

BOX^{AND}
LOOP

Iron Man Helmet
MK5

Build Guide

Thank you! And Welcome!

This build guide accompanies the STL files you've downloaded in order to build your own Iron Man MK5 helmet. Before starting the build you will need all the parts printed as well as all the wiring done with code uploaded to Arduino.

Non-moving parts go together with m2 bolts for dry fitting. Glue can be used for final assembly.

When assembling the face, adjust the position of the arms on the servo and not the code. If the any part is not closing all the way or is pushing through, take off the servo arm, reposition and check again.

Anytime two plastic moving parts are touching, add a washer in between.

9g servos can be rotated by hand, but the wing servos can be damaged by hand and should only be moved by Arduino/PCA9685.

STL file	Count	Mirror
arduino	1	No
arm_A	6	No
arm_B	2	No
battery	1	No
brow_center	1	No
brow_center_mount	1	No
brow_main	2	Yes
brow_side	2	Yes
cheek	2	Yes
chin	1	No
dome01	1	No
dome02	1	No
dome03	1	No
dome04	1	No
eye	2	Yes
jaw	1	No
mouth	1	No
nose_center	1	No
nose_side	2	Yes
servoArm_A	6	No
servoArm_B	2	No
servoArm_Main	2	Yes
wire_back	2	Yes
wire_brow	1	No
wire_cheek	2	Yes
wire_main	1	No
wire_nose	1	No
arm_Main	2	Yes

Bolt	Count
m2x4mm	24
m2x6mm	22
m2x8mm	25
m2x10mm	2
m3x6mm	6
m3x8mm	40
m3x10mm	4

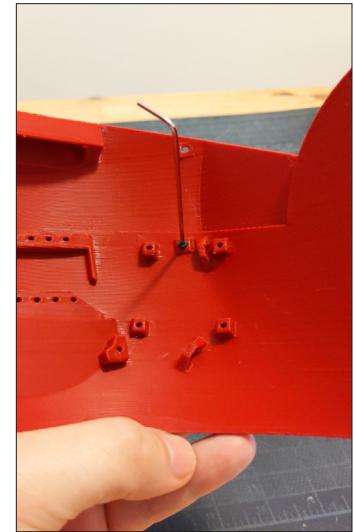
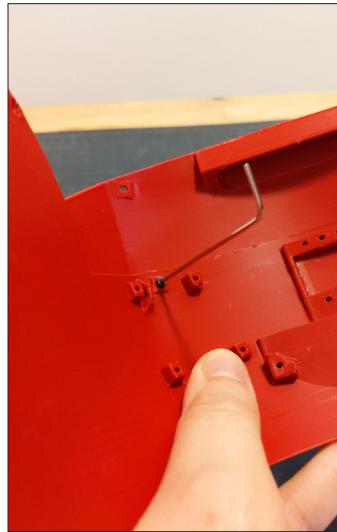
Step 1.

Start with Dome04 and Dome03.



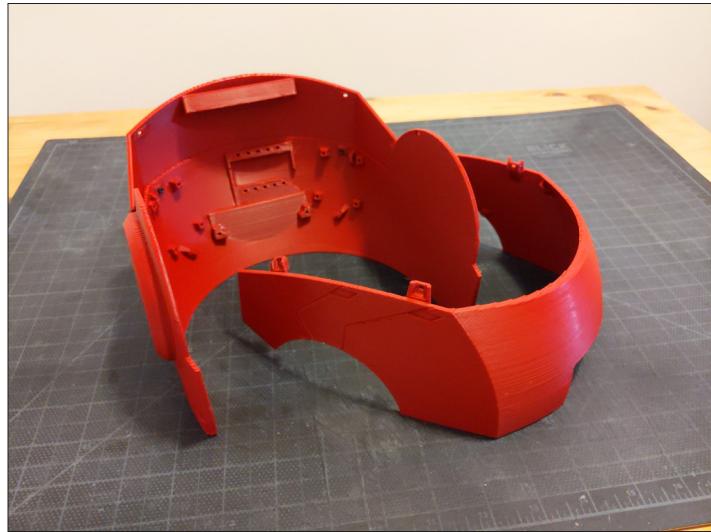
Step 2.

Use two m2x4mm bolts to attach.



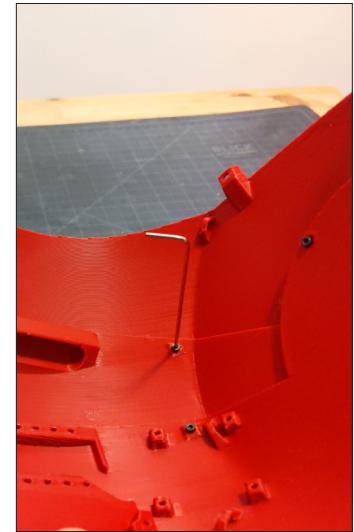
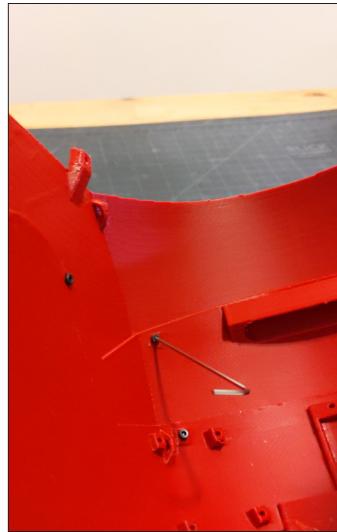
Step 3.

Add Dome02.



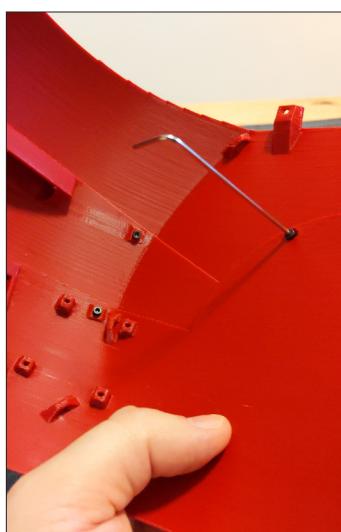
Step 4.

Use two m2x4mm bolts to attach in the back.



Step 5.

Use two m2x4mm bolts to attach by the ears.

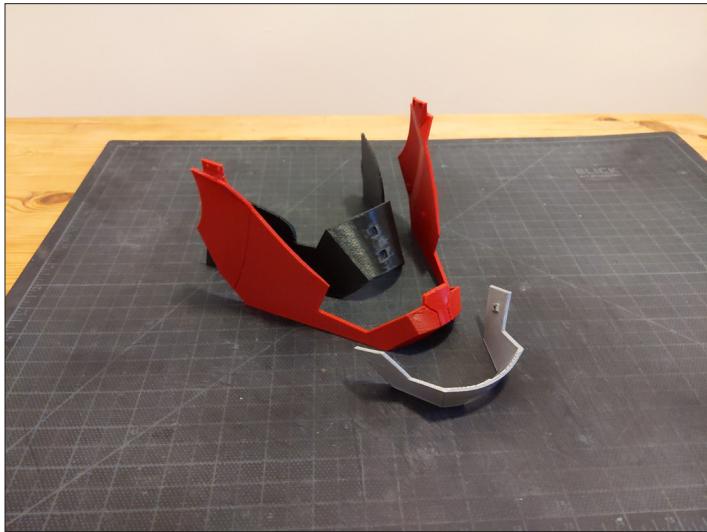


Step 6.

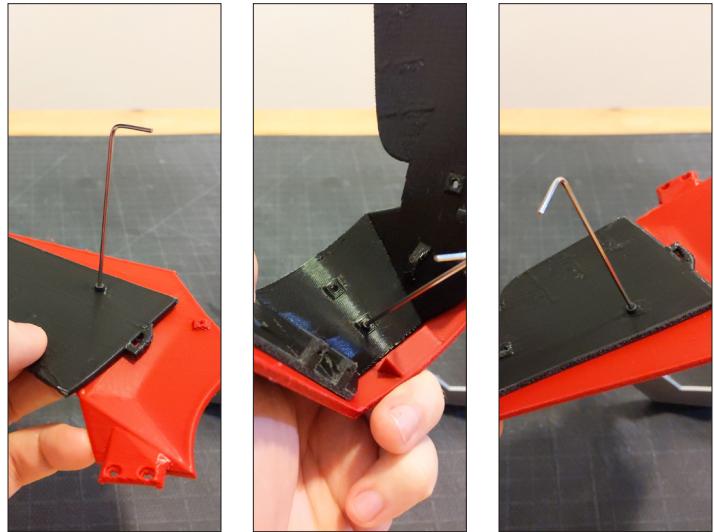
Admire Dome04, Dome03, Dome02.



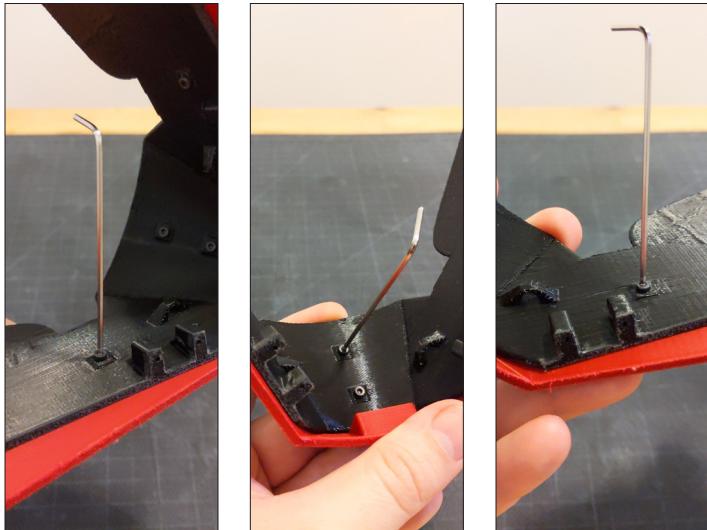
Step 7.
Collect Jaw, Mouth, Chin.



Step 8.
Use three m2x4mm bolts to attach Jaw and Mouth.



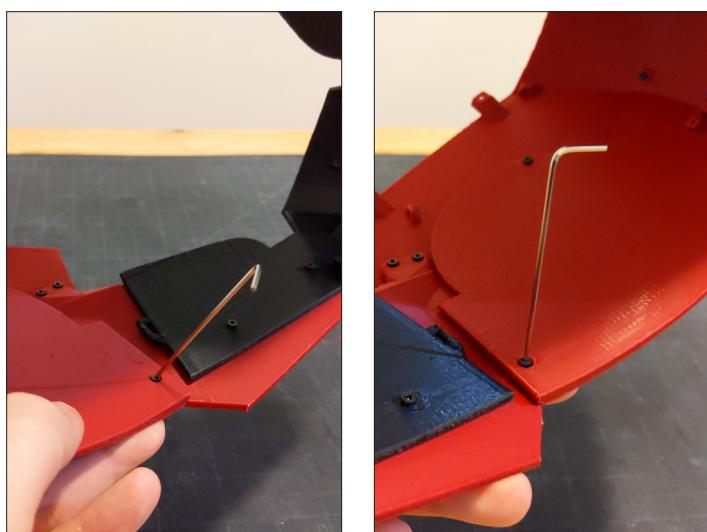
Step 9.
Use three m2x4mm bolts to attach Chin and Mouth.



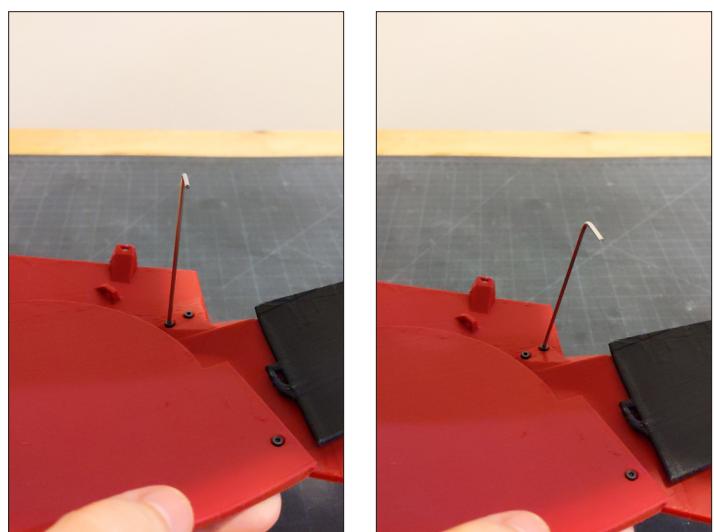
Step 10.
Bring back in the domes.



Step 11.
Use two m2x4mm bolts to attach by the ears.

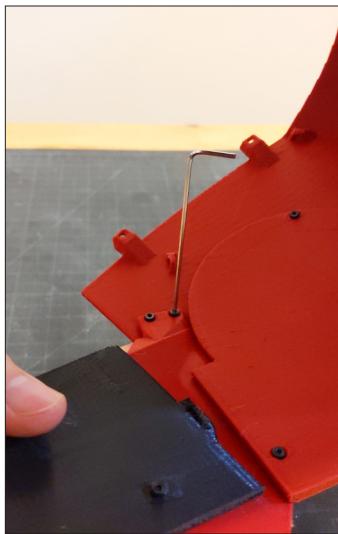
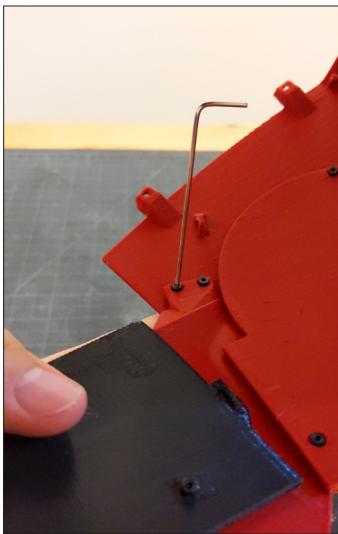


Step 12.
Use two m2x4mm bolts to attach by the left cheek.



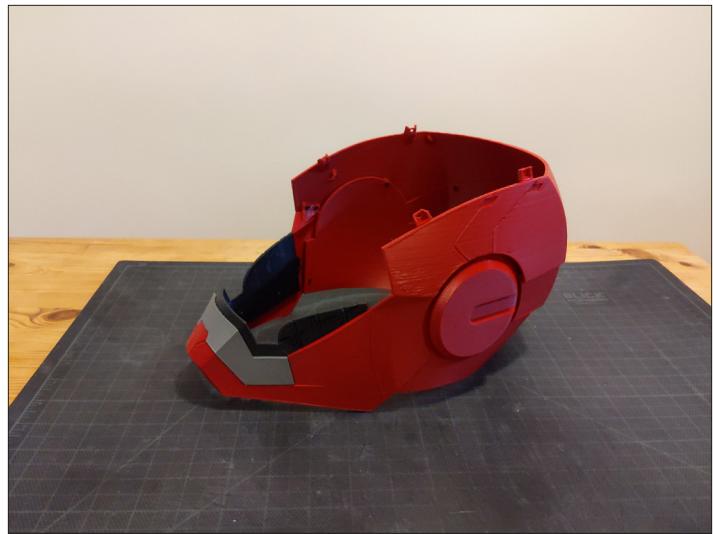
Step 13.

Use two m2x4mm bolts to attach by the right cheek.



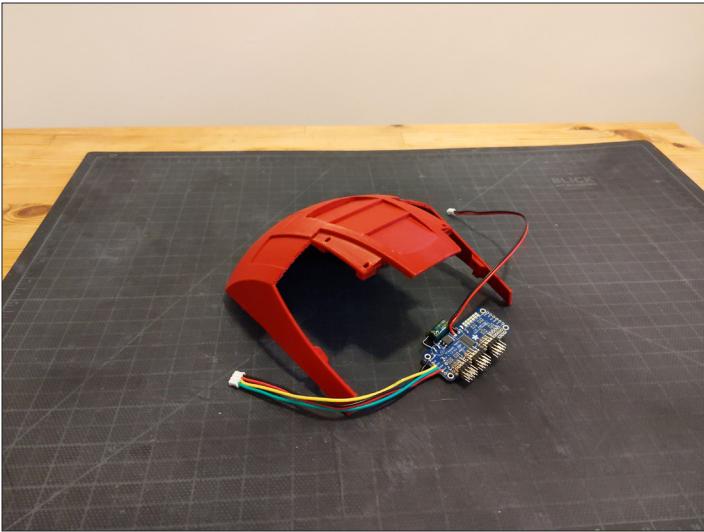
Step 14.

Admire again (the hard part starts now).



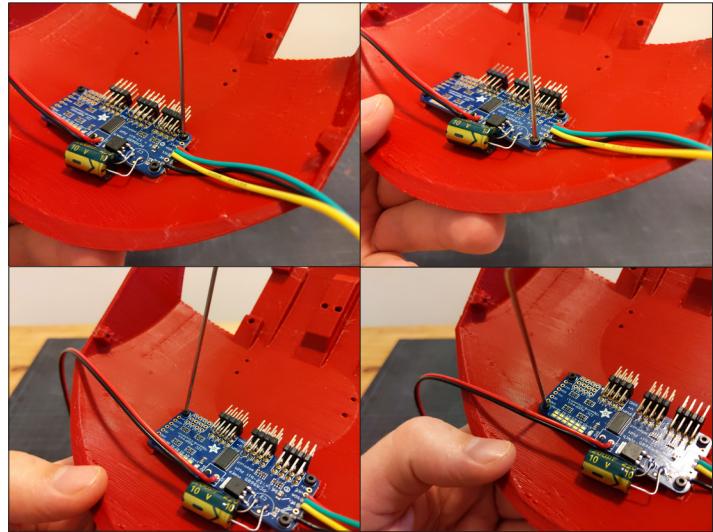
Step 15.

Grab Dome01 and PCA9685 (wired up already).



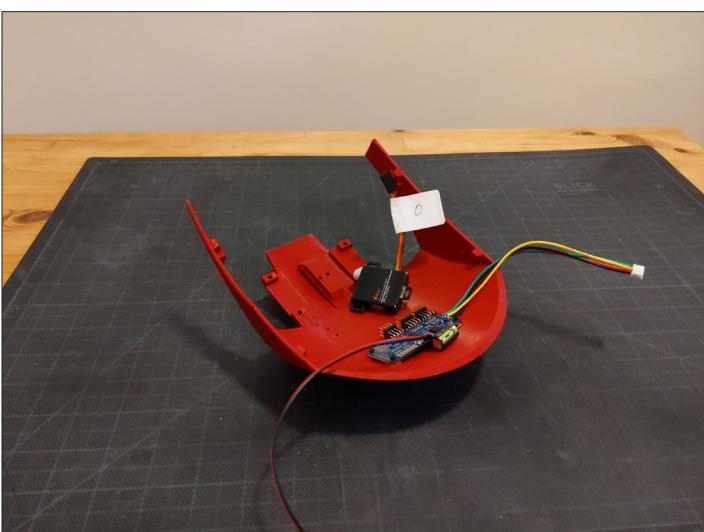
Step 16.

Use four m2x6mm bolts to attach PCA9685.



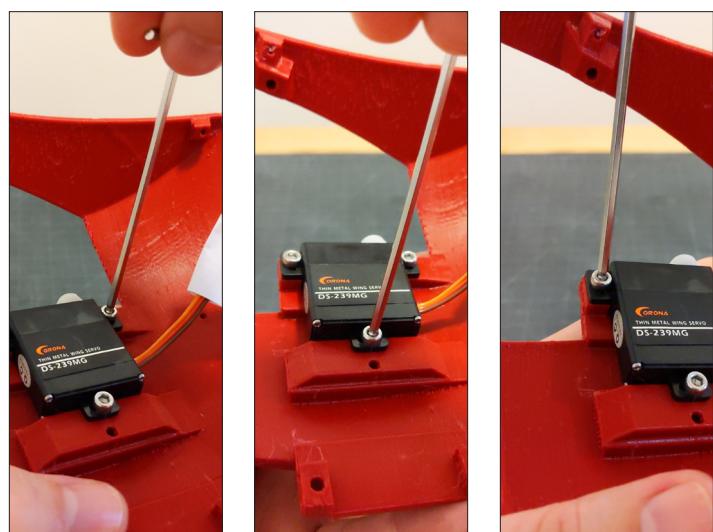
Step 17.

Grab servo #0 (trimmed to length).

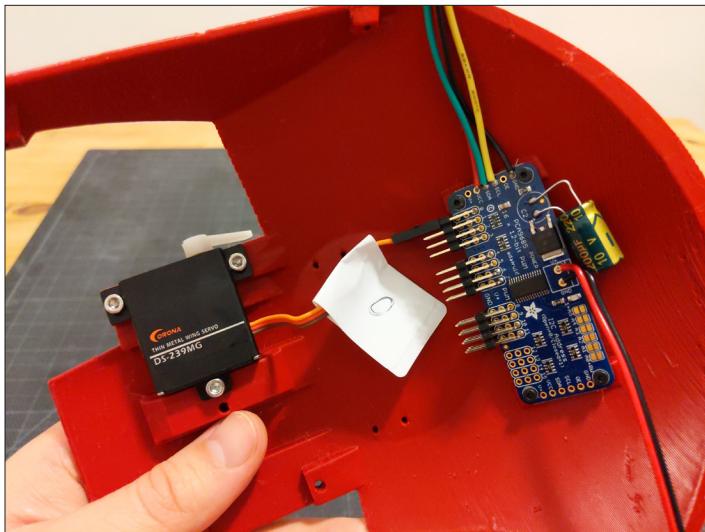


Step 18.

Use three m3x8mm bolts to mount the servo.



Step 19. Plug the servo into PCA9685 #0. Connect Arduino, button and power.



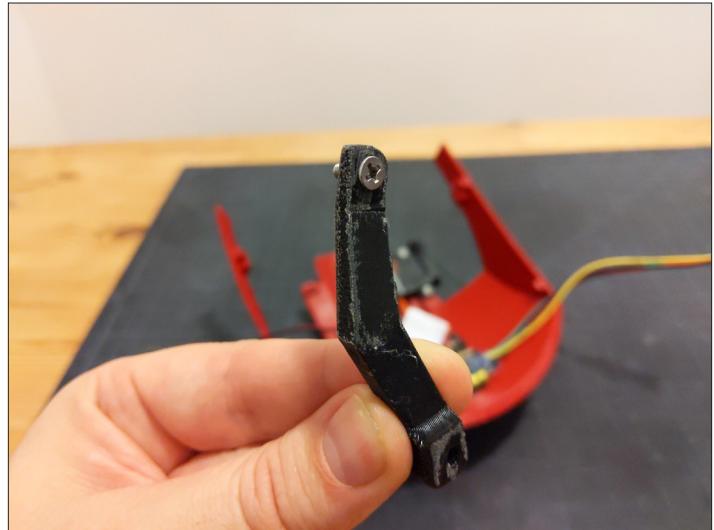
Step 20. Rotate the servo into closed position (using button) and attach the arm at this angle.



Step 21.
Place servoArm_Main and use m2x8mm to attach.



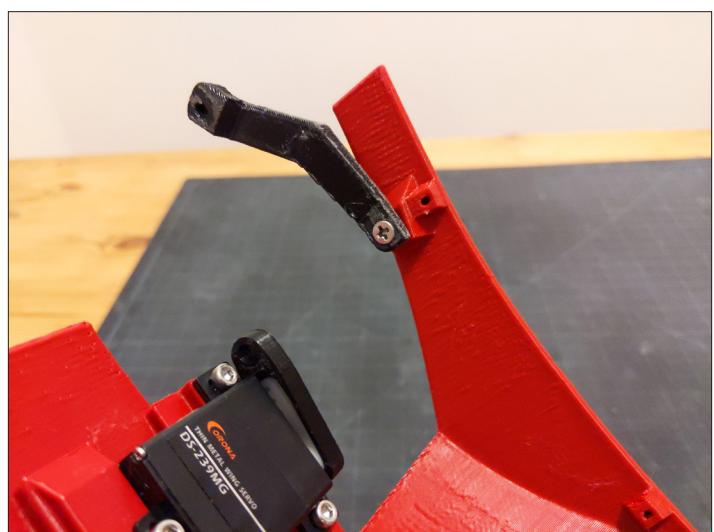
Step 22.
Grab arm_Main and insert m3x8mm as shown.



Step 23.
Place a washer on the other side.



Step 24.
Attach to Dome01, same side as servo.



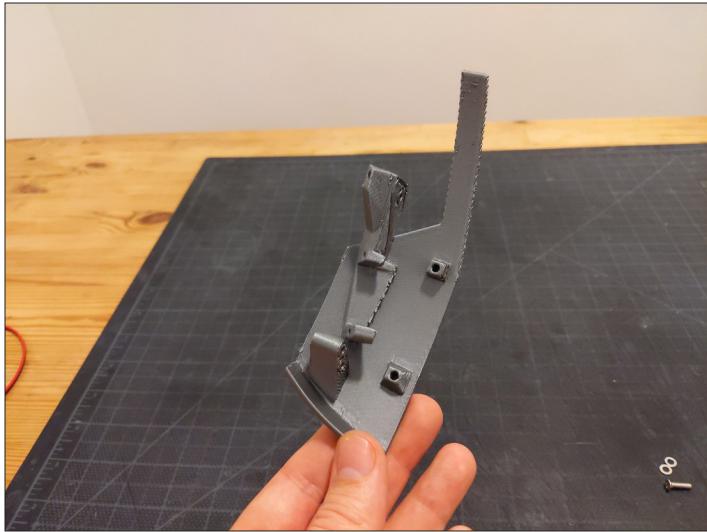
Step 25.
Insert m3x10mm bolt.



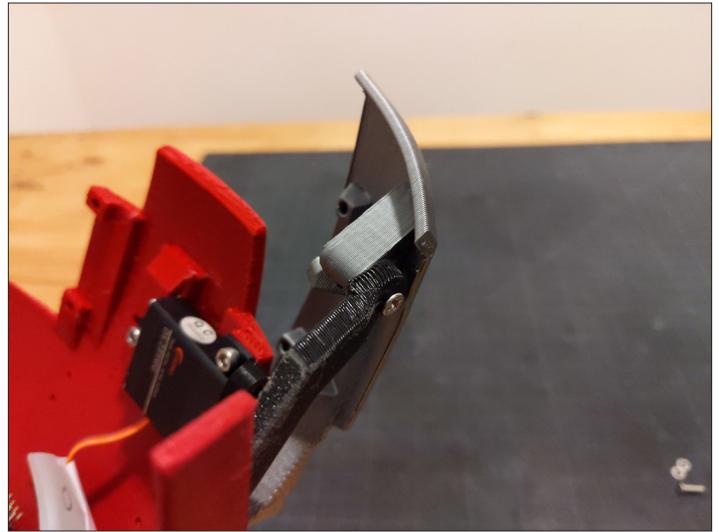
Step 26.
Place the washer.



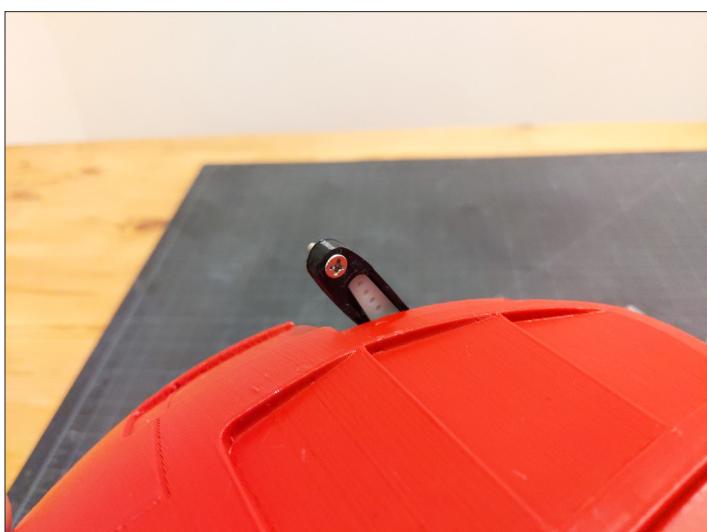
Step 27.
Find the brow_main.



Step 28.
Attach as shown.



Step 29. Switch the servo position to open (using the button) and insert m3x10mm bolt.



Step 30.
Add the washer.



Step 31.

Bring brow_main into position and attach.

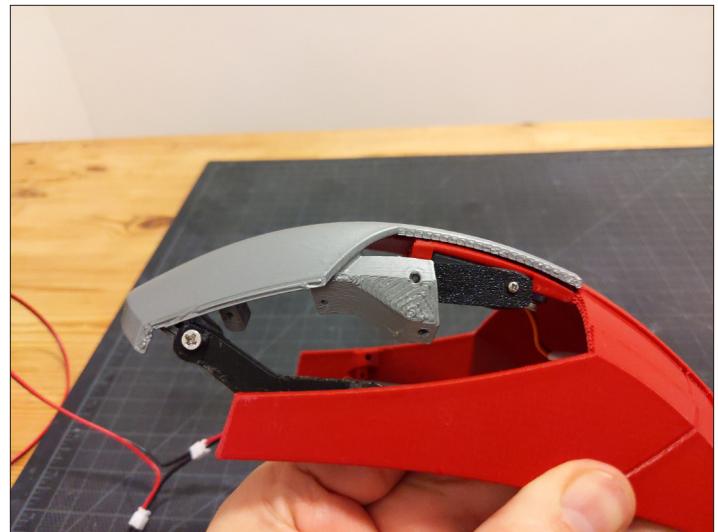


Step 32.

Run a test and it show look like this closed.

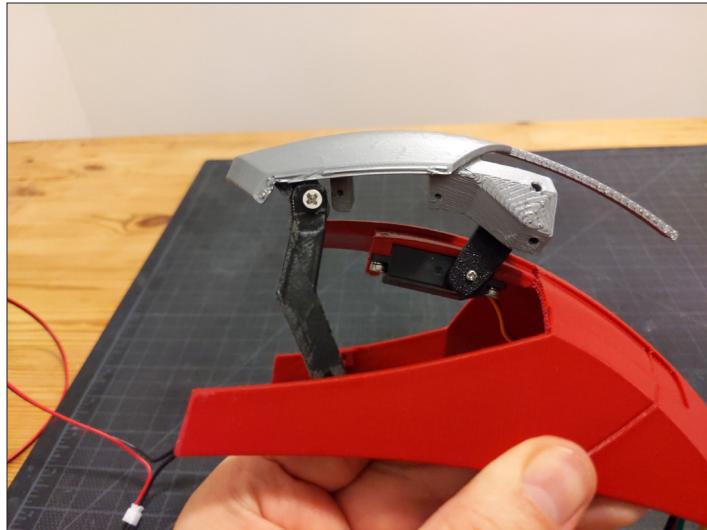
Step 32.

Run a test and it show look like this closed.



Step 33.

And like this open.

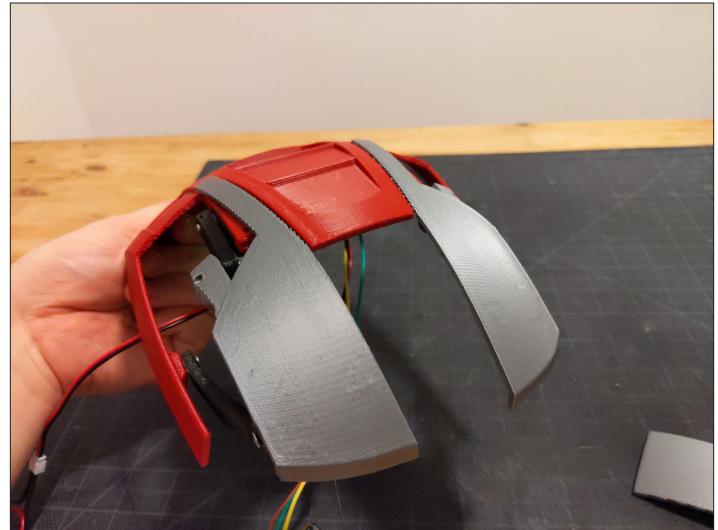


Step 34.

The movement must be synchronous.

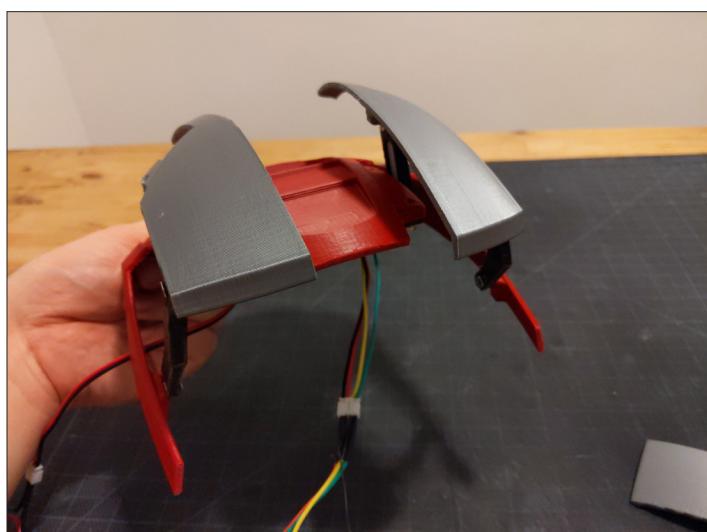
Step 34.

Now repeat on the other side with new servo #1.



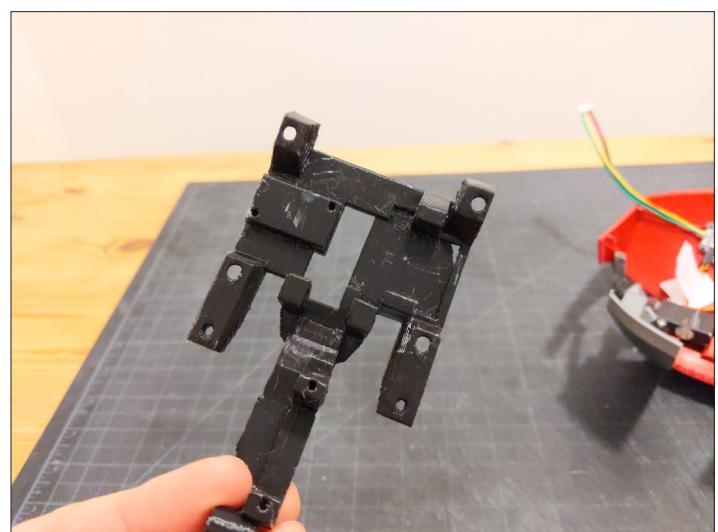
Step 35.

The movement must be synchronous.



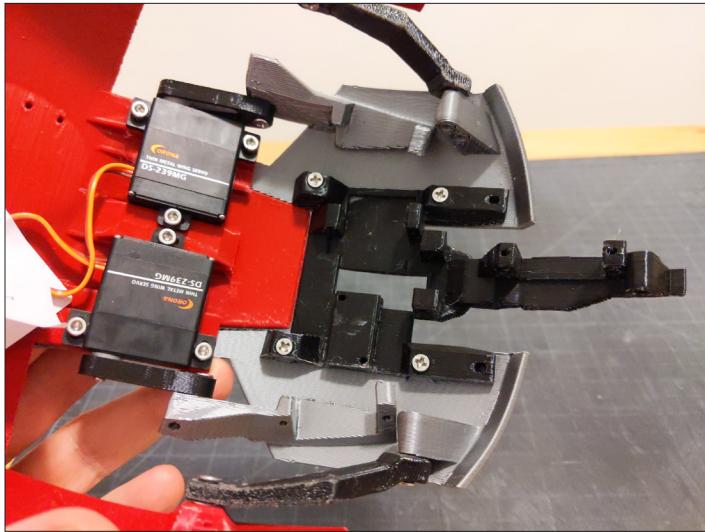
Step 36.

Grab brow_center_mount.



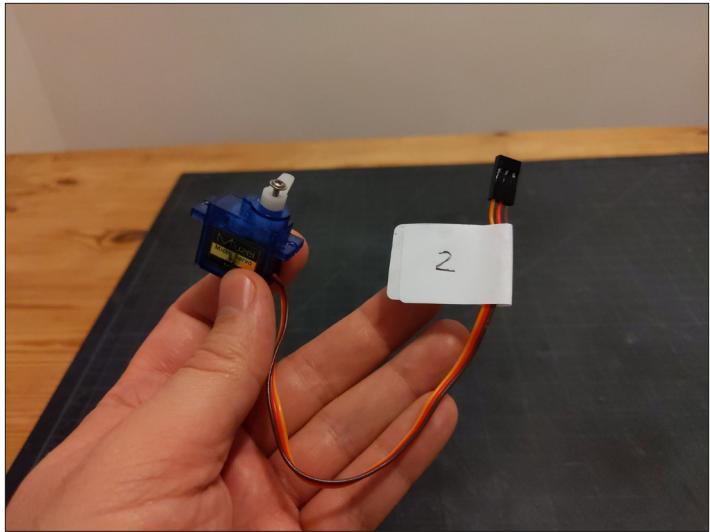
Step 37.

Attach brow_center_mount with four m3x6mm bolts.



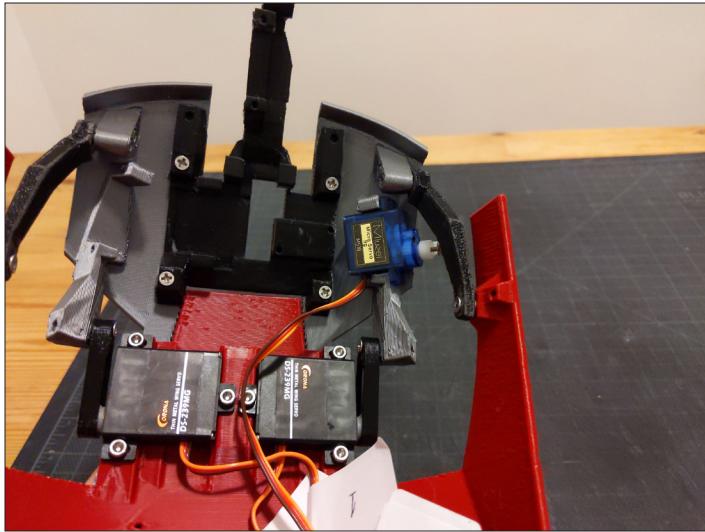
Step 38.

Find servo #2 (proper wire length).



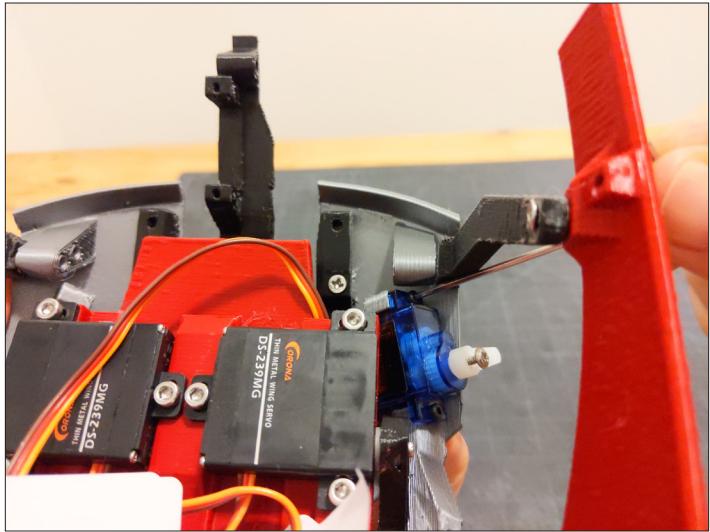
Step 39.

Place it as shown.



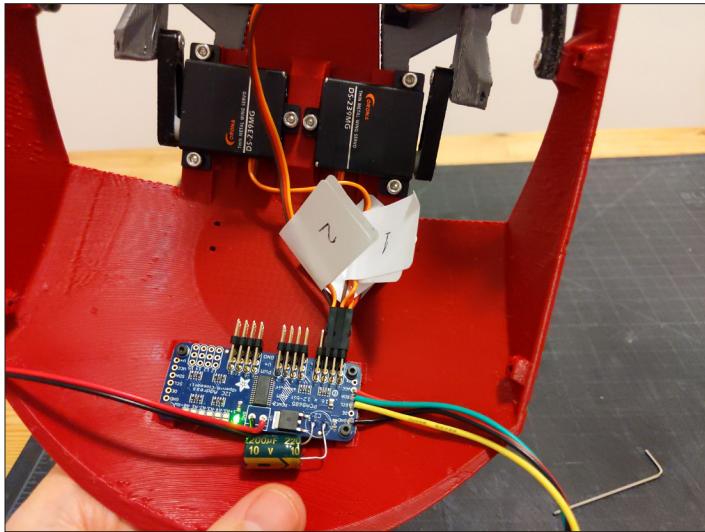
Step 40.

Attach with two m2x8mm bolts.



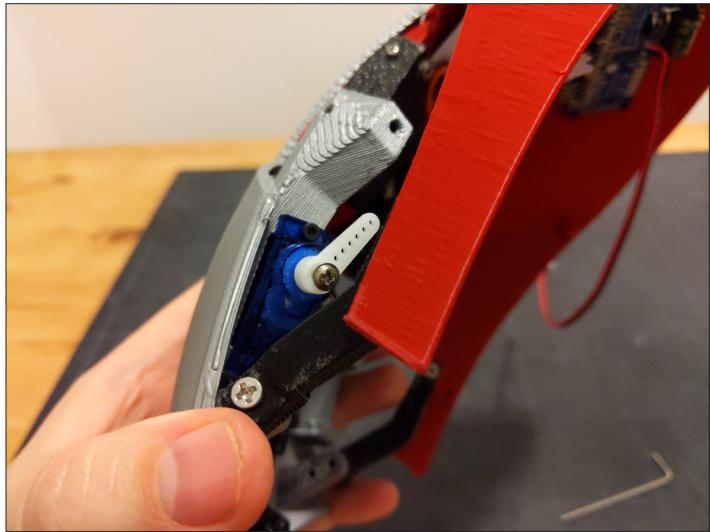
Step 41.

Plug the servo into PCA9685 #2.



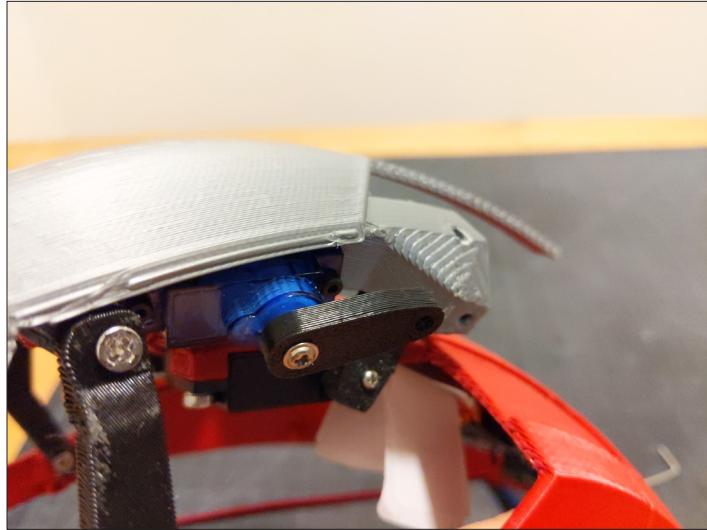
Step 42.

In closed position (button), this is the arm position.



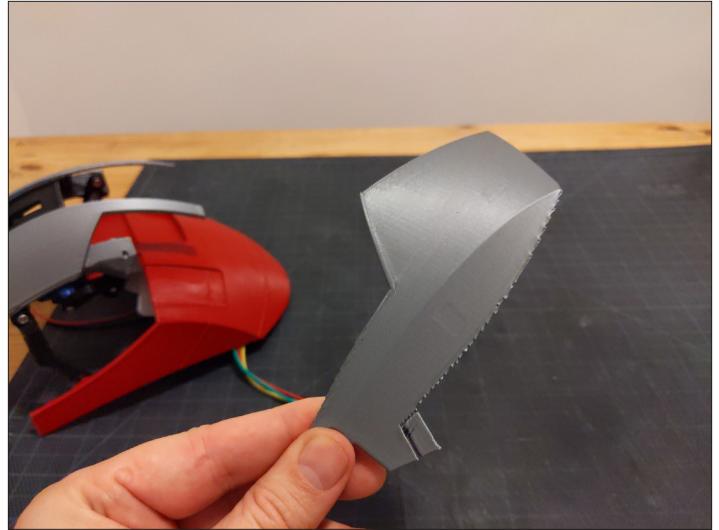
Step 43.

Attach servoArm_B with screw that came with servo.

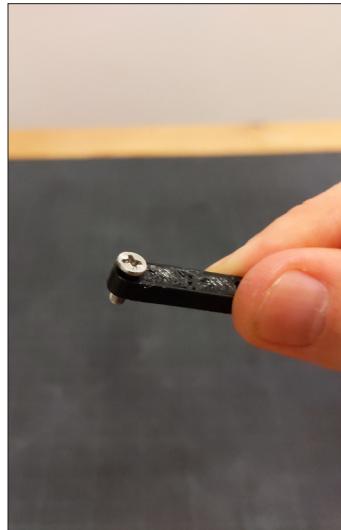


Step 44.

Grab brow_side.

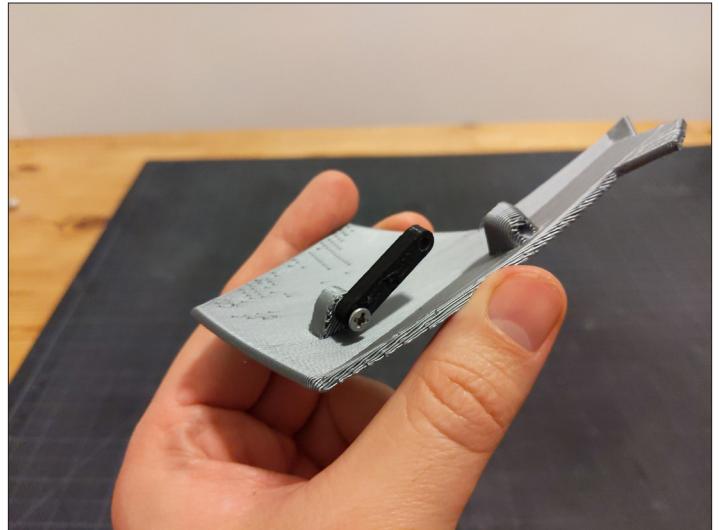


Step 45. Insert m3x8mm bolts into arm_A and top it with a washer.



Step 46.

Attach to brow_side as shown.



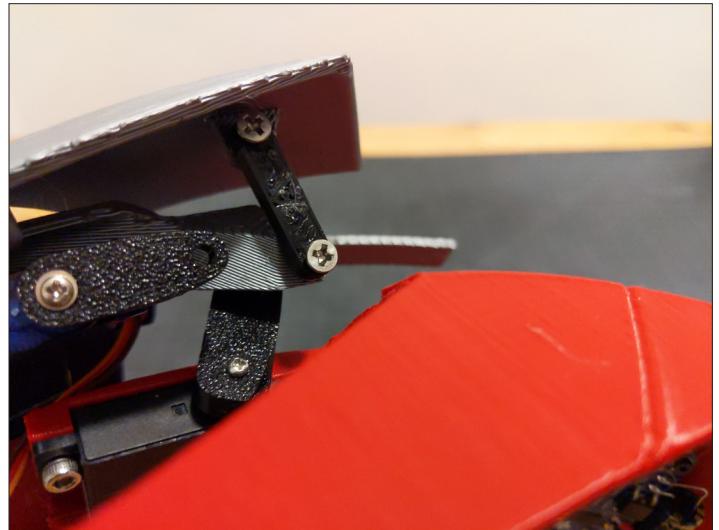
Step 47.

Insert m3x8mm bolt and washer into the arm.



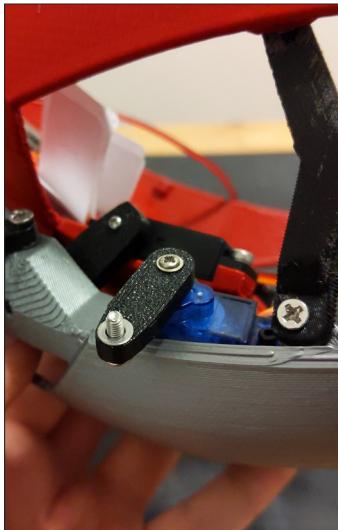
Step 48.

Attach to brow_main as shown.



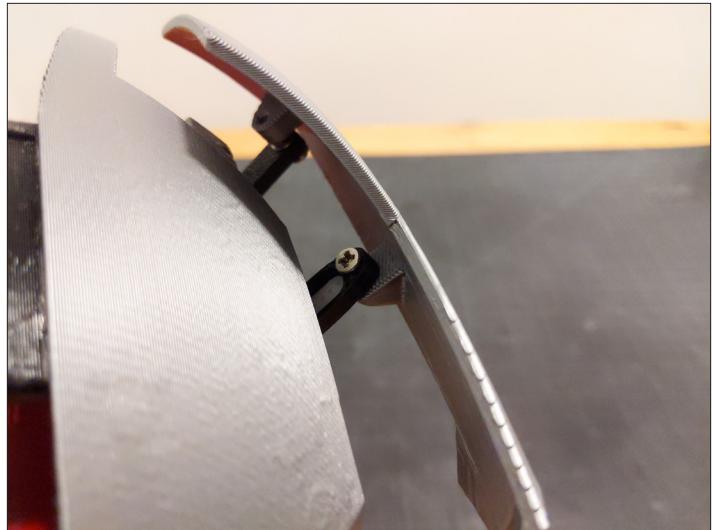
Step 49.

Insert m3x8mm bolt into servoArm_B with a washer.



Step 50.

Attach to brow_side as shown.



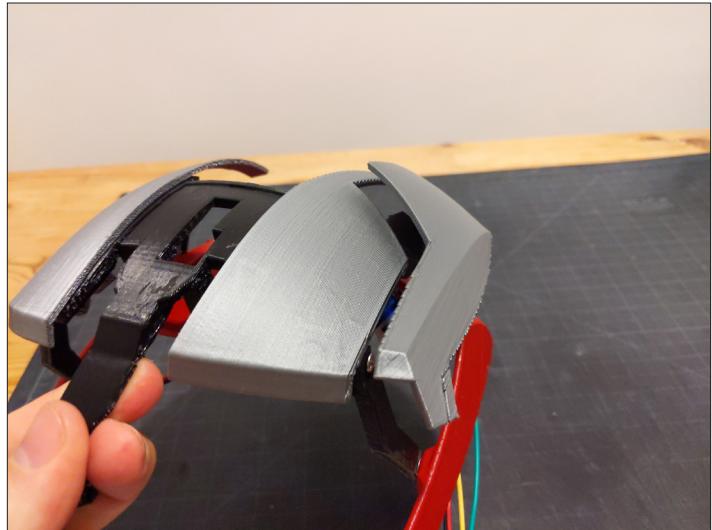
Step 51.

Test it out at closed.



Step 52.

And at open.



Step 53.

Repeat on the other side with servo #3.

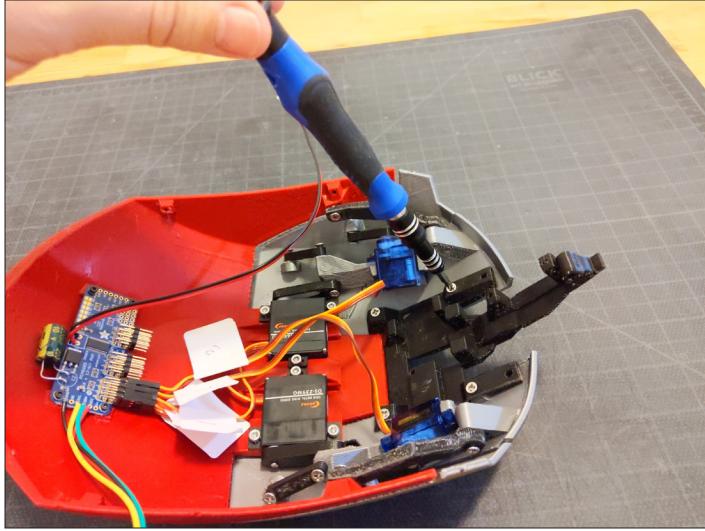


Step 54.

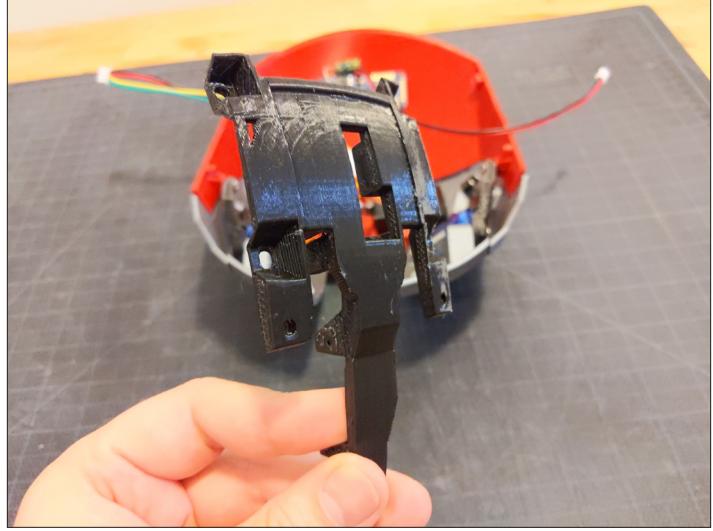
Movement must match across both sides.



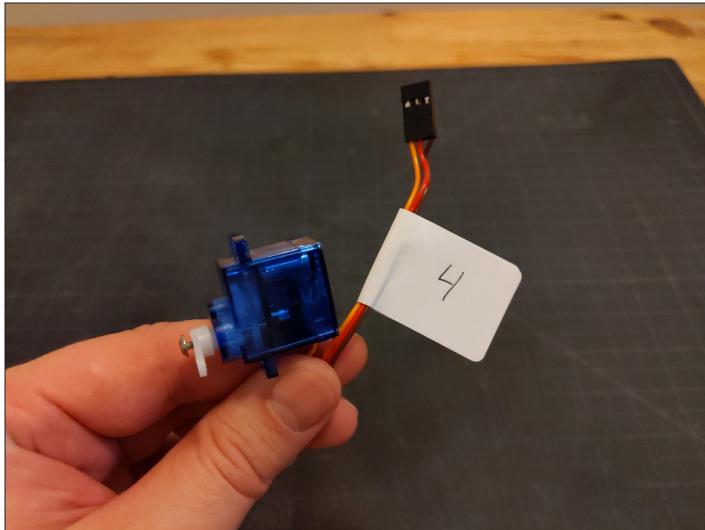
Step 55.
Remove four bolts on the brow_center_mount.



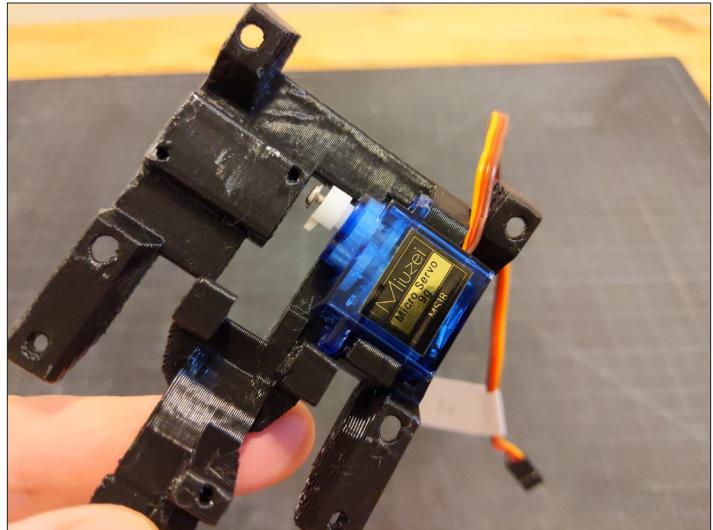
Step 56. The rest of the face assembly will easier to build separate.



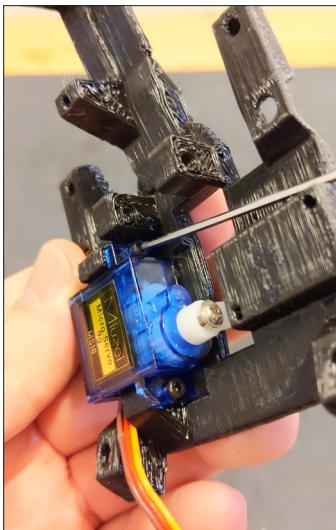
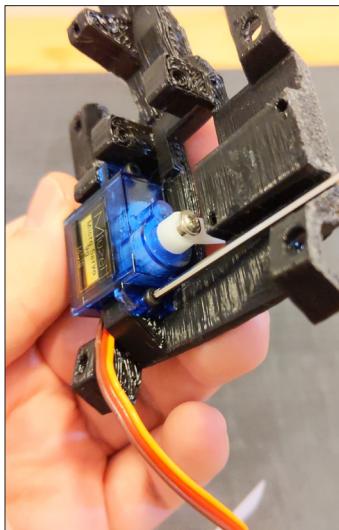
Step 57.
Find servo #4.



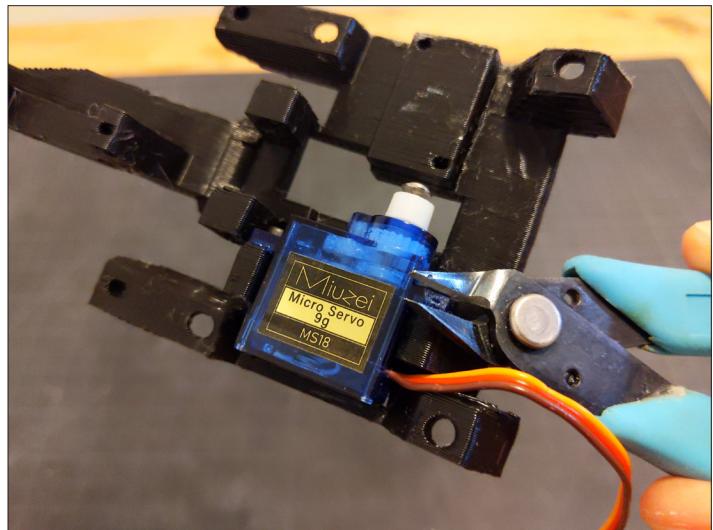
Step 58.
Place as shown.



Step 59.
Attach with two m2x8mm bolts.

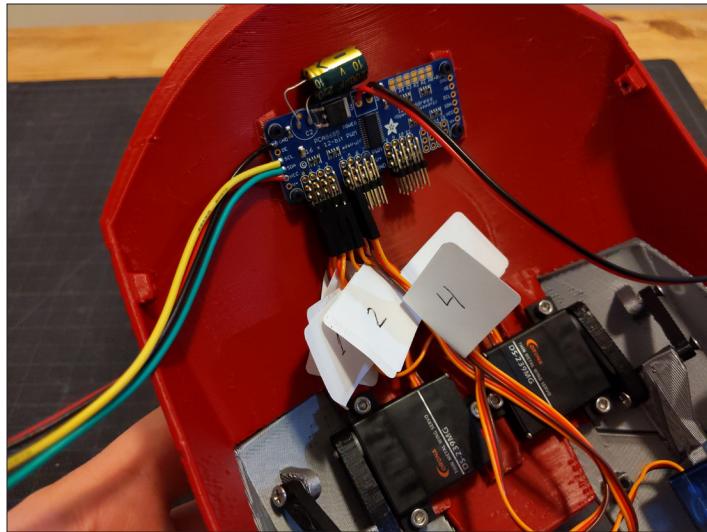


Step 60.
Trim some plastic for clearance.



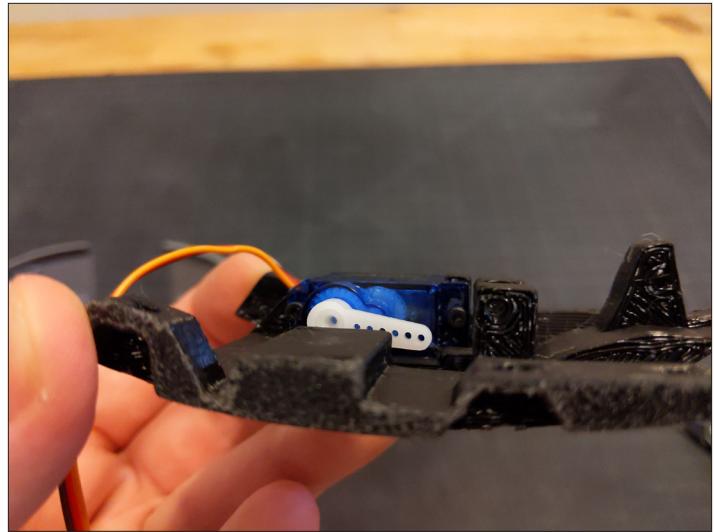
Step 61.

Plug servo in into PCA9685 #4.



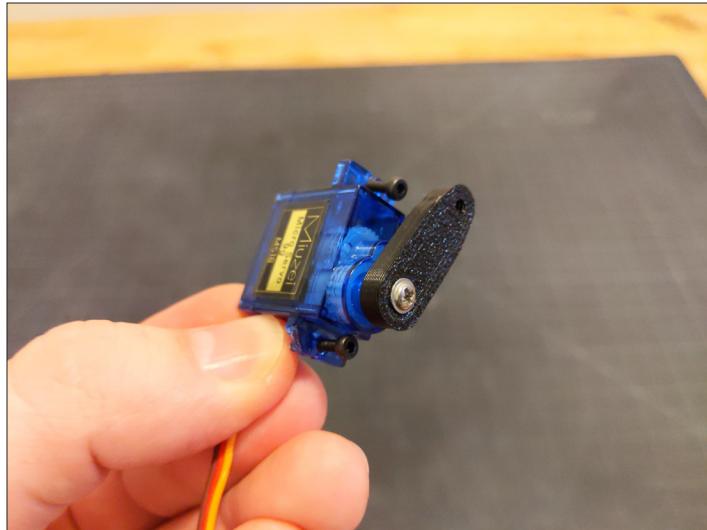
Step 62.

In the closed position, the arm must be as shown.



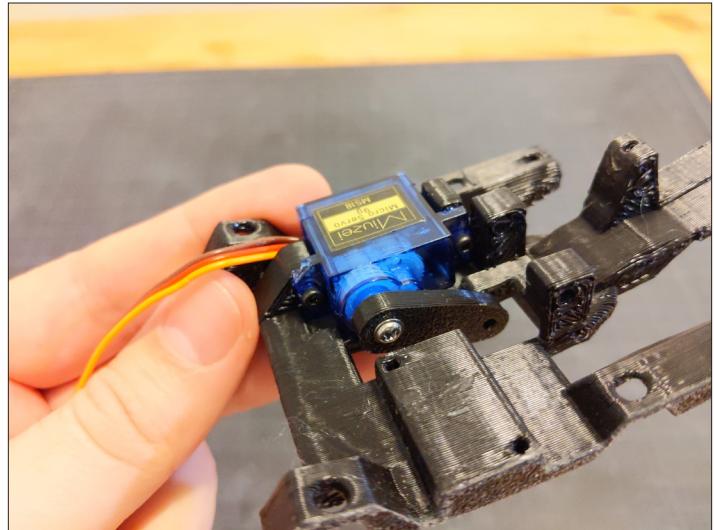
Step 63.

Remove the servo at attach the servoArm_A.



Step 64.

Install the servo back in.



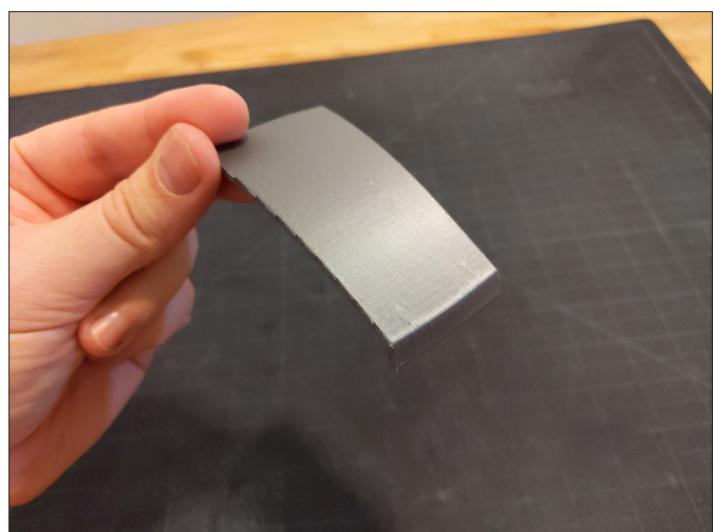
Step 65.

Prep arm_A with m3x8mm bolt and a washer.



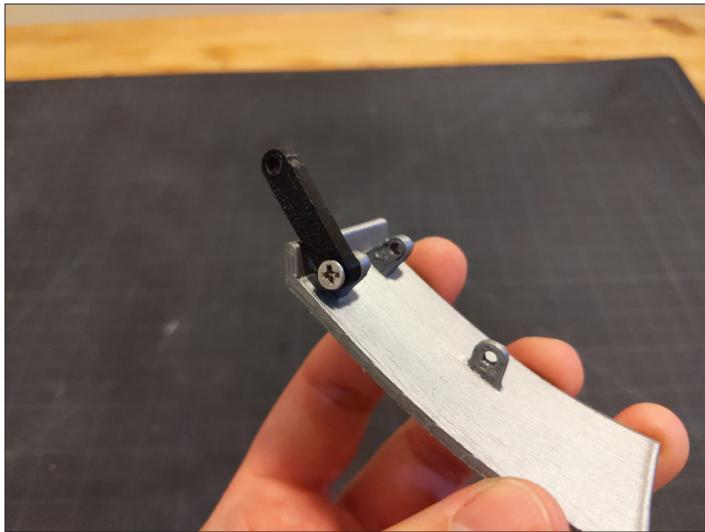
Step 66.

Grab brow_center.



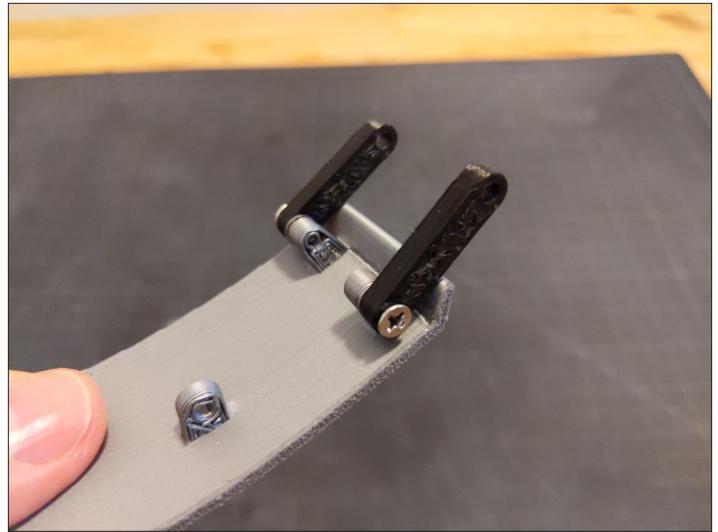
Step 67.

Attach arm_A to brow_center.



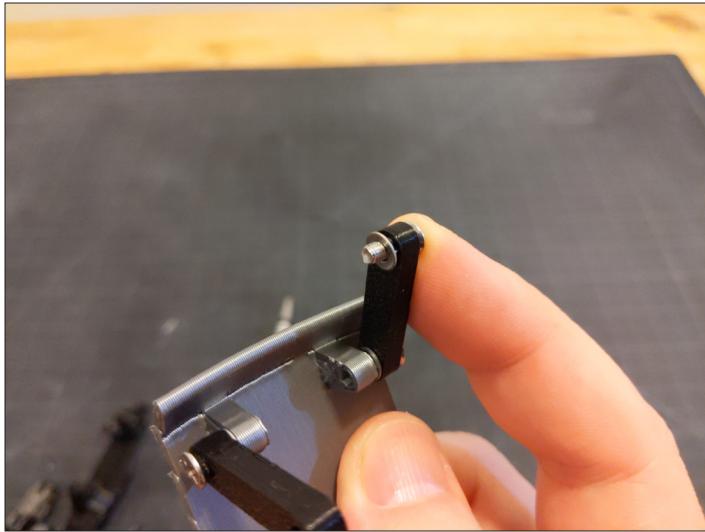
Step 68.

And another arm_A on the other side.



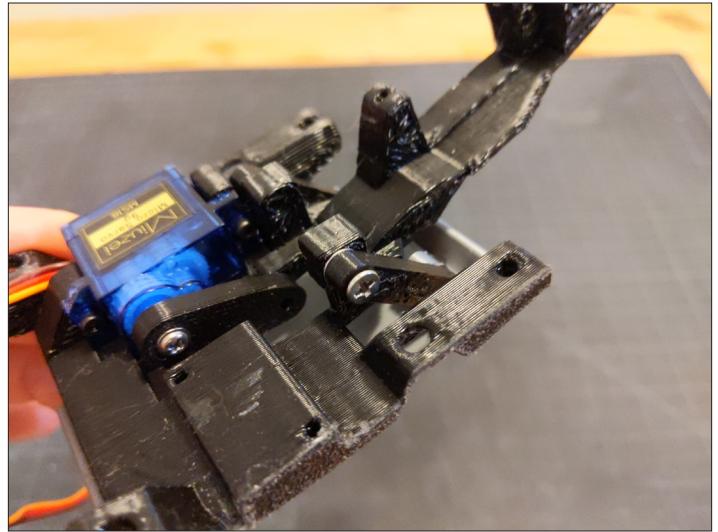
Step 69.

Place m3x8mm bolt and a washer into arm_A.



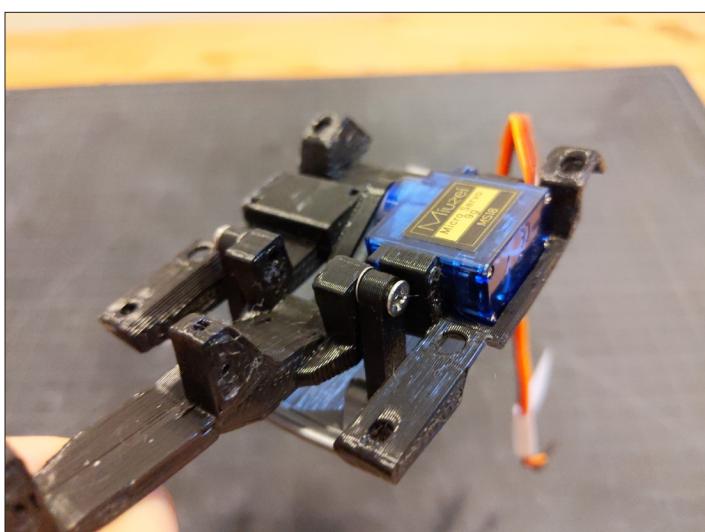
Step 70.

Attach to brow_center_mount.



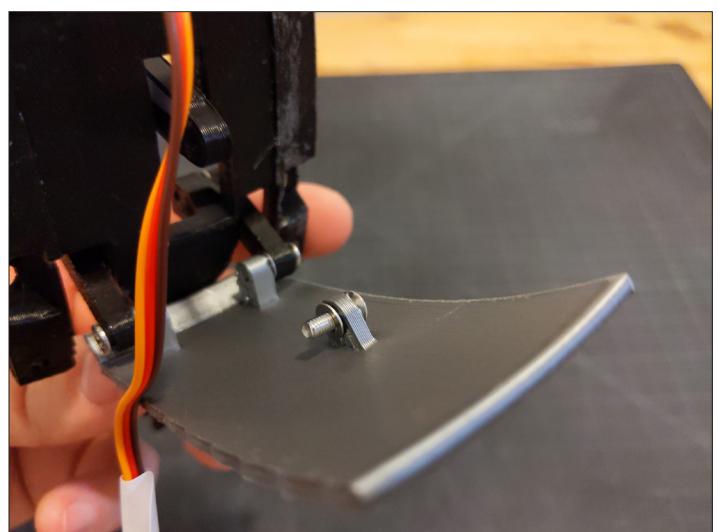
Step 71.

And attach the other arm as well.



Step 72.

Insert m3x8mm into brow_center.



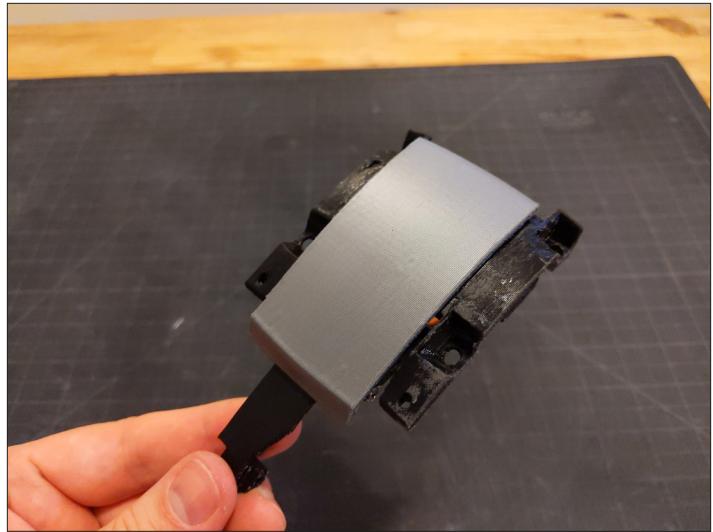
Step 73.

Screw that bolt into servo arm.



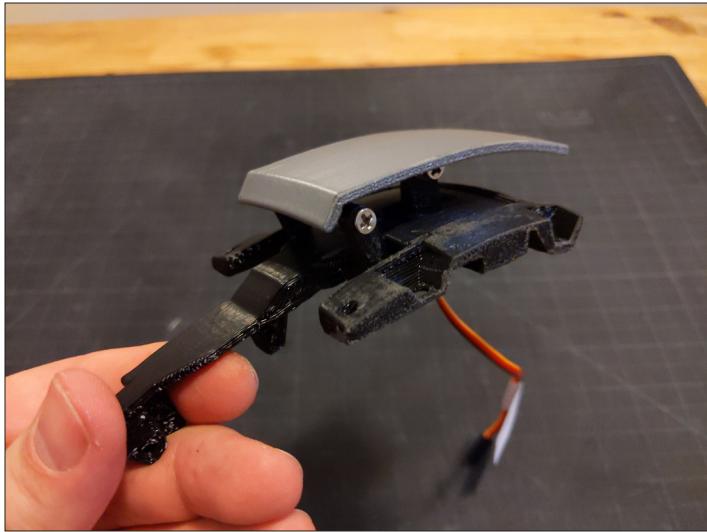
Step 74.

When animated, brow_center should lay flat.



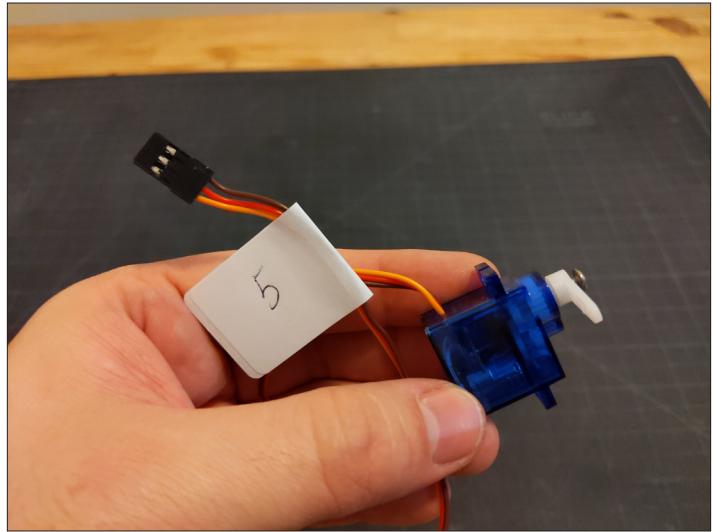
Step 75.

And at open it should raise just so.



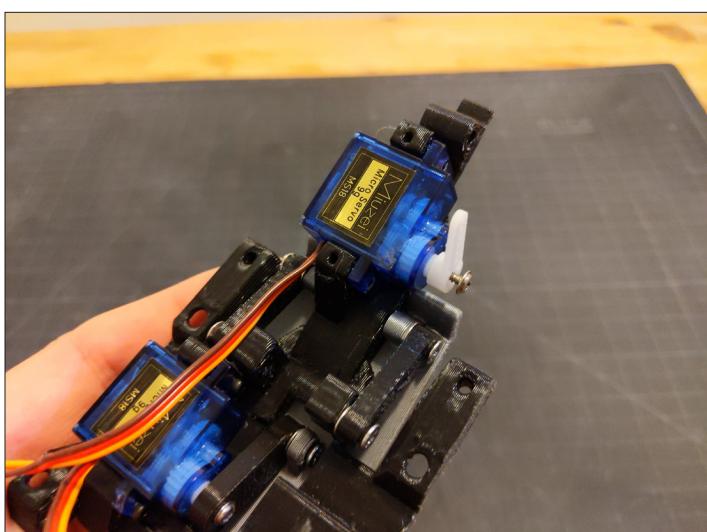
Step 76.

Moving on, and grad servo #5.



Step 77.

Place and attach with two m2x8mm bolts.



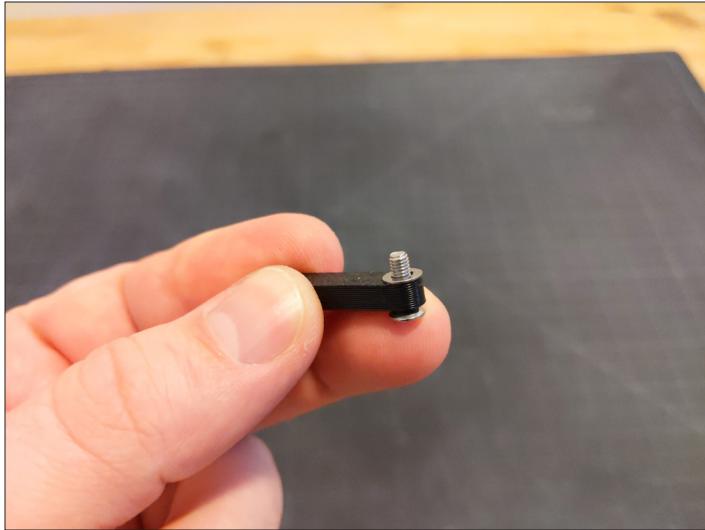
Step 78.

At closed position, this is the servo arm position.



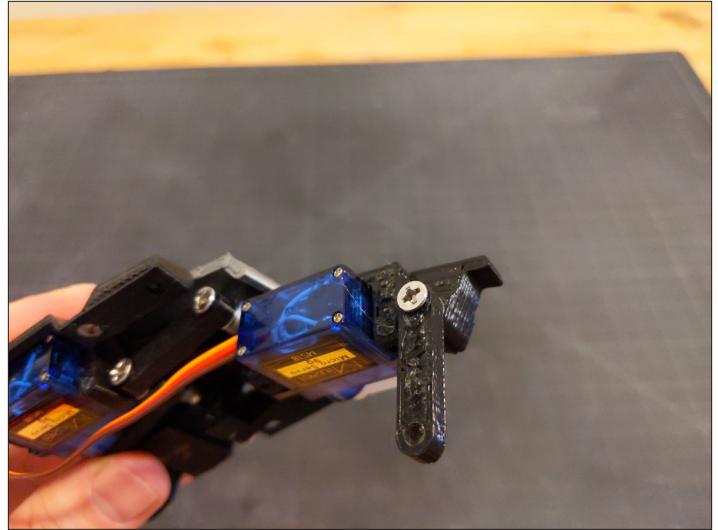
Step 79.

Prep another arm_A with m3_8mm bolt and washer.



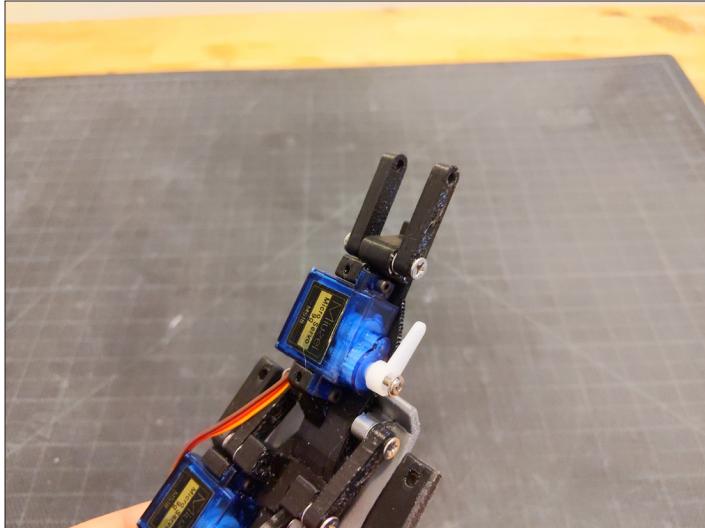
Step 80.

Attach arm_A to brow_center_mount.



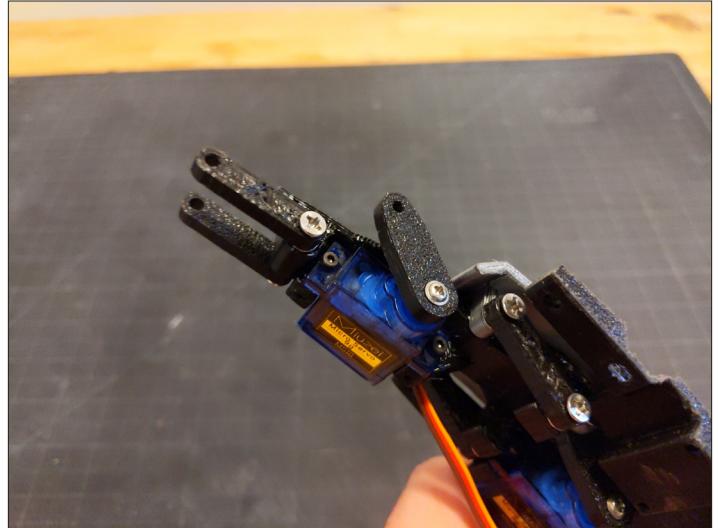
Step 81.

Duplicate on mirror side.



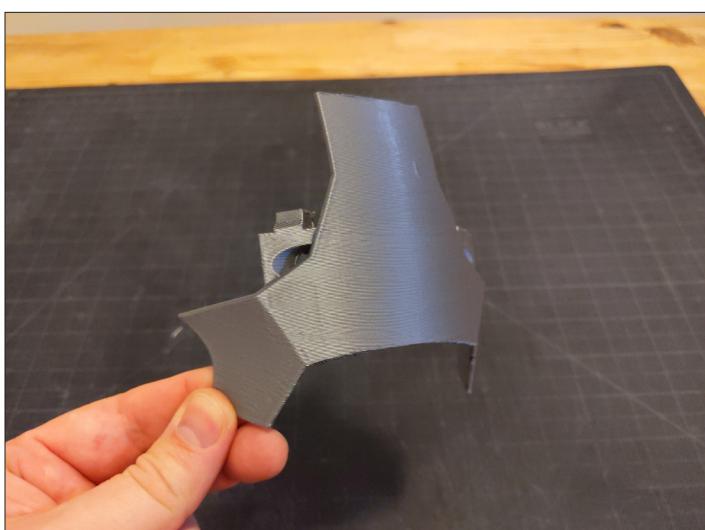
Step 82.

Attach servoArm_A to the servo.



Step 83.

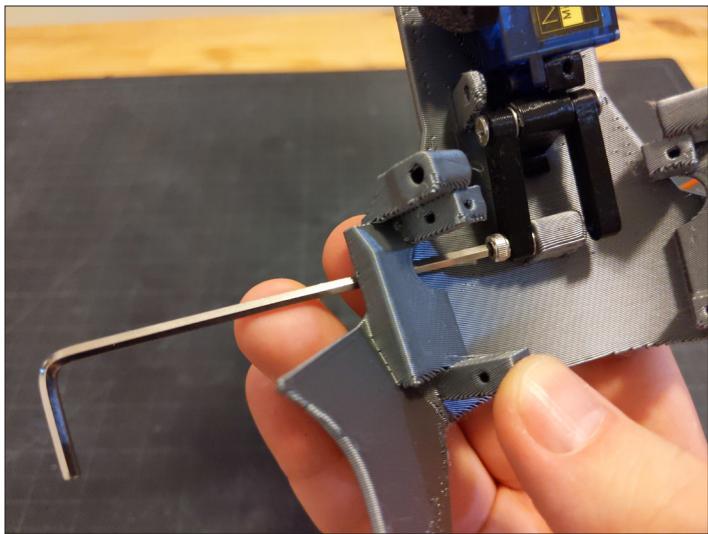
Grab your nose_center.



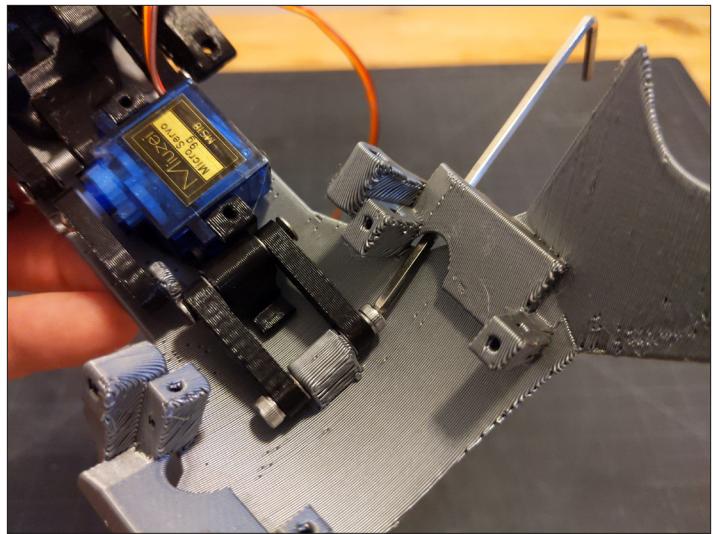
Step 84. Prep open side of arm_A with m3x8m bolts and washer.



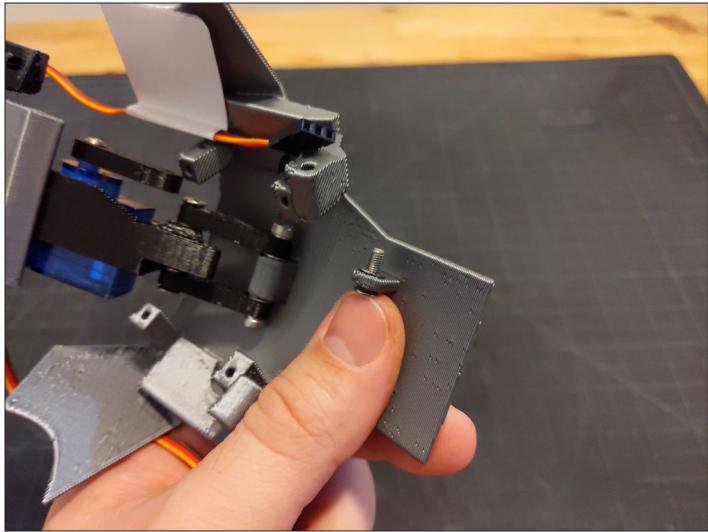
Step 85. Attach the bolts to nose_center through the access hole.



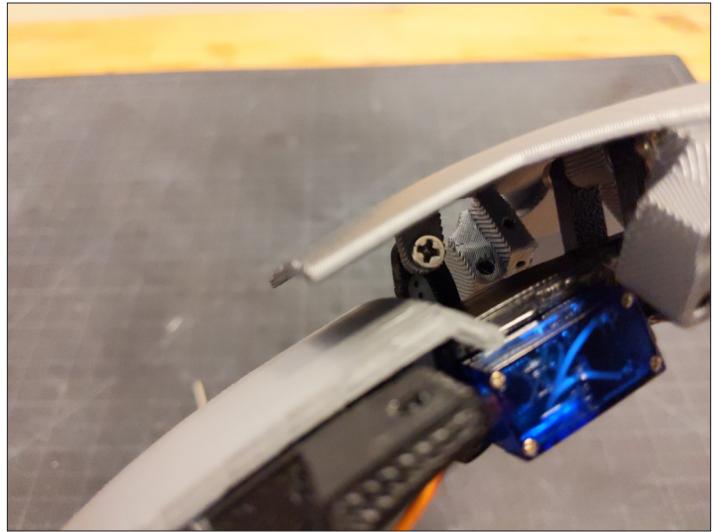
Step 86.
On both sides.



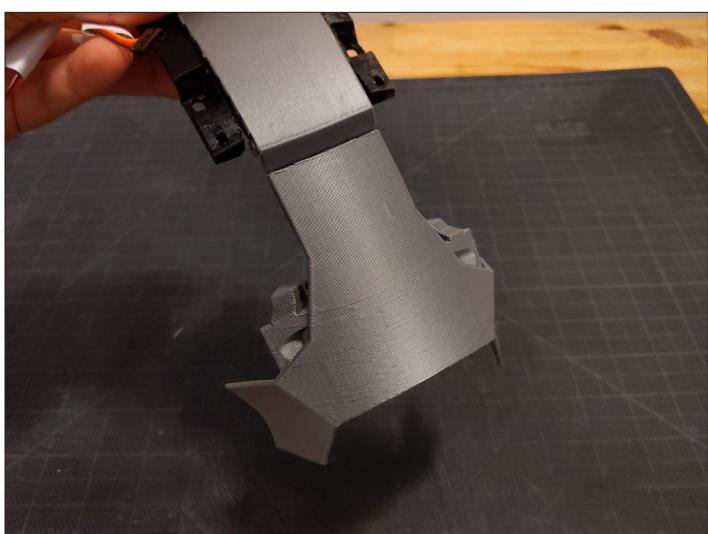
Step 87.
Prep nose_center with m3x8mm bolts and washer.



Step 88.
Screw the bolts into servo arm_A.



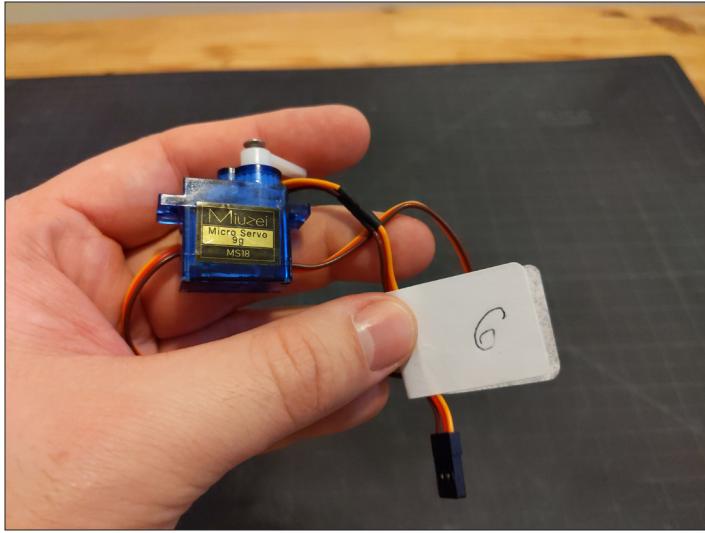
Step 89. At close, nose_center must be flat and aligned with brow_center.



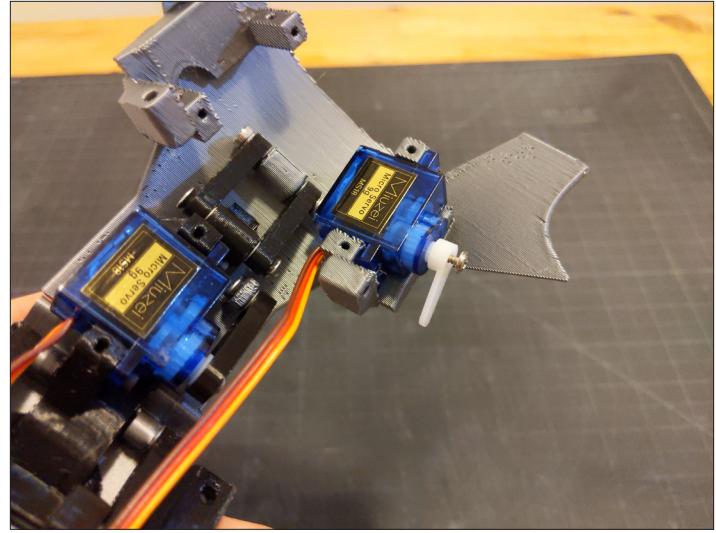
Step 90.
At open, both parts should be raised as shown.



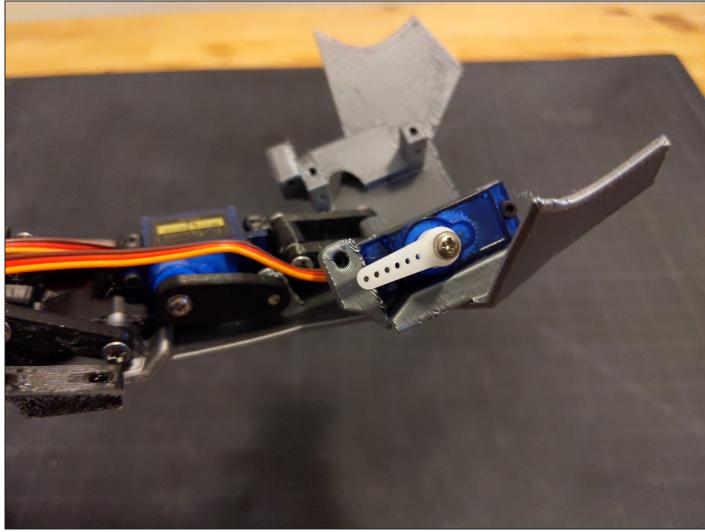
Step 91.
Find servo #6



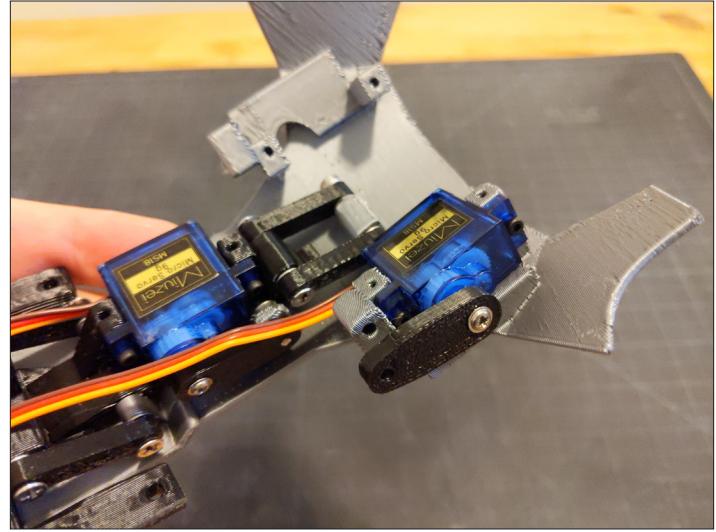
Step 92.
Place and attach with m2x8mm bolts.



Step 93.
Servo arm position at close.



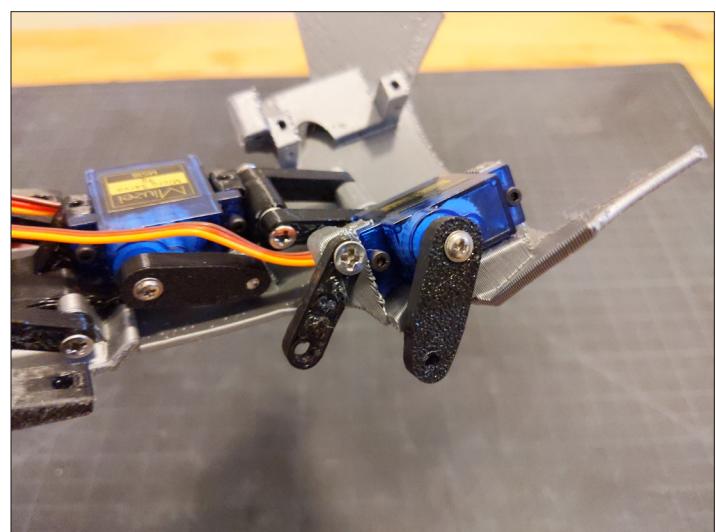
Step 94.
Attach servoArm_A.



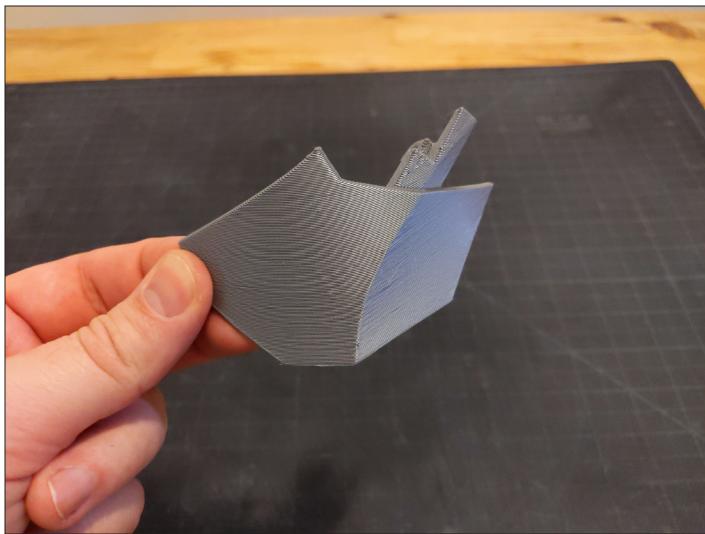
Step 95.
Prep arm_B with m3x8mm bolt and a washer.



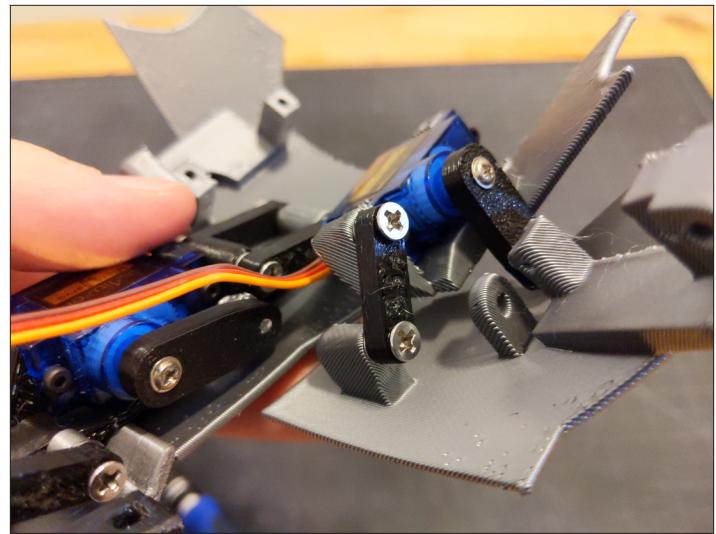
Step 96.
Attach to nose_center as shown.



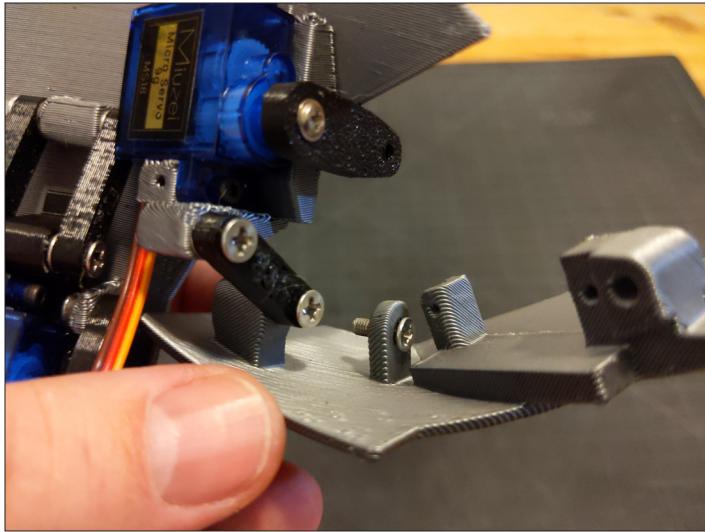
Step 97.
Grab nose_side



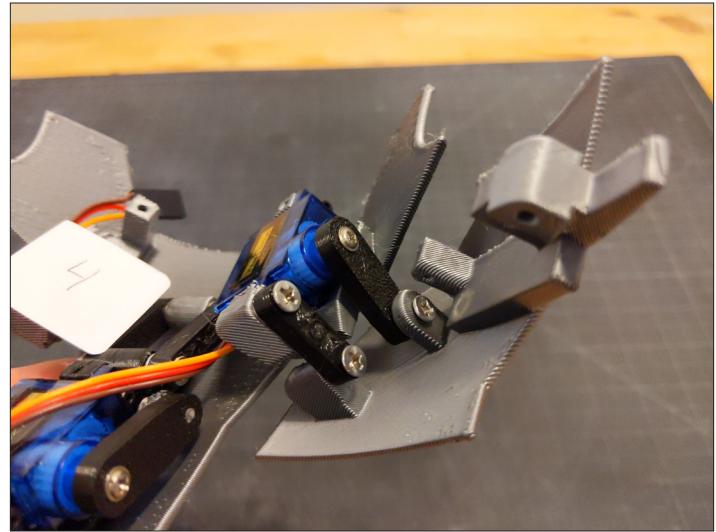
Step 98.
Attach with m3x8mm bolt to arm_B.



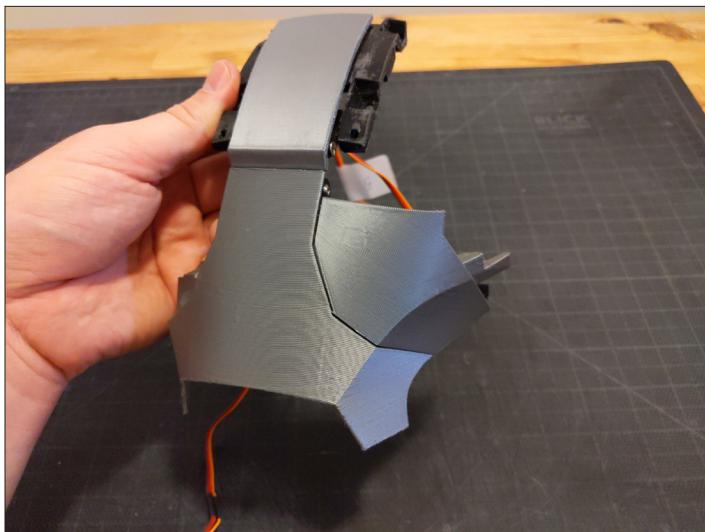
Step 99.
Prep nose_side with m3x8mm bolt and a washer



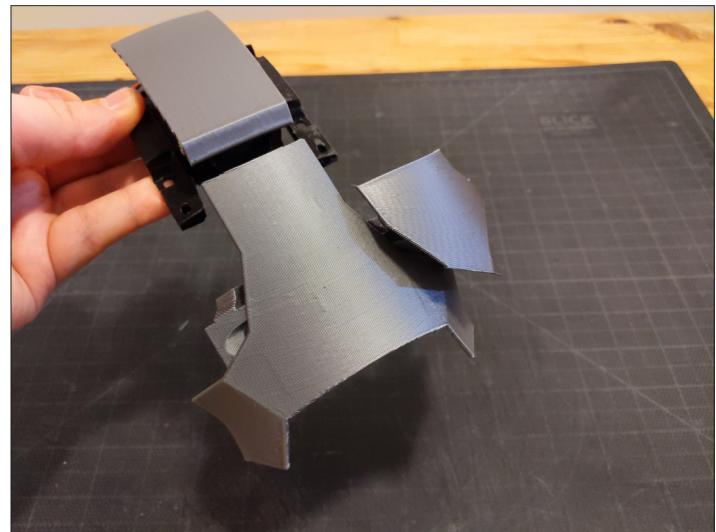
Step 100.
Screw into servoArm_A (a bit tricky angle).



Step 101.
When closed, the parts should line up and be flat.

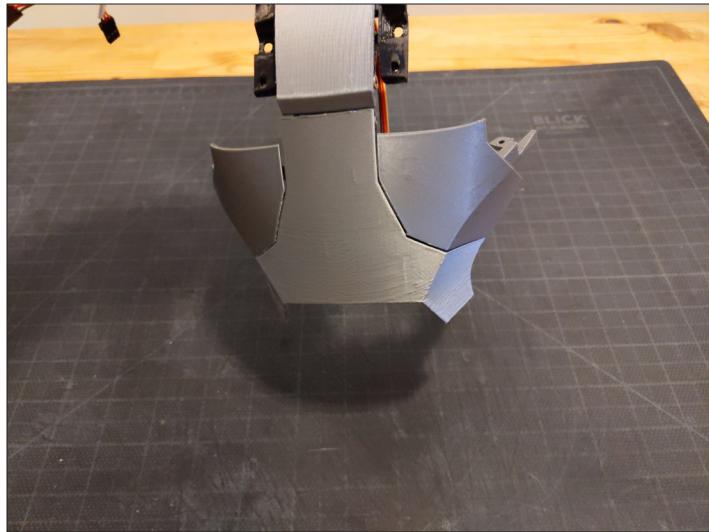


Step 102.
At open, nose_side should come in and down.



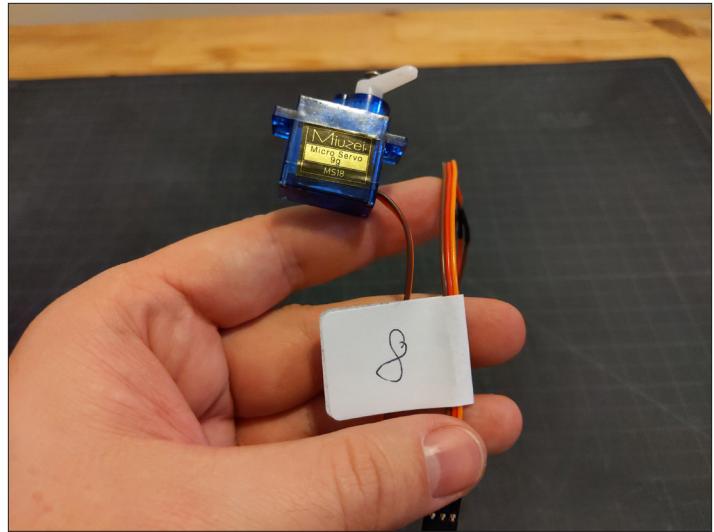
Step 103.

Mirror on the other side with servo #7.



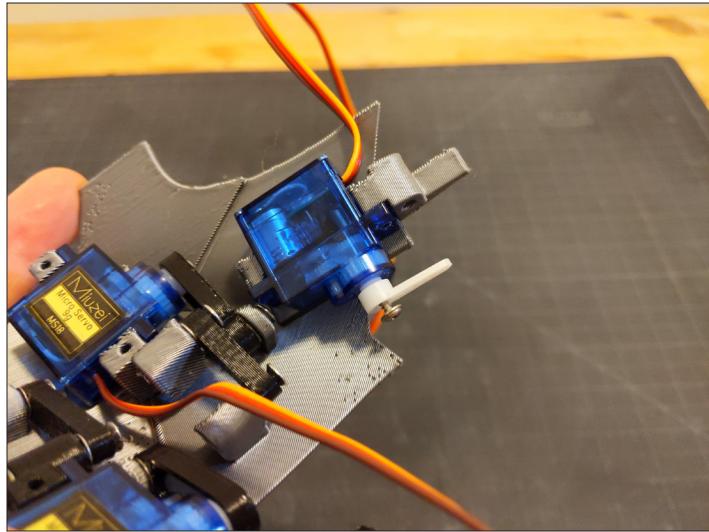
Step 104.

Grab servo #8.



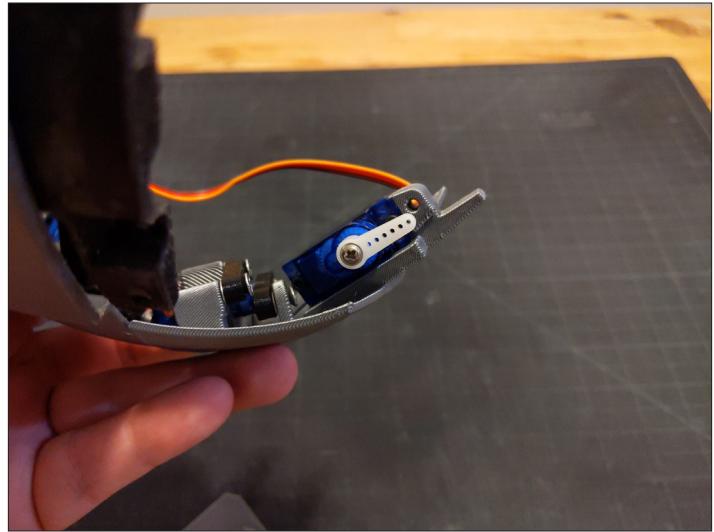
Step 105.

Attach to nose_side with two m2x8mm bolts



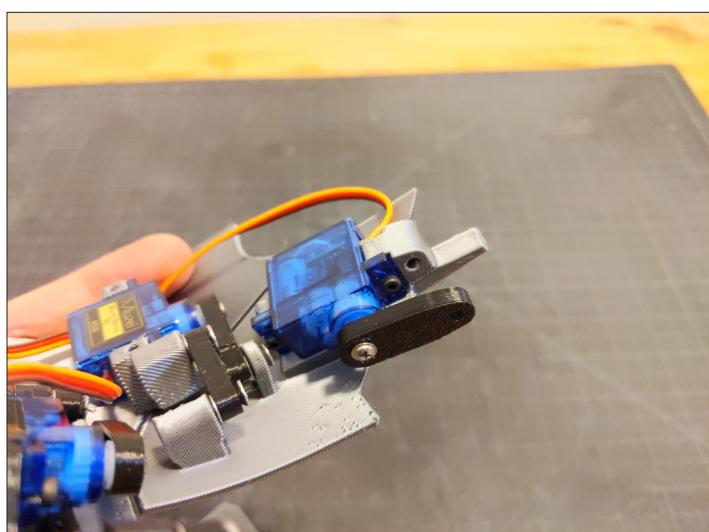
Step 106.

Servo arm position at closed.



Step 107.

Attach servoArm_A.

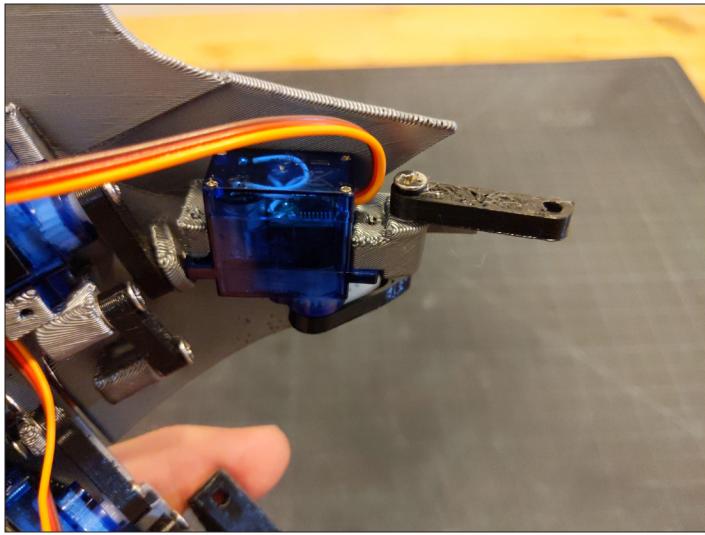


Step 108.

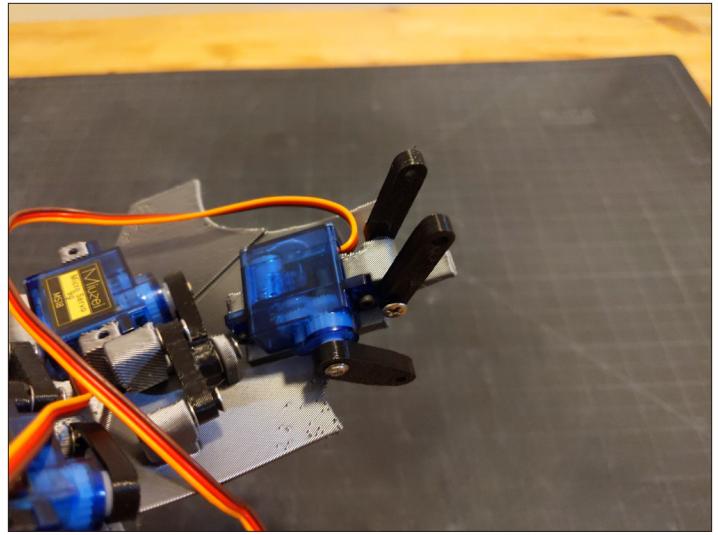
Prep arm_A with m3x8mm bolt and a washer.



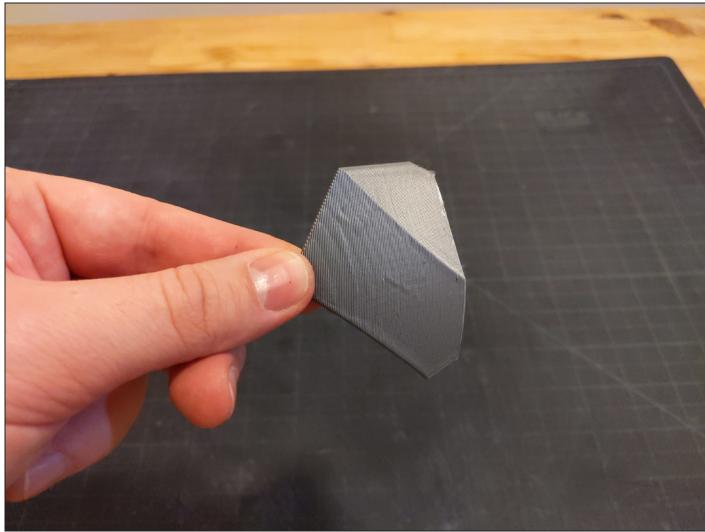
Step 109.
Attach arm_A to nose_side.



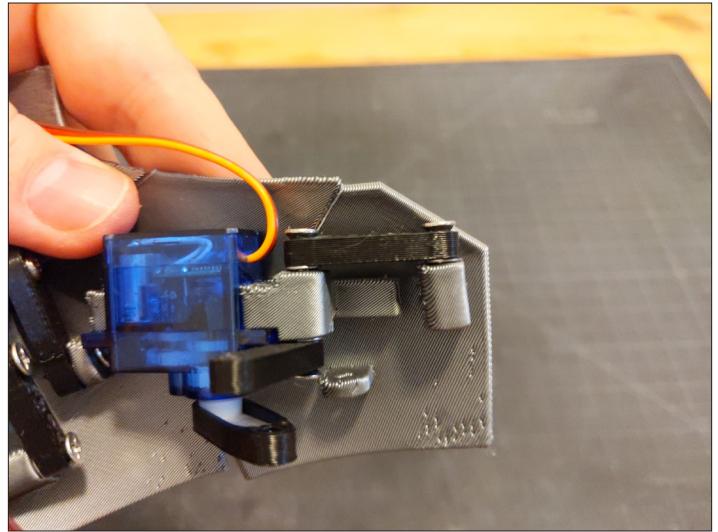
Step 110.
Twice.



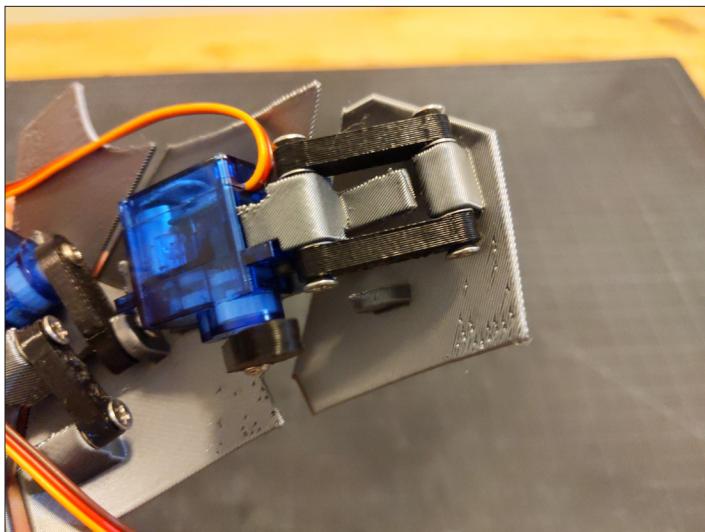
Step 111.
Grab cheek.



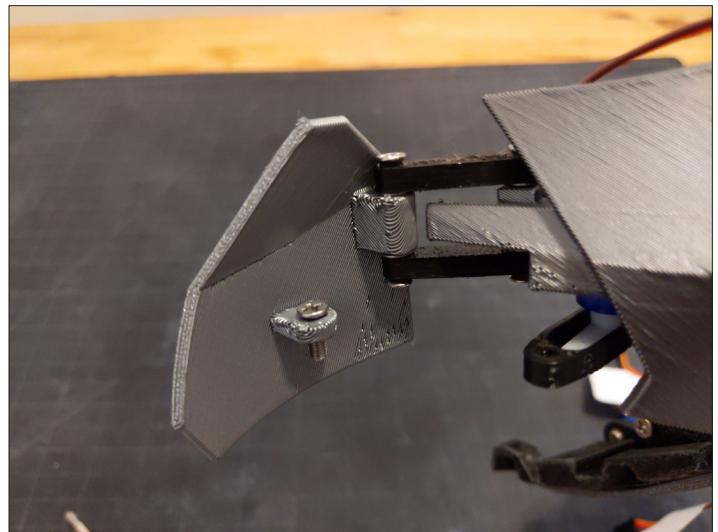
Step 112.
Attach using m3x8mm bolt and washer.



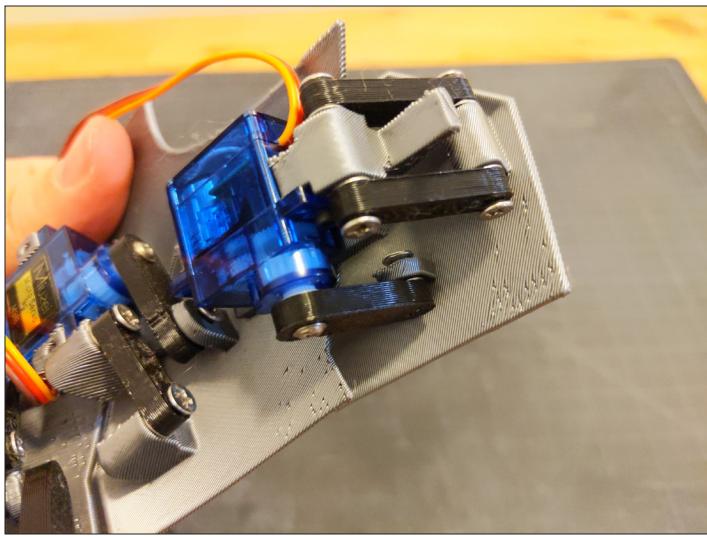
Step 113.
Twice.



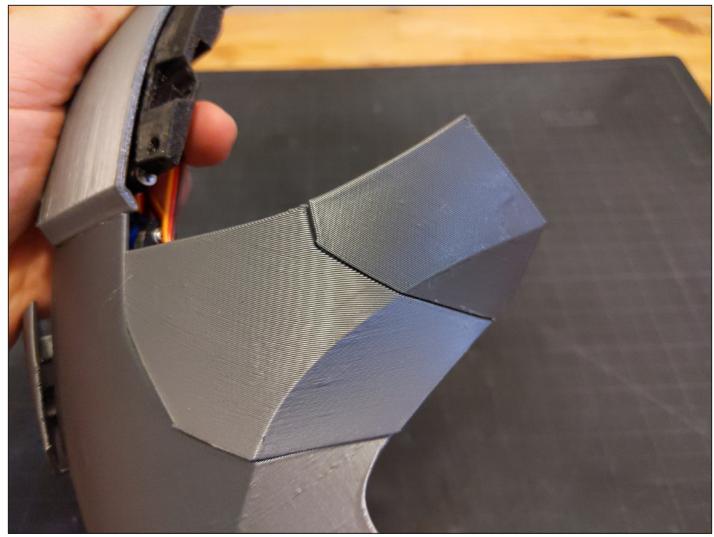
Step 114.
Insert m3x8mm bolt and washer into cheek.



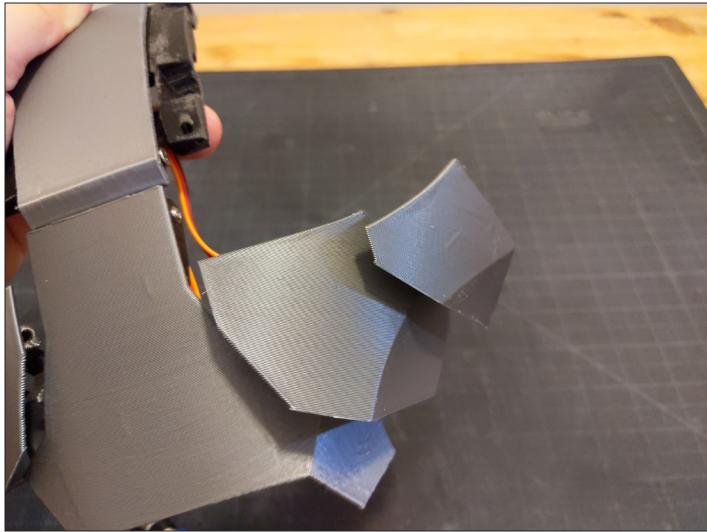
Step 115.
Screw into servoArm_A.



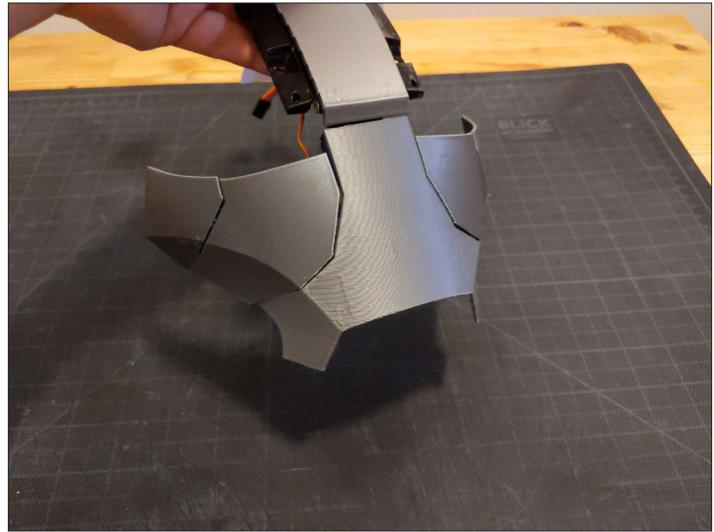
Step 116.
At close, all parts should line up and lay flat



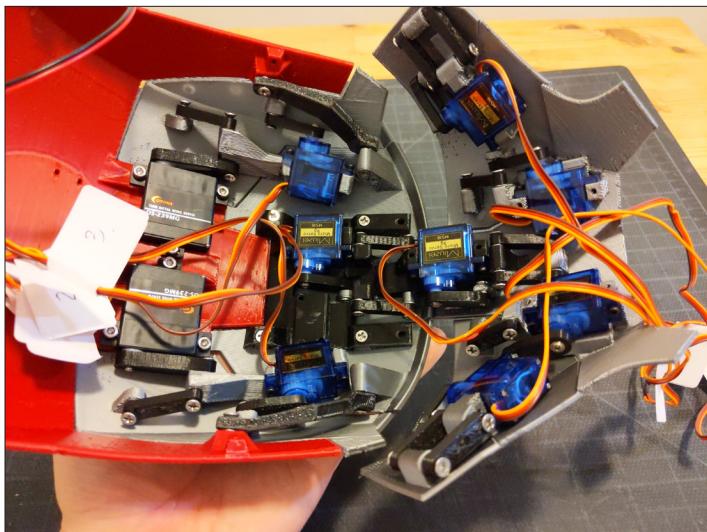
Step 117.
At open, they should come down and in.



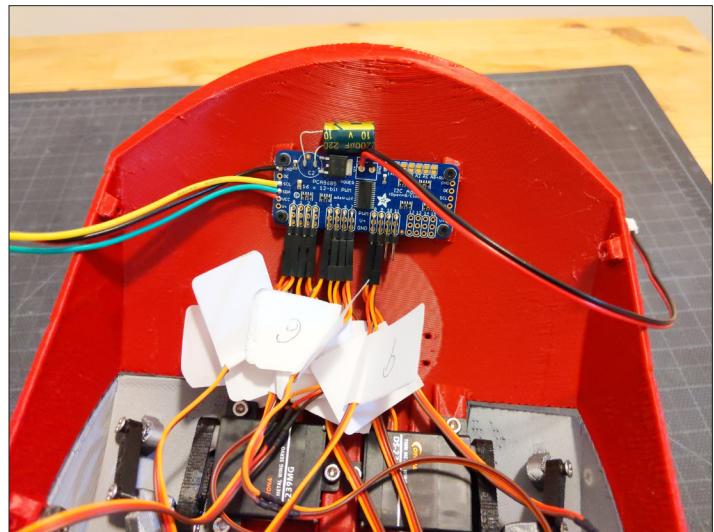
Step 118.
Mirror on the other side with servo#9.



Step 119.
Re-attach brow_center_mount.



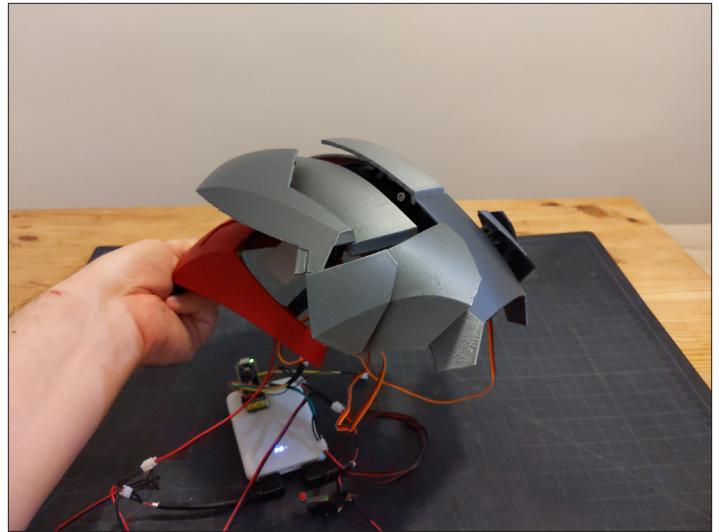
Step 120.
Connect all servos to PCA9685.



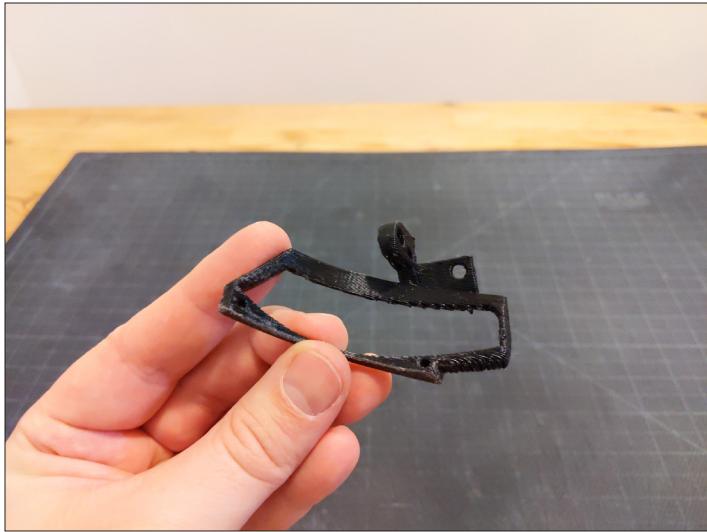
Step 121.
Alignment at closed.



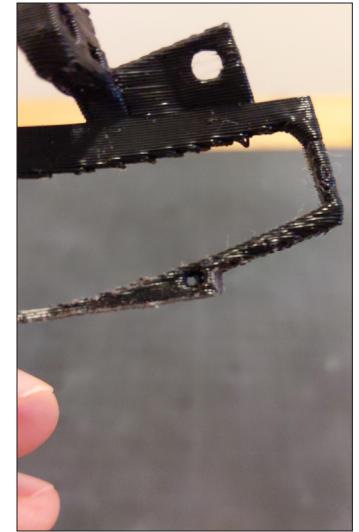
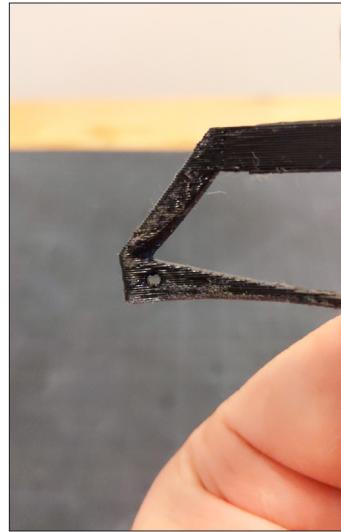
Step 122.
Alignment at open.



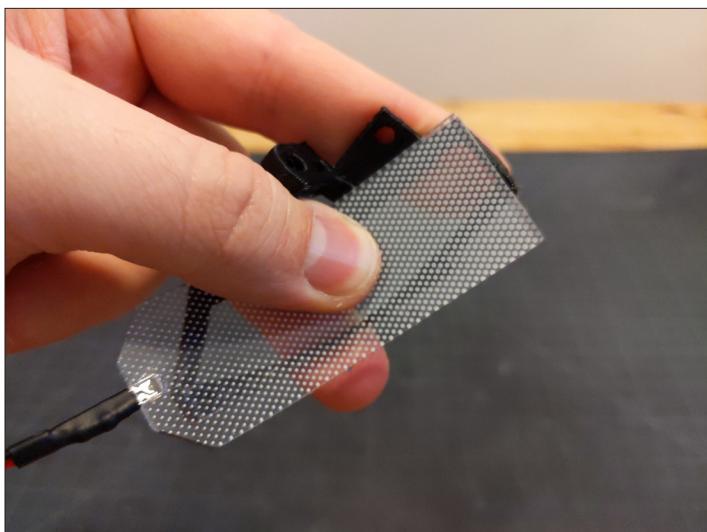
Step 123.
Find eye.



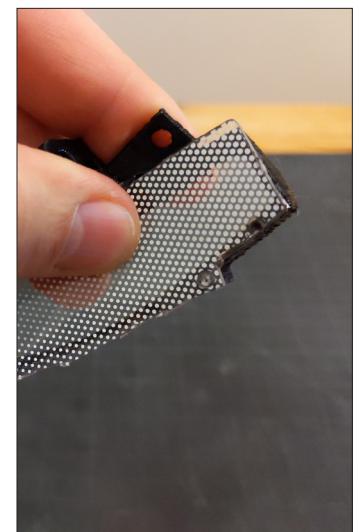
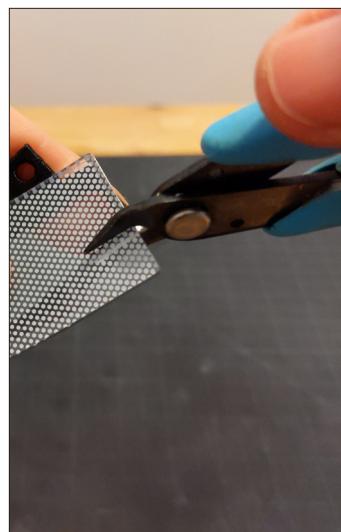
Step 124.
There are two holes at the bottom.



Step 125. Align led panel as shown and mark for those two holes.

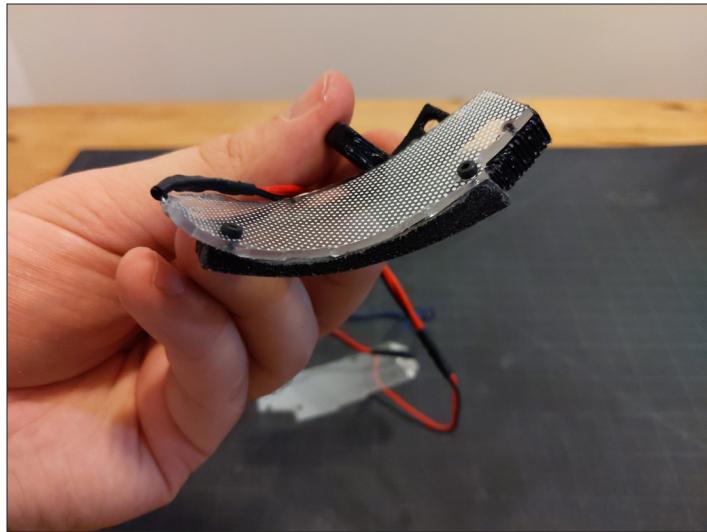


Step 126.
Trim away the bottom along the printed part.



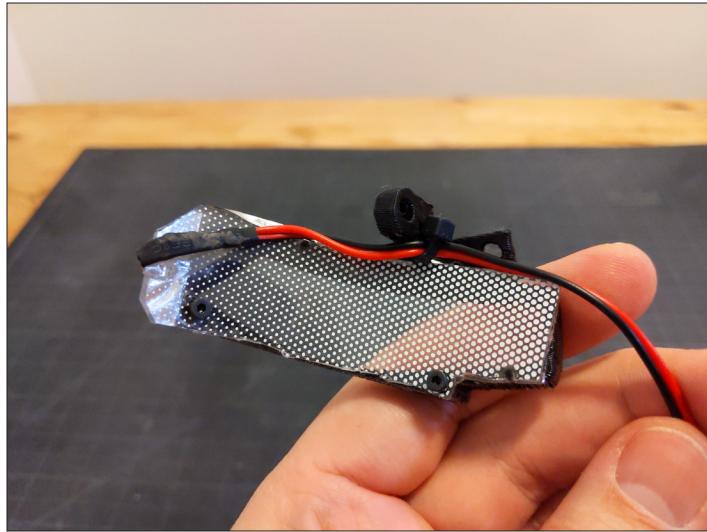
Step 127.

Use two m2x8mm bolts to attach.

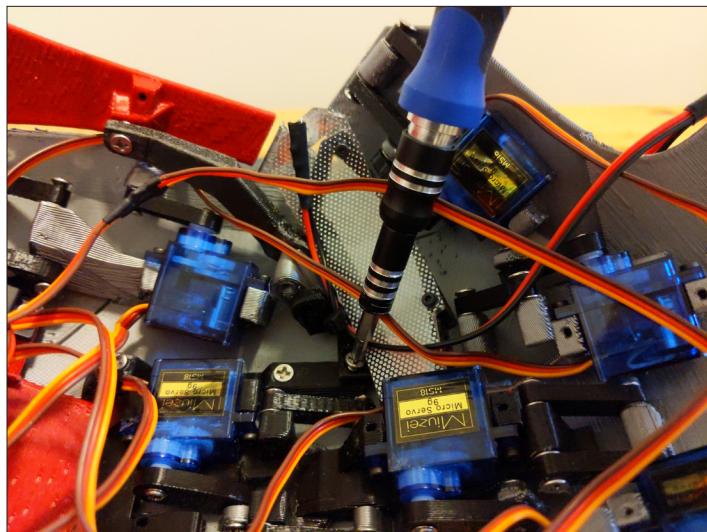


Step 129.

Cable must run this way for clearance.

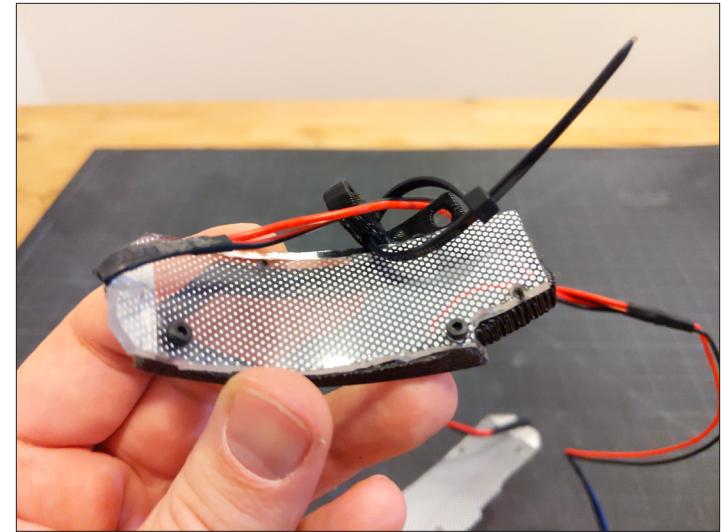


Step 131. Attach the eye to brow_center_mount with m3x6mm bolt.



Step 128.

Zip-tie cable as shown.



Step 130.

Mirror the other side.



Step 132.

Marvel at your work for a bit, hard work is done.



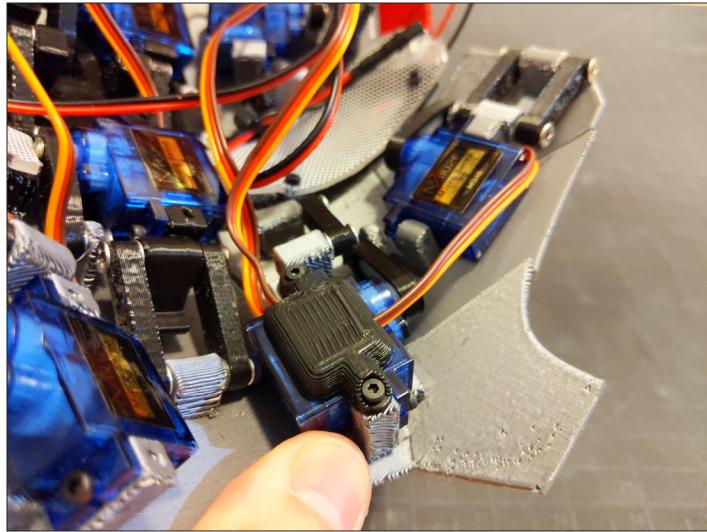
Step 133.

Time for wire management. Find wire_cheek.



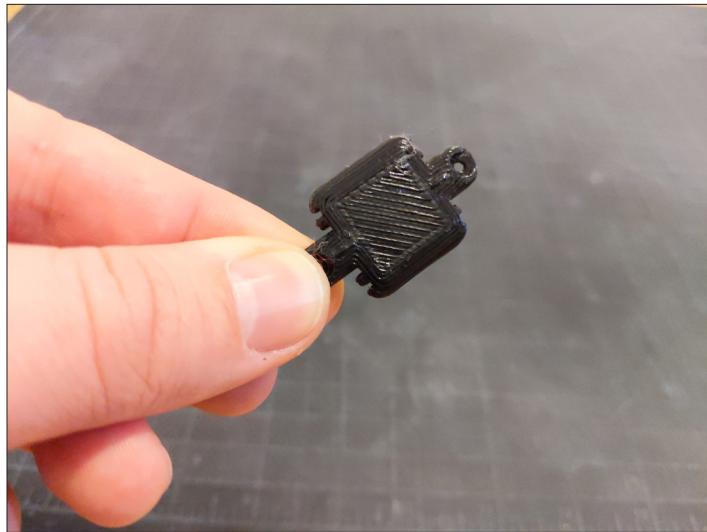
Step 135.

Mount on top of servo #7 with two m2x6mm bolts.



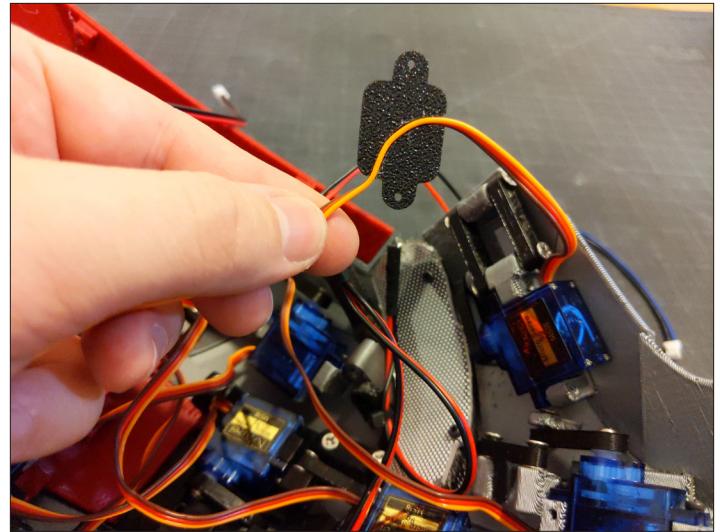
Step 137.

Grab wire_nose.



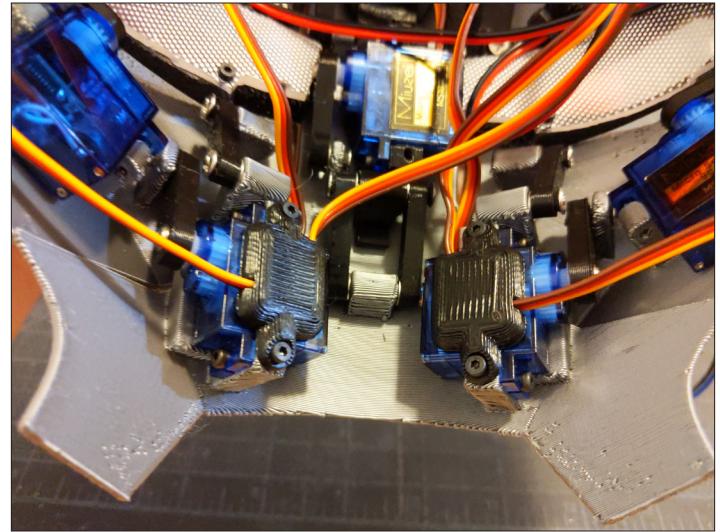
Step 134.

Insert wire from servo#9.



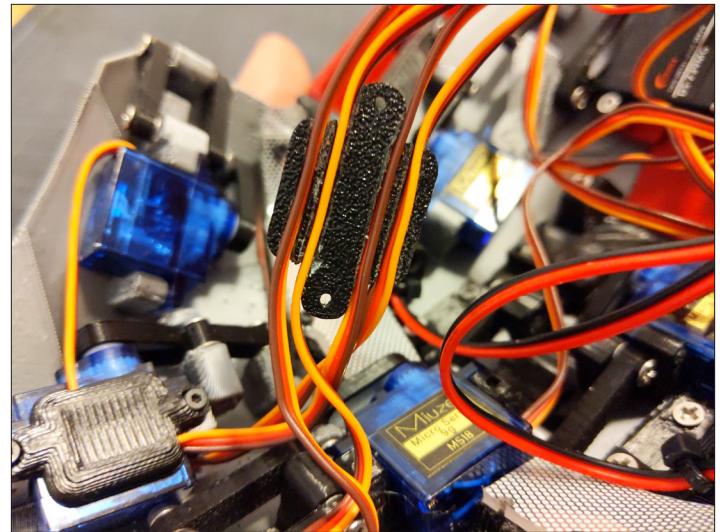
Step 136.

Mirror the other side.



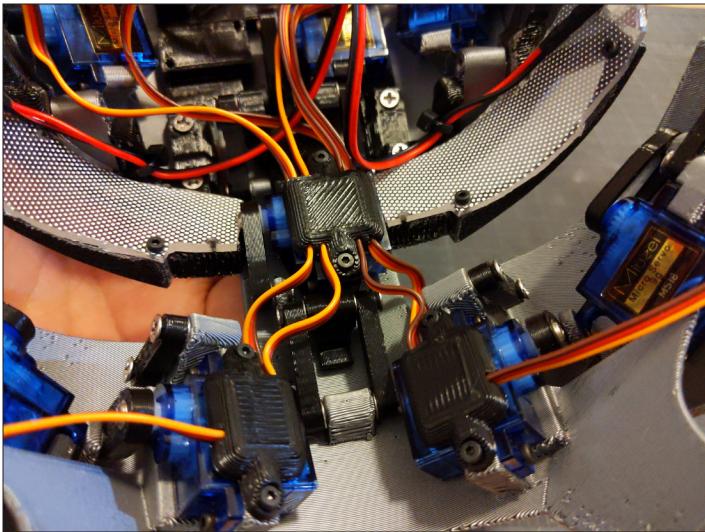
Step 138.

Insert wires from servos 6, 7, 8, 9.



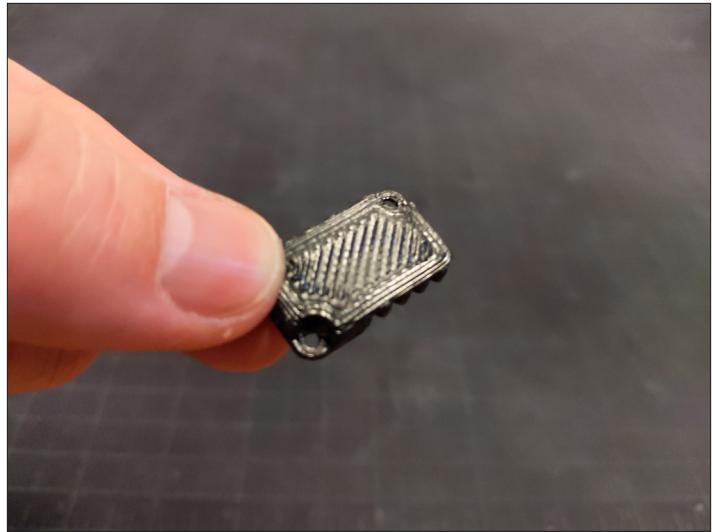
Step 139.

Mount on top of servo #5 with two m2x6mm bolts.



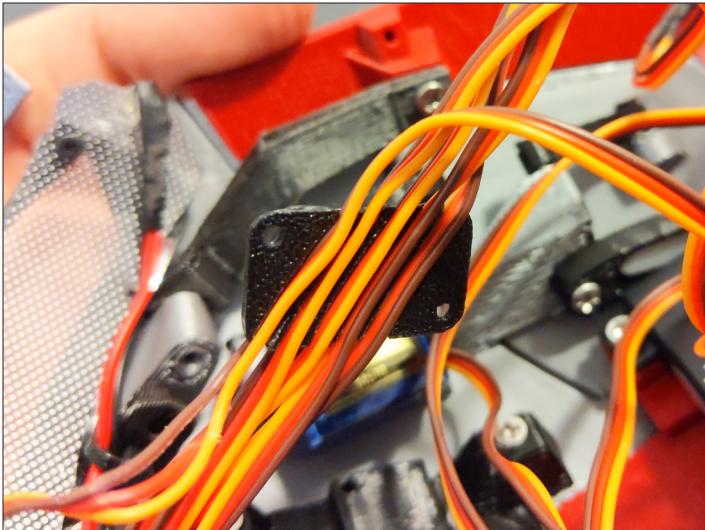
Step 140.

Grab wire_brow.



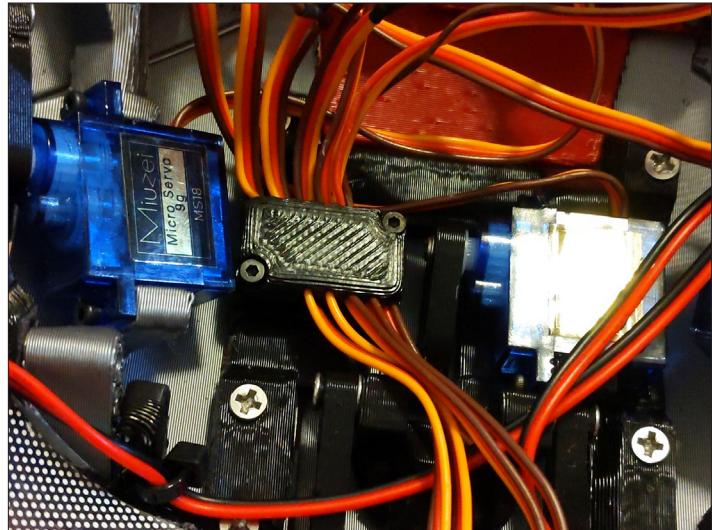
Step 141.

Insert wires from servos 5, 6, 7, 8, 9.



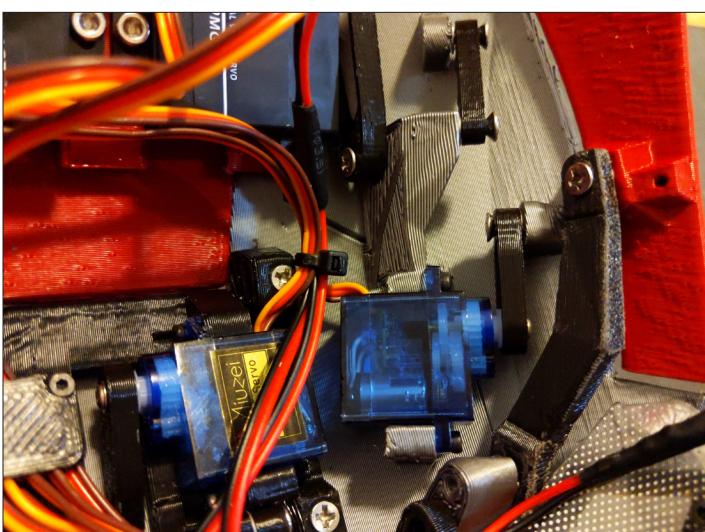
Step 142.

Attach to brow_center_mount with m2x6mm bolts.



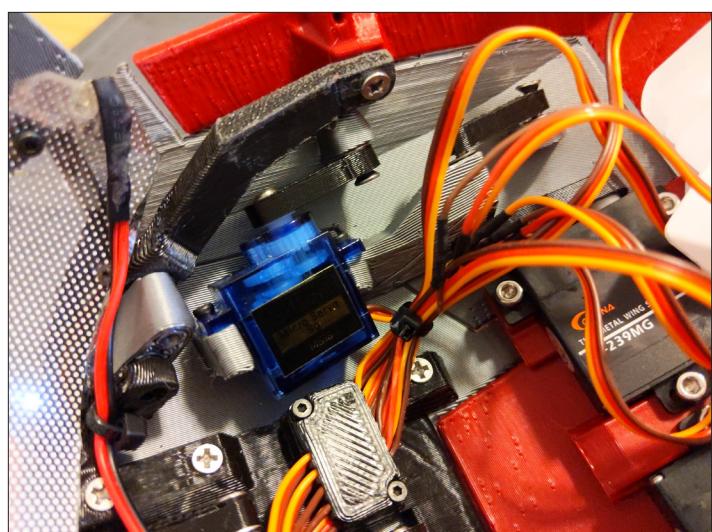
Step 143.

Zip-tie servos 3, 4 and eye wires together.

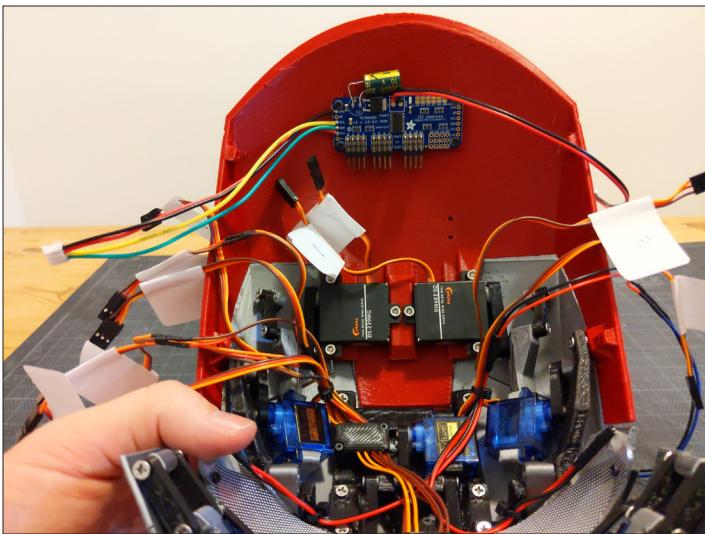


Step 144.

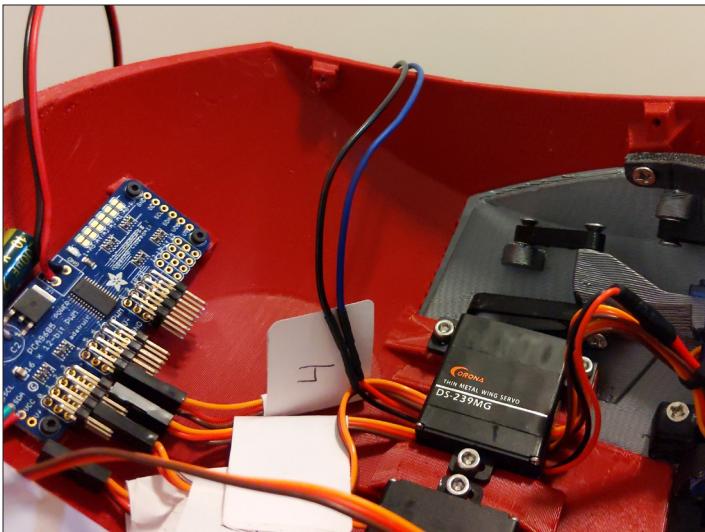
Zip-tie servos 2, 5, 6, 7, 8, 9 together.



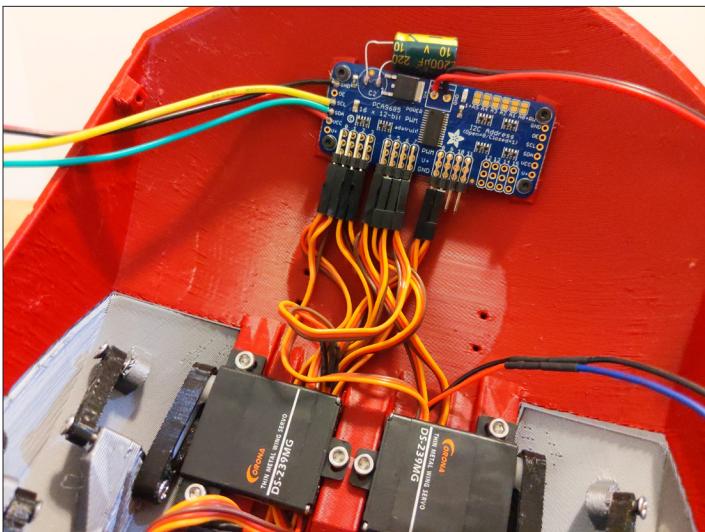
Step 145.
Unplug all servos.



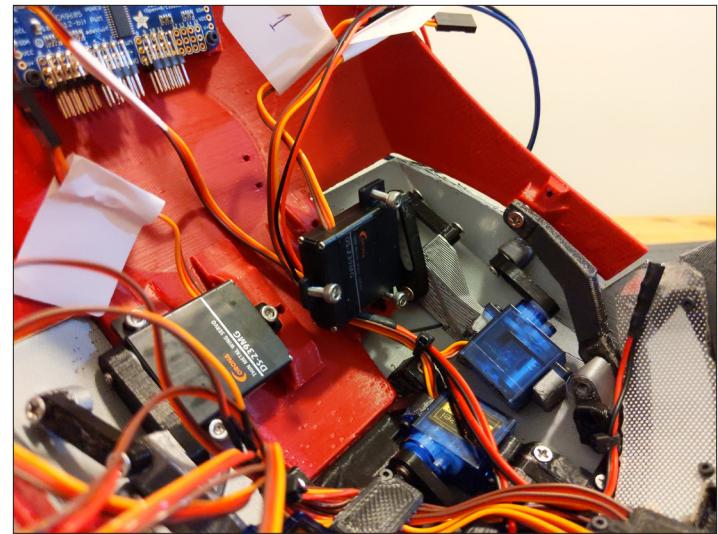
Step 147. Place wires into the channel under the servo and re-attach the servo.



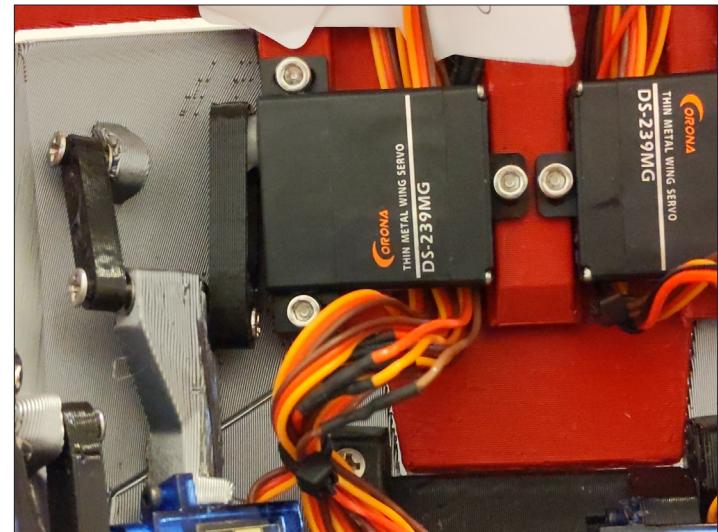
Step 149.
Plug all servos back in and remove tags.



Step 146.
Temporary un-screw servo #1.



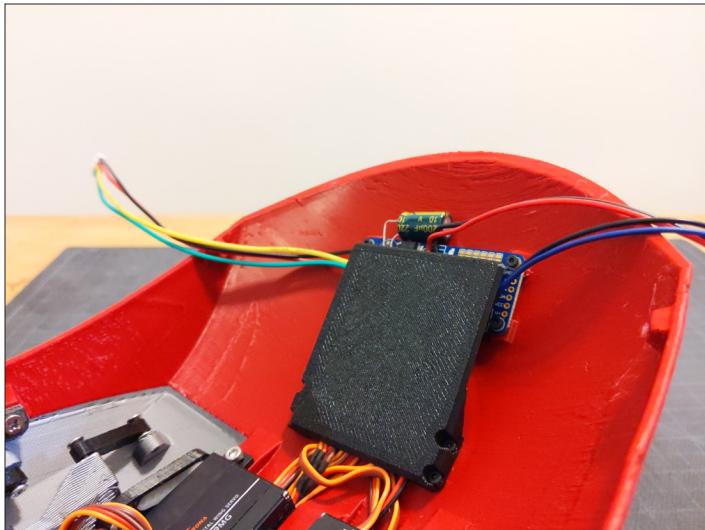
Step 148.
Repeat on the other side.



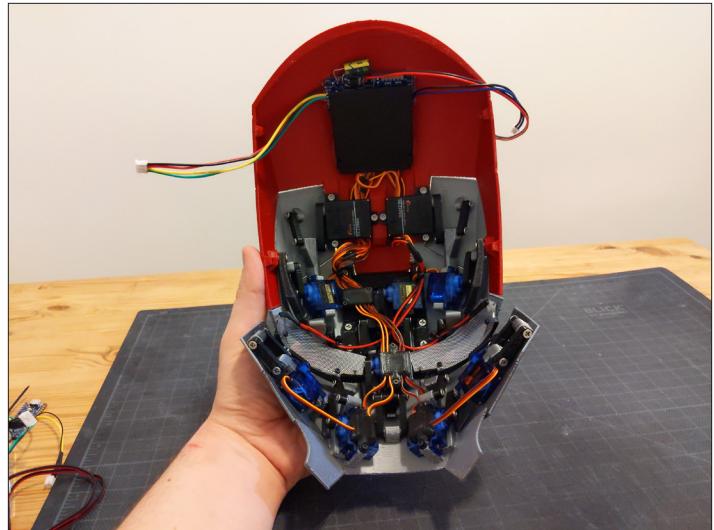
Step 150.
Grab wire_main.



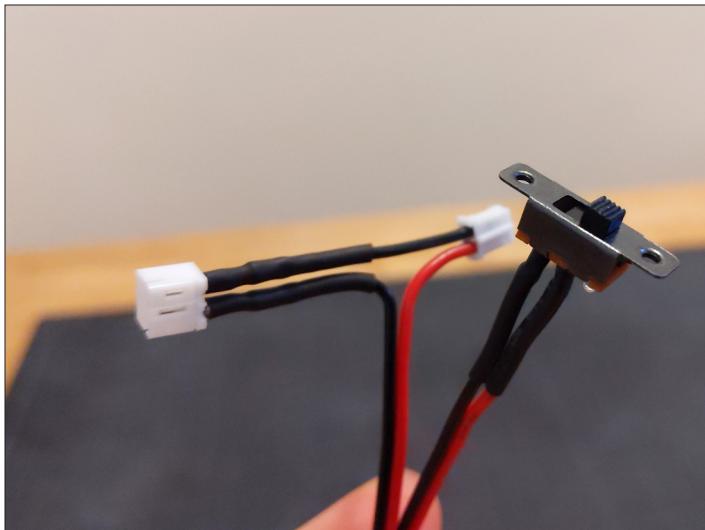
Step 151.
Attach to dome01 with four m2x6mm bolts



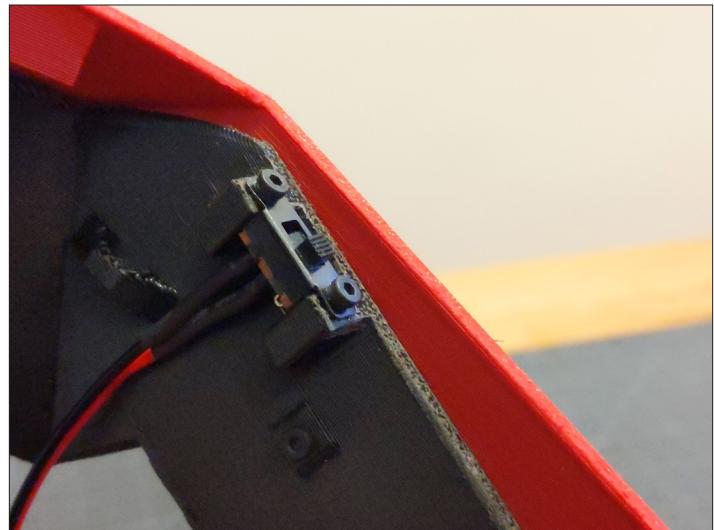
Step 152.
Admire your commitment to clean wire work.



Step 153.
Grab your slide switch.



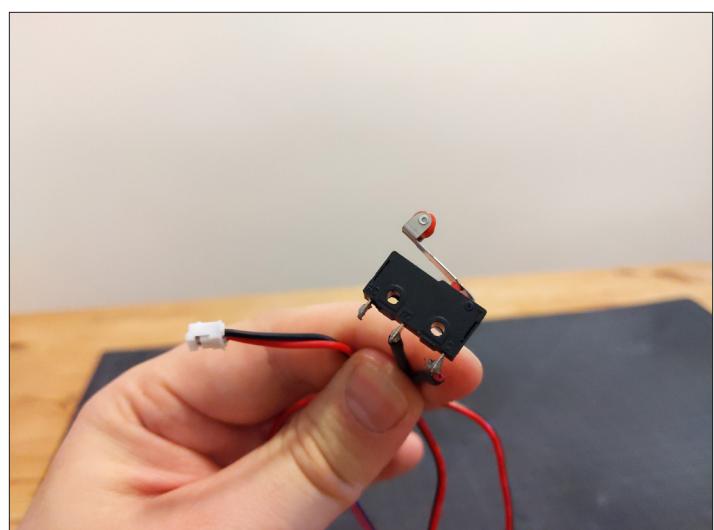
Step 154.
Mount to mouth with m2x8mm bolts



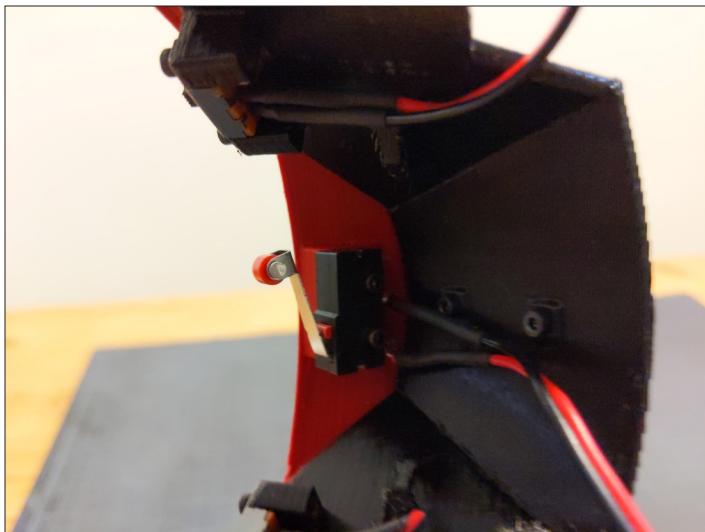
Step 155.
On both sides.



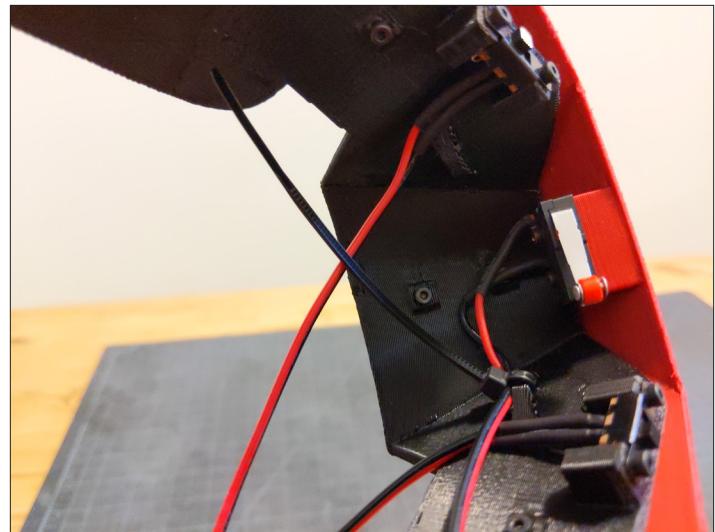
Step 156.
Grab your limit switch.



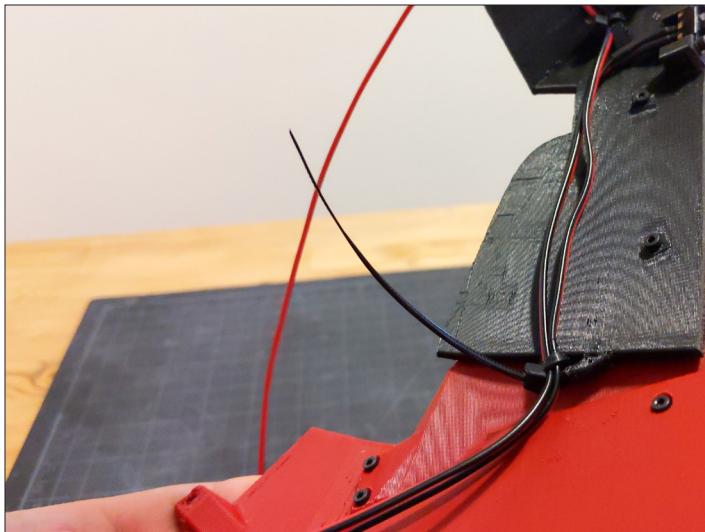
Step 157.
Attach to jaw with m2x10mm bolts



Step 158.
Zip-tie limit switch wire to mouth



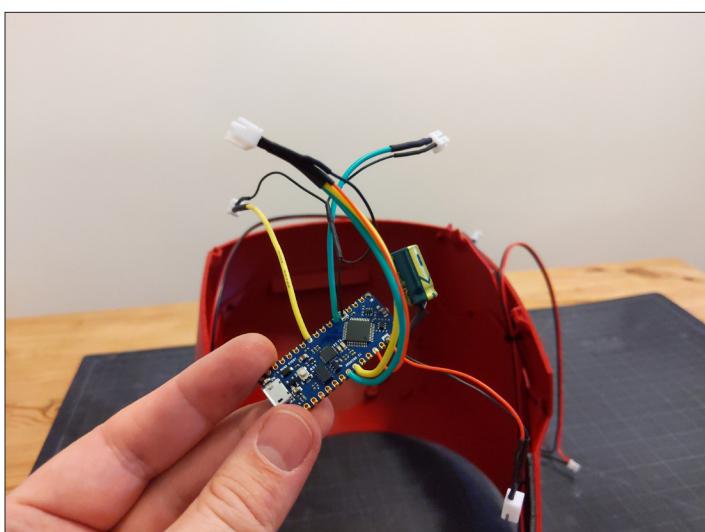
Step 159.
Zip-tie limit and slide switch wires to mouth.



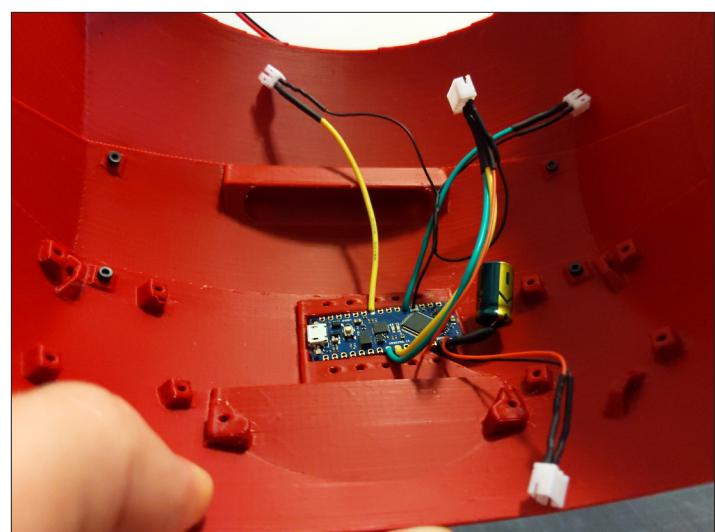
Step 160.
Zip-tie same wires to dome02.



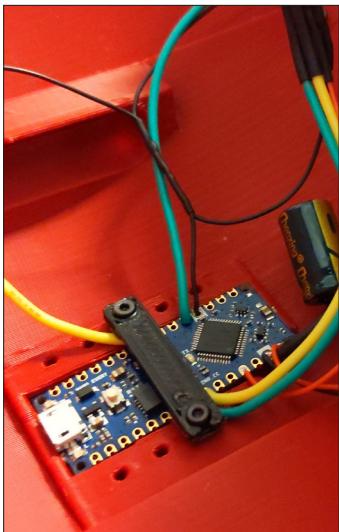
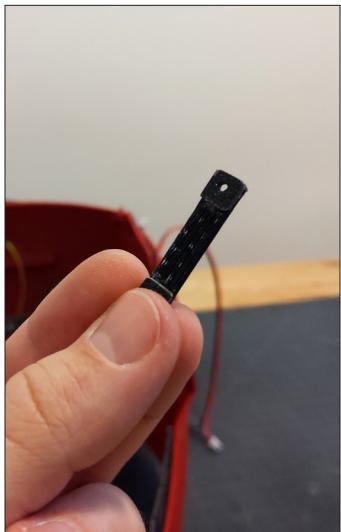
Step 161.
Grab your wired up Arduino Nano.



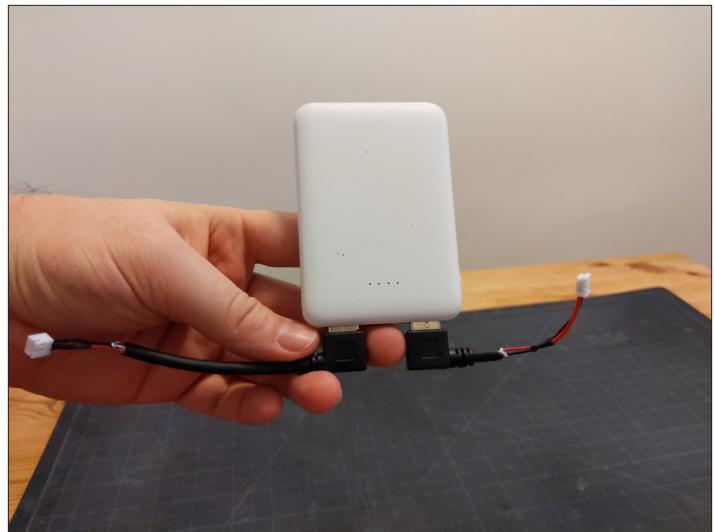
Step 162.
Place into dome04.



Step 163. Grab part “arduino“ and secure Nano with two m2x4mm bolts. Do not over-tighten.



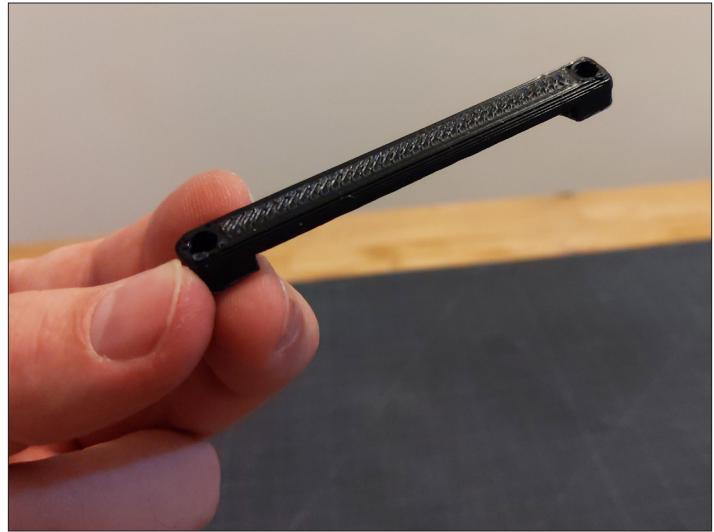
Step 164.
Plug usb cables into power bank.



Step 165.
Place the power bank over Nano.



Step 166.
Grab part “battery“.



Step 167.
Secure power bank with two m2x6mm bolts.

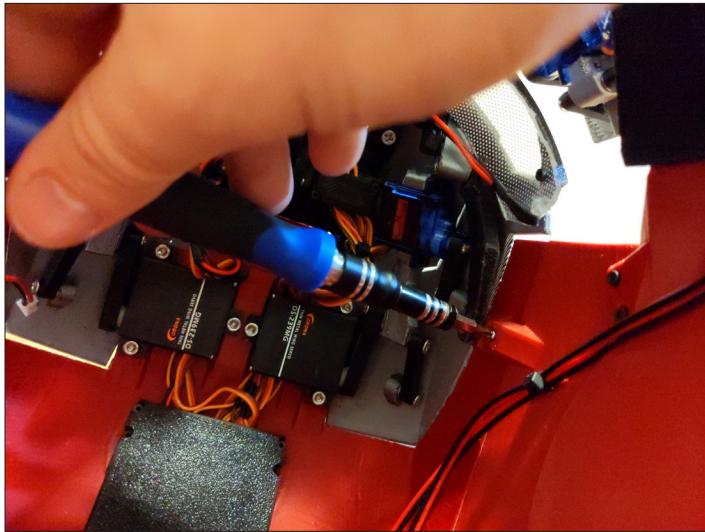


Step 168.
Time to attach two halves together.



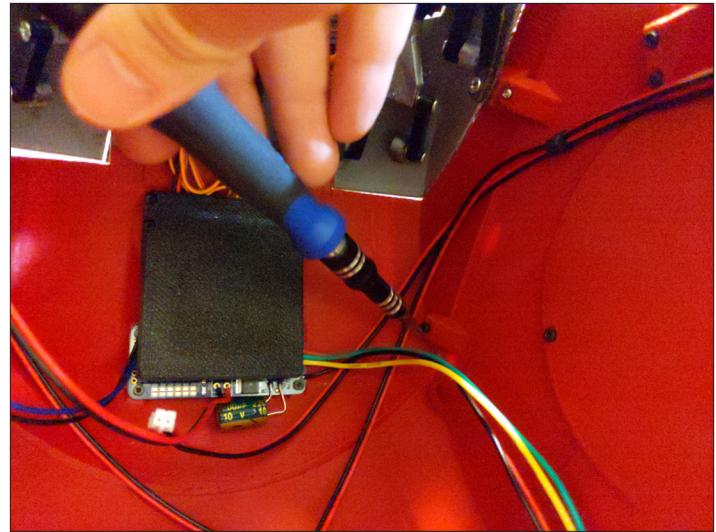
Step 169.

Use m2x6mm bolts by the cheek.



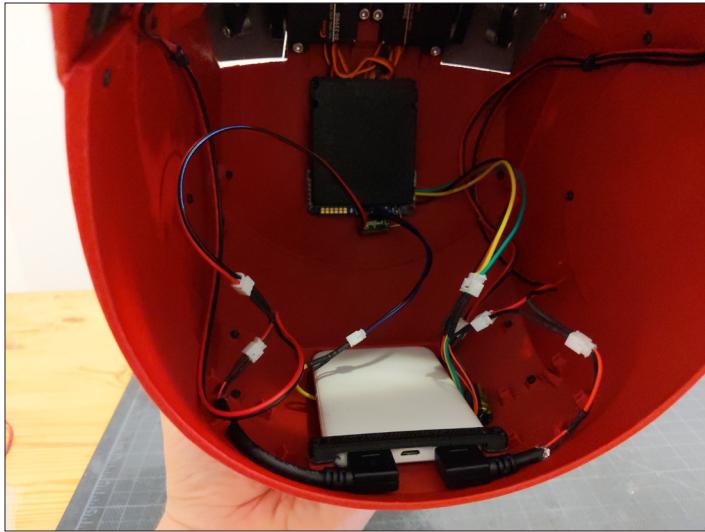
Step 170.

And another m2x6mm by the back.



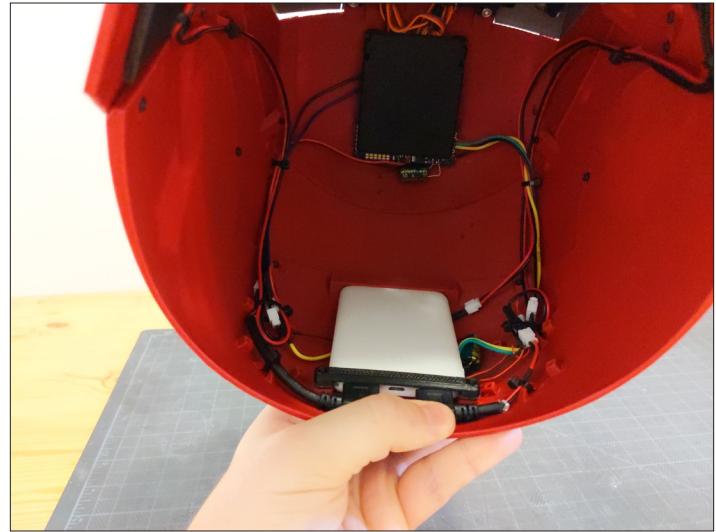
Step 171.

Connect all wires



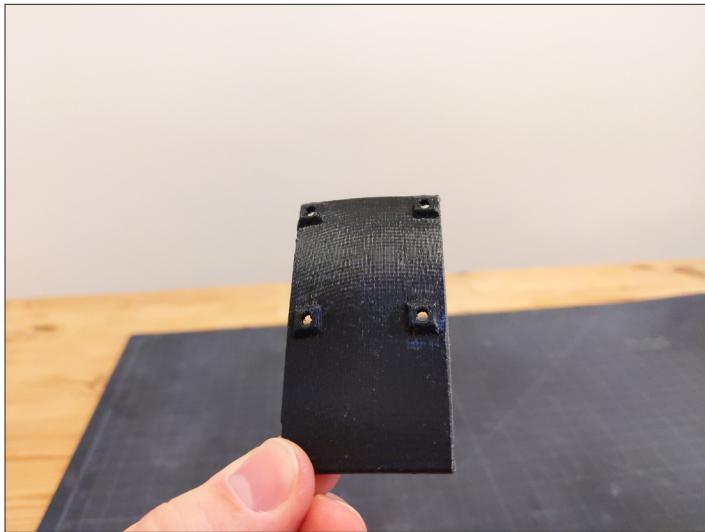
Step 172.

Zip-tie them all down.



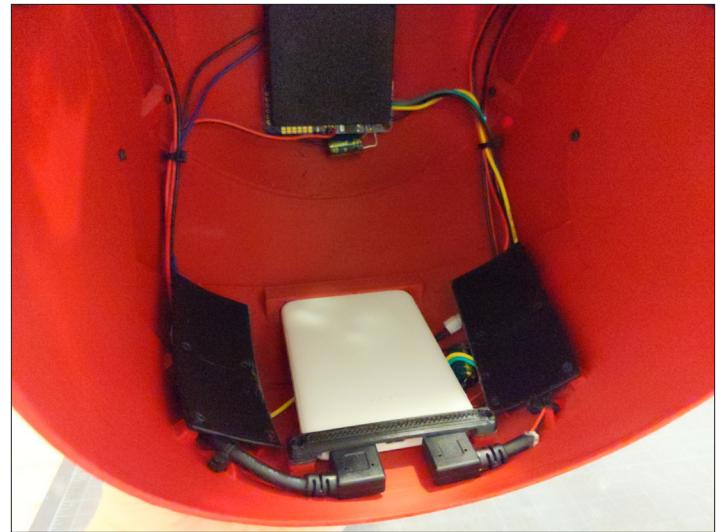
Step 173.

Grab wire_back.



Step 174.

Attach with m2x4mm bolts



Step 175.

Congratulations! You are all done and ready to wear your own Iron Man MK5 helmet.

