

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

Date: 10/02/2026 - 10/08/26

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
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Christian Dittmar Greaves	cdittmargrea@wisc.edu	Communicator
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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:

Last week, the team held our preliminary presentation and submitted our preliminary report. We also did significant research into specific components and circuit designs, ending up with an LTspice model of the analog portion of our circuit which has been verified using the embedded spice simulation. We also purchased all necessary mics, op amps, and a CODEC as well as acquiring an ESP32 MCU and the specified values of resistors and capacitors. However, we still need to find a breadboard of suitable size for the prototype circuit and are hoping that they can be purchased at the design lab.

Difficulties / advice requests:

As we designed the circuit, we realized that there are several sensitive components that can be easy to destroy during prototyping if the proper precautions are not taken. We purchased a few extras to try and account for this but with our somewhat limited budget we are worried that thorough testing of our designs may incur costs that we cannot afford at this time. Are there any recommendations for ways to test our circuit that don't risk the functionality of the components?

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
- Research integration of all circuit components

Charlie:

- Finish uploading all research from preliminary report into lab archives
- Assist in circuit assembly and research further into other alternatives
- Finish feedback reviews

Christian:

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

Johnny:

- Begin fabrication and test circuit
- Continue researching

Sam:

- Assist in beginning physical design process
- Complete training
- Organize and catalog all research performed thus far (while continuing research for testing methods, ect)
- Finish reflection of peer reviews

Jonas:

- Help with design
- Finish training
- Do reflection and feedback review

Timeline

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

Filled boxes = projected timeline

X = task was worked on or completed

Previous week's goals and accomplishments

Preliminary Report

- Completed and submitted

Circuit design research and selection

- Purchased mics, op amps, and a CODEC as well as
- Acquired all necessary capacitors, resistors, and an MCU

Update preliminary deliverables

- Briefly revised the PDS and updated cost spreadsheet

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Josh Slager	10/2/2026	Preliminary Presentation	2	15.25	33.5
		Circuit component research	3		
		Circuit design research	2		
	10/3/2026	LTspice circuit design	4		
		Circuit Validation	1		
	10/4/2026	Team meeting	.75		
	10/6/2026	Preliminary Report Section	1		
	10/7/2026	Editing Preliminary Report	1		
		Feedback Fruits	.5		
Charlie Fischesser	10/2/2026	Preliminary Presentation	2	7.5	23.5
	10/4/2026	Team meeting	1		
	10/6/2026	Report Work (Research/Section)	2		
	10/7/2026	Report Work (final additions/editing)	2		
		Feedback Fruits	.5		
Christian Dittmar Greaves	10/3/3036	Preliminary Presentation Work	.5	5.5	21.5
	10/6/2026	Research Testing methods	2		
		Making LT SPICE circuit	.5		
		Testing Filter in LT SPICE	.5		
		Diagrams for presentation	.5		
		Presentation	1.5		
Johnny Sellers	10/2/2026	Presentations	2	5	17.5
	10/4/2026	Weekend Meeting	0.5		
	10/5/2026	Work on Report	1		
	10/7/2026	Continue research and Feedback Fruits	1.5		
Sam Wallin	10/2/2026	Preliminary Presentation	2	6.75	20.25
	10/4/2026	Team meeting	.75		
	10/7/2026	Team meeting	.5		
	10/7/2026	Preliminary Report section	3		
	10/7/2026	Peer feedback	.5		

Jonas Zhang	10/2/2026	Presentation	2	6.5	21
	10/3/2026	Work on report	1		
	10/5/2026	Training	3		
	10/6/2026	Ordering and spreadsheet	0.5		

Current design:

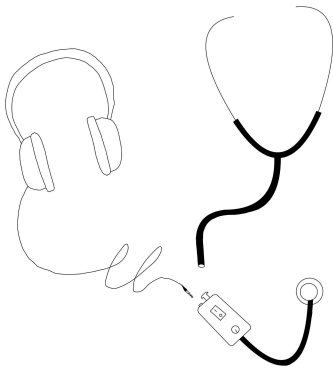


Figure of Selected Headset Design

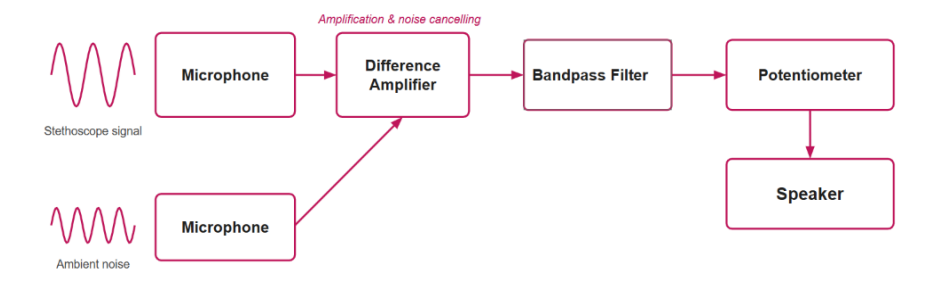
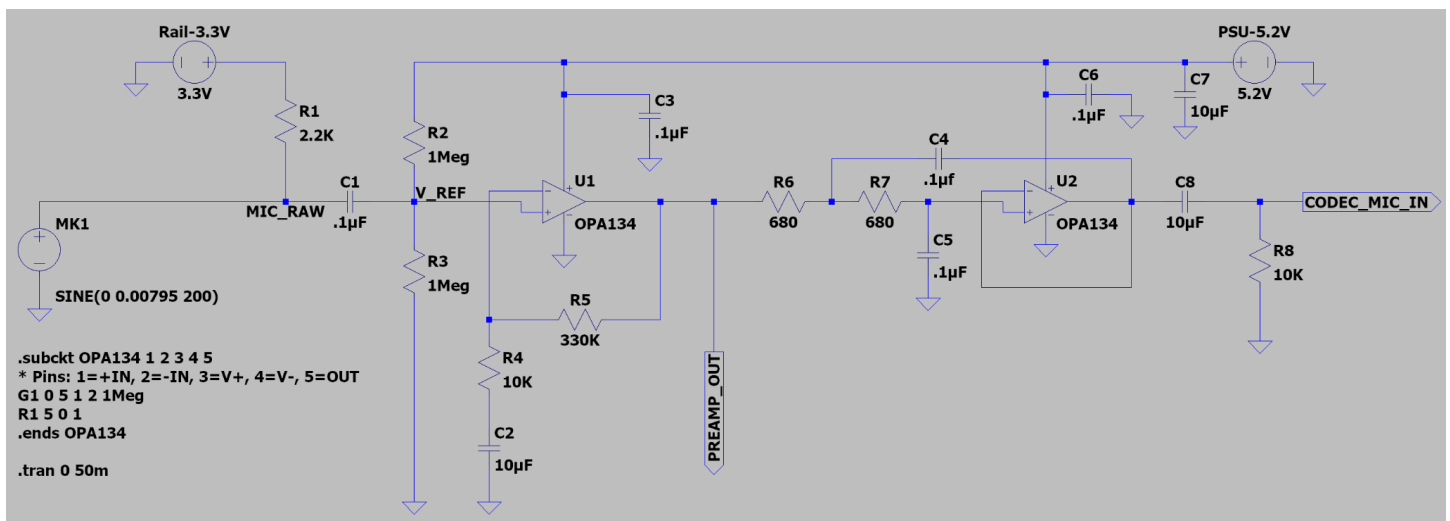


Figure of Electronic Components Parts.



BME Design: 200, 300, 301, 400 and 402

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
Category 1- First Design/ Microphones + Amplifier										
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	Link
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	Link
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-N D	10/6/26	2	\$2.03	\$4.06	Link