

## Assembling the PAWS Headset

### I. Items required

- PAWS assembled PCB x 1
- PAWS MEMS\_MIC\_V0 x 4
- Headset x 1
  - We used a model like this one: [https://www.amazon.com/IAXSEE-Headphones-Microphone-Lightweight-Smartphones/dp/B07CM2HCC7/ref=sr\\_1\\_2\\_sspa?s=videogames&ie=UTF8&qid=1544734003&sr=1-2-spons&keywords=headphones&psc=1](https://www.amazon.com/IAXSEE-Headphones-Microphone-Lightweight-Smartphones/dp/B07CM2HCC7/ref=sr_1_2_sspa?s=videogames&ie=UTF8&qid=1544734003&sr=1-2-spons&keywords=headphones&psc=1)
- 1.5V AAA batteries x 3
- AAA battery holder x 1
  - Example: <https://www.digikey.com/product-detail/en/keystone-electronics/2478/36-2478-ND/303823&?gclid=EAIaIQobChMIqrSq3t2d3wIVBiSGCh0LSgU3EAQYBCA BEgLDSfD BwE>
  - NOTE: This battery holder was too big to fit in our headset, so we 3D printed a smaller holder and made our own contacts from wires.
- 3.3V CR2032 battery x 1
- CR2032 battery holder x 1
- Power Switch x 1
  - We used a switch like this one: <https://www.digikey.com/product-detail/en/e-switch/EG2209A/EG1908-ND/101741>

### II. Assembling the Headset

This document details how to create the PAWS Headset from the PAWS PCB + the 4 MEMS microphones.

#### Step 1: Assemble PAWS pcb

Generate the PAWS PCB using the design files located here: [https://github.com/Columbia-ICSL/PAWS-FrontEnd/tree/master/PAWS/pcb/PAWS\\_pcb/AltiumCMFiles](https://github.com/Columbia-ICSL/PAWS-FrontEnd/tree/master/PAWS/pcb/PAWS_pcb/AltiumCMFiles)

The design was generated using [Altium CircuitMaker](#), so you can also access the design files through the software here: <https://circuitmaker.com/Projects/Details/Stephen-Xia/ICSL-PS-Combined>

Populate the board using the components detailed in the schematics and design. Your populated board will look something like this:

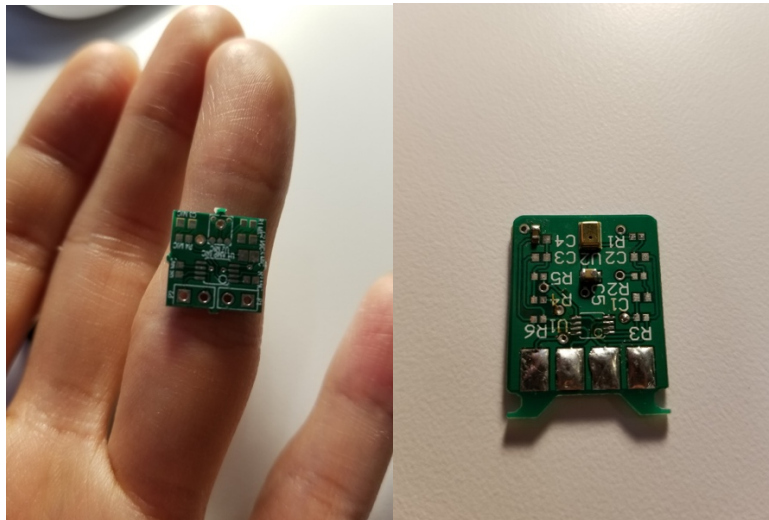


### Step 2: Assemble 4 MEMS microphones

The PAWS system requires 4 MEMS microphones. You can generate 4+ microphones using the schematic + layouts found here: [https://github.com/Columbia-ICSL/PAWS-FrontEnd/tree/master/PAWS/pcb/MEMS\\_pcb/AltiumCMFiles](https://github.com/Columbia-ICSL/PAWS-FrontEnd/tree/master/PAWS/pcb/MEMS_pcb/AltiumCMFiles)

The design was generated using [Altium CircuitMaker](https://circuitmaker.com/Projects/Details/Stephen-Xia/MEMSMICV0), so you can also access the design files through the software here: <https://circuitmaker.com/Projects/Details/Stephen-Xia/MEMSMICV0>

Populate the microphones using the components detailed in the schematics and design. Your populated boards will look something like this (depending on the version):



### Step 3: Prepare the headset

The headset will have four microphones mounted on it and will contain the PAWS PCB + batteries. An overview of the headset, with microphones + PCB is highlighted in the following figure.



Note that there is one microphone on the back of the head that is attached by an extra strip of material.



First, take off both covers of the headset. To do this, remove the cushion, and then unscrew the cover.



We need to also drill a few holes in the headset for the microphone wires to come out of. For the two microphones attached one on each side of the headset, drill a small hole on each side:



On one side of the headset, drill a hole on the underside of the cushion for the fourth microphone that is intended to be attached onto the person's shirt. We drilled the hole on the left ear.



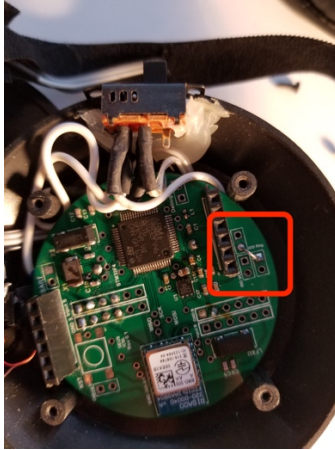
Make sure there is room for the wires to travel from one side to the other, since one side will hold the pcb and the other side will hold the battery used to power the system.





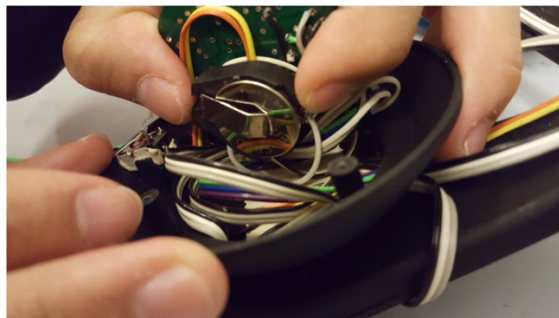
Step 4: Prepare the PAWS PCB.

Make sure one of the pins from *IDD 3V3* is connected to *IDD Reg*



Step 5: Connect PCB with microphones, switch, and battery

The PAWS PCB is housed in the left ear. The CR2032 batteries + holder can be placed underneath the PCB, while the AAA battery holder will go into the right ear.



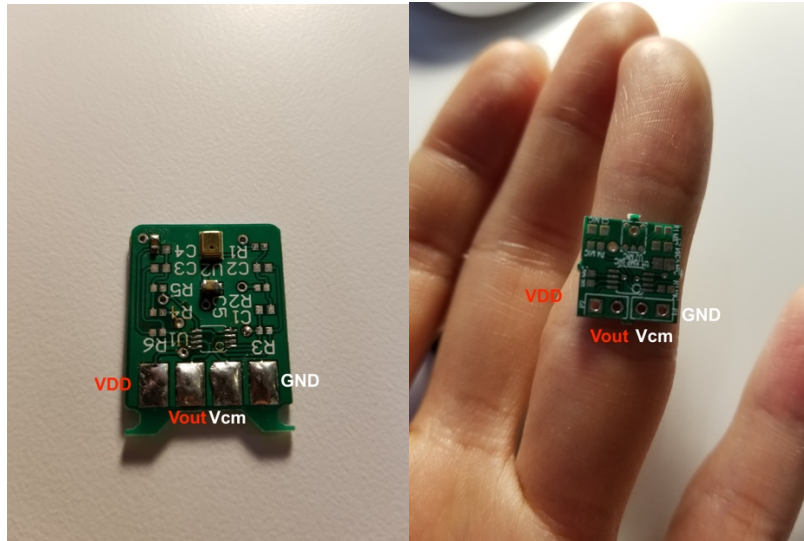
Connect the negative end of the battery to the PCB *GND* and connect the positive end of the battery to one of the middle prongs on the switch as shown below. Then, connect the corresponding prong at the end of the switch to the PCB *VDD* as shown below. This way, the switch will act as a power button; in the figure below, the board is turned on when the switch is to the left.



Next, we have to connect the four microphones + coin cell battery used to power the microphones. Before soldering the microphone connections in place, make sure the wires are looped through the holes created in the headset created in the previous steps that way the microphones will be in the correct place after soldering is complete.

Connect the negative end of the coin cell battery to any of the pins in *GND B*. Connect the positive end of the battery to the middle prong on the same switch that is attached with the AAA batteries. In the figure below, the prongs you should attach the coin cell battery is underneath the prongs that control the AAA batteries that power the board. Connect the prong on the end of the switch to the *VDD* pin of each of the four microphones; you will have one wire connected to the prong that breaks out into four wires that power all of the microphones. Now the switch controls power to both the coin cell and the board.





The VDD of all microphones are all connected to the coin cell and switch; we need to connect each microphone's *Vout* and *GND* pins to the PAWS board. The *Vcm* pin for each microphone will remain unconnected for this version of PAWS. Connect each of the four microphone's *GND* pin to any pin in *GND S* on the PAWS PCB.



Next, connect each microphone's *Vout* pin to the *Input S* pins on the PAWS PCB. The order is important if you want to exactly replicate our system.

- Mic 1: Left side
- Mic 2: Right side
- Mic 3: Behind head
- Mic 4: Shirt mic





All the required electrical wiring is complete; reassemble the headset and try it out with the smartphone application.