

## ClearPulse: Stethoscope with noise canceling headphones (and amplification option)

**Date:** 10/9/2026 - 10/15/26

**Client:** Dr. Lenard Markman

**Advisor:** Prof. Randy Bartels

**Team:** Charlie Fischesser, Christian Dittmar Greaves, Johnny Sellers, Jonas Zhang, Josh Slager, Sam Wallin

| Name                      | Email                 | Role         |
|---------------------------|-----------------------|--------------|
| Josh Slager               | jslager@wisc.edu      | Co-leader    |
| Charlie Fischesser        | fischesser@wisc.edu   | Co-leader    |
| Christian Dittmar Greaves | cdittmargrea@wisc.edu | Communicator |
| Johnny Sellers            | jsellers4@wisc.edu    | BSAC         |
| Sam Wallin                | swallin3@wisc.edu     | BWIG         |
| Jonas Zhang               | jjzhang6@wisc.edu     | BPAG         |

### Problem statement:

Traditional stethoscopes can be difficult to use effectively in noisy or high-vibration environments, including hospitals, helicopters, and ambulances. Environmental noise and poor acoustic conditions can interfere with healthcare providers' ability to accurately hear and distinguish heart and lung sounds, potentially compromising the reliability of auscultation. Providers with hearing loss may also experience these same difficulties. Additionally, prolonged use of traditional stethoscope ear pieces can lead to discomfort or ear canal irritation.

Our team will address these limitations by designing and fabricating a stethoscope system that incorporates noise amplification with optional passive noise isolation of over-the-ear headphones or active noise cancellation. The system will improve the clarity of heart and lung sounds across a broad range of environmental conditions while prioritizing comfort and ease of use. The final design must be durable, cost-effective, and manufacturable, with potential for commercial development through WARF or other outside organizations.

## **Brief status update:**

The team met to purchase a large breadboard and practice soldering. The components we ordered last week are scheduled to arrive Friday, so we hope to start building the circuit soon after. We also found a smaller ESP32 microcontroller at the design lab and have started discussing using that microcontroller as an alternative. We discussed the different parts of our prototyping process, from developing code for the microcontroller to soldering the microphone components onto the breadboard to building the circuitry with the amplifiers, capacitors, resistors, etc.

## **Difficulties / advice requests:**

n/a

## **Goals:**

### ***Major team goals for the next week***

1. Functional prototype of the electronics
2. Come up with testing procedures

### ***Next week's individual goals***

Josh:

- Design a fritzing diagram of the analog circuit
- Work on assembly of the analog front end circuitry
- Research ways to reduce the footprint of our circuit

Charlie:

- Finish uploading all research from preliminary report into lab archives
- Assist in circuit assembly and research further into other alternatives
- Continue to practice soldering
- Determine which design training to complete

Christian:

- Begin coding microcontroller and assembly of circuit.
- Reporting research into lab-archives, and why we're no longer using the difference amplifier.

Johnny:

- Continue software research to figure out which CODEC algorithms we will use

- Complete in-person intro to machining training
- Assist in assembling circuit prototype

Sam:

- Research viability of different audio processing algorithms and forecast potential shortfalls
- Complete Lathe/Mill training
- Continue to organize and catalog all research performed thus far (while continuing research for testing methods/benchmarks)
- Engage more in understanding circuitry/electronics testing

Jonas:

- Practice soldering
- Study circuit
- Research

## Timeline

| Task                   | Sept |    |    |    | October |   |    |    |    | November |    |    |    | December |    |    |
|------------------------|------|----|----|----|---------|---|----|----|----|----------|----|----|----|----------|----|----|
|                        | 3    | 10 | 17 | 24 | 1       | 8 | 15 | 22 | 29 | 5        | 12 | 19 | 26 | 4        | 11 | 18 |
| <b>Project R&amp;D</b> |      |    |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| Empathize              |      | X  |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| Background             | X    | X  | X  | X  |         |   |    |    |    |          |    |    |    |          |    |    |
| Prototyping            |      |    |    | X  | X       | X | X  |    |    |          |    |    |    |          |    |    |
| Testings               |      |    |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| <b>Deliverables</b>    |      |    |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| Progress Reports       | X    | X  | X  | X  | X       | X | X  |    |    |          |    |    |    |          |    |    |
| Prelim presentation    |      |    |    |    |         | X |    |    |    |          |    |    |    |          |    |    |
| Final Poster           |      |    |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| <b>Meetings</b>        |      |    |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| Client                 | X    |    |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| Advisor                |      |    | X  | X  | X       | X |    |    |    |          |    |    |    |          |    |    |
| <b>Website</b>         |      |    |    |    |         |   |    |    |    |          |    |    |    |          |    |    |
| Update                 | X    | X  | X  | X  | X       | X | X  |    |    |          |    |    |    |          |    |    |

Filled boxes = projected timeline

X = task was worked on or completed

## Previous week's goals and accomplishments

### Circuit Prototyping

- Purchased large breadboard
- Practiced soldering

*Activities*

| Name                      | Date                                                               | Activity                                                                                                                                                         | Time (h)                         | Week Total (h) | Sem. Total (h) |
|---------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------|----------------|
| Josh Slager               | 10/11/26<br>10/14/26<br>10/15/26                                   | Feedback review and reflection<br>Team meeting<br>Fritzing Diagram work                                                                                          | .5<br>1<br>1                     | 2.5            | 36             |
| Charlie Fischesser        | 10/11/26<br>10/14/26                                               | Feedback review and reflection<br>Team Meeting                                                                                                                   | .5<br>1                          | 1.5            | 25             |
| Christian Dittmar Greaves | 10/11/26<br>10/14/26                                               | Feedback Review and Reflection<br>Team Meeting. Teaching<br>Oscilloscope use                                                                                     | .5<br>2                          | 2.5            | 24             |
| Johnny Sellers            | 10/9/2026<br>10/11/26<br>10/14/26<br>10/14/26                      | BSAC meeting<br>Feedback review and reflection<br>Team meeting<br>Software Research                                                                              | 1<br>0.5<br>1<br>1.5             | 4              | 21.5           |
| Sam Wallin                | 10/10/26<br>10/11/26<br><br>10/11/26<br>10/14/26                   | Intro to Machining Canvas<br>Cataloging previous research/testing<br>methods research<br>Peer feedback reflection<br>Team meeting (and oscilloscope<br>practice) | 2<br>2<br><br>.5<br>1.75         | 6.25           | 26.5           |
| Jonas Zhang               | 10/10/2026<br>10/11/2026<br>10/14/2026<br>10/14/2026<br>10/14/2026 | Reflection<br><br>Research/Circuit<br><br>Finished training<br><br>Team meeting                                                                                  | 0.5<br><br>0.5<br><br>1<br><br>1 | 3              | 24             |

## Current design:

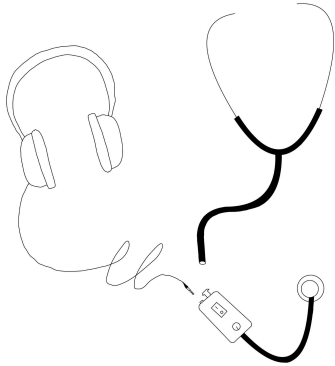


Figure of Selected Headset Design

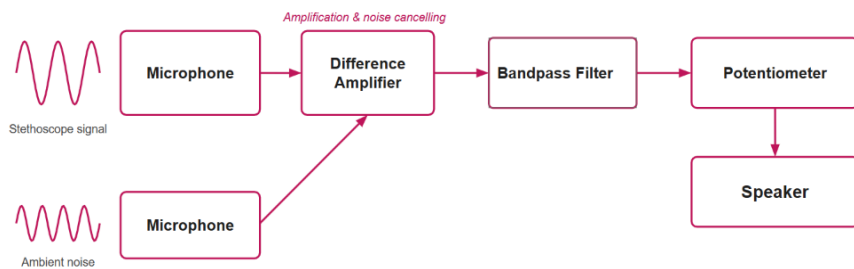
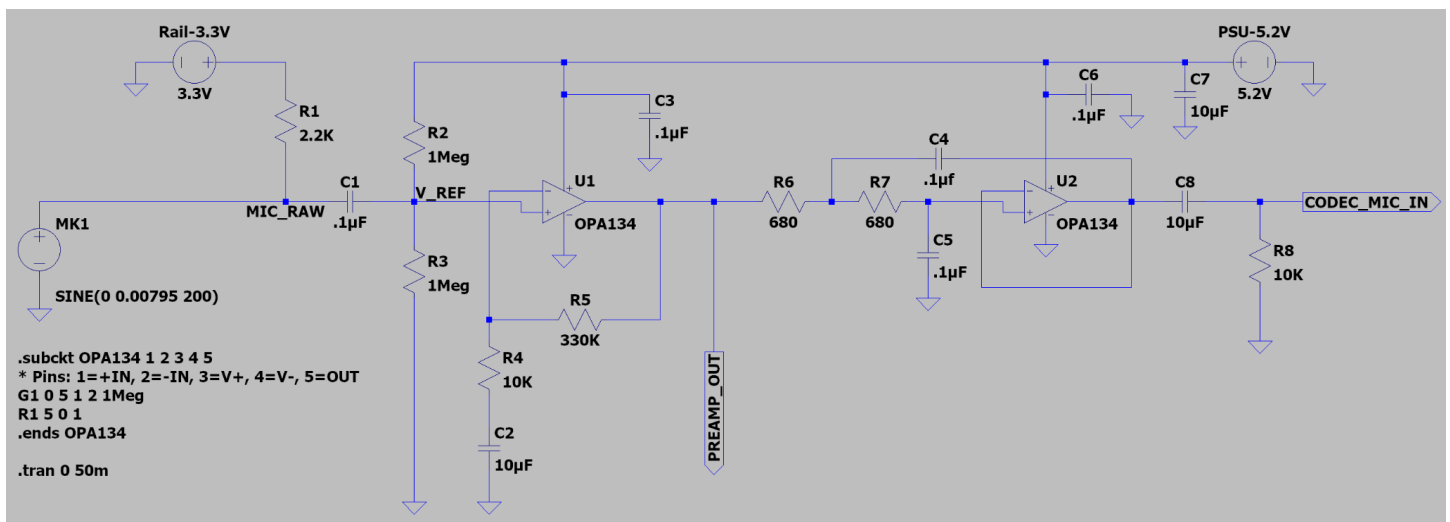


Figure of Electronic Components Parts.



LTspice model of the analog section of our circuit

## Materials and expenses:

| Item                                                     | Description                                                     | Manufacturer           | Mft Pt#         | Vendor     | Vendor Cat#  | Date       | QTY | Cost Each | Total   | Link                 |
|----------------------------------------------------------|-----------------------------------------------------------------|------------------------|-----------------|------------|--------------|------------|-----|-----------|---------|----------------------|
| <b>Category 1- First Design/ Microphones + Amplifier</b> |                                                                 |                        |                 |            |              |            |     |           |         |                      |
| M5STACK AUDIO MODULE                                     | ES8388 CODEC Audio Platform Evaluation Expansion Board          | M5Stack Technology Co. | M144            | Digikey    | 2221-M144-ND | 10/6/26    | 1   | \$7.95    | \$7.95  | <a href="#">Link</a> |
| IC OP AMP 1CH 8-PDIP                                     | Audio Amplifier 1 Circuit 8-PDIP                                | Texas Instruments      | OPA134PA        | Digikey    | OPA134PA-ND  | 10/6/26    | 4   | \$4.39    | \$17.56 | <a href="#">Link</a> |
| MIC COND ANLG OMNI -45DB 0.236"D                         | Analog Microphone Electret Condenser 2 V ~ 10 V Omnidirectional | PUI Audio              | POM-2245L-C33-R | Digikey    | 668-1390-ND  | 10/6/26    | 2   | \$2.03    | \$4.06  | <a href="#">Link</a> |
| <b>Category 2-Design Lab Expenses</b>                    |                                                                 |                        |                 |            |              |            |     |           |         |                      |
| Breadboard                                               | Breadboard                                                      |                        |                 | Design Lab |              | 10/14/2026 | 1   | \$3.00    | \$3.00  |                      |