Gesture Control Remote V1 – Build Instructions

The gesture control remote is built around the M5StickC microcontroller, which is powered by an ESP32 PICO chip. In this initial iteration of the gesture control remote, the M5StickC PCB is stripped from its original housing and installed in a 3D printed housing with additional components.

Bill of Materials:

For this project, electronic parts were primarily sourced from Digikey, a sponsor of the Hackaday Dream Team projects.

#	Quantity	Digikey Part Number	Description	Unit Cost	Cost	
1	1	2221-K016-D-ND	M5STICKC WITH WATCH ACCESSORIES	$ 12.88	$ 12.88	**A**
2	1	1568-1492-ND	BATTERY LITHIUM 3.7V 1AH	$ 9.95	$ 9.95	
3	1	1568-1083-ND	BREADBOARD GENERAL PURPOSE PTH	$ 2.95	$ 2.95	**B**
4	1	1597-1200-ND	VIBRATION ERM MTR 12000 RPM 3V	$ 2.55	$ 2.55	**C**
5	1	2N7000FS-ND	MOSFET N-CH 60V 200MA TO-92	$ 0.36	$ 0.36	
6	1	BC3919CT-ND	RES 10K OHM 0.4W 1% AXIAL	$ 0.21	$ 0.21	
7	1	1655-1893-1-ND	DIODE SCHOTTKY 30V 1.1A DO41	$ 0.17	$ 0.17	
8	1	450-1650-ND	SWITCH TACTILE SPST-NO 0.05A 24V	$ 0.10	$ 0.10	
9	4	-	M2 SCREWS, 10 MM LENGTH	$ 0.05	$ 0.20	
10	1	2221-C008-ND	ATOM LITE ESP32 DEV KIT	$ 6.19	$ 6.19	**D**
11	1	2057-CA-USB-AM-CM-3FT-ND	USB 2.0 A MALE TO TYPE C MALE, 3	$ 2.67	$ 2.67	**D**
					$ 38.23	

BOM NOTES:

A: Kit includes microcontroller, watch strap, and USB-C cable

B: Similar part sourced from local store: https://www.canadarobotix.com/products/588

Discrepancy in dimensions may require adjustments in CAD files.

C: Similar part sourced from local store: https://www.creatroninc.com/product/full-size-breadboard-fr4-prototyping-board/ A section was cut off from a large prototyping board in the build assembly below. Discrepancy in thickness may require height offset for tactile switch in CAD files.

D: Used for device receiver

Consumable materials:

- Hookup wire
- Solder wire
- 3D printing filament
- Crazy Glue / Epoxy

Helpful Tools:

- Soldering Iron
- Flush Cutter
- Wire Stripper
- Tweezers
- Allen Keys
- Sandpaper
- 3D Printer
- Screwdriver
- Scalpel

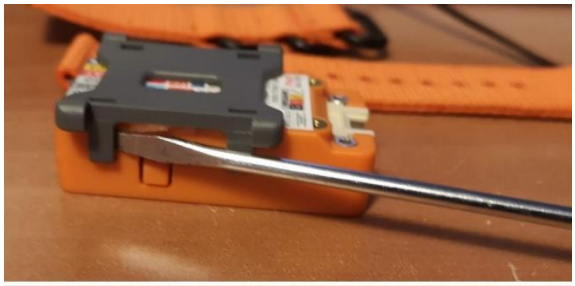
Assembly Procedure:

A. M5StickC Teardown
B. Soldering
C. 3D Printing and Final Assembly

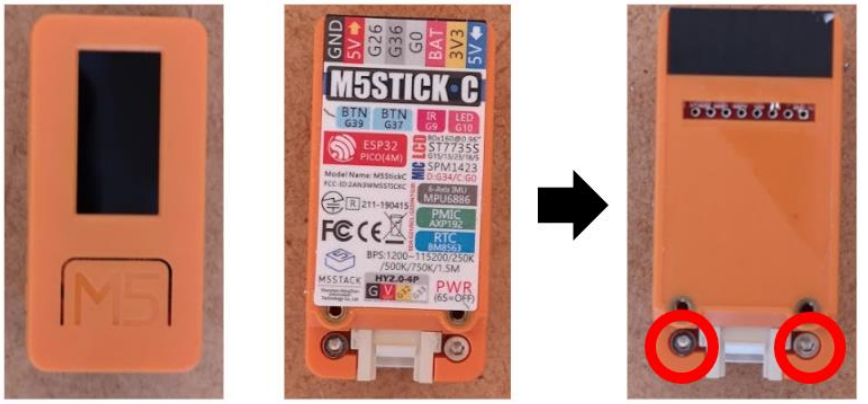
A) M5STICKC TEARDOWN

1. The M5StickC kit comes with the microcontroller, a USB cable, a watch strap, and some grey, plastic parts that will not be used for this device.

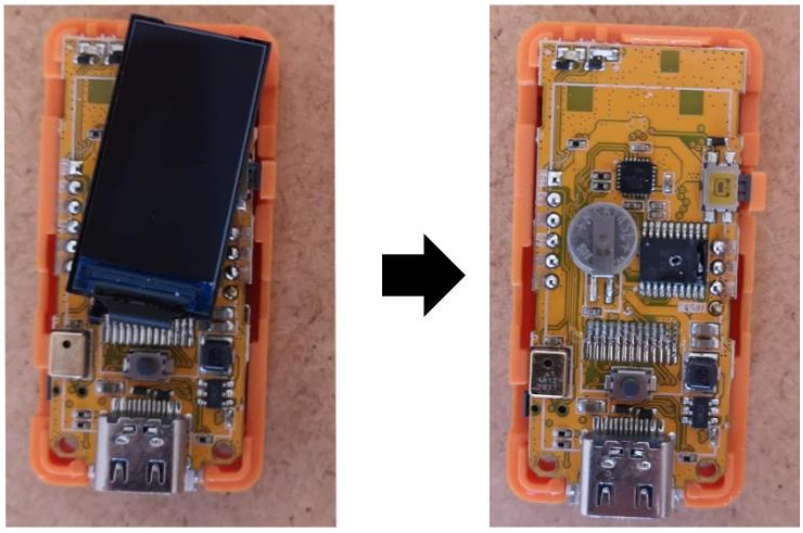
2. Using a flat screwdriver (or some other flat tool), disassemble the watch straps and the grey plastic part from the M5StickC unit.



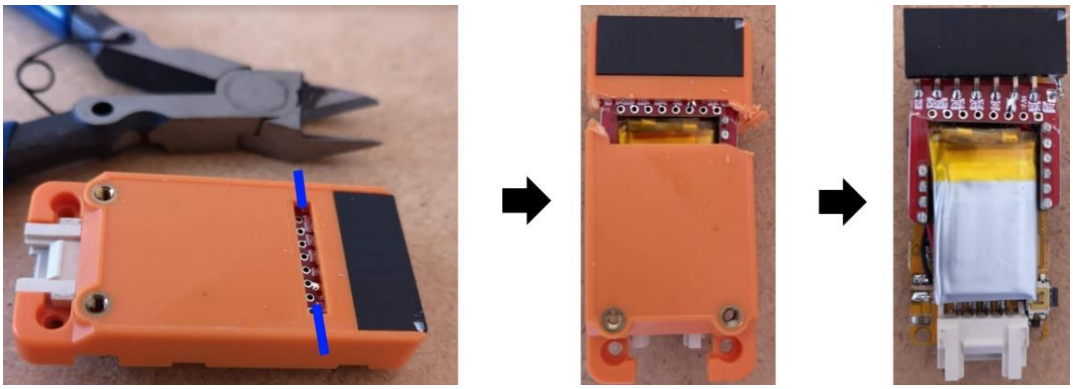
3. Take the M5StickC unit and peel the sticker from the back. Using an Allen key, unscrew the two screws located on the back of the device (circled in red) and remove the top cover of the device. Keep the screws as they will be re-used in the final device.



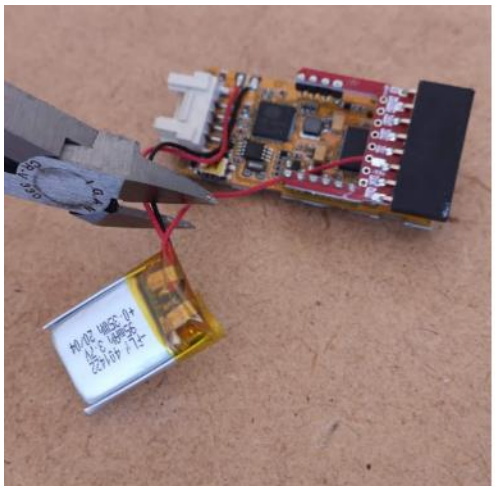
4. The LCD screen won't be used in this device. Tear away the LCD screen. (The pins driving the LCD will be disabled in the firmware.)

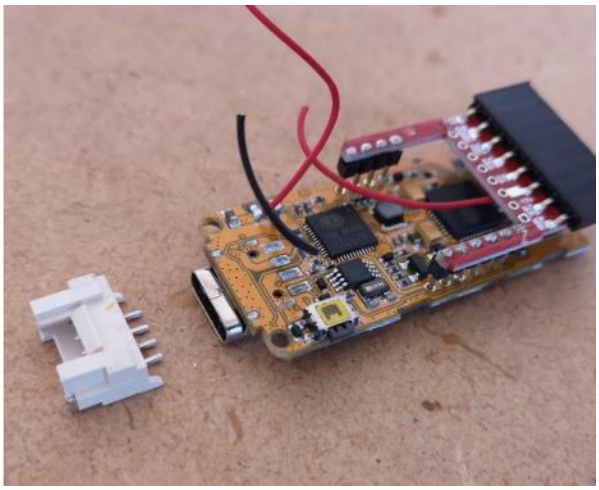


5. Using a flush cutter, cut away the orange housing from the PCB (along the blue lines).

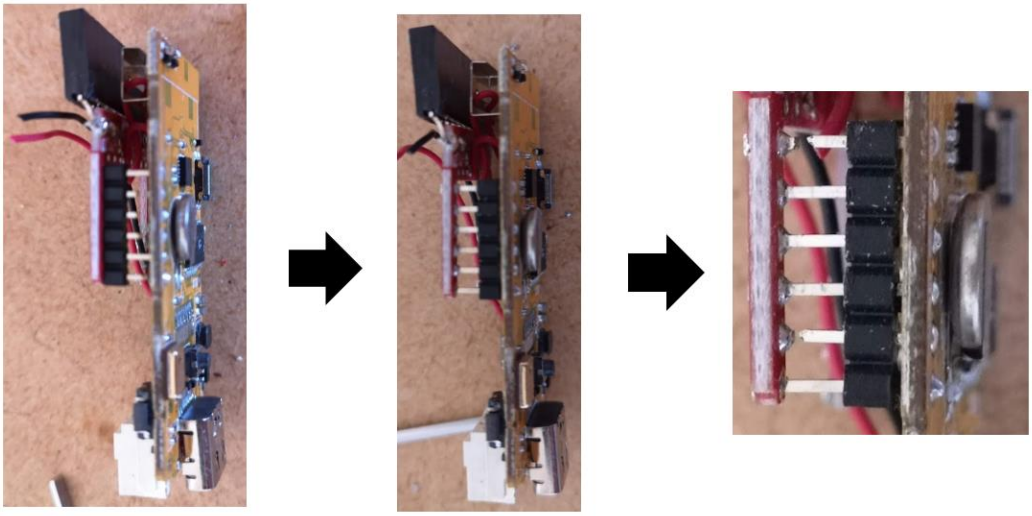


6. Remove the battery (will be replaced) and the grove port (causes interference). Remove the battery and trim the three wires to detach it. Bend the grove port upwards to break it away form the pin. (The images in step 7 and 8 show the grove port still attached, which was removed after.)





7. Separate the red PCB from the header pins. Using a scalpel or razor blade, separate the black plastic body from the red PCB and slide it down so it is touching the orange PCB. Do this for both sets of header pins. Keep the black plastic as it will be used as a spacer for the new PCB protoboard to rest on. Using a flush cutter, cut off the top of the header pins to detach the red PCB from the orange PCB.



SLIDE DOWN THE BLACK PLASTIC BODY TO TOUCH ORANGE PCB

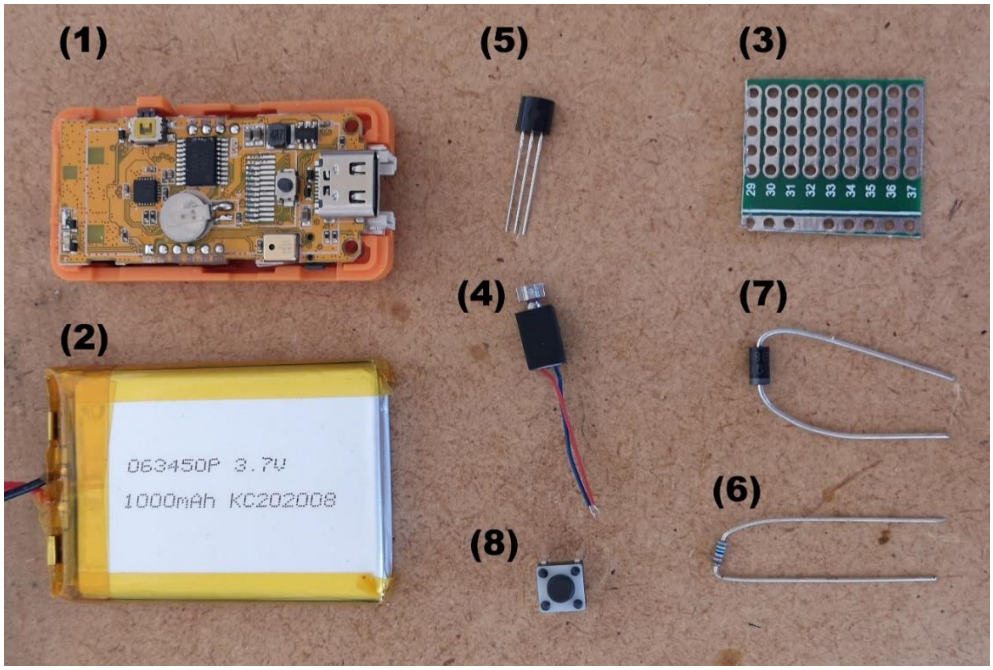
TRIM OFF TOP OF PINS AND REMOVE RED PCB

8. The PCB prototyping board that was chosen was a different pitch than the header pin spacing on the orange PCB. To accommodate, most unnecessary pins were trimmed away. In the picture below, the two pins on the top side are the important pins. Two pins are kept on the bottom side are not used, but will be soldered to the new PCB prototyping board for support.

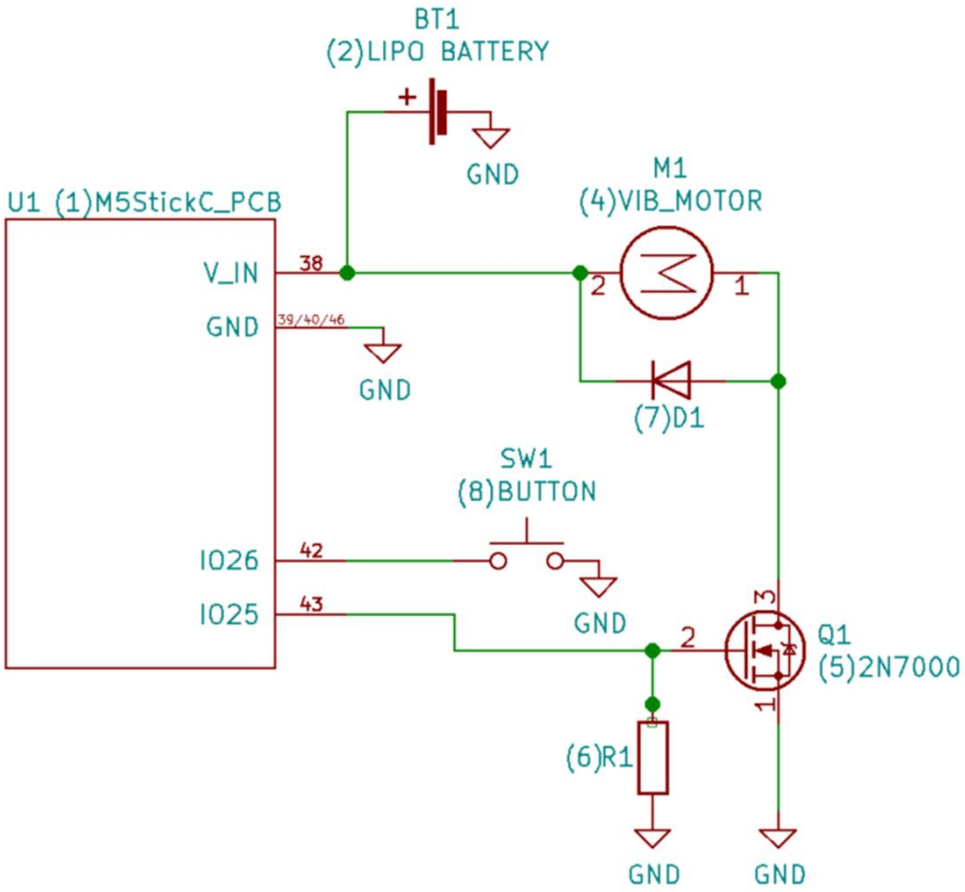
Once this is done, the PCB is ready for the next step to solder the extra components. To summarize, the M5StickC PCB, 2 watch straps, 2 screws, and the USB cable need to be kept from the M5StickC kit.

B) SOLDERING

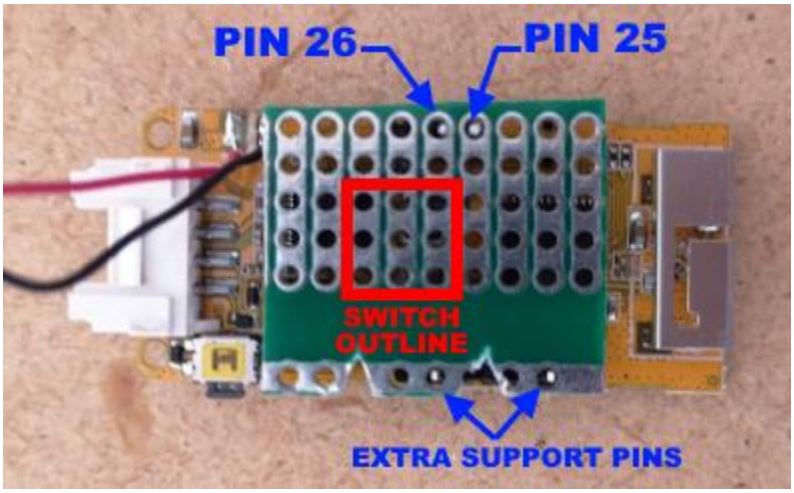
BOM: From the BOM, components 1-8 are used in this step and shown in the image below. The PCB protoboard used here was about 1 mm thick, had 5-hole strips, and cut to size to fit the width of the M5StickC PCB.



Schematic Diagram: An electrical schematic is shown below. The pin numbers are referencing the column number of the PCB protoboard of the specific example shown below in step 2.



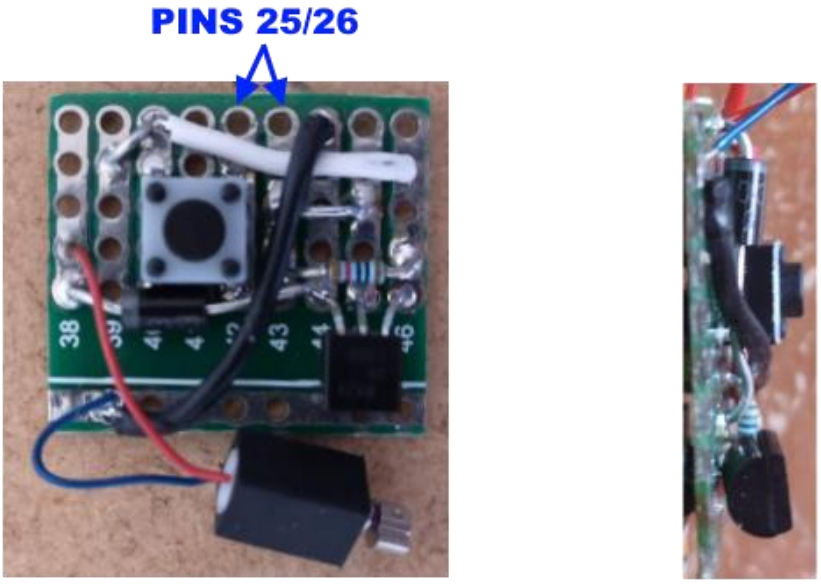
1. Lay the protoboard on top of M5StickC PCB to check where the GPIO pins will be soldered. There are 3 rows on the bottom for the transistor and multiple rows on top for battery/switch connections. For component placing, the switch which should be placed at the centre of the M5StickC PCB.



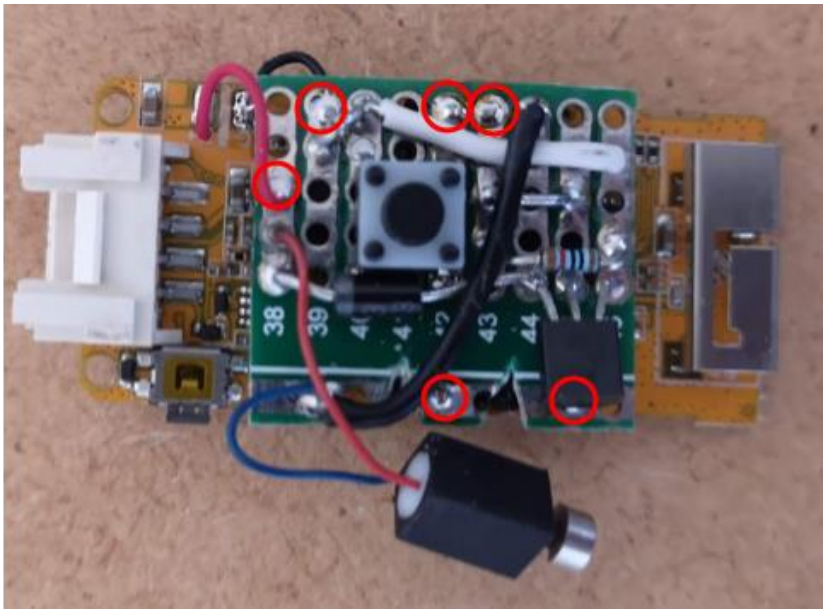
2. Solder components (4)-(8) to the protoboard (3) according to the wiring diagram.

   Note 1: The tactile switch should be taller than all the other electronic components by a minimum of 0.5 mm.

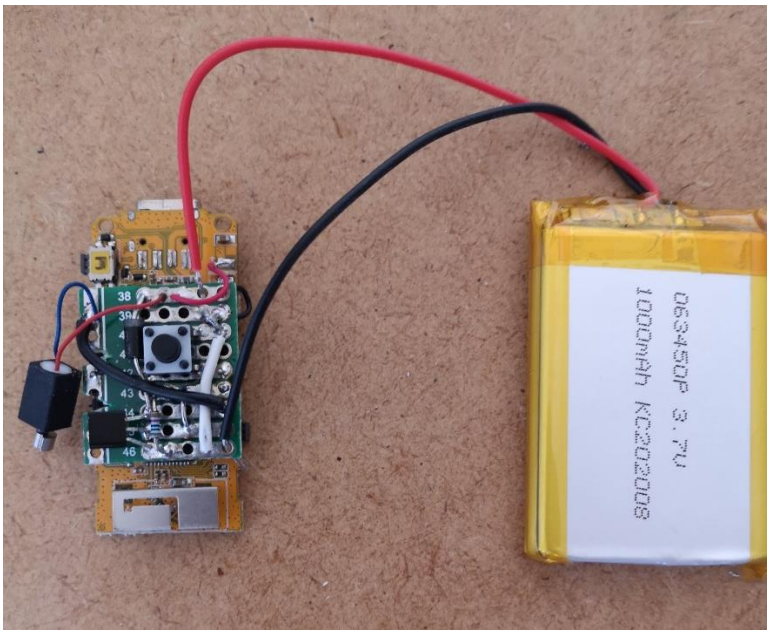
   Note 2: The vibrating motor is designed to be located on the opposite side of the pins 25/26 inside the housing. Make sure the wire is long enough to orient in a similar position to the one in the image below.



3. Solder PCB protoboard to the M5StickC PCB. Solder pins 25 and 26, the battery terminal connections (red and black wires sticking out from the M5StickC PCB), and the non-essential support pins on the opposite side.

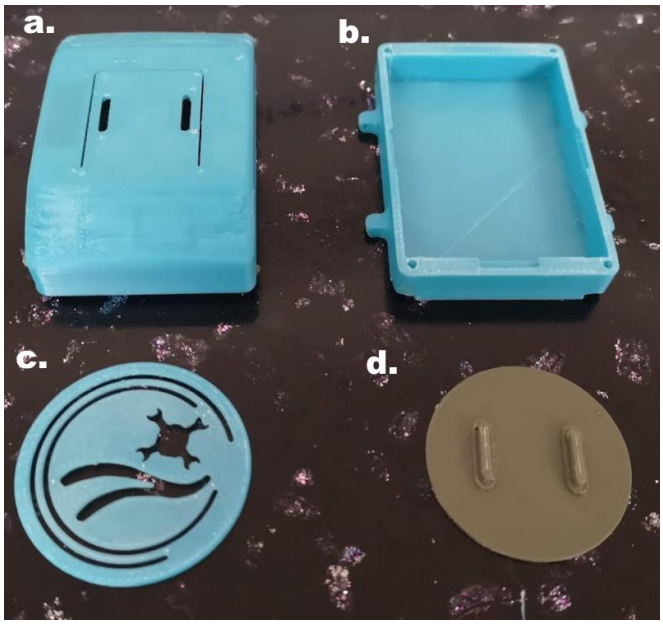


4. Finally, solder the battery (2) to the PCB protoboard.



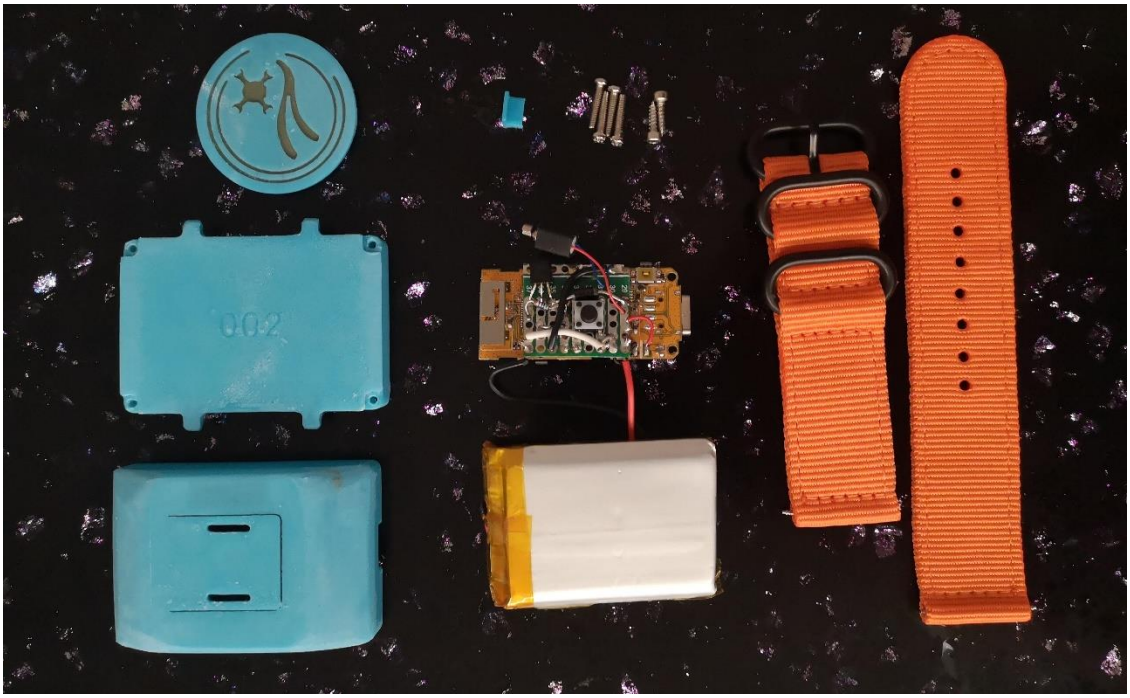
C) 3D PRINTING AND FINAL ASSEMBLY

1. There are 4 STL files to print. The first two are necessary and the last two parts are to add a decorative button to the device, which can be customized.
    a. Top housing
    b. Base housing
    c. Button graphic
    d. Button (different colour)



2. After printing, check that the PCB assembled in the previous step fits with the housing. Using the two screws from the original kit, screw down the PCB to the top housing so that the switch is touching the housing. Check that the two halves of the housing can enclose the PCB. More importantly, check that there is almost no gap between the tactile switch and the top housing. There is an embossed 3D printed square pad in the STL file that is meant to be sanded down to manually tune this height.

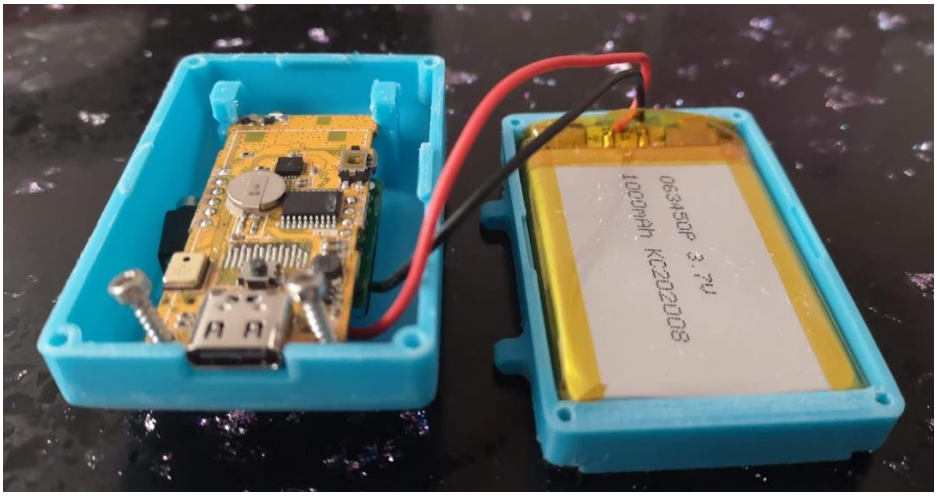
3. After checking that the PCB and housing will fit and doing optional 3D printed post-processing steps, prepare for final assembly. Parts are laid out and shown below. The button and button graphic parts are glued together. Besides the 4 printed parts and the electronics, we will need the wrist straps and 2 screws from the kit and 4 additional M2 screws.



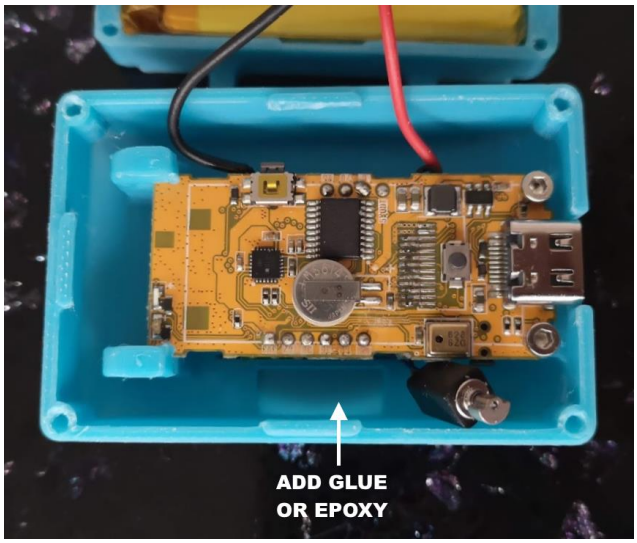
4. Place battery in base casing part.

5. Snap in the button to the top of the housing.

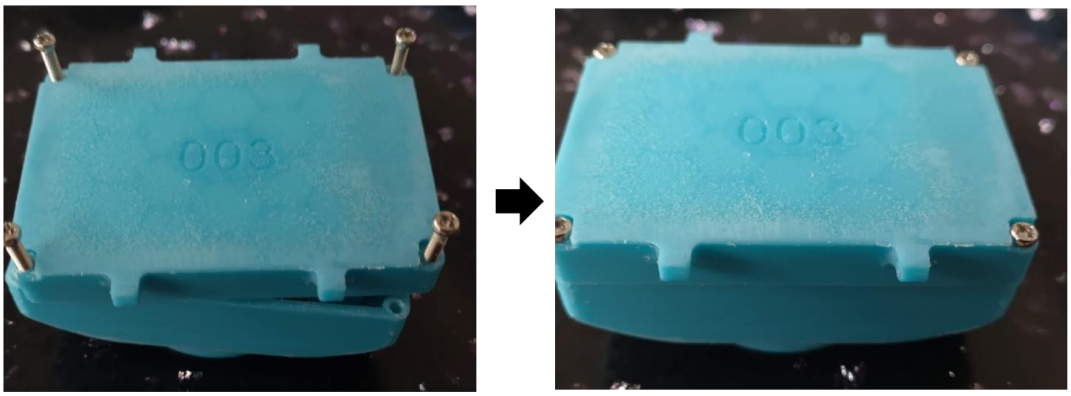
6. Using the two screws that came with the kit, screw down the PCB to the top housing.



7. On one side of the top housing, there should be a square cutout for the motor to sit. Add glue/epoxy here and place the motor in the cutout. Try to not get any on the moving part of the motor.



8. Put the two halves of the housing together and insert the 4 remaining screws from the bottom.



9. Add the two watch straps to finish the assembly of the gesture control remote.