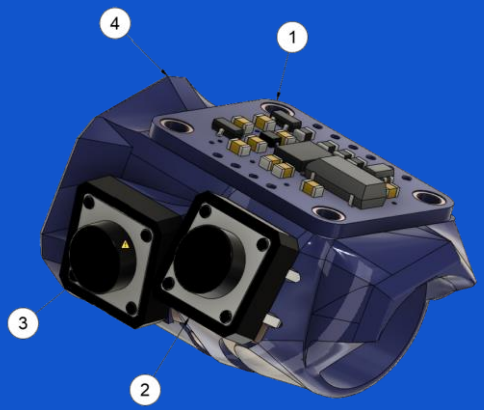
This creates a DIY PCB underneath the ESP32 that flexes with our TPU.



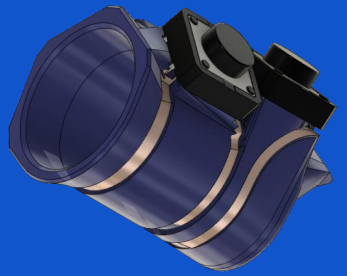
Copper!

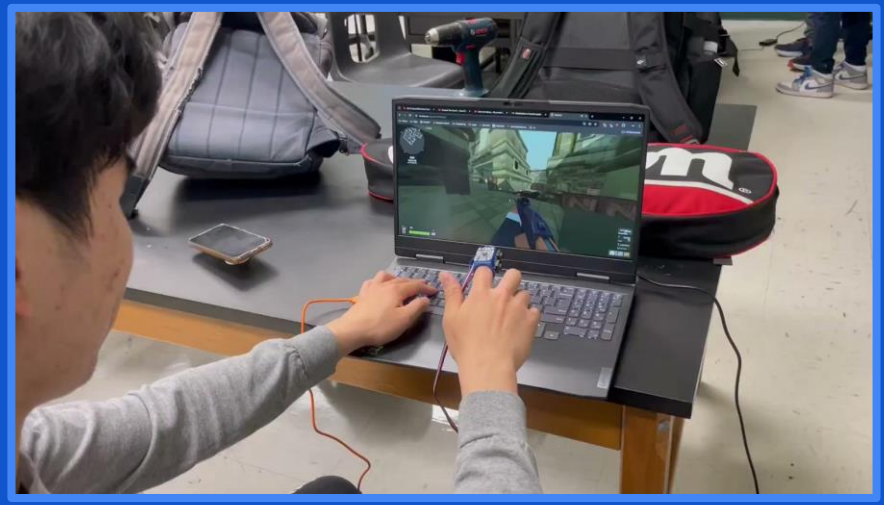
Final Product





Parts List	
Item	Part Name
1	2472 BNO055 Breakout v3
2	Left Click 12mm Tactile Button
3	Right Click 12mm Tactile Button
4	Ring





Testing Results

Comfort Rating: 7.7/10 (± 1.2)

IMU Test: Cuff-Link vs. Trackpad

Cuff-Link

rank	speed (ms)	accuracy
#1	684	89%
#2	709	100%
#3	751	89%
#4	783	100%
#5	1038	100%
#6	1040	80%
#7	1043	100%
#8	1057	89%

Trackpad

rank	speed (ms)	accuracy
#1	765	100%
#2	748	100%
#3	768	100%
#4	733	80%
#5	764	100%
#6	893	73%
#7	812	89%
#8	789	89%

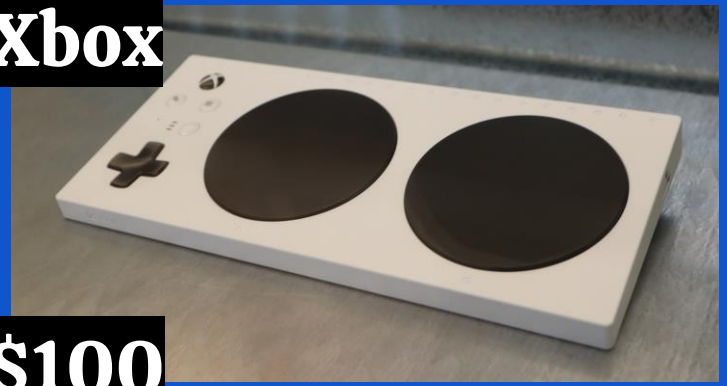
Mean Difference (Trackpad - Cufflink): 126.54 ms

Top 3 testers scored FASTER using the Cuff-Link

Cost of Production

$19.95 - ESP32-C3-DevKit-RUST-1
$49.50 - SEN0240 EMG Sensor
$29.95 - Adafruit 9-DoF IMU
$4.24 - 3.7V 150mAh Li-ion Battery
$7.95 - Arduino DRV2605L Haptic Motor Controller
$1.95 - Vibrating Mini Motor Disc
$0.75 - Tactile Switch Buttons (3x)
$0.57 - 5mm Plastic Bevel LED Holder (3 LEDs)
$0.48 - 5mm Red LED (3x)
$1.32 - Overture TPU Blue Filament (47 g)
$0.67 - Hook-and-Loop Cable Tie (2.7 in.)
$14.95 - Adafruit Qi Wireless Receiver

Total: $132.28



Retail Price: $159.99

References

1. Dyson Canada. (n.d.). *Canadian Engineer's device helps patients with limited hand mobility paint and draw.* Dyson.com. https://www.dysoncanada.ca/en/discover/sustainability/james-dyson-award/guided-hands
2. "Computer Access - Motor Dexterity." Washington Assistive Technology Act Program, U of Washington, 2023, watap.org/tourofat/computer-access-motor-dexterity. Accessed 17 Oct. 2023.