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

Date: 10/16/26 - 10/22/26

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:

We had another meeting with our client, in person, to discuss our prototype we have created thus far. We received our budget from our client during this meeting and were able to get all of our client's questions answered. We also spent time in Wendt creating our circuit board and looking into using the oscilloscope to begin some preliminary tests. We split the team up, with those unfamiliar with MATLAB, to begin training into using MATLAB for signal processing assistance.

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
3. Familiarize with MATLAB program for those unfamiliar
4. Prepare Show and Tell

Next week's individual goals

Josh:

- Test analog and front end circuitry
- Research CODEC communication protocols

Charlie:

- Finish uploading all research from preliminary report into lab archives
- Finish circuit assembly and begin testing with oscilloscope
- Continue to practice soldering
- Prepare for Show and Tell
- Finish design training
- Complete some signal processing training in MATLAB to familiarize with wavelets

Christian:

- Continue coding microcontroller and assembly of circuit
- Continue 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
- Work on signal processing Matlabs courses
- Assist in assembling circuit prototype

Sam:

- Research viability of different audio processing algorithms and forecast potential shortfalls
- Complete Intro to Machining training in-person portion
- Complete training to increase MATLAB capabilities and test circuit/digital processes
- Prepare for show and tell

Jonas:

- Figure out how to use Matlab
- Research algorithms
- Get ready for Show and Tell

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	X	X								
Testings																
Deliverables																
Progress Reports	X	X	X	X	X	X	X	X								
Prelim presentation						X										
Final Poster																
Meetings																
Client	X							X								
Advisor			X	X	X	X	X									
Website																
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

- Created circuit on breadboard
- Labeled corresponding wires with labels

- Determined preliminary circuitry requirements for tests
- Began MATLAB training for signal processing

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Josh Slager	10/19/21 10/20/21	Client Meeting Analog Circuit Fabrication	1.5 2.5	4	40
Charlie Fischesser	10/17/26 10/19/26 10/21/26	Update LabArchives Client Meeting Team Meeting Understanding LTSpice to Breadboard LabView Training	1.5 1.5 1 1 1	6	31
Christian Dittmar Greaves	10/17/26 10/118/26 10/18/26 10/19/26 10/21/26 10/21/26	Documenting relevant training for sophomores. Research on Signal Processing Techniques MATLAB Signal Processing Trainings Client Meeting Team Meeting Redrawing Circuit Schematic for readability Inspecting Circuit / Calibrating Potentiometer	1hr 5 hr 3hr 1.5 hr 1hr 1hr 2hr	14.5	38.5
Johnny Sellers	10/19/26 10/20/26-10/22/26 10/21/26 10/21/26	Client Meeting Intro to Machining In-Person Training Team Meeting Matlab onramp completion	1.5 4.5 1 1	8	29.5
Sam Wallin	10/19/26 10/21/26	Cataloging research Team Meeting	1.5 1	2.5	29
Jonas Zhang	10/18/26 10/19/26 10/20/26 10/21/26	Matlab+Fix Lab archives Client Meeting Mathlab Team Meeting	1.5 1.5 1 1	5	29

Current design:

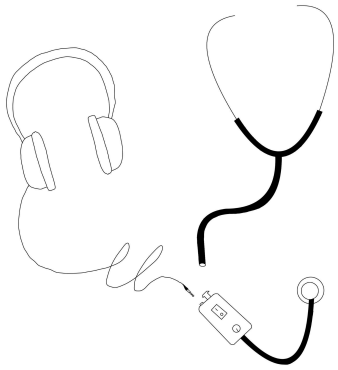


Figure of Selected Headset Design

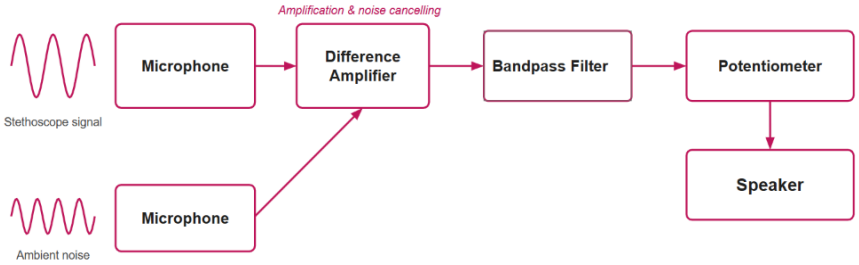
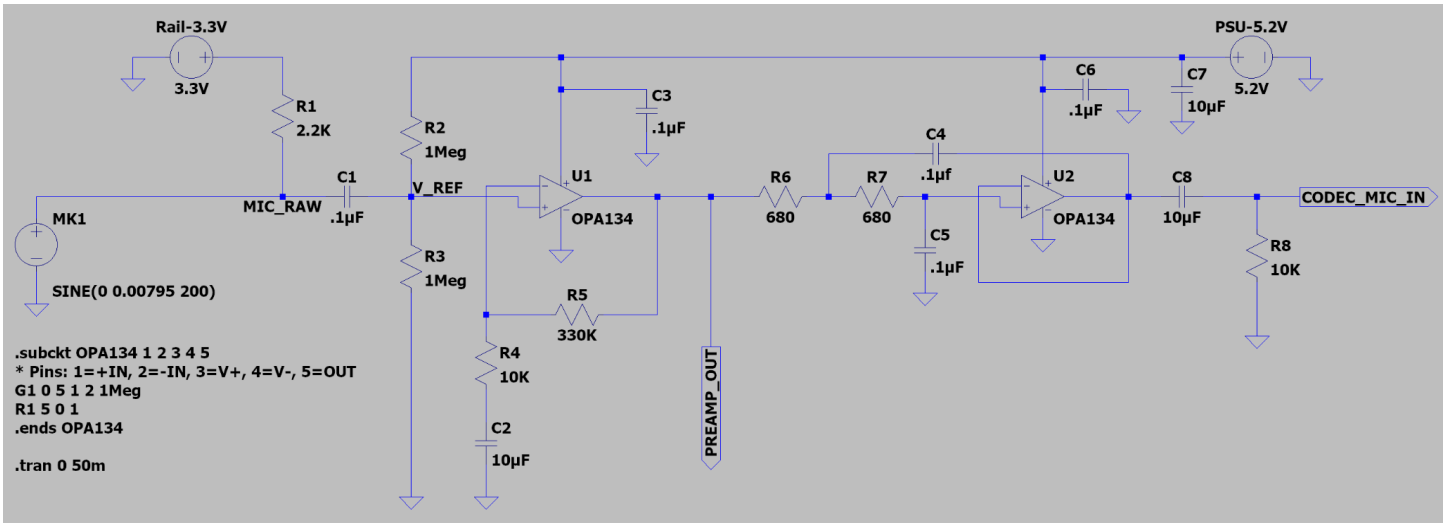


Figure of Electronic Components Parts.



LTspice model of the analog section of our circuit

Materials and expenses:

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

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-ND	10/6/26	2	$2.03	$4.06	Link
Category 2-Design Lab Expenses										
Breadboard	Breadboard			Design Lab		10/14/2026	1	$3.00	$3.00	