Taking Control: A Novel Galvanic Stimulation Device for the Visually Impaired

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Instructions Booklet

Contents

Part 1: Assembling the GVS Device

1. Organize and layout all the components on a hard, non-carpet, table/floor.
2. Following standard through-hole soldering procedures, solder the materials in chronological order according to the reference positions.
3. Perform a short-circuit test with a multimeter and check for solder bridges.
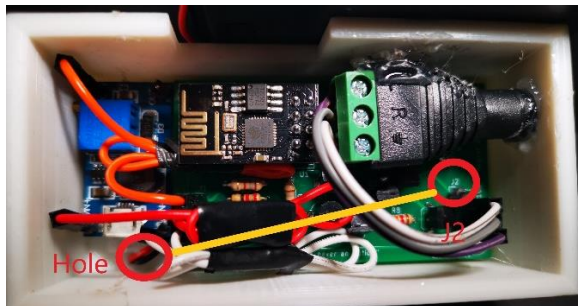4. Place the PCB board in the Housing Case. Orientate the board by referencing Figure 1 & 2:

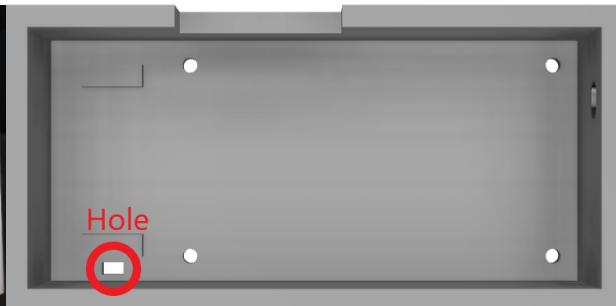*Figure 1: J2 should be in parallel with the hole.*   *Figure 2: Position of the hole in digital form.*

5. From the bottom of the housing case, slide the two black and red cables from the battery into the hole as illustrated in Figure 4.
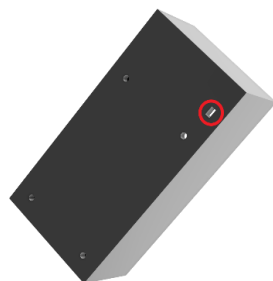

Figure 5: Location of the hole on the backside   *Figure 6: The red and black wire should be inserted into this hole.*

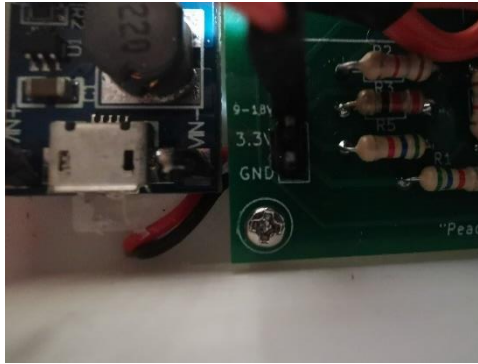6. Solder the red wire to 3.3v, and the black wire to ground.

Figure 7: Red wire - 3.3v, black wire – GND

7. Insert one M2x14mm screw into the hole in every corner on the PCB. Make sure the head of the screw is on the front side. Proceed to mount one M2x6mm female to female standoff for each respective screw,
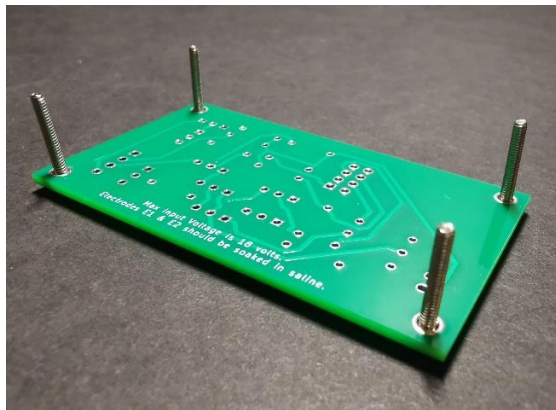

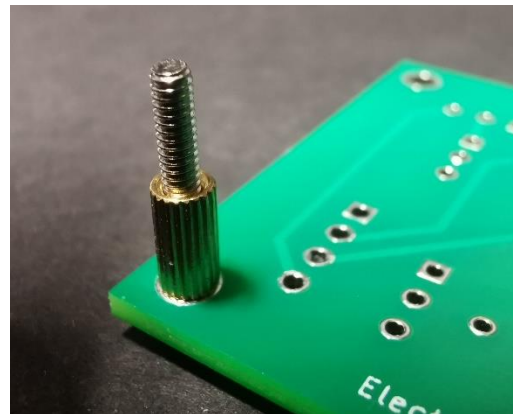*Figure 8: Respective locations for each of the screws*

Figure 9: The standoff in the screw

8. Align and insert the four screws on the PCB to the four holes on the housing case. Keep the original orientation.

Figure 10: Screw hole locations on the housing case

9. Secure one M2 hex nut for each screw hole. Tighten the hex nut so that the hex nut does loosen.

10. Set the housing case aside. On the MT3608 Boost Regulator, use standard through-hole soldering procedures to solder one Conn_01x01_Male Pin Header into each corner hole.
11. Using the unshielded jumper cable, solder, and link "VIN+" and "OUT- "together to ensure that both ports are grounded.
12. Hot glue the MT3608 Boost Regulator to the 3D printed rectangular spacers.
13. Using Figure 9 as a reference, connect the 3 females to female jumper wires to their corresponding pins (wires: red, blue, green)
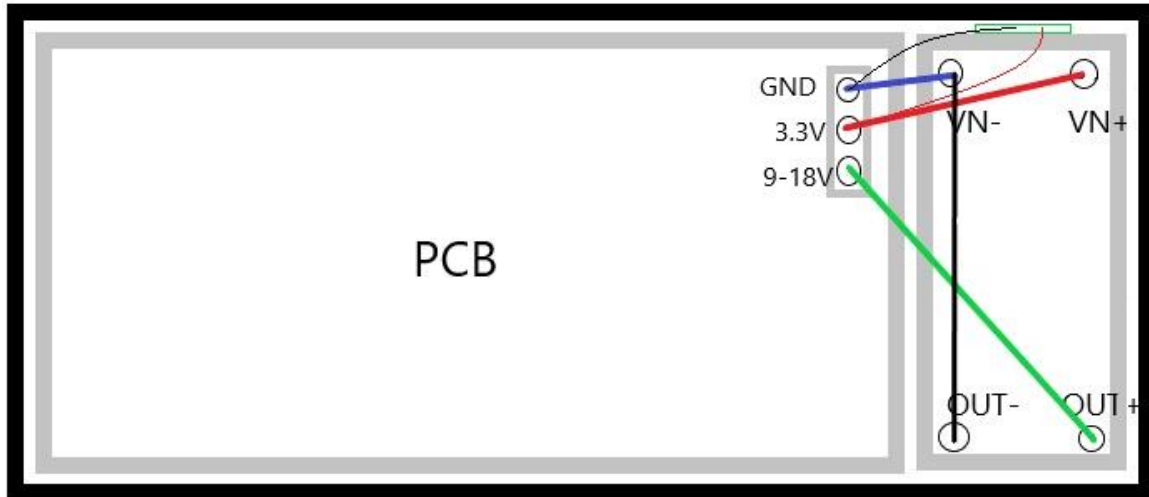

Figure 11: Schematic image

14. Insert the ESP8266 module into the Conn_02x04_Female Pin Header. The module should be oriented as illustrated in Figure 10
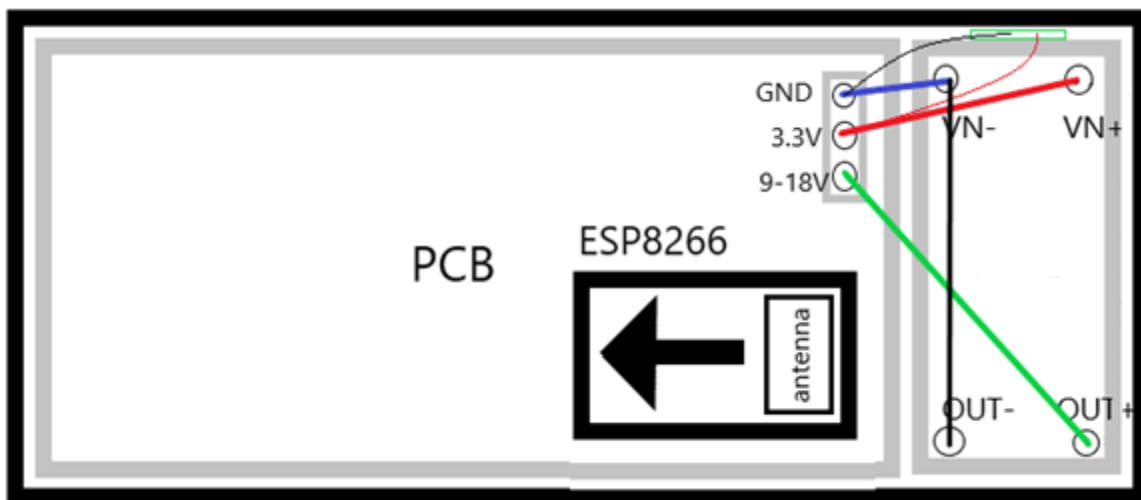

Figure 12: ESP8266 Orientation

15. Strip one of the ends off all three 3 females to female jumper wires.
16. Untighten the three screws from each terminal port.
17. Insert each copper end to a terminal port. Immediately tighten the terminal screws to prevent it from falling outwards,
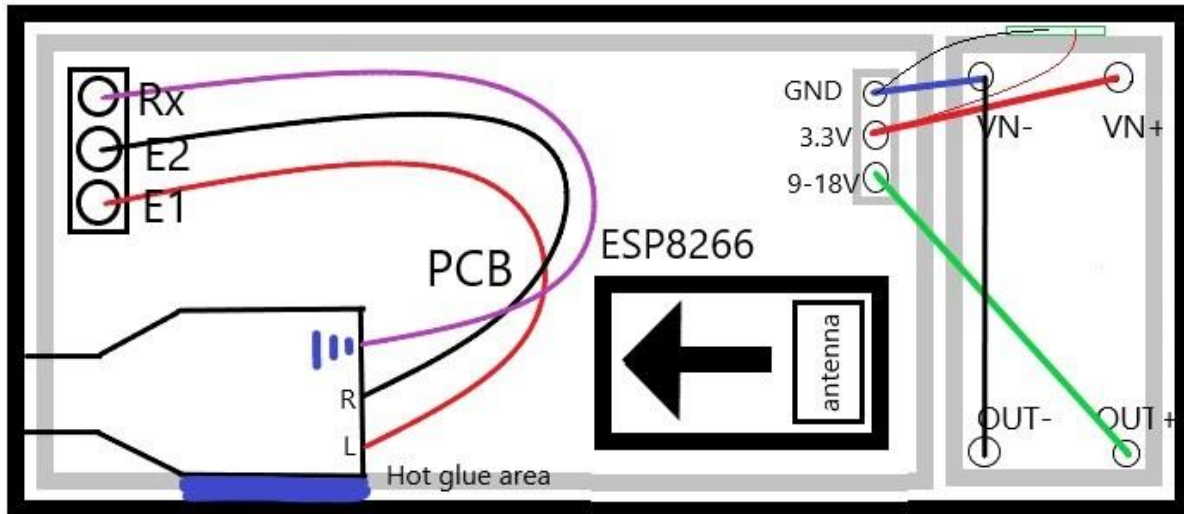18. Connect the female wires to the PCB as shown in Figure 11

Figure 13: Wiring diagram

19. Align the female jack port to the circled hole (as drawn in Figure 12). Hot glue the wall of the adapter to the housing case wall (illustrated in Figure 13)
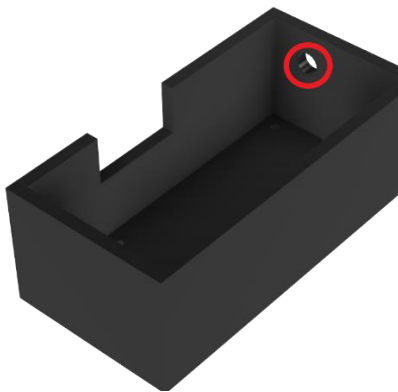

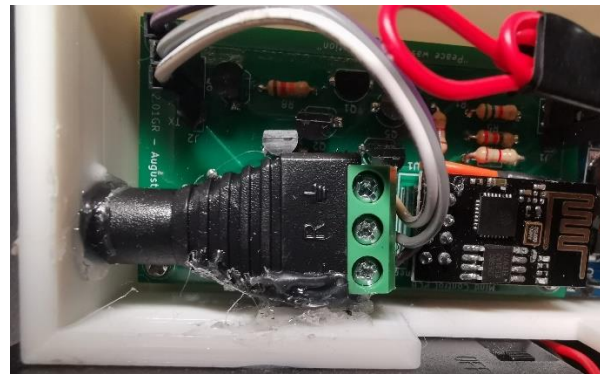*Figure 14: Align the jack port to the red circle*
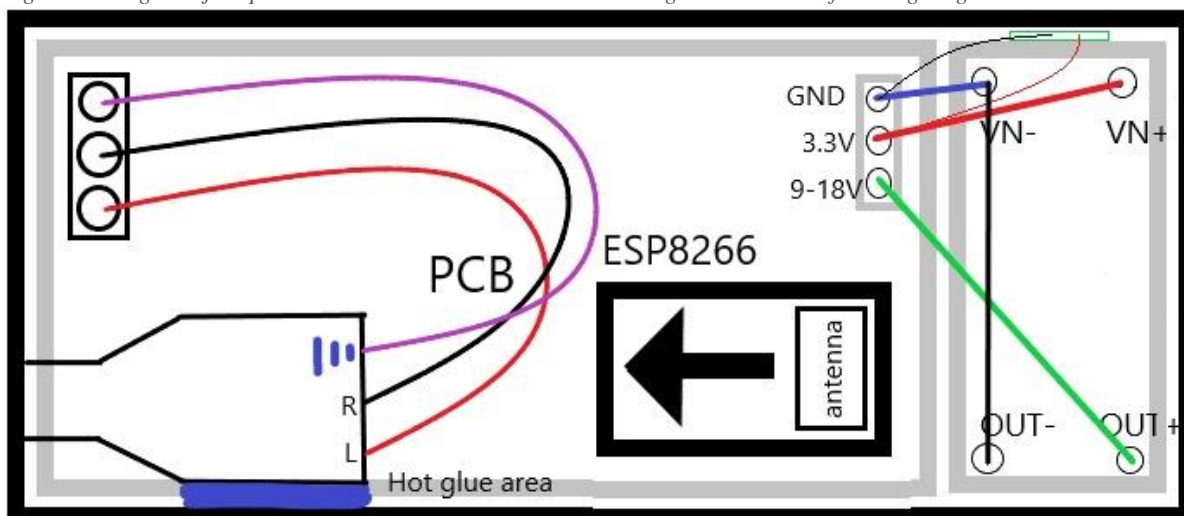

Figure 15: Result after hot gluing

Figure 16: Hot glue required area coloured in blue

20. After inserting two AA batteries into the case, glue it onto the system. The on/off switch should be facing inwards and in between the partially cut-off wall.
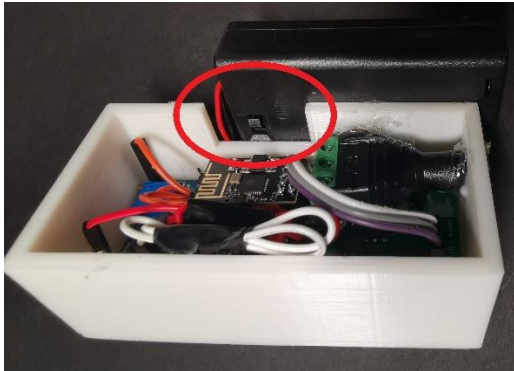

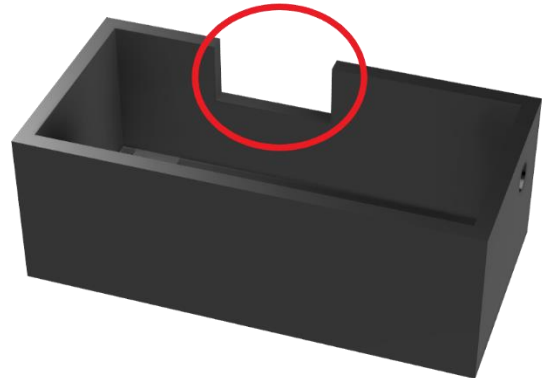*Figure 17: Location of the partially cut-off wall*

Figure 18: Location of the on/off switch

21. Perform a functionality test by switching on the battery. The ESP8266 module should light up.

Part 2: Setting up the Camera System

1. Place the Tripod mount to ¼" screw conversion adapter onto the tripod mount. Ensure the mount is at a 45-degree angle. Proceed to tighten the tripod mount.
2. With the ¼" female thread and the adapter aligned, screw the camera clockwise to fasten it onto the mount. The camera should be facing straight forward.
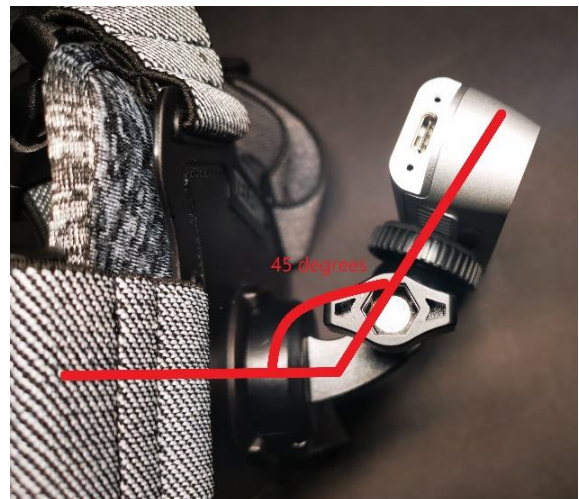

Figure 19: Location of the thread

Figure 20: The camera should be at a 45-degree angle

3. Plug in the USB-C to USB-A adapter from the D435 camera to the laptop.

Part 3: Software Uploading and Hardware Preparation

1. Pull out the ESP8266 module from the PCB. Insert the module onto the USB ESP8266 breakout, connect it to a laptop, and upload the Arduino code
2. Plug the ESP8266 module back into the PCB.

3. Find and download all modules required in Python. (Listed in "requirements.txt). Proceed to copy and paste the python code into your respective python integrated development environment.
4. To allow the laptop to continue running after the lid is closed, change the display settings.

Part 4: Final Setup

1. Compile and run the python code.
2. Initiate the GVS system by switching on the battery.
3. Plug the 3.5mm Electrode pad wire into the jack. Proceed to insert the 2 2mm pins into the 2 respective 2mm electron pads.
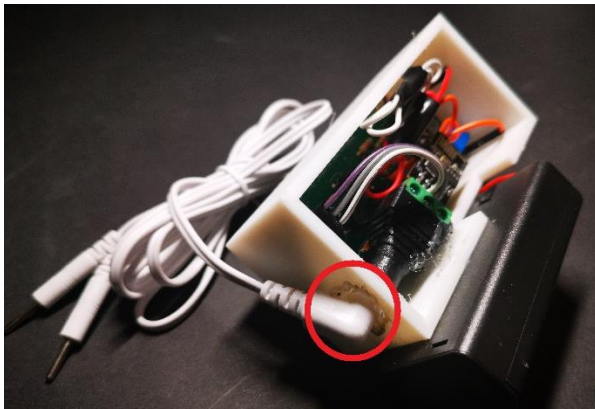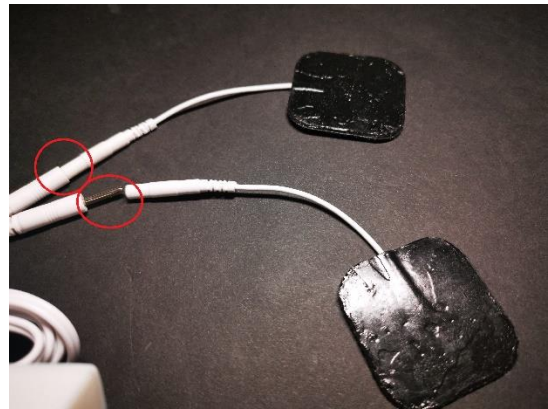

Figure 21: 3.5mm port circled in red

Figure 22: 2mm plug circled in red

4. Attach the two-electron-pads onto the participant's mastoid process. The pads should stick onto the skin because of the pad's gel-like substance.
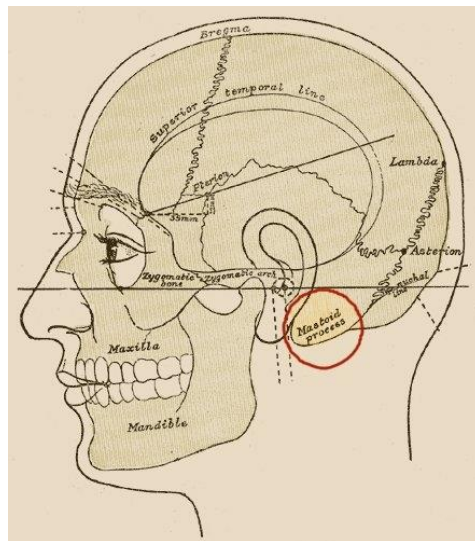

Figure 23: Location of the mastoid process

5. On the laptop, find the WIFI "SF2022", and press connect. This will ensure communication between the laptop (client) and the ESP8266 (server).
6. Close the lid of the laptop and put it into the ventilated bag while ensuring the USB-C to USB-A port is still firmly attached. The participant should start feeling electrons being transferred.