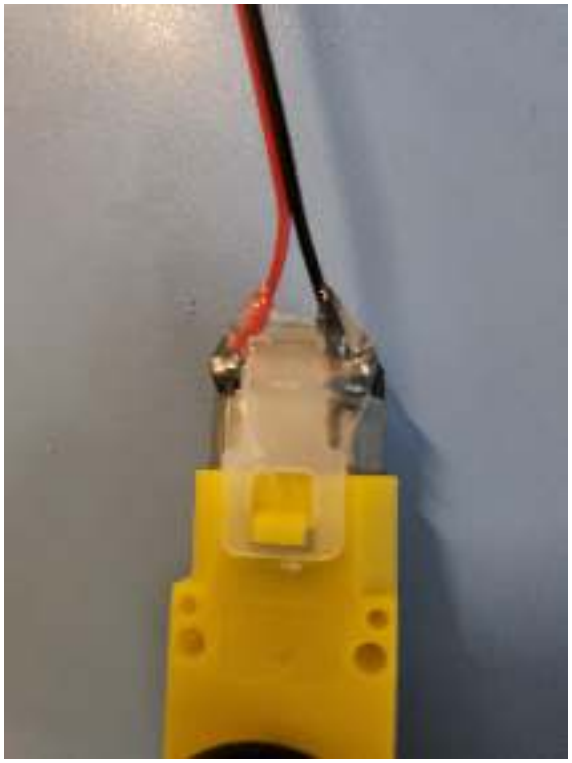
Rehabot2.0 Production Manual

1. 3D-print and preprocess casings and parts

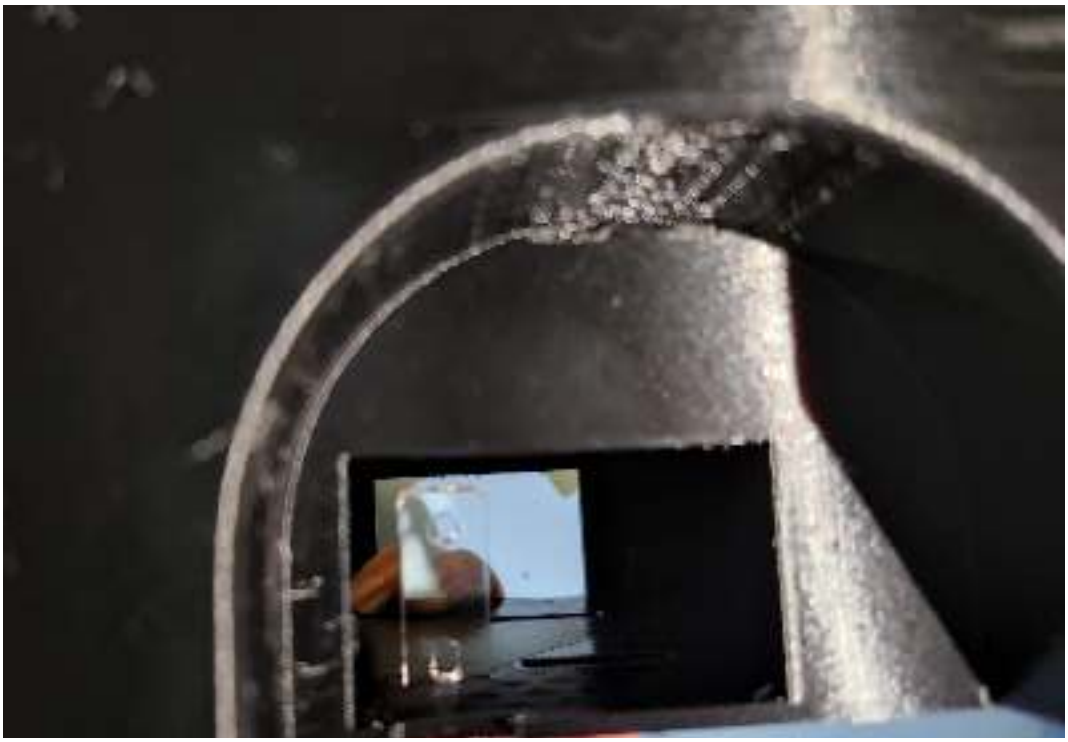
2. Print ArUco markers with IDs 0 and 1, and dictionary size of 5x5
3. Fold and tape paper markers and attach velcro to back of marker
4. Sew buckle and velcro to elastic bands as shown
5. Attach black support pieces to the motors

6. Solder wires to motors, and ensure that there are no exposed wires

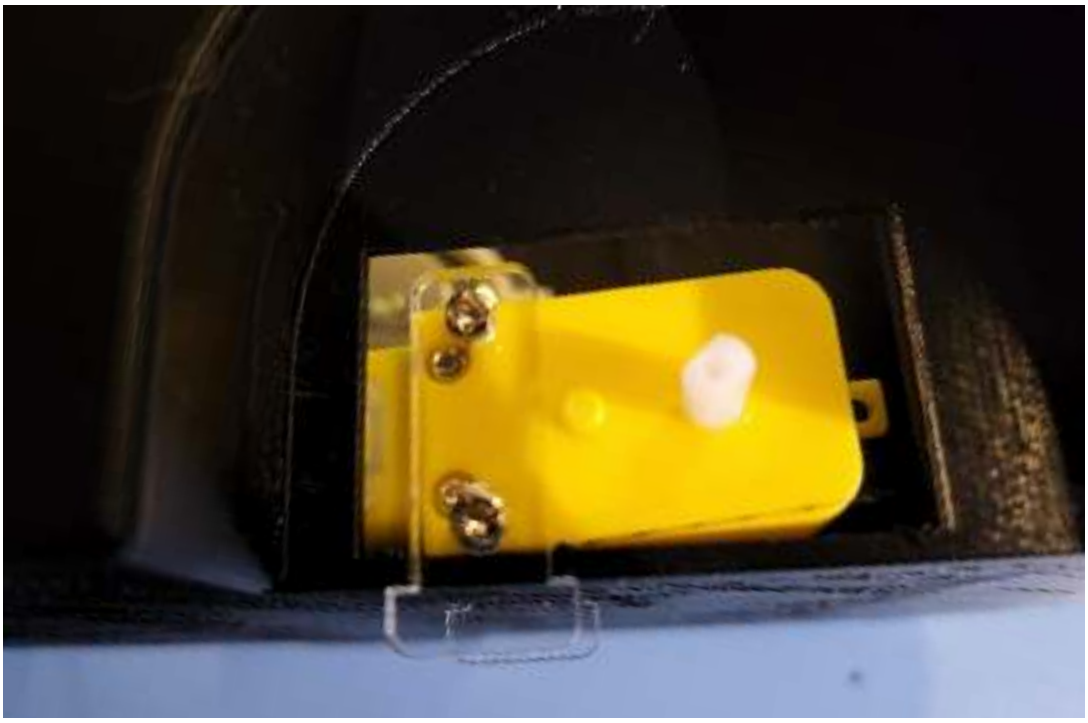


7. Attach motors to bottom casing with holders included in 4-wheel drive set

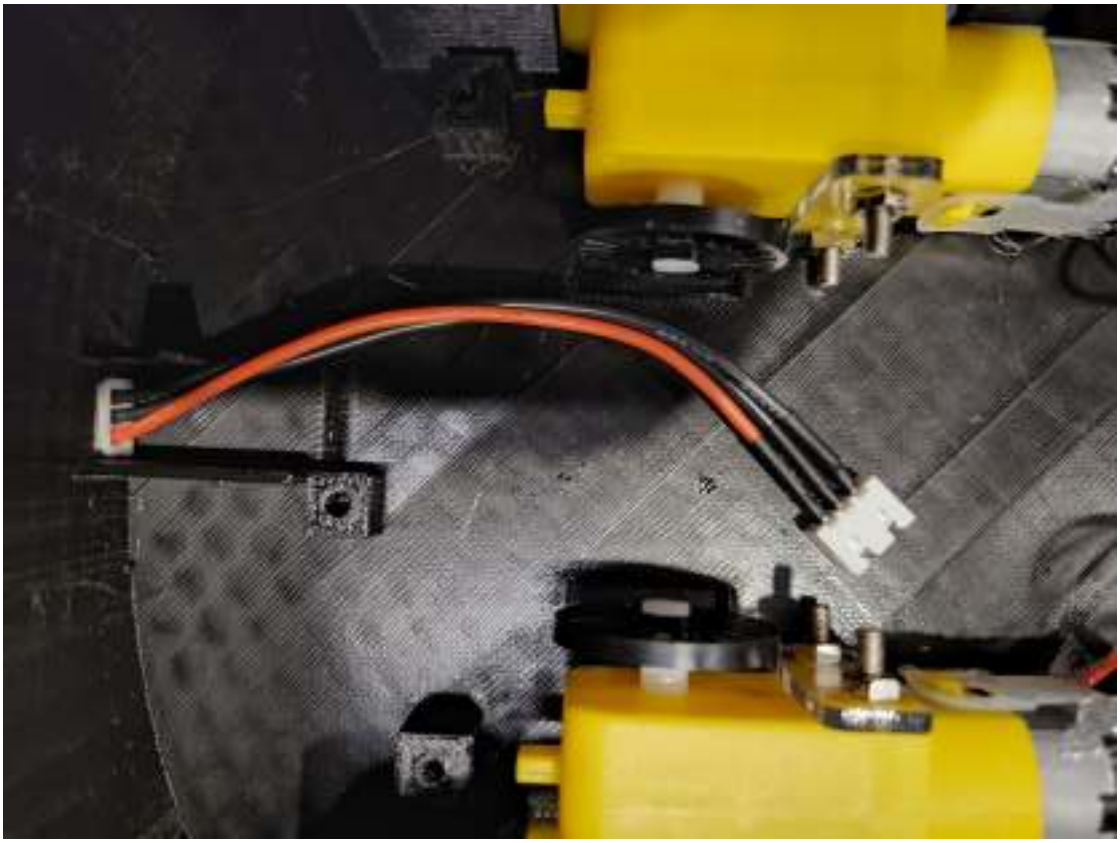
7.1. Insert the transparent plastic support piece into the holes on the bottom of the casing

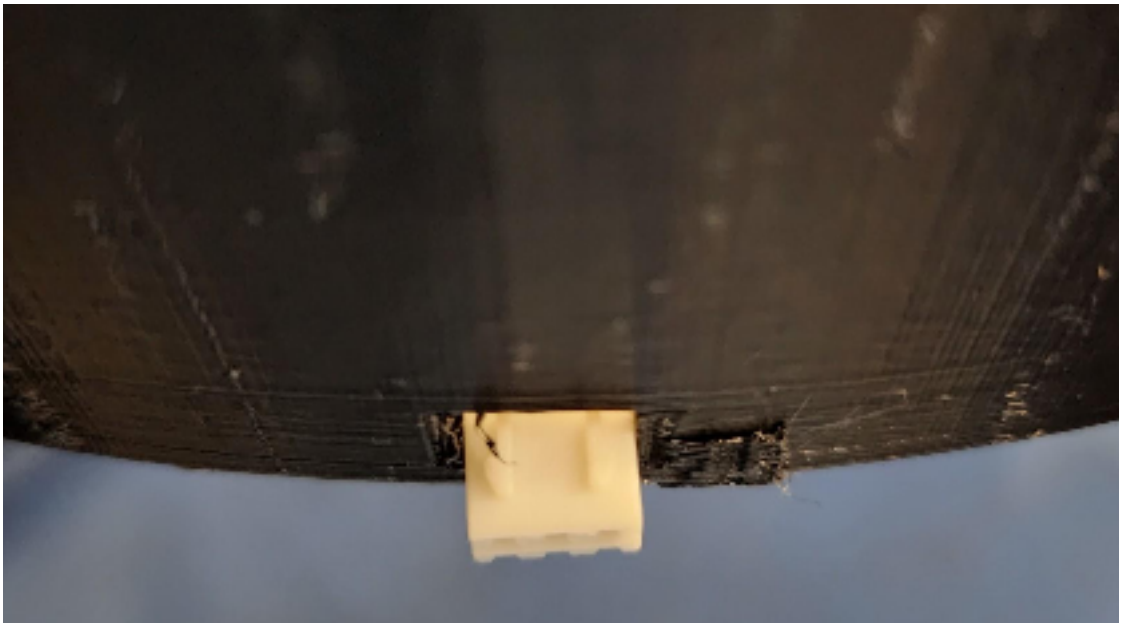


7.2. Place another transparent plastic support on the motor and attach the two plastic supports and the motor with the nuts and screws provided

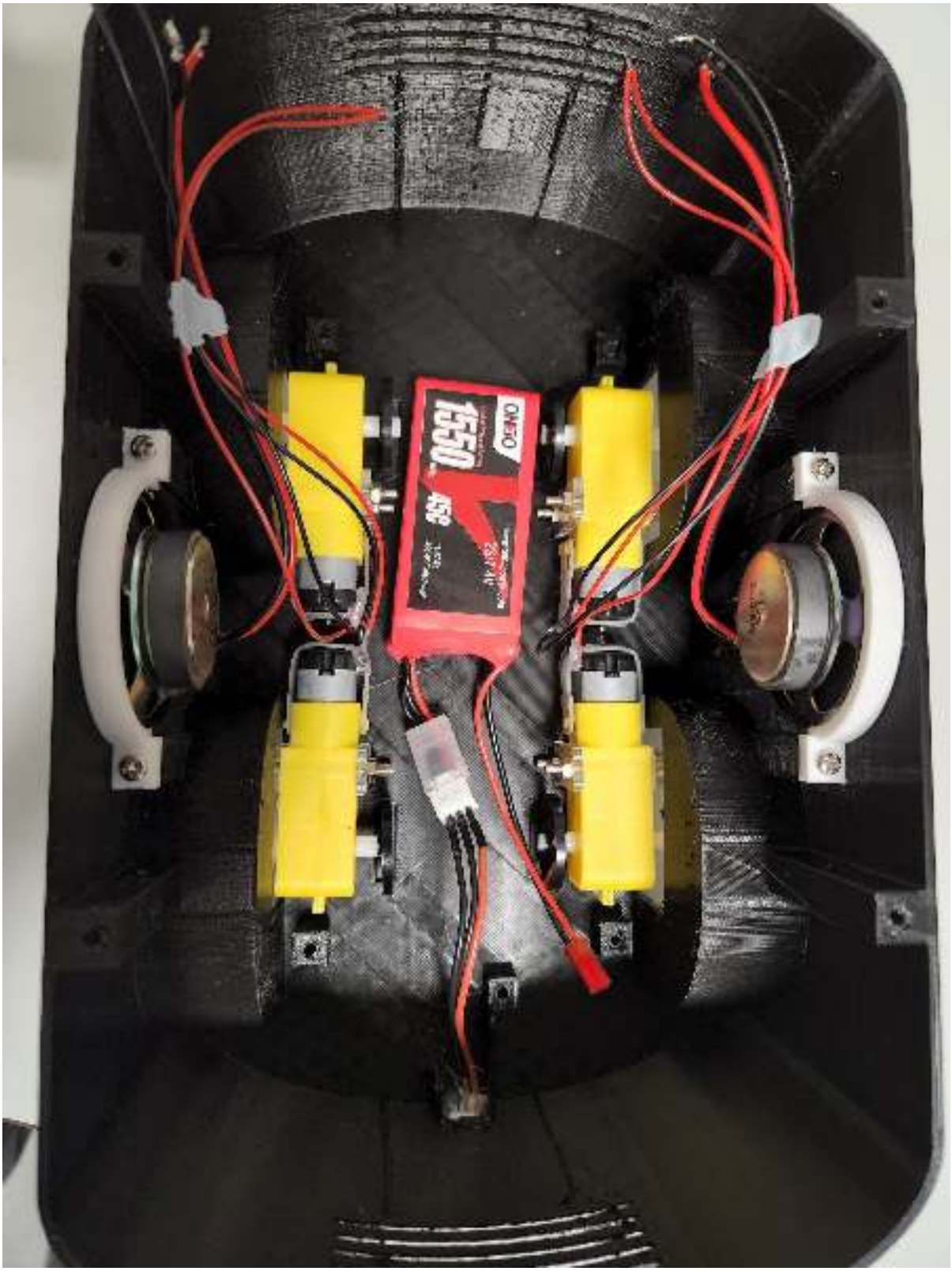


8. Attach li-po battery balance lead extender to the casing

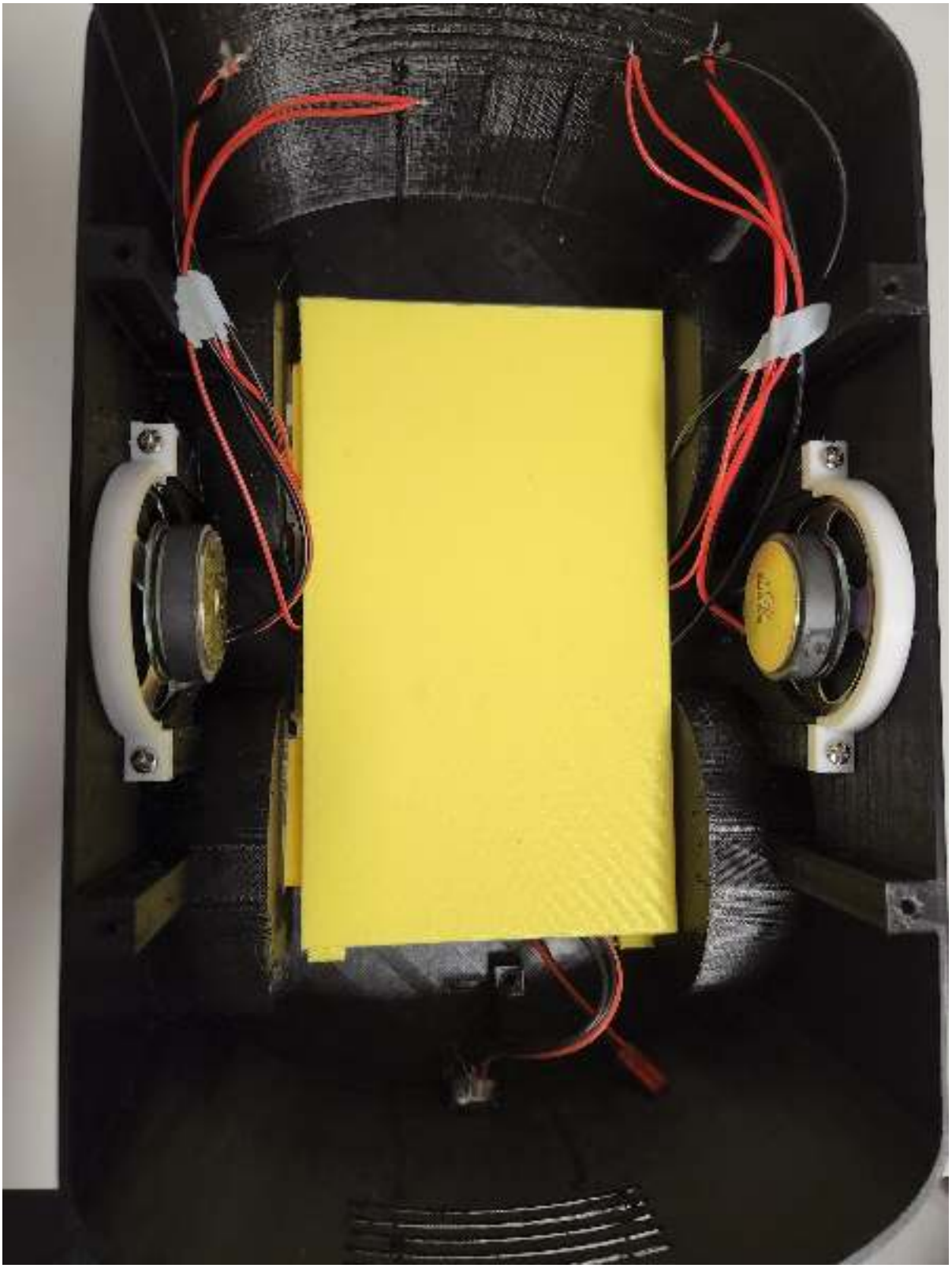




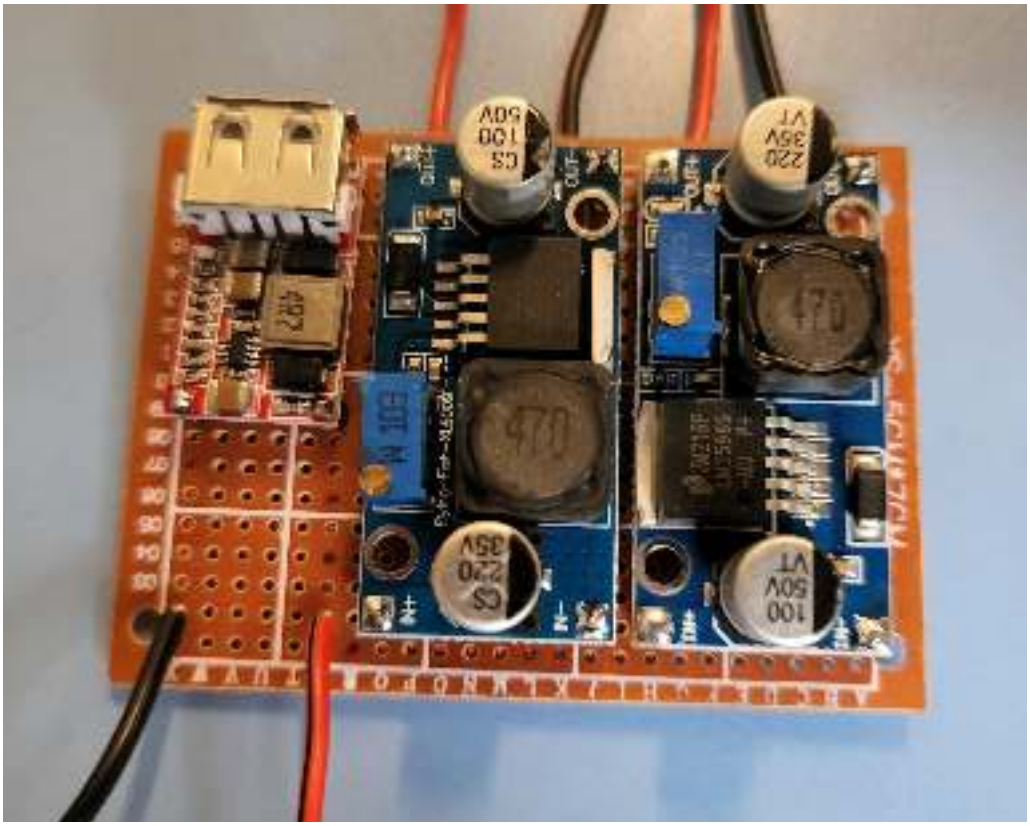
9. Attach li-po battery to the balance lead extender and place lipo battery at the bottom of the casing

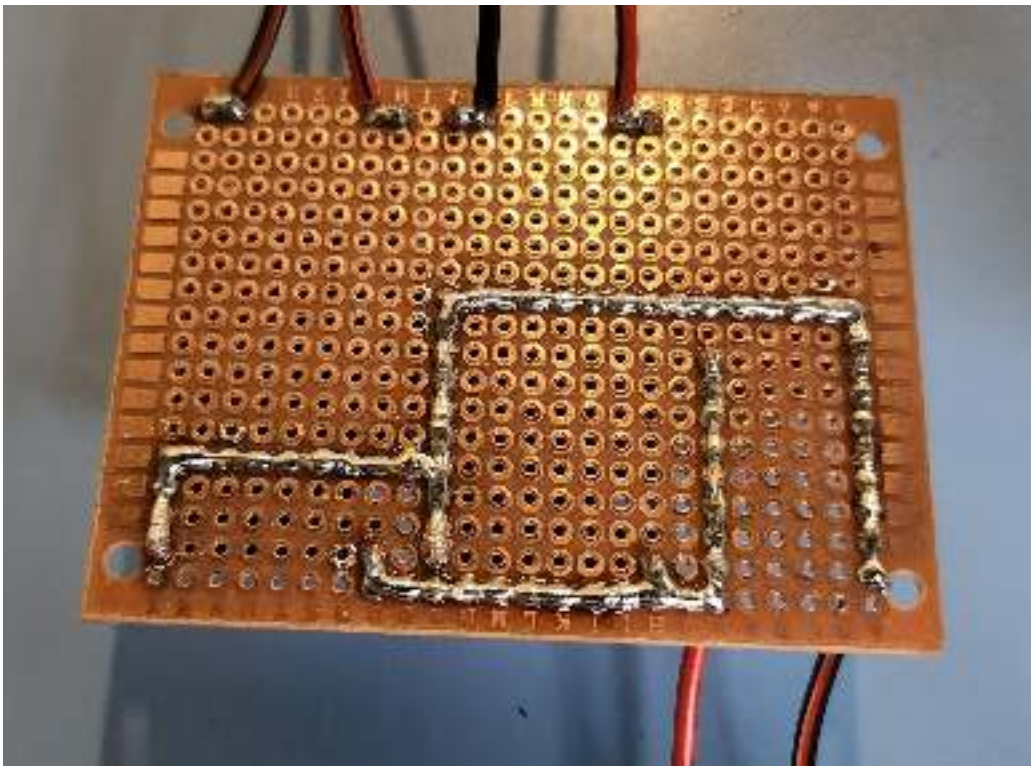


10. Screw support structure onto the bottom casing



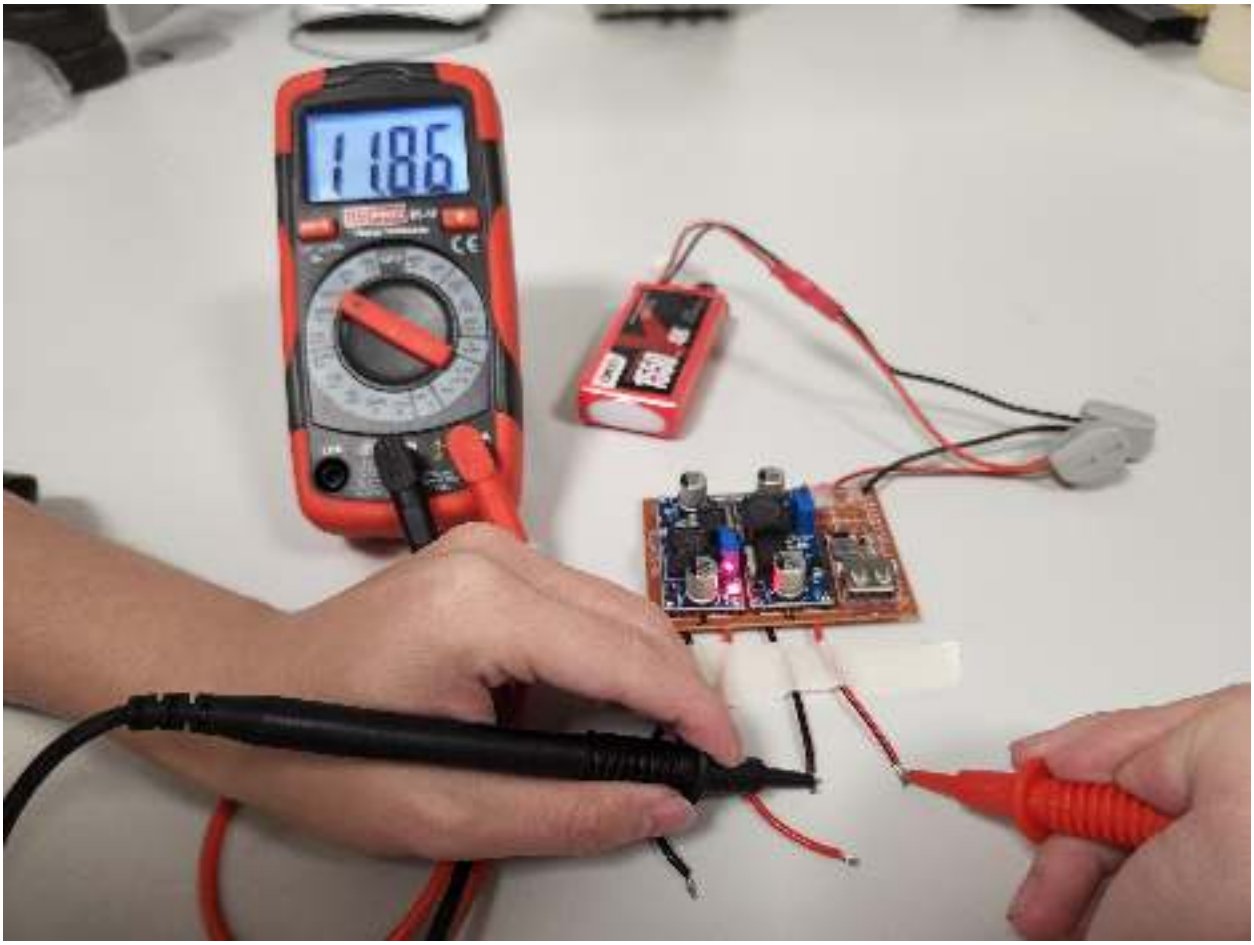
11. Solder the XL6009 step-up, LM2596 step-down, and 5V/3A USB step-down boards onto a protoboard as shown



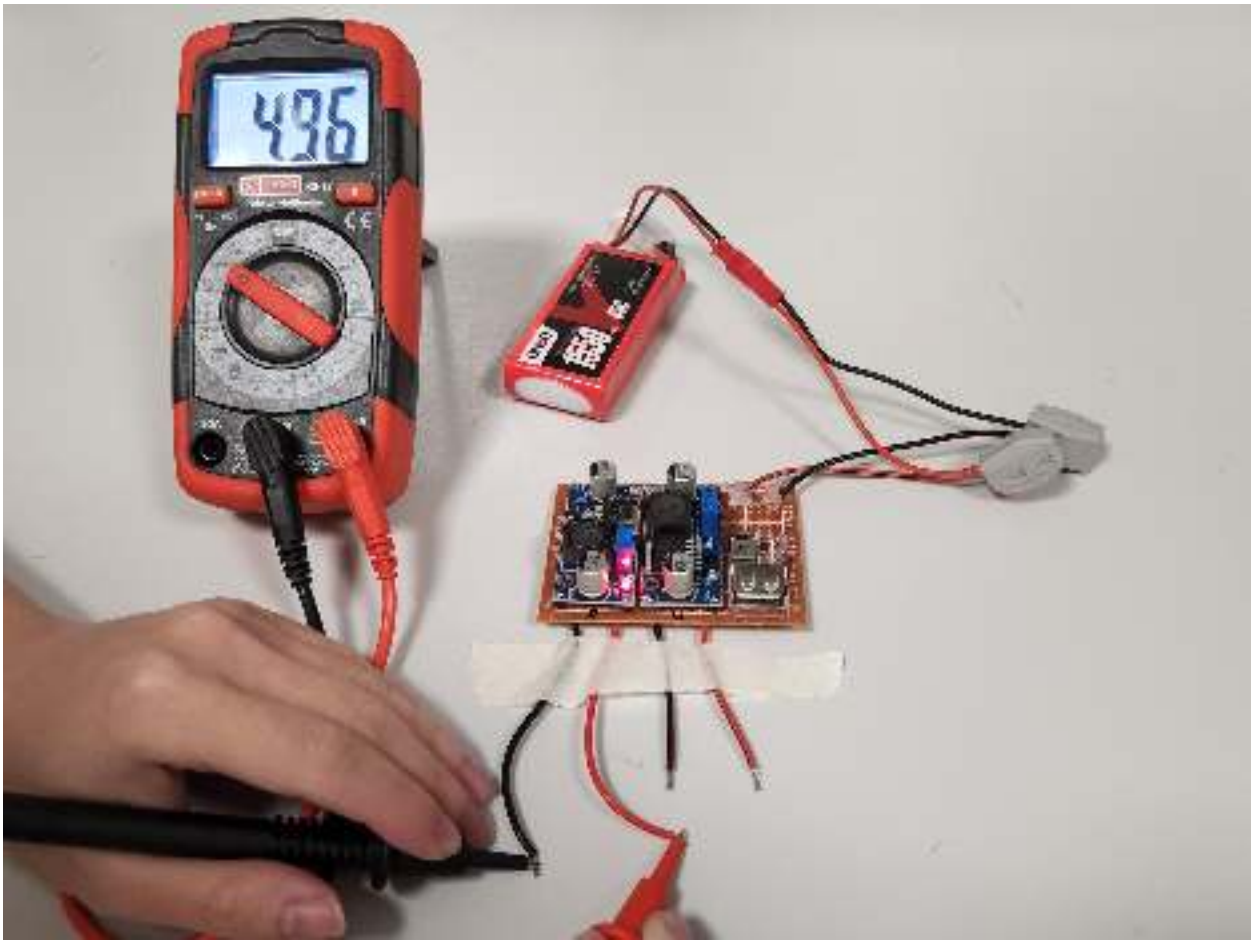


12. With a multimeter, ensure that

12.1. Output voltage of the XL6009 is 12.0V, and

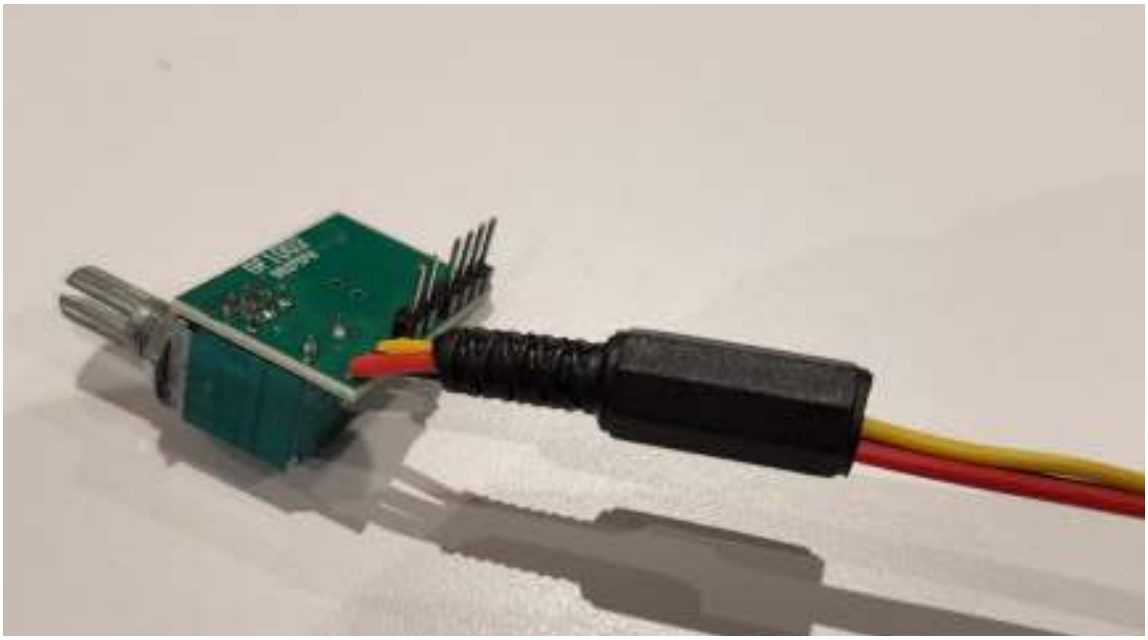


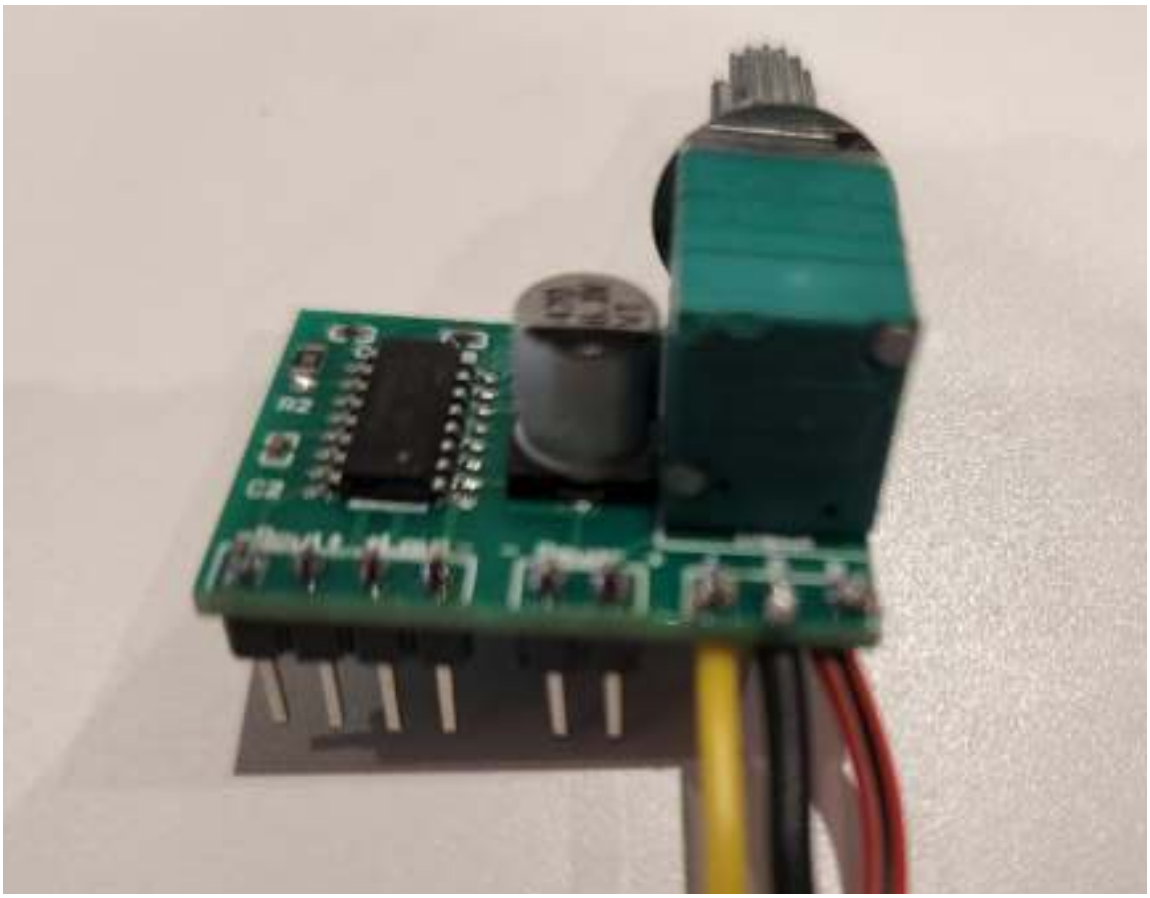
12.2. Output voltage of the LM2596 is 5.0V



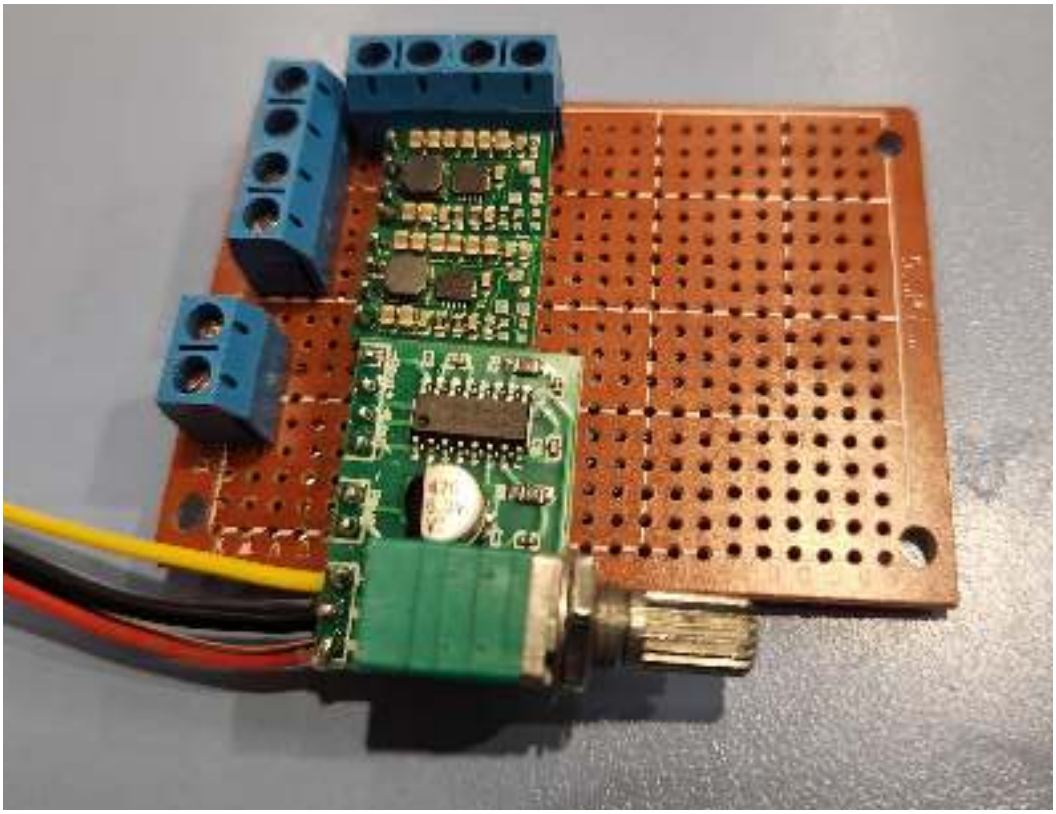
13. Unscrew the housing from the 3.5mm audio jack and solder the 3.5mm audio jack as shown, wherein ground is the longest terminal, and left and right are the terminals next to the ground terminal respectively

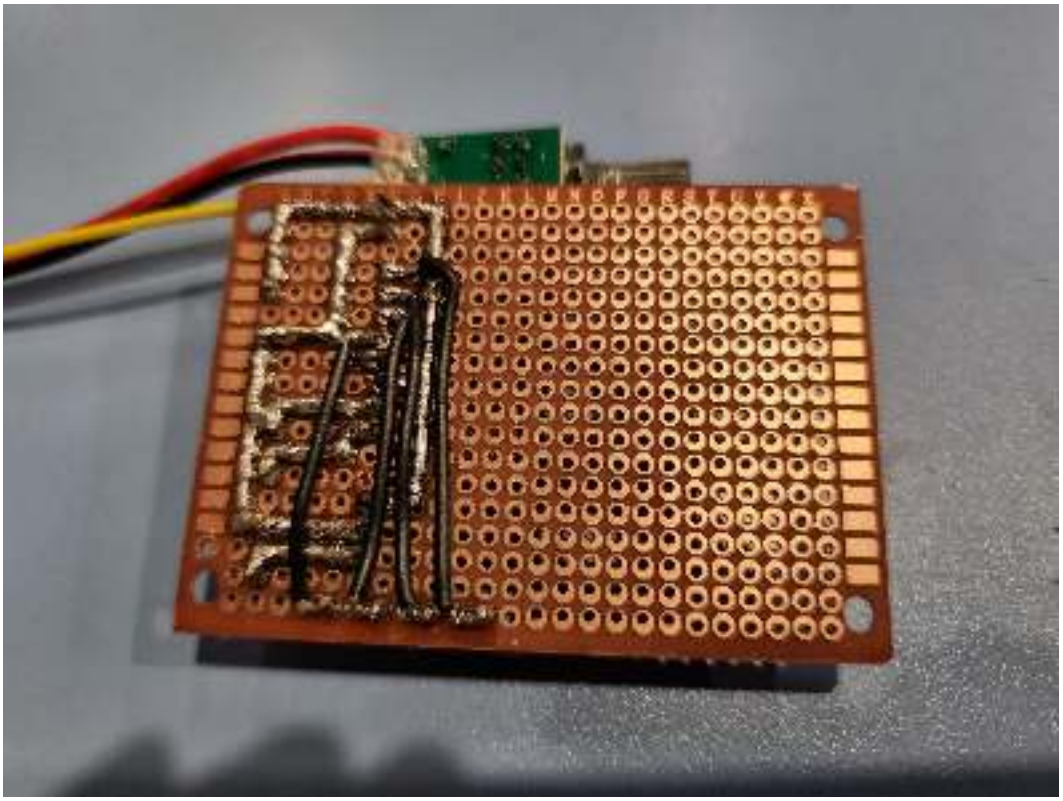
14. Thread audio jack housing through the audio cables and then solder the cables to the PAM8403 speaker amplifier board



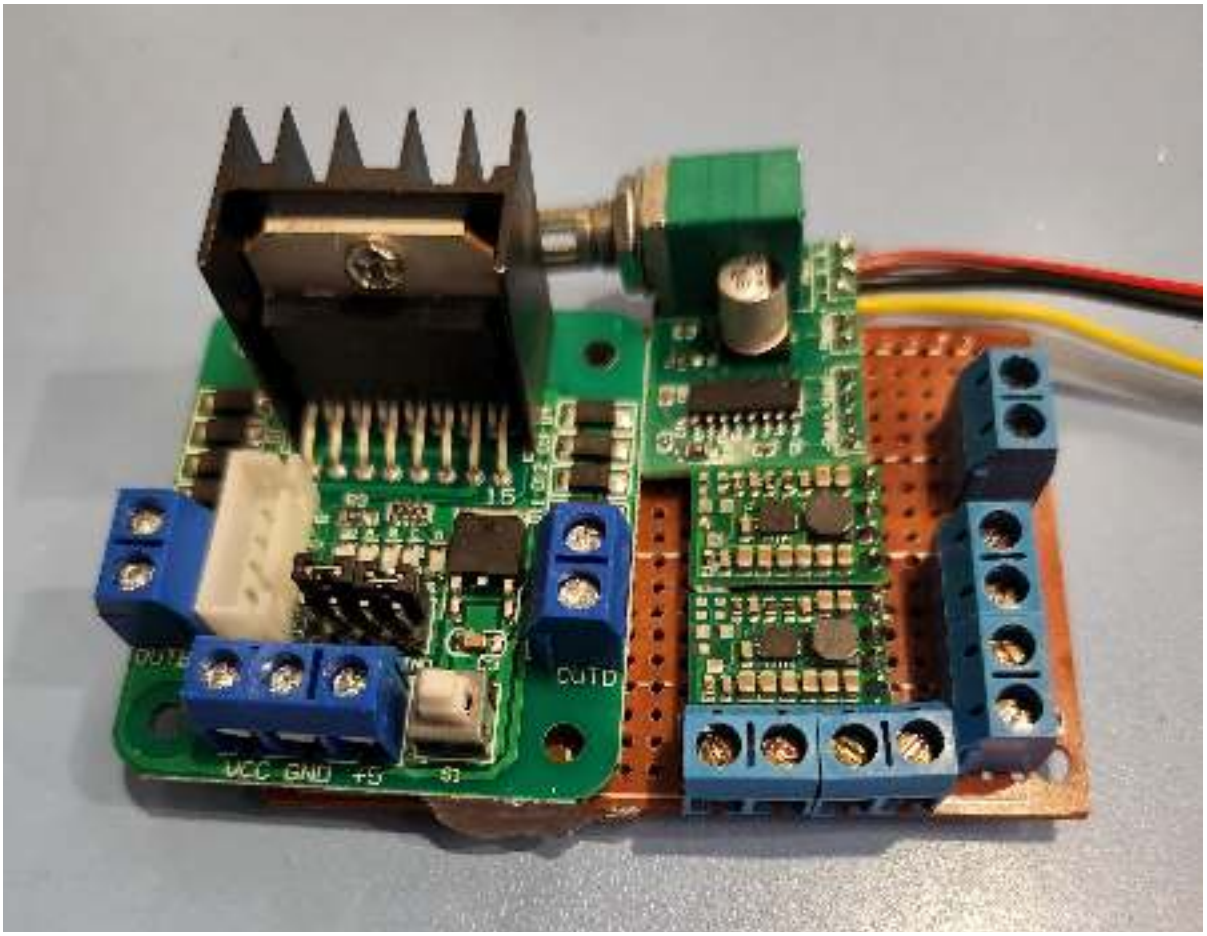


15. Solder the PAM8403 speaker amplifier board with 3.5mm audio jack and 3.3V step-down S7V8F3 boards, along with 5 terminal blocks onto a protoboard as shown



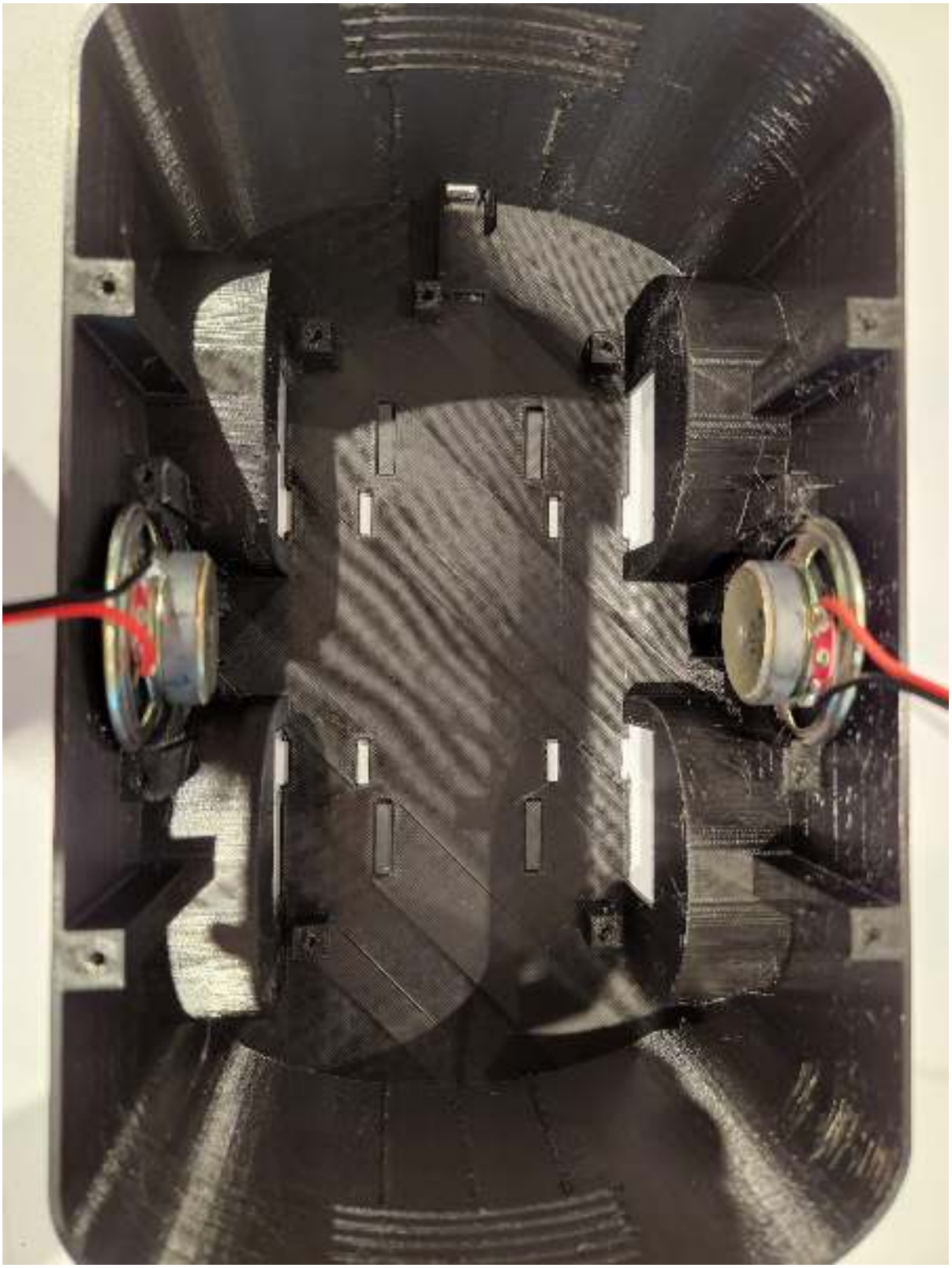


16. Attach L298D motor driver onto the protoboard as shown

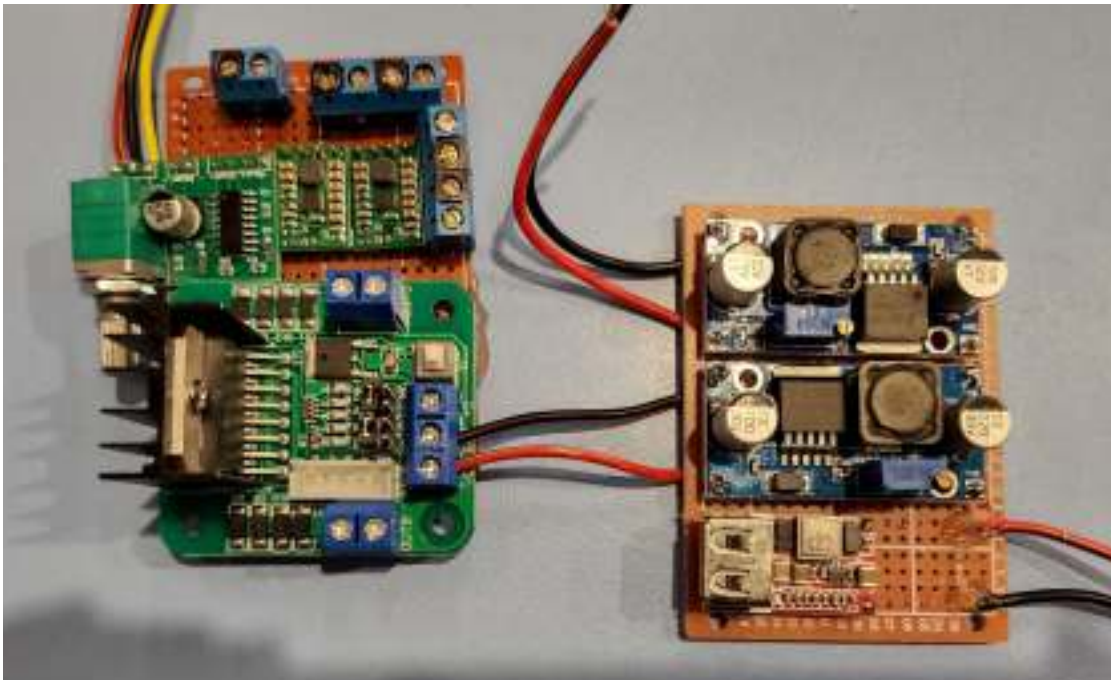


17. Solder wires to speakers, and ensure that there are no exposed wires

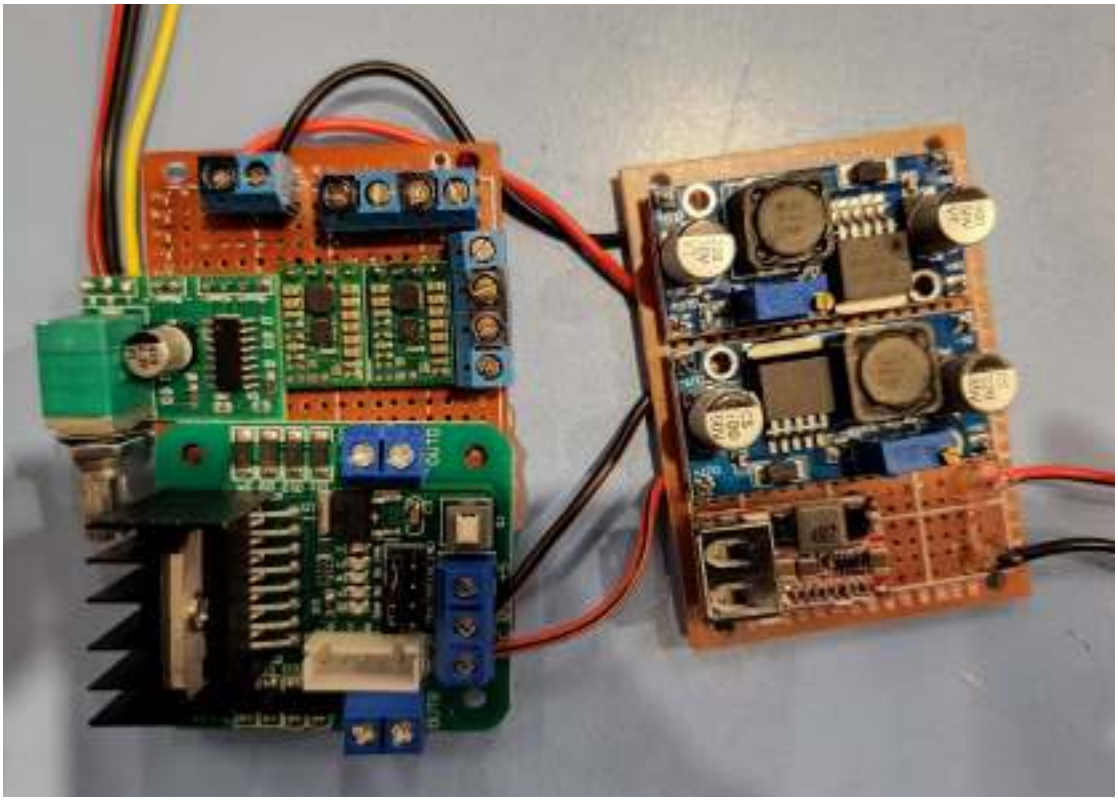
18. Attach speakers to casing, and screw down the 3D-printed speaker holders



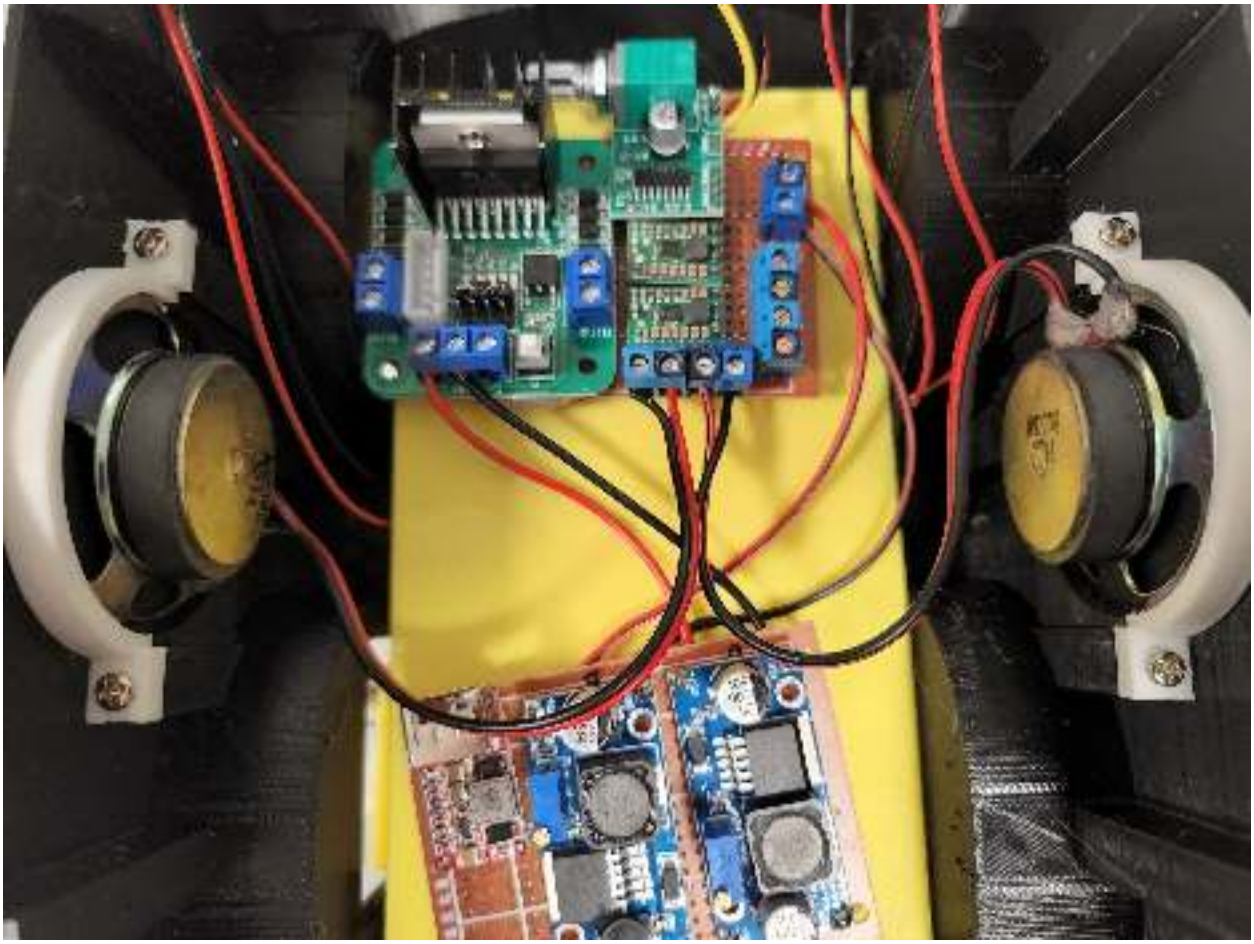
19. Connect the XL6009 step-up (12.0 V) to the motor driver as shown



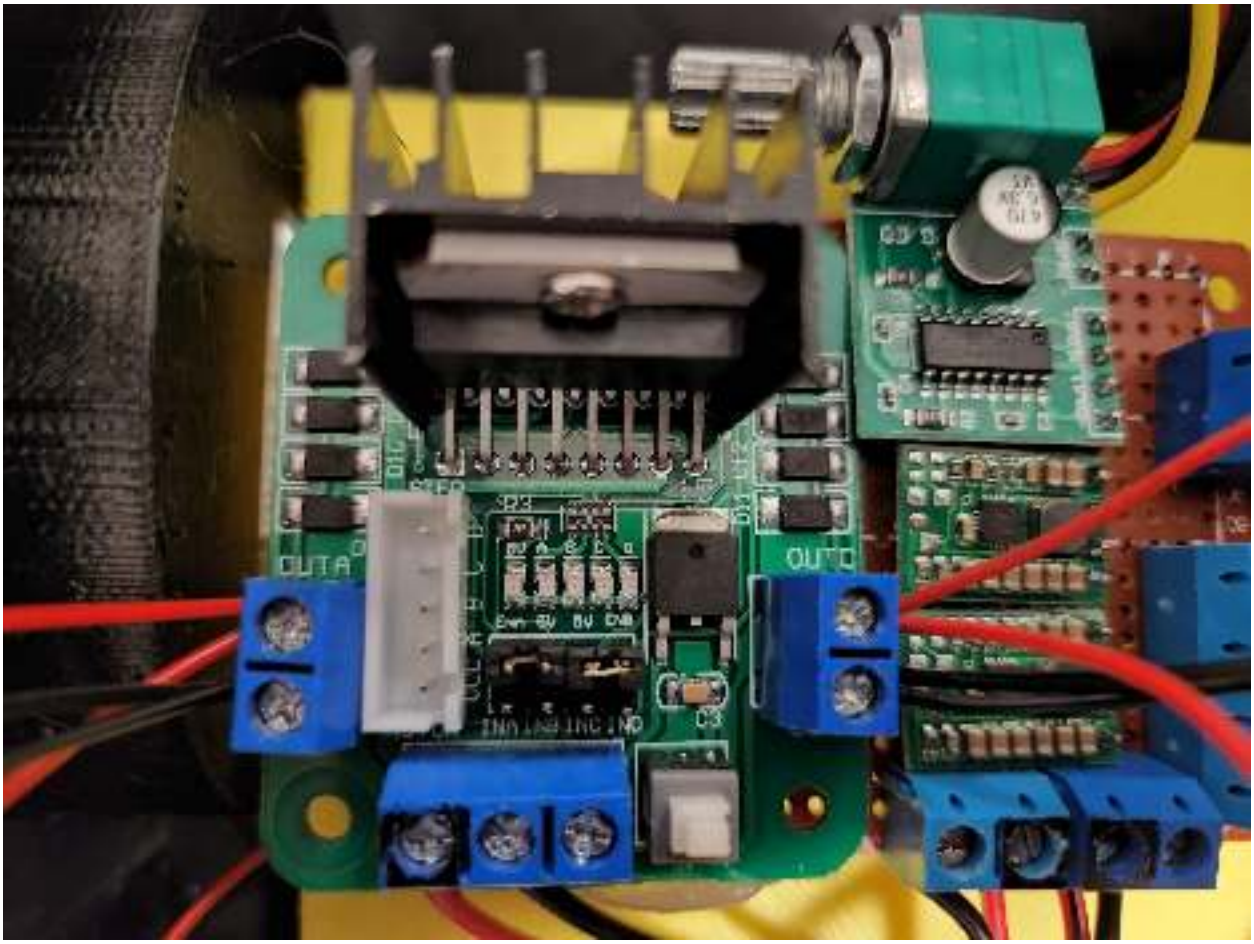
20. Connect the LM2596 step-down (5.0 V) to the other protoboard as shown



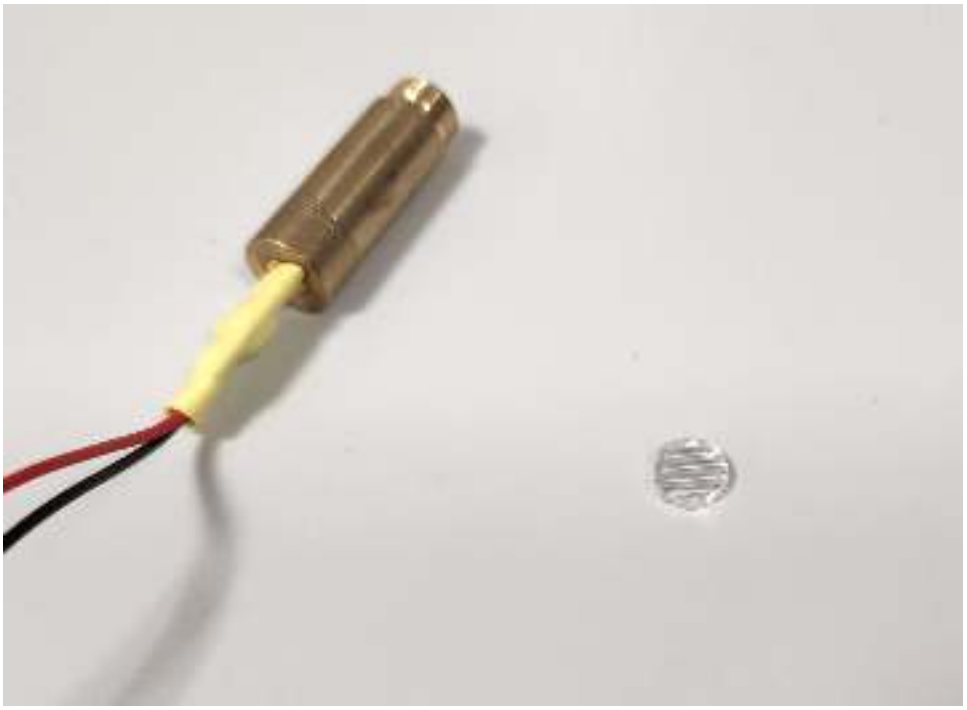
21. Connect speakers to the terminal blocks as shown



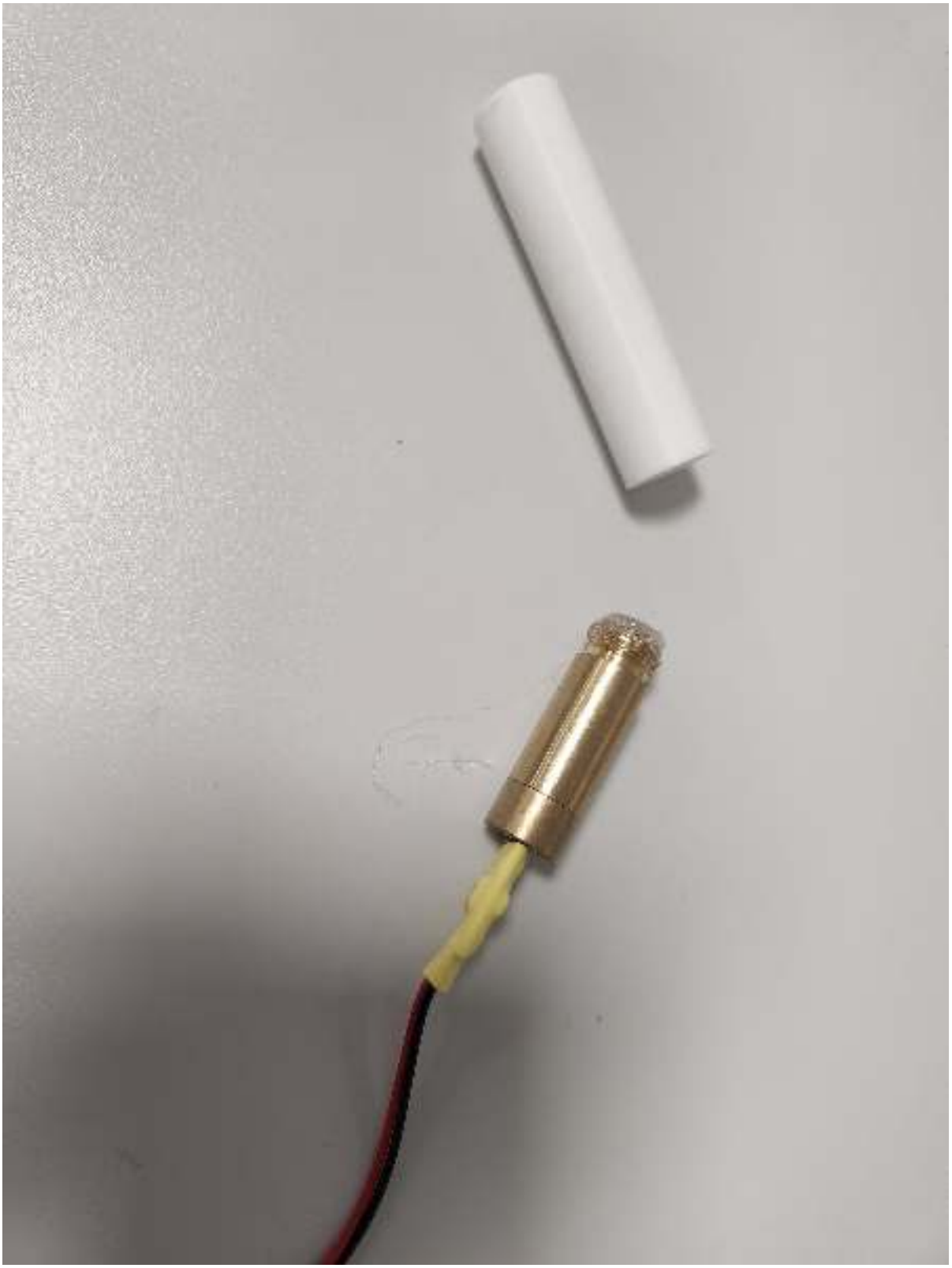
22. Connect motors to the motor driver as shown

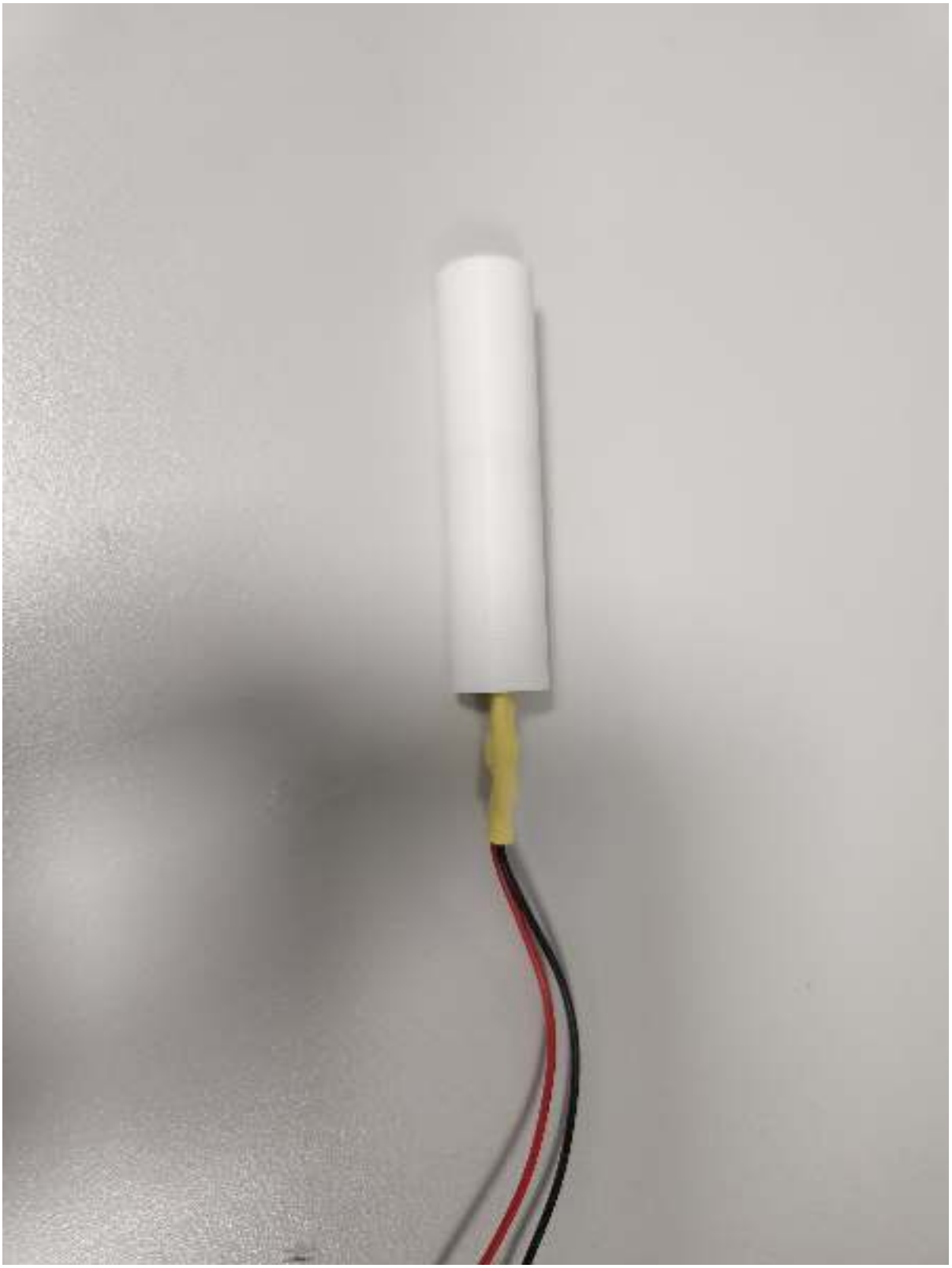


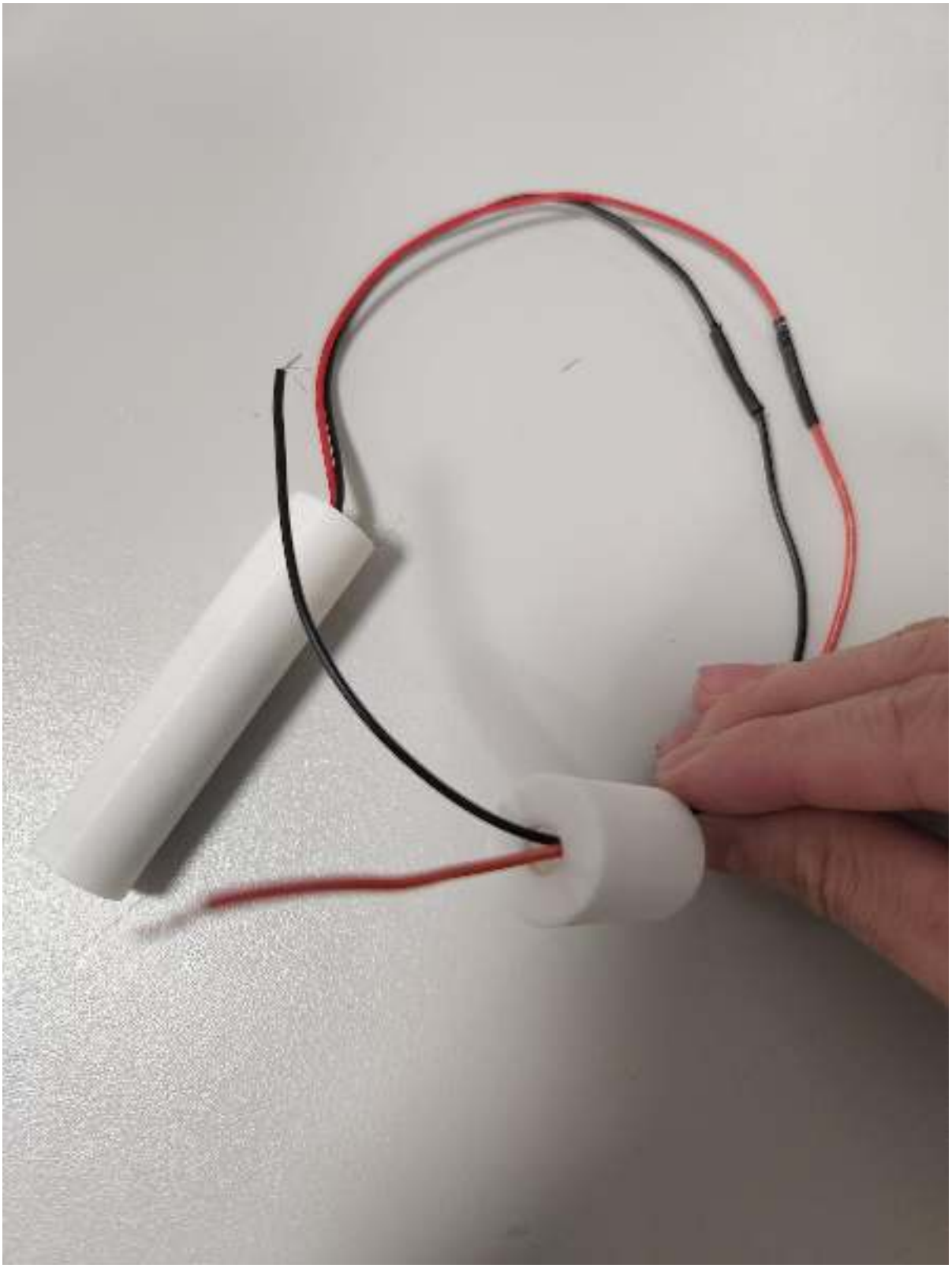
23. Attach line grating on to the green dot lasers

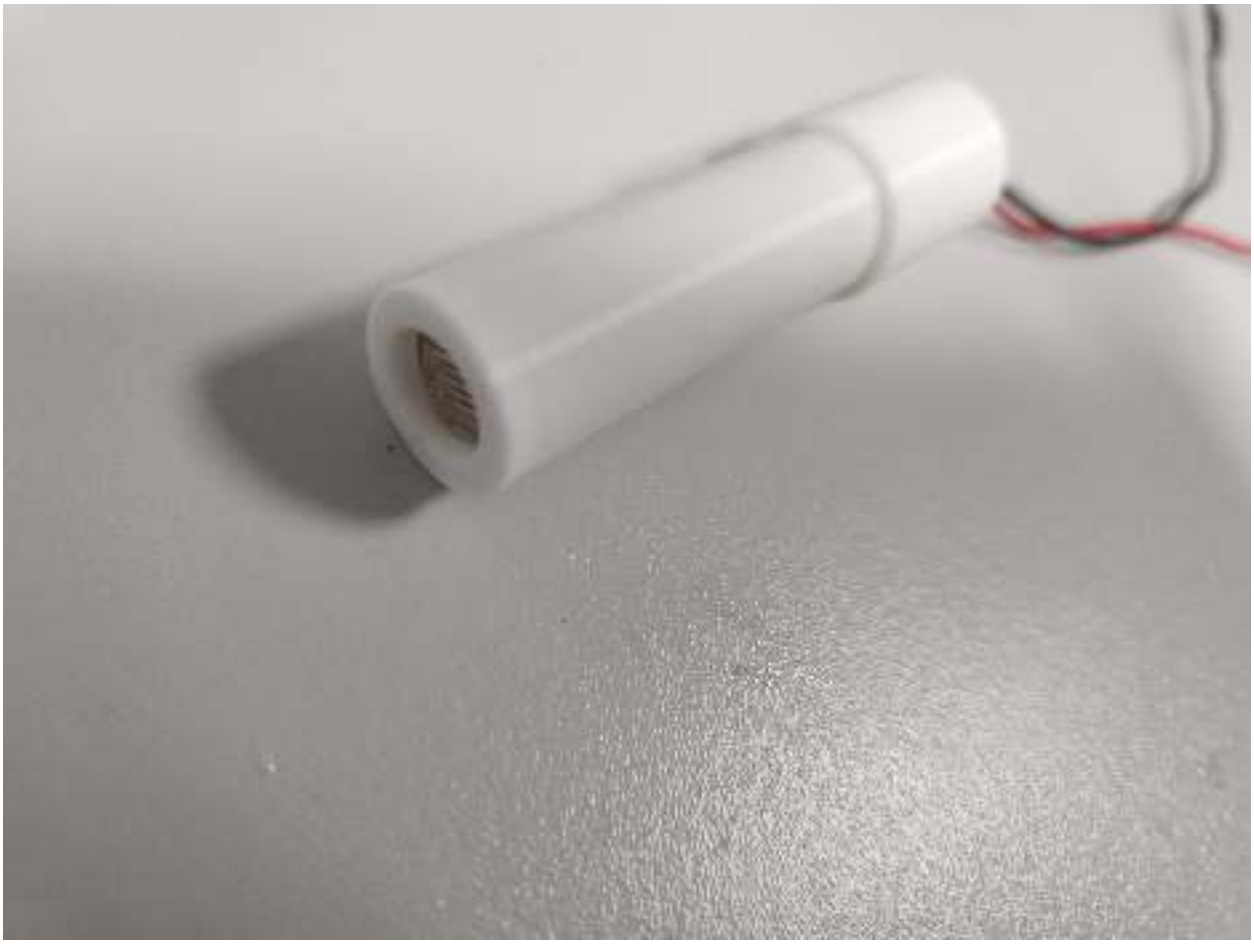


24. Place lasers in the laser holders

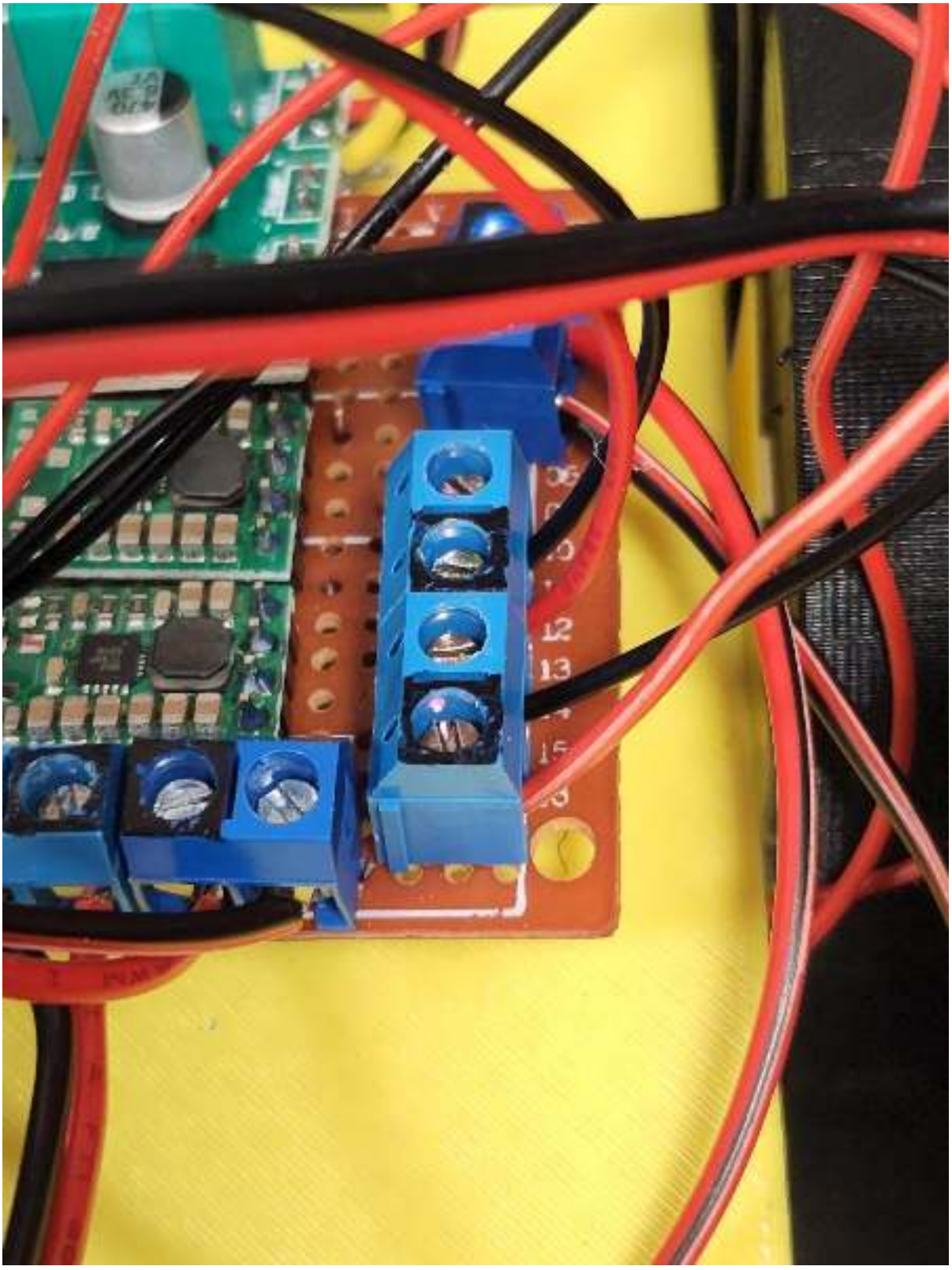








25. Connect lasers to the terminal blocks as shown

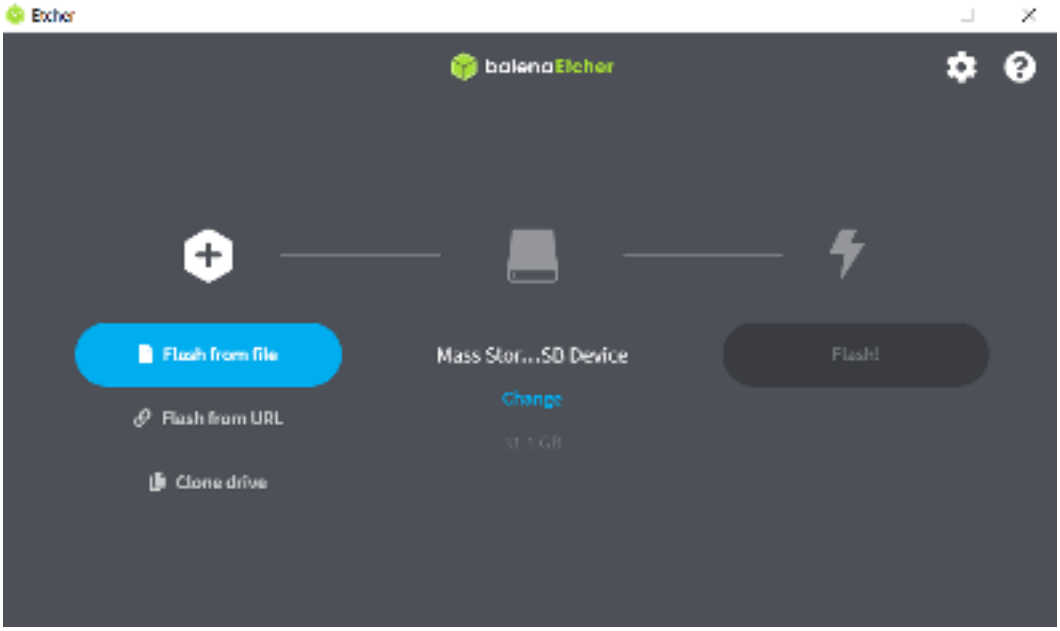


26. Burn firmware image onto microSD card

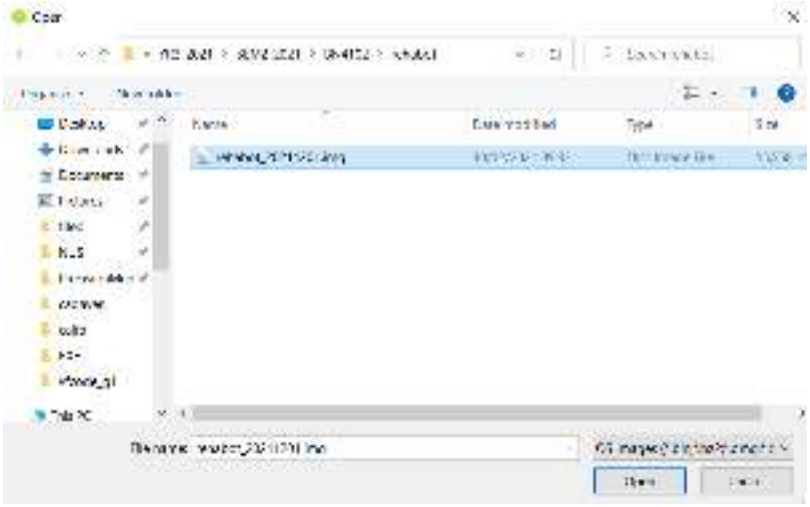
26.1. Download Balena Etcher at https://www.balena.io/etcher/

26.2. If using a pre-installed microSD, reformat microSD card first

26.3. Open balenaEtcher and select **Flash from file**

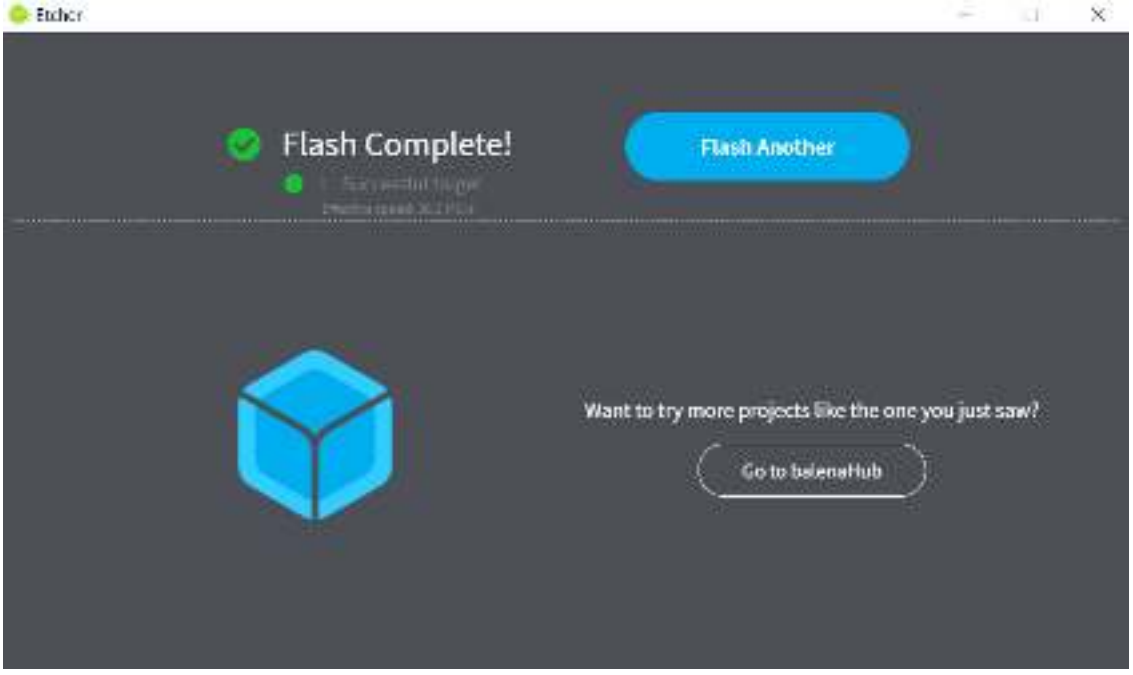


26.4. Select **rehabot_<RELEASE_DATE>.img** or download image of **Raspberry Pi with OS** (https://www.raspberrypi.com/software/operating-systems/) and ensure that correct storage device to be flashed is selected



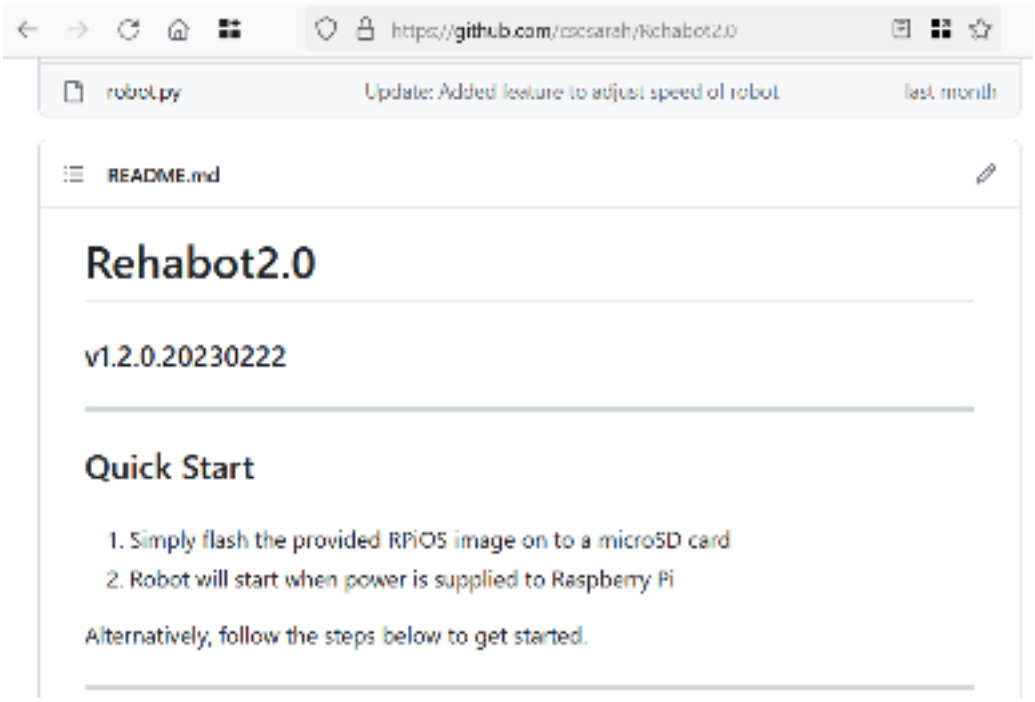
26.5. Select **Flash**

26.6. Flash complete



If flash fails to successfully run to completion, reformat and restart flashing process

26.7. If you have flashed an image of **Raspberry Pi OS**, continue with the steps as described in https://github.com/csesarah/Rehabot2.0



27. Insert microSD card into Raspberry Pi

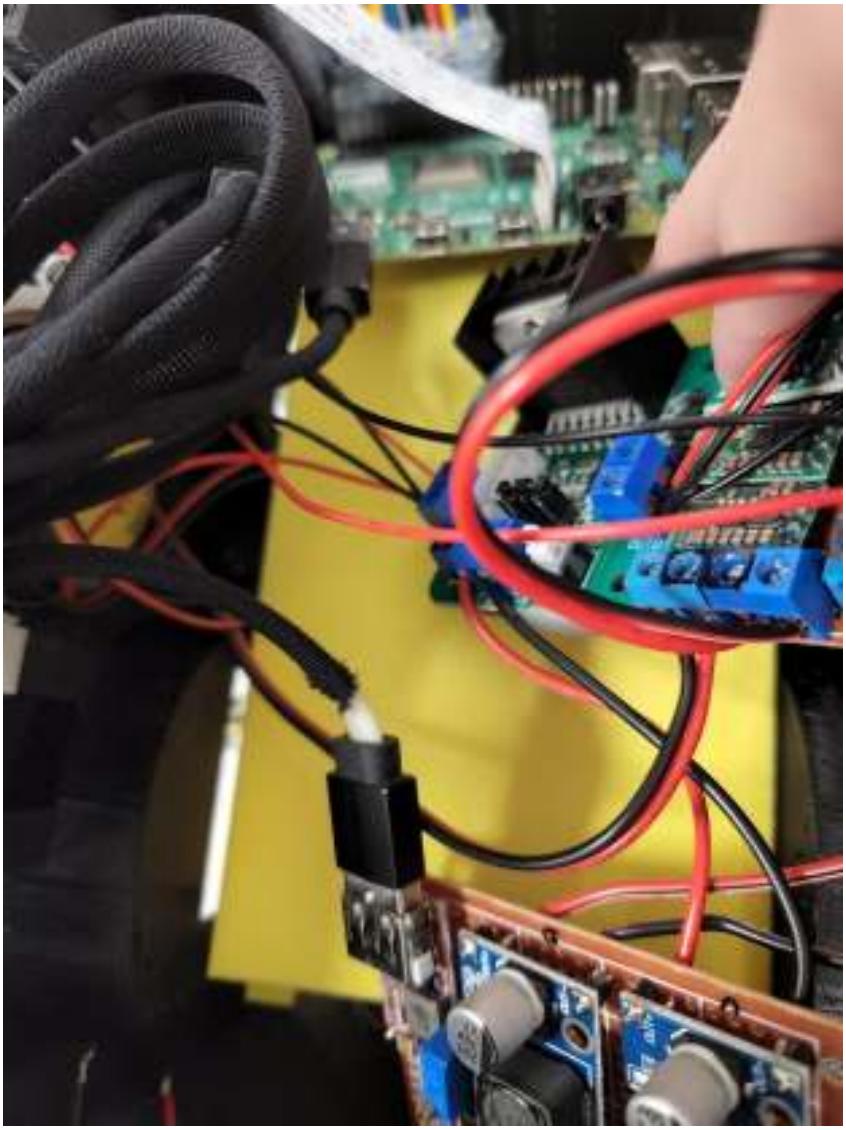
28. Attach camera to the Raspberry Pi

    28.1. Gently pull up on the edges of the port's plastic clip

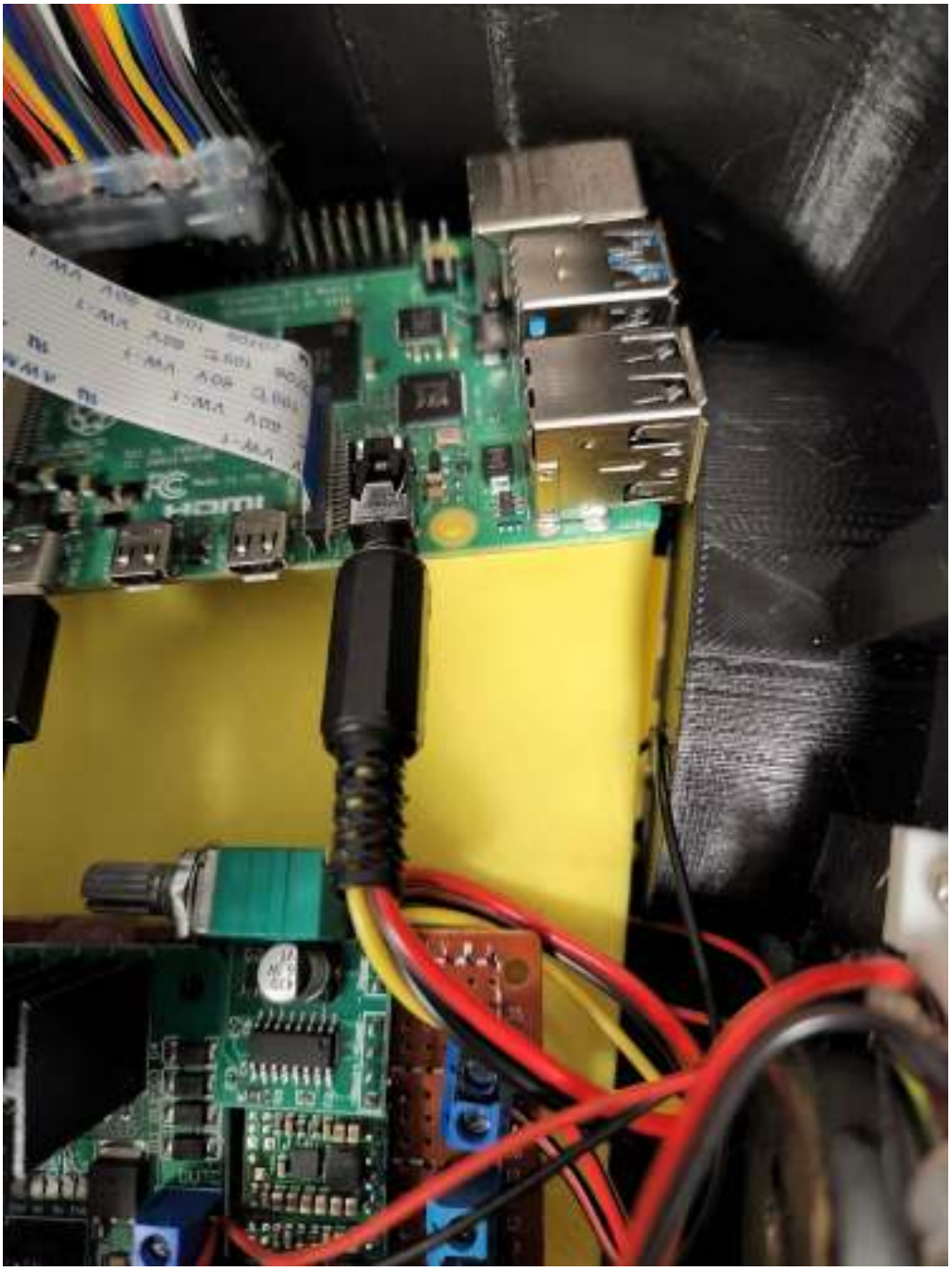
    28.2. Insert the Camera Module ribbon cable and make sure the connectors at the bottom of the ribbon cable are facing the contacts in the port (words printed on the cable facing Ethernet port if using original ribbon cable of Raspberry Pi V2 camera, words printed on the cable facing away from Ethernet port if using extender ribbon cable)

28.3. Push the plastic clip back into place and ensure that ribbon cable is well-connected

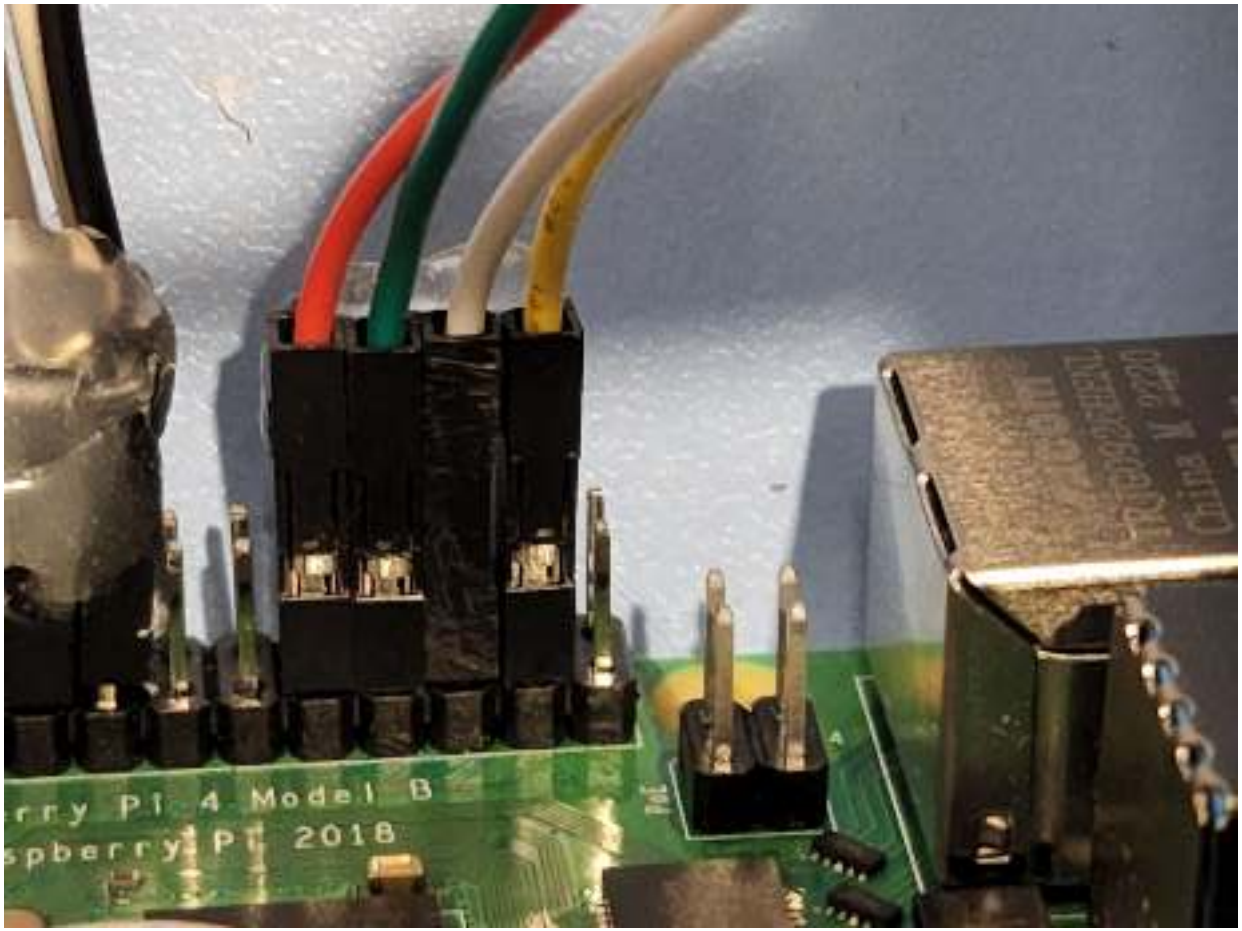
29. Connect USB-C to USB cable from the 5V/3A USB step-down board to the Raspberry Pi

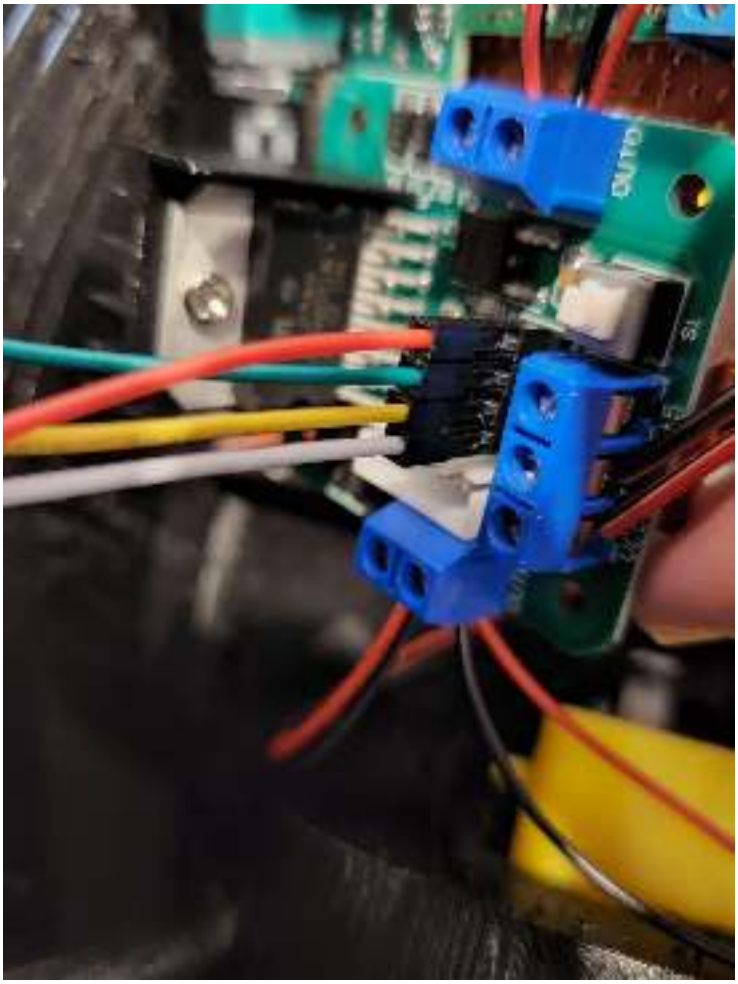


30. Connect 3.5mm audio jack to the Raspberry Pi

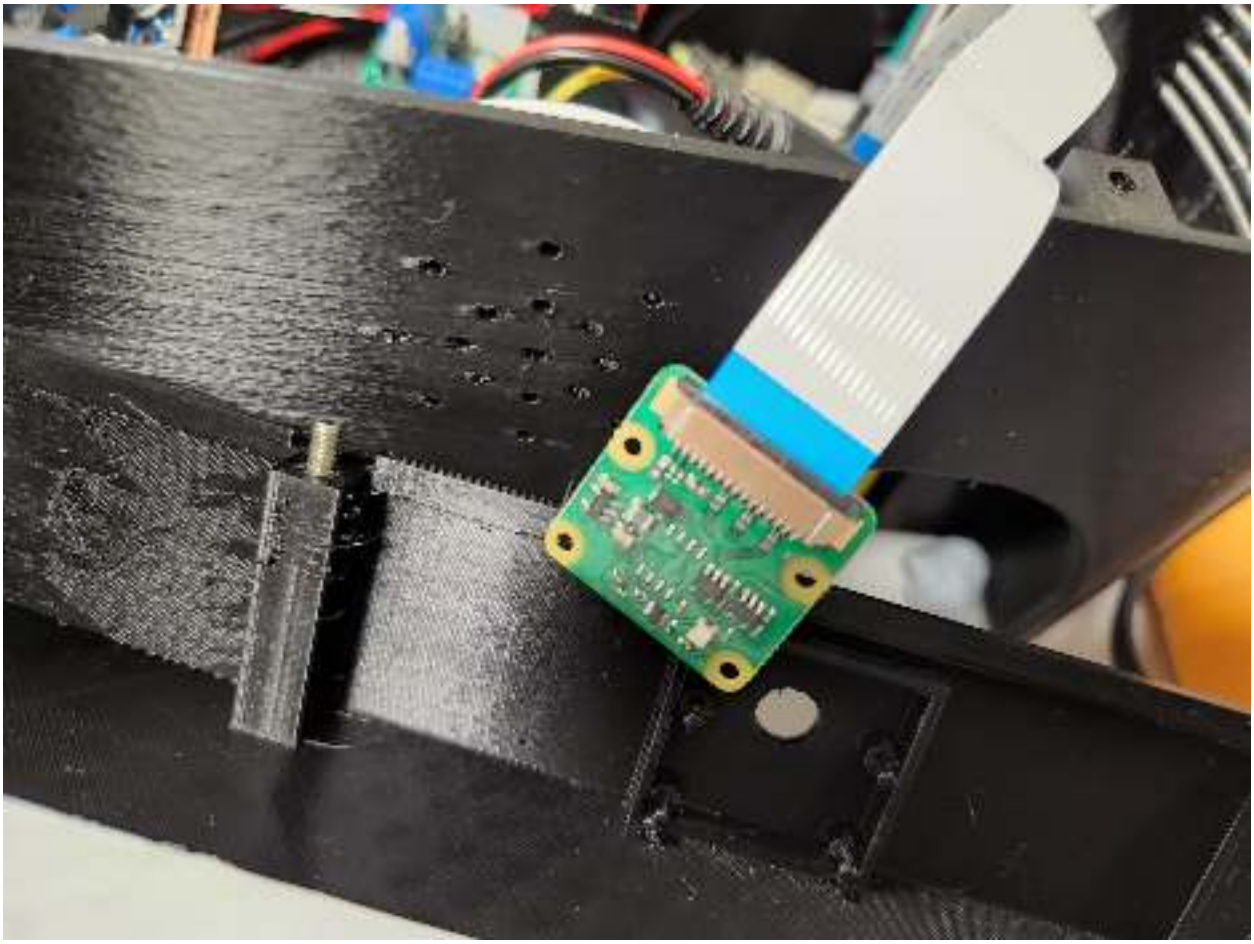


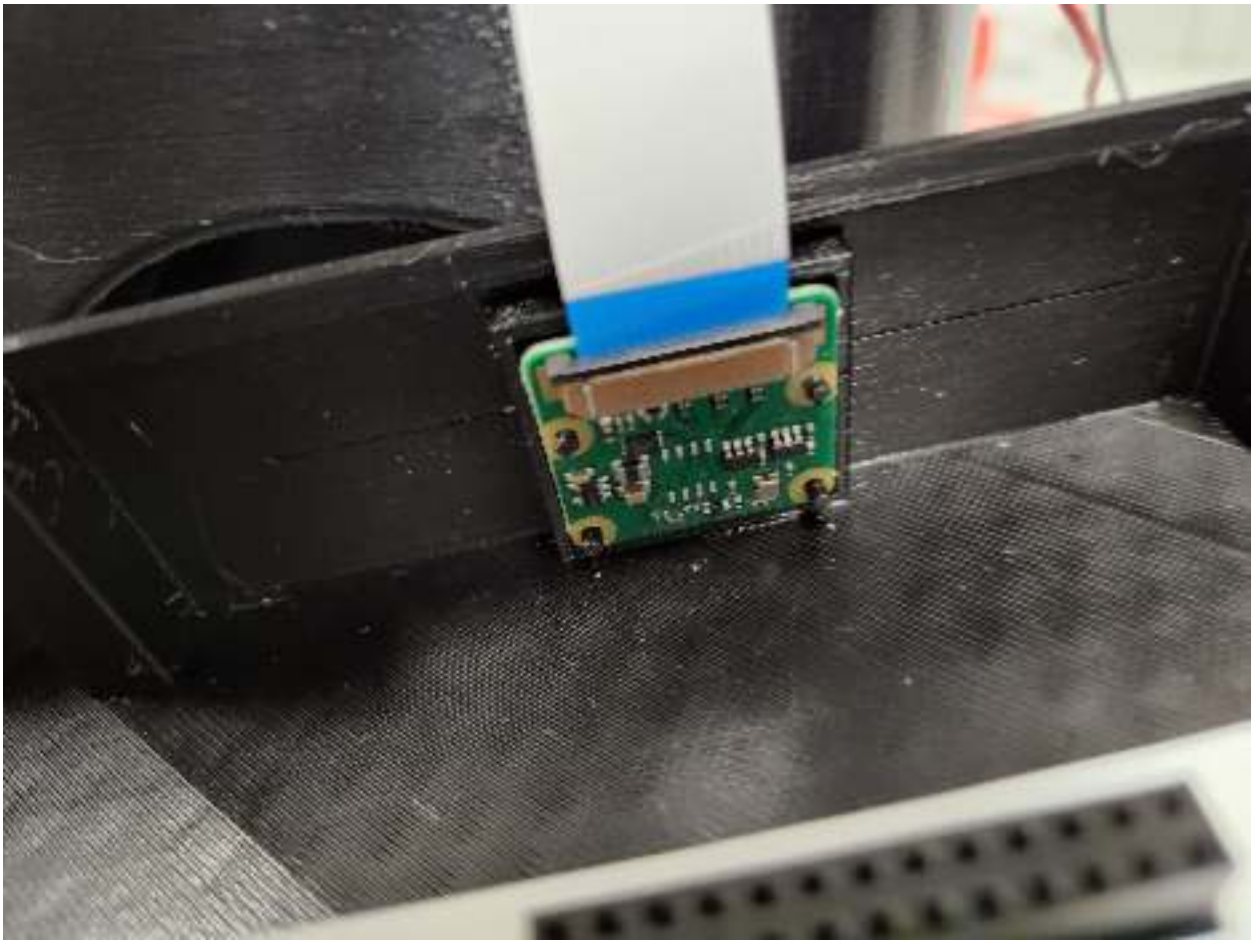
31. Connect the motor driver to the Raspberry Pi with female-female dupont wires as shown:
    - GPIO pins 6, 13, 19, 26 to driver input pins
    - GPIO pins 16, 20 to driver enable A and B pins (if there are jumpers on the enable pins on motor driver, disconnect jumpers first)

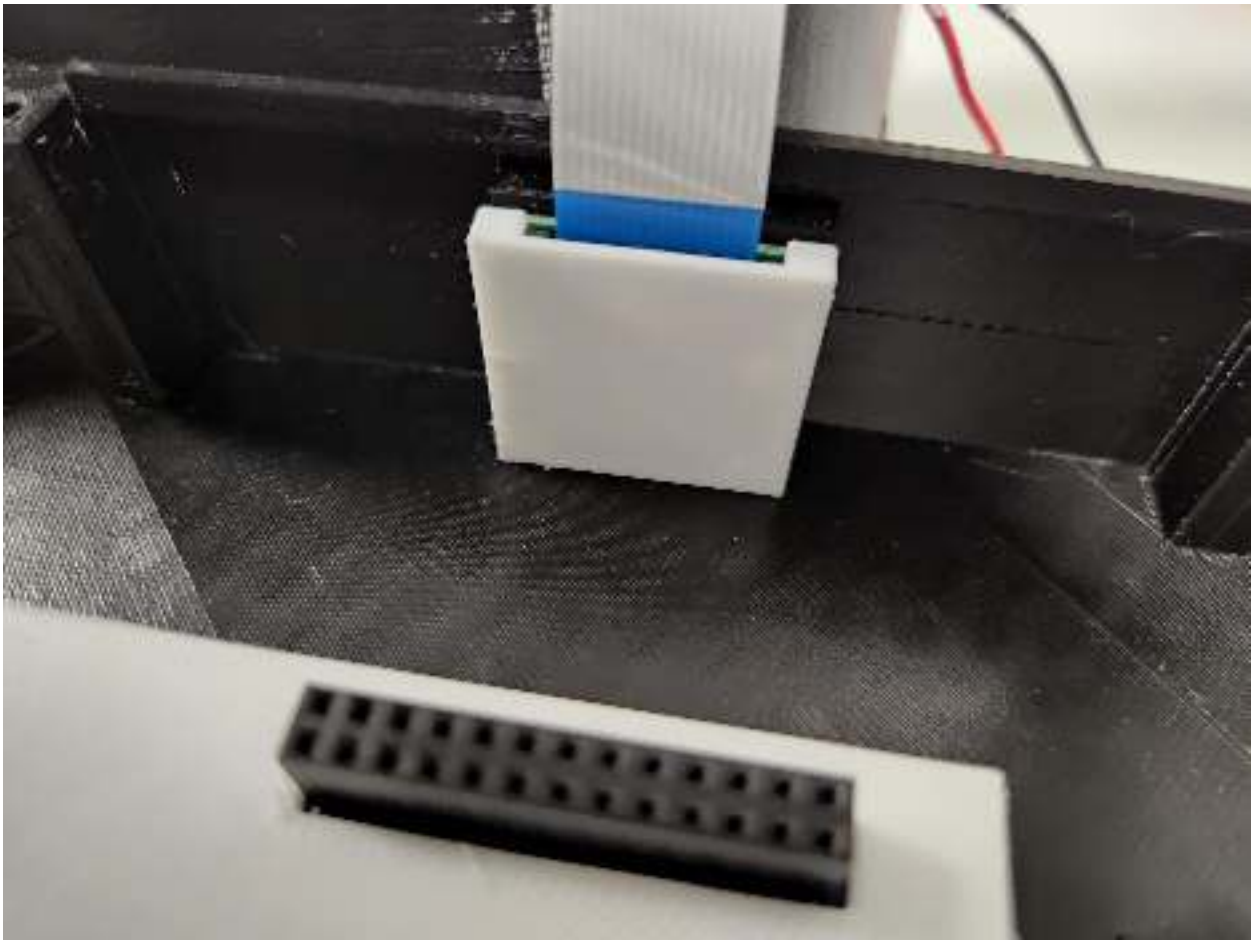

rry Pi 4 Model B
spberry Pi 2018

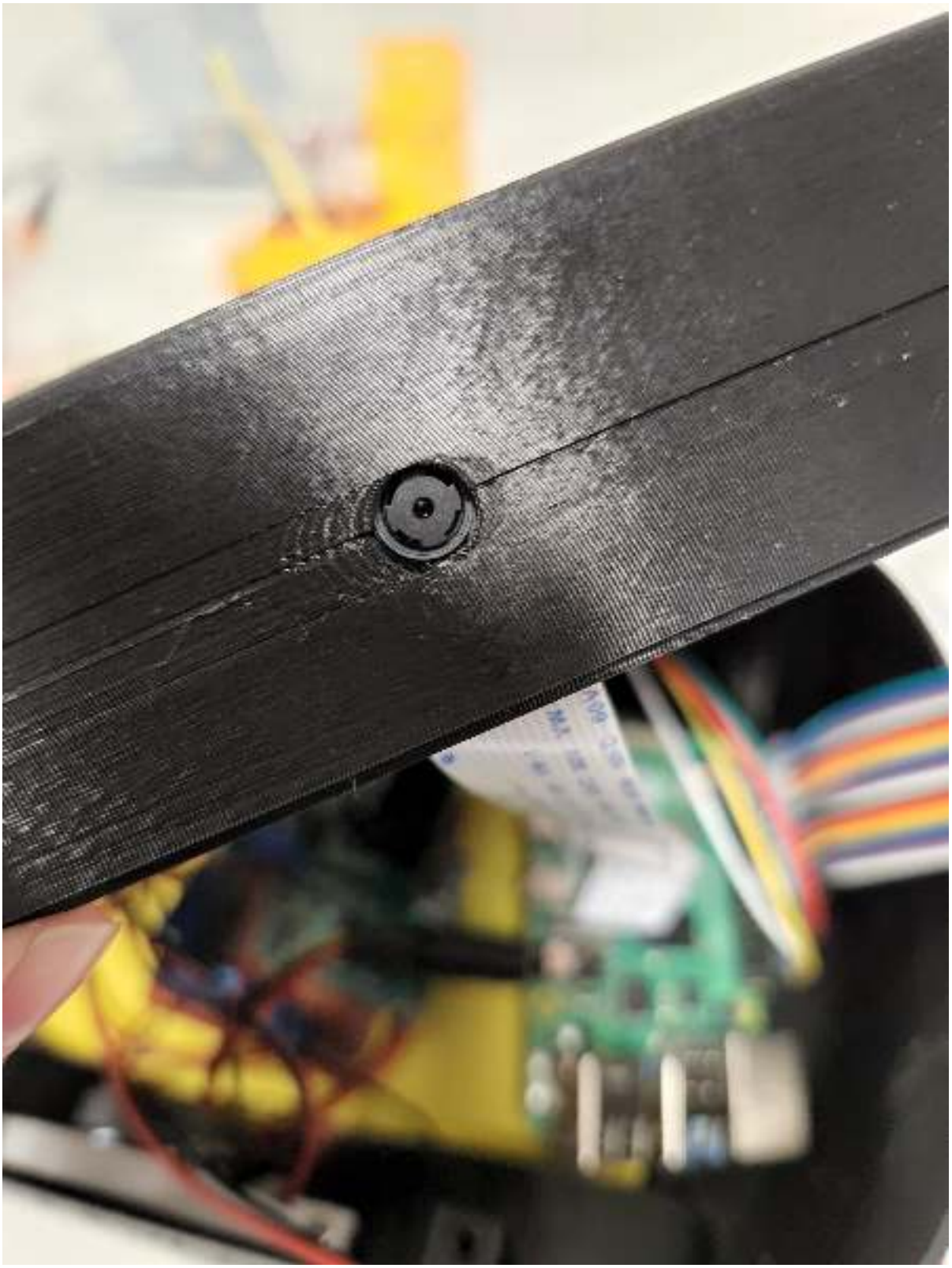


32. Attach camera and camera holder onto the top casing



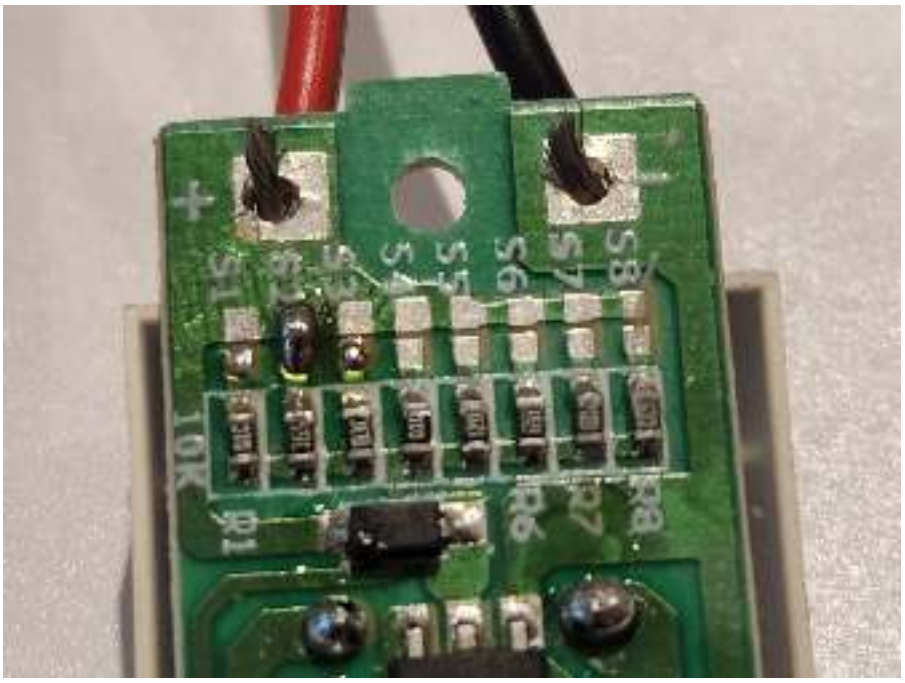






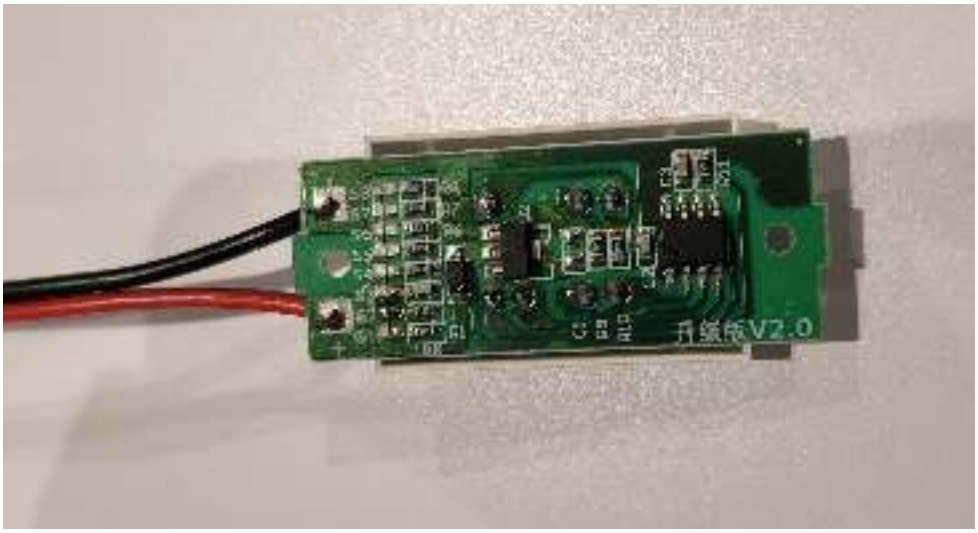
33. Attach touchscreen to the top casing

34. Ensure that the battery level indicator is such that only the S2 (7.4 V) pads are soldered together



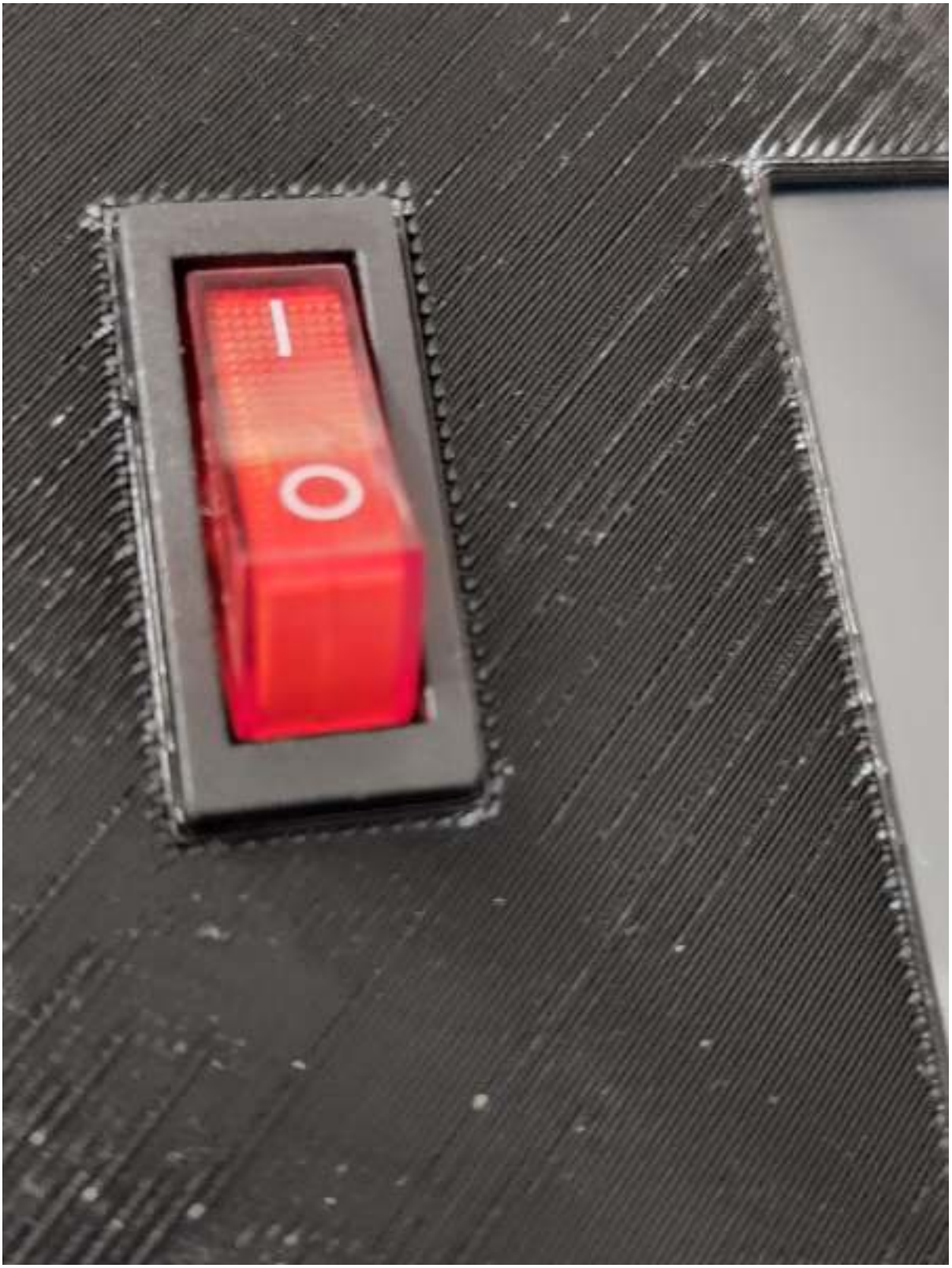
Otherwise, use a desoldering pump to desolder existing connections and then solder the correct S2 connections

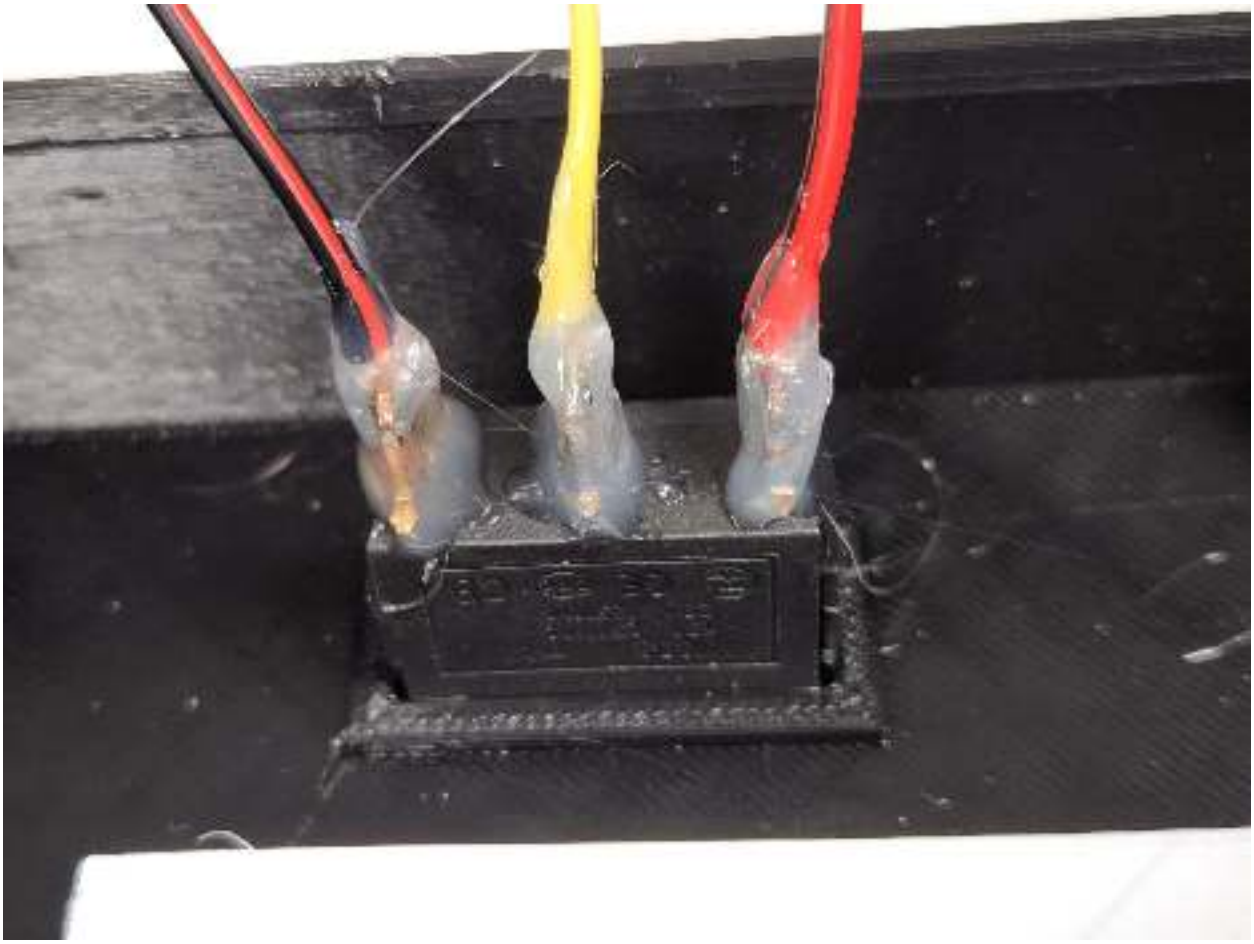
35. Solder red and black wires to the positive and negative terminals of the battery level indicator respectively



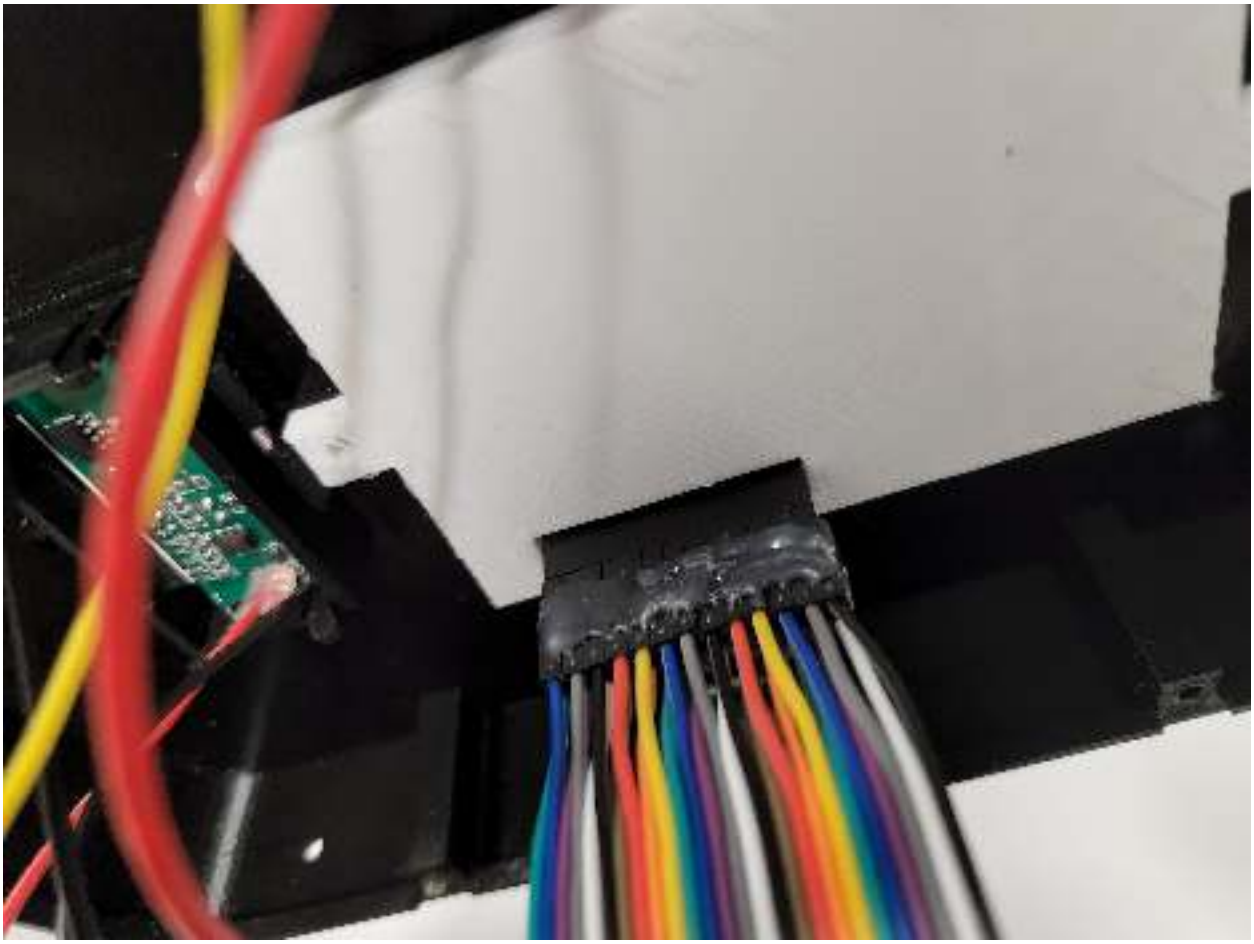
36. Attach battery level indicator onto the top casing with the plastic bracket

37. Attach rocker switch to the top casing and Solder wires to the rocker switch as shown

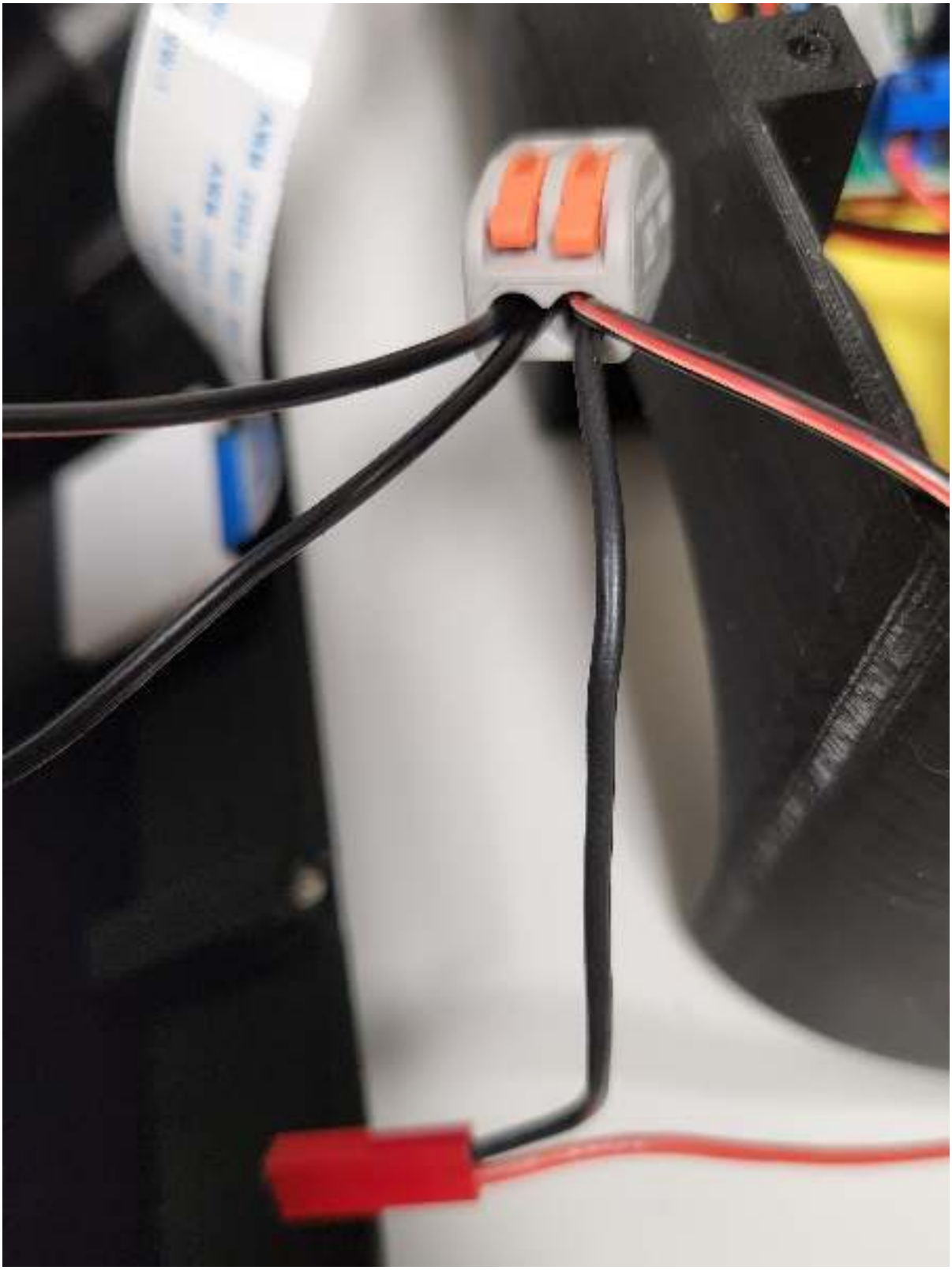

I
O



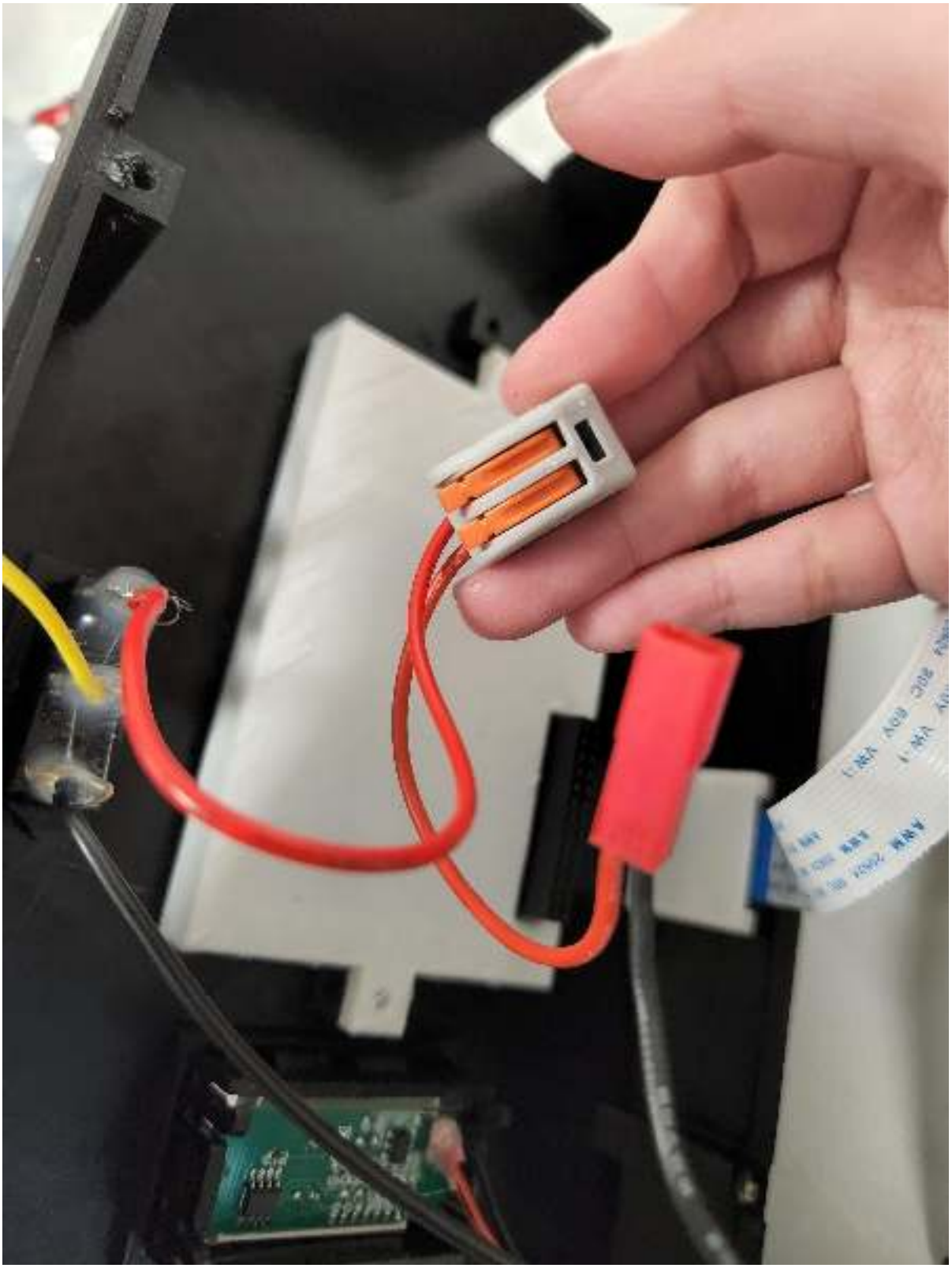
38. Connect the touchscreen to the Raspberry Pi with male-female dupont cables



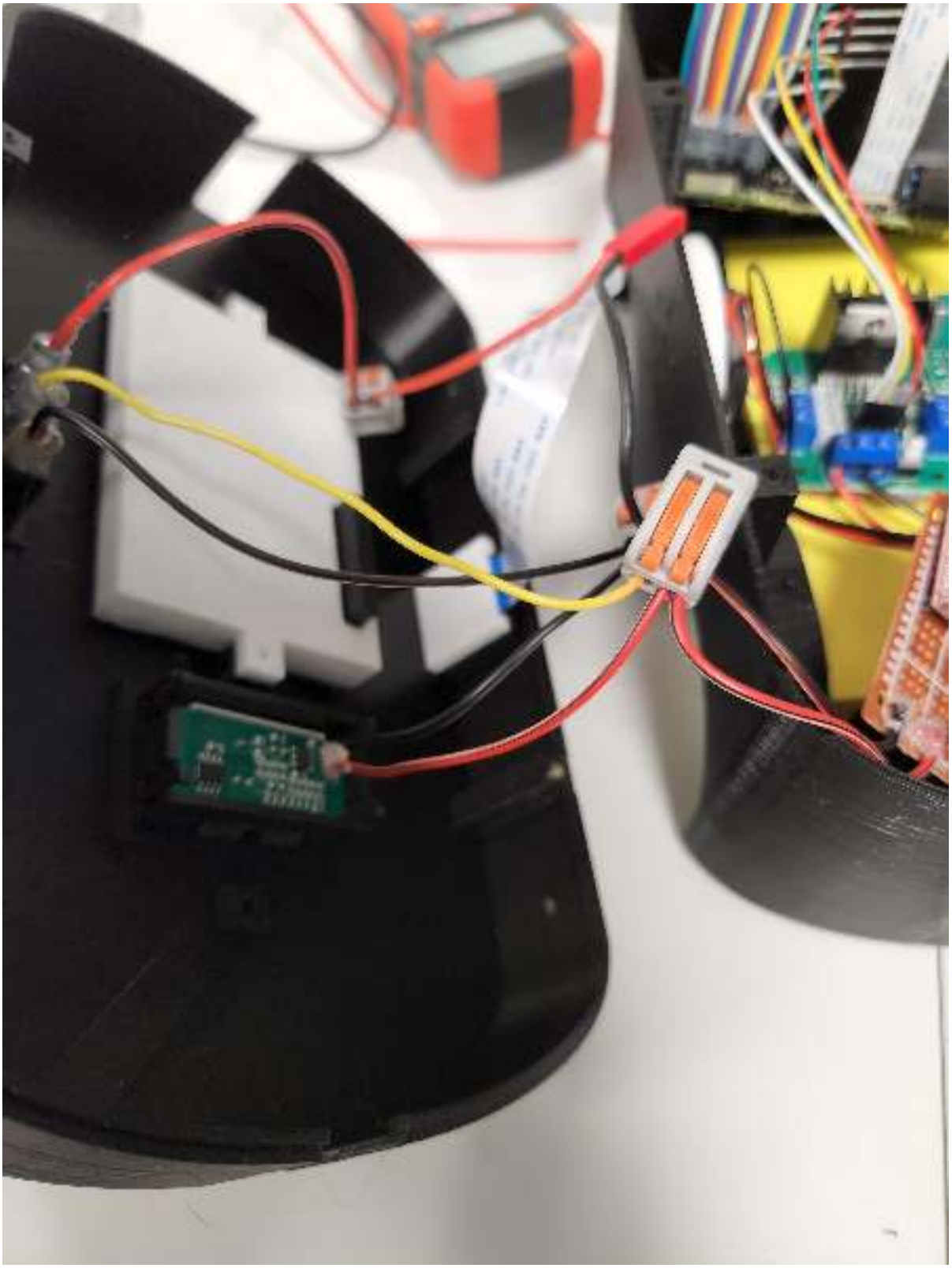
39. Connect all ground cables, to ground cable of li-po battery



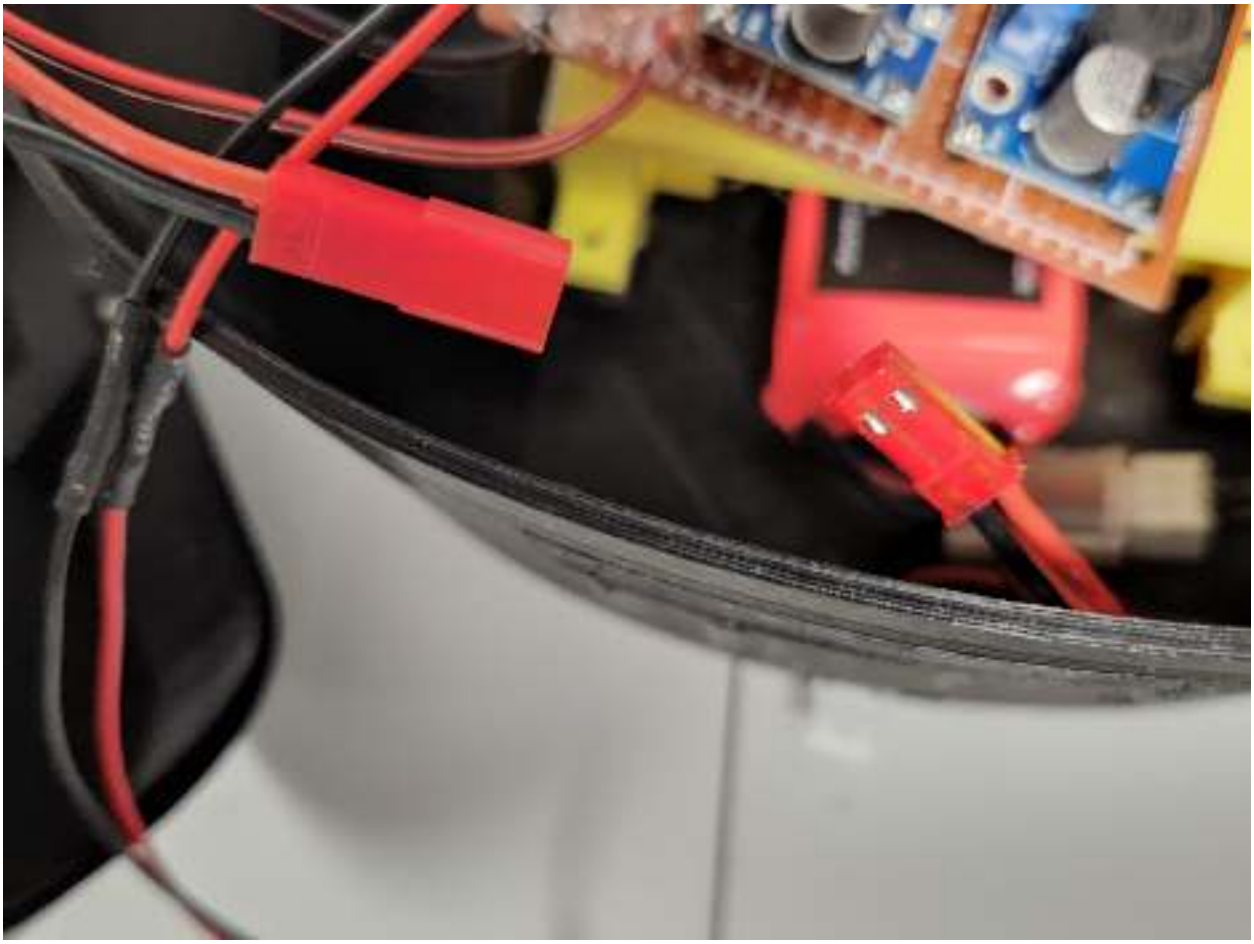
40. Connect power cable of lipo-battery to switch

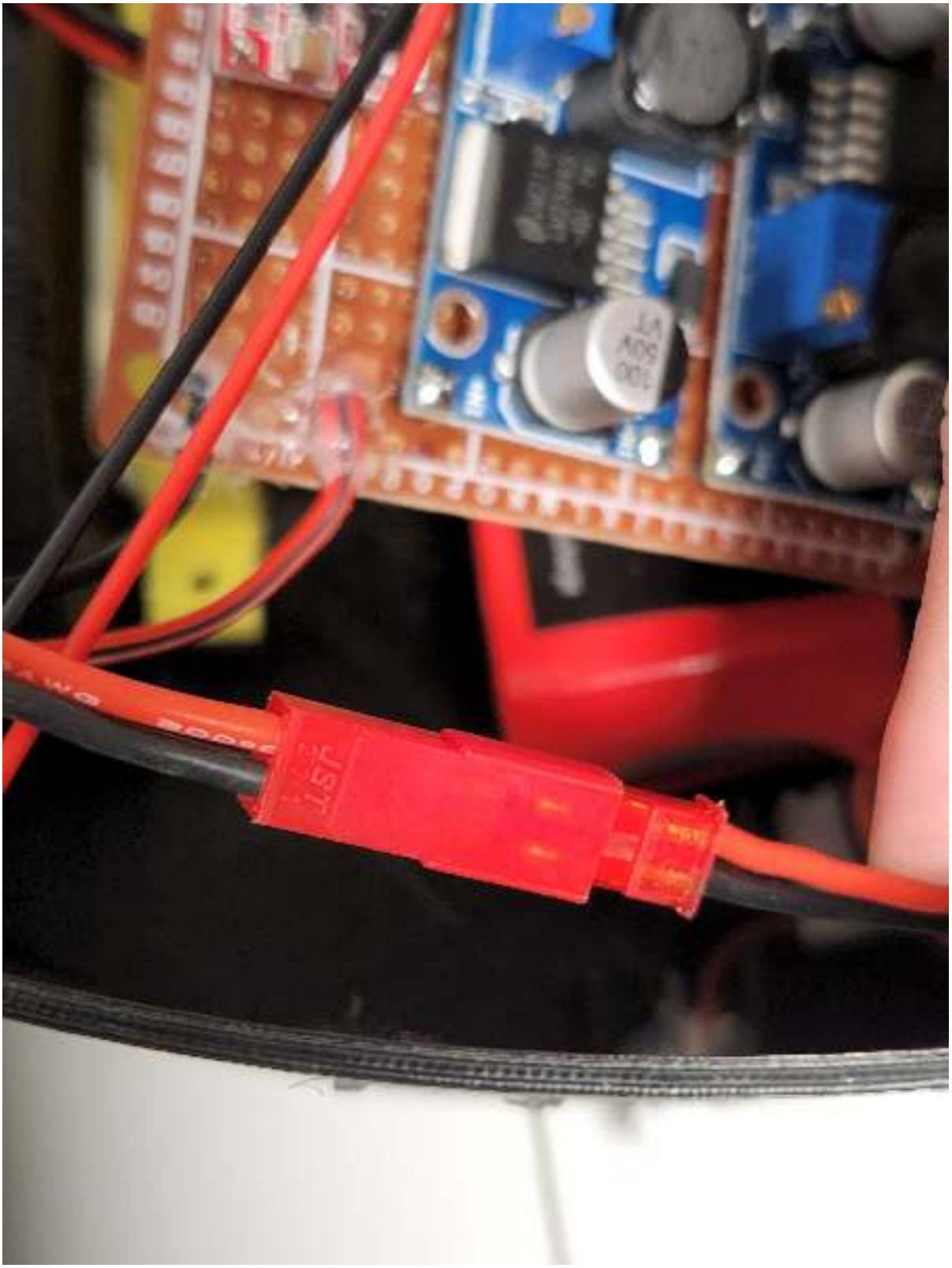


41. Connect all power cables to switch



42. Connect the battery to the JST connector





43. Power on and ensure that device is working

43.1. Touchscreen is responsive to touches

43.2. Sound emitted from speakers can be heard clearly

Otherwise, check that volume controller on the PAM8403 board is turned up to the loudest possible volume, and check audio jack connections

43.3. Camera can detect markers and robot moves in the correct direction when markers are detected (ie. wheels do not move in opposite direction)

If wheels are moving in opposite direction, check motor drive to Raspberry Pi connection

43.4. Powers off when switch offed

44. Align and attach lasers to the top casing such that they are at least 0.3 m away and parallel to the front and back of the robot respectively

45. Screw down top casing to bottom casing