ListenBetter: Stethoscope with noise canceling headphones

BME 200/300

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Presentation Overview

Advisor:

Prof. Justin Williams

Figure 1: Justin Williams
[1]

Clients:

Dr. Lenard Markman

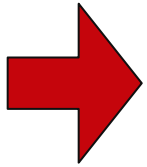
Figure 2: Dr. Lenard Markman
[2]

Problem Statement

Problem:

Auscultation difficulties for healthcare workers

- High-noise environments
- Practitioners with diminished hearing.



Goal:

Noise cancelling headphones integrated into a stethoscope

- Comfortable
- Cost-effective
- Blocks out outside noise
- Easy to operate

Background and Introduction

Background:

- Traditional Stethoscope is ineffective in emergency transport situations (↑ dB).
- Pair of noise canceling headphones accompanied by stethoscope can reduce background noise.
- Increase diagnostic accuracy with new stethoscope design

Competing Designs:

- Active Noise Control Stethoscope (Patent)

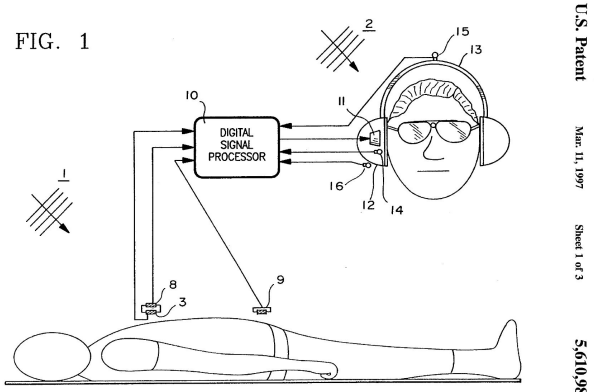


Figure 3: Active Noise Control Stethoscope

Product Design Specification

Client Requested Functions:

- Reliability to hear in noisy environments
- Over the ear headphones.
- 2-3 year lifespan
- $150 budget
- FDA Class 2 medical device regulation compliance [4]

Electric Design without ANC

- Performs Best in Clinical Setting
- Has adjustable gain
- No ANC → Ear Fatigue
- High maintenance due to battery replacement
- Lowest Cost Solution

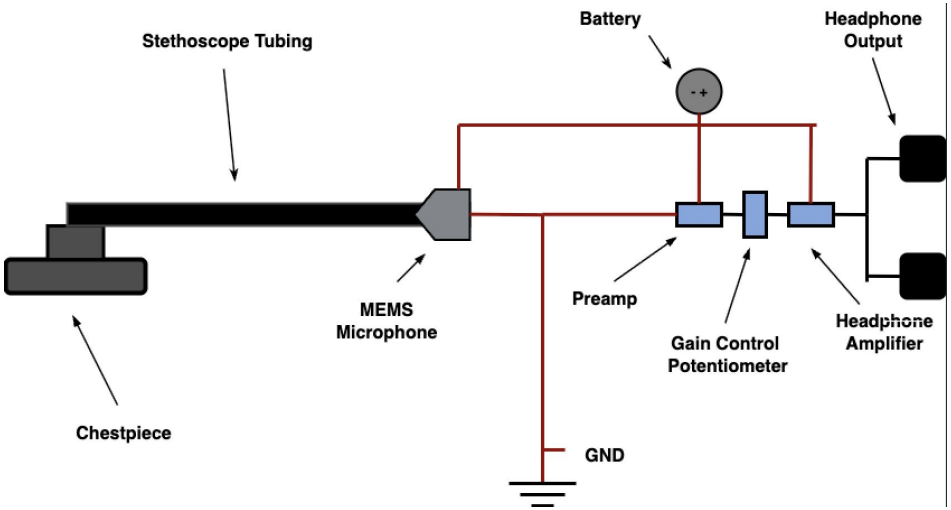


Figure 4: Electric Design without ANC Schematic

Figure 5: Electric Design without ANC CAD Representation

Electronic Stethoscope With ANC

- Destructive interference with ANC
- Multiple mics
- Multi-headed
- Battery carriage

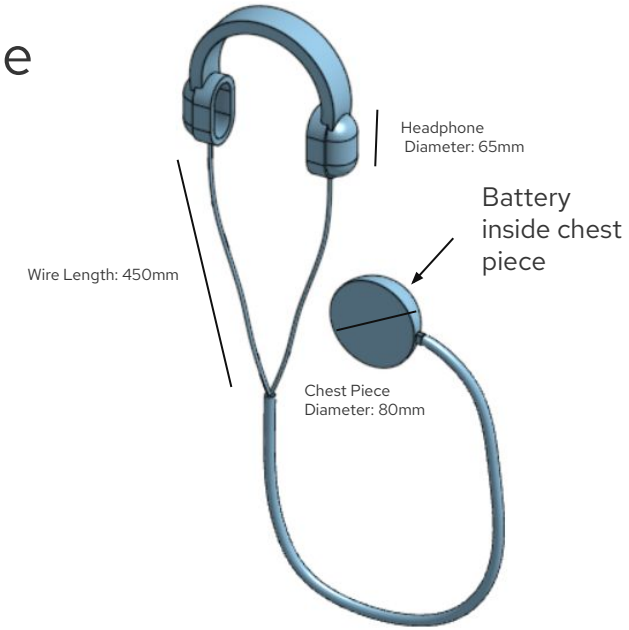


Figure 6: Electronic Stethoscope With ANC Cad Representation

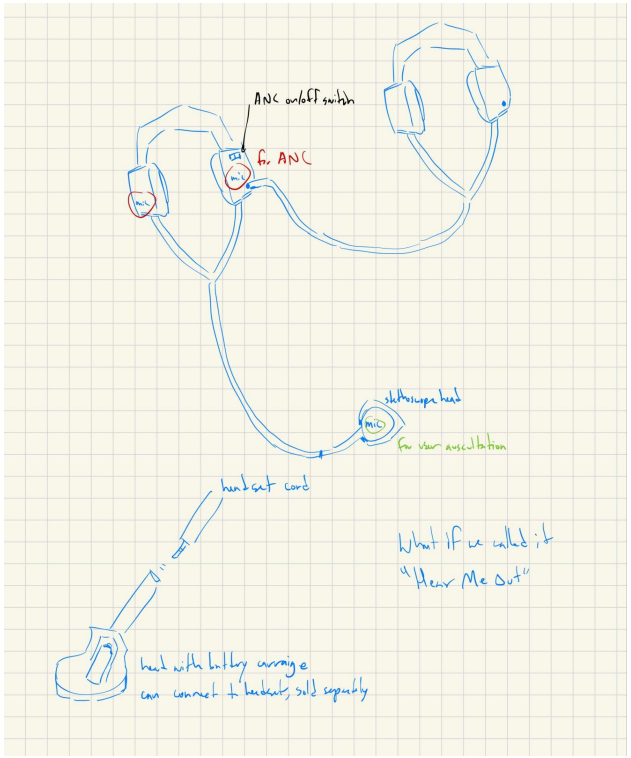


Figure 7: Sketch Illustration

Acoustic Stethoscope with ANC

- Active Noise Cancellation
- Adaptable
- Improving comfort
- Simple but effective

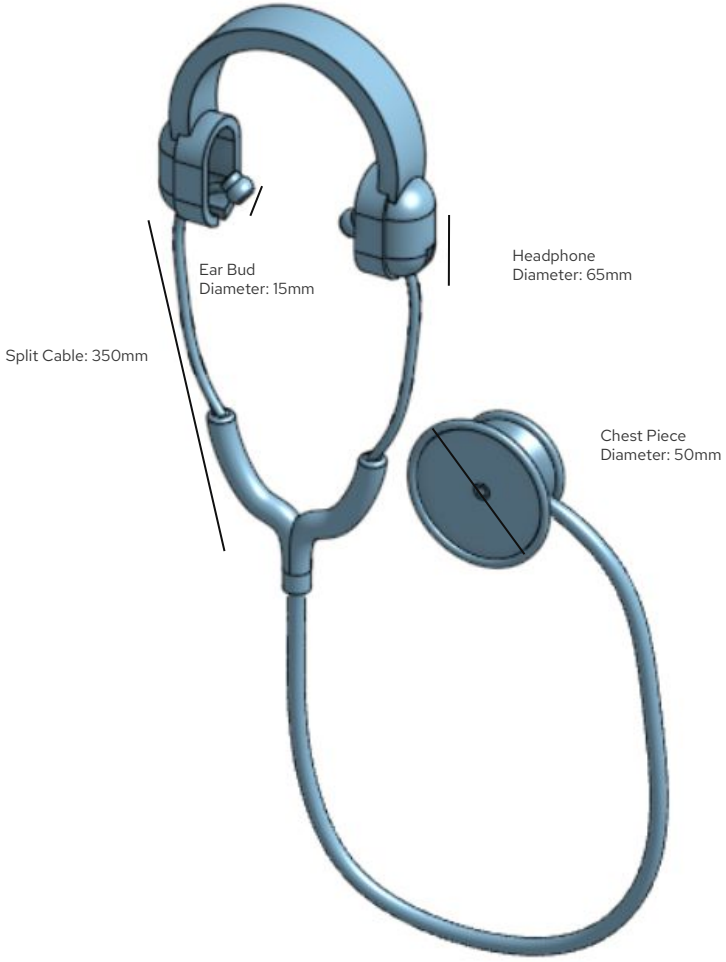


Figure 8: Acoustic Stethoscope with ANC

Table 1: Design Matrix

Proposed Stethoscope Design							
Design	Electronic Wire Design without ANC			Electronic Stethoscope with ANC		Acoustic Stethoscope with ANC	
Pictures							
Criteria	**Weight**	**Score (max 5)**	**Weighted Score**	**Score (max 5)**	**Weighted Score**	**Score (max 5)**	**Weighted Score**
Sound quality	25	3	15	3	15	4	20
Ergonomics & comfort	20	3	12	4	16	2	8
Hygiene & Maintenance	15	2	6	2	6	4	12
Clinical Versatility	15	3	9	4	12	3	9
Feasibility	15	4	12	3	9	5	15
Cost	10	5	10	3	6	4	8
Sum	**100**	**Sum**	64	**Sum**	64	**Sum**	**72**

Future Work

- Add double headed option to allow multiple people to listen in on a single sound
- Electronic stethoscope iteration
- Design version with sound amplification

Future Work (Continued)

Potential obstacles

- OSHA regulations

- Circuit issues

Project Goals

- Develop single unit

- Look for future opportunities for development/patents

Acknowledgements

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References

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[2] “Dillon’s Law at OMED ’24: Training and Visibility,” *ACOFP ORG*, 2024. https://www.acofp.org/news-and-publications/blogs/acofp-voice/2024/10/02/dillons-law-omed-training-visibility (accessed Sep. 26, 2025)

[3] T. R. Harley, “Active noise control stethoscope,” US5610987A, Mar. 11, 1997 Accessed: Sept. 18, 2025. [Online]. Available: https://patents.google.com/patent/US5610987A/en

[4] U.S. Food and Drug Administration, Medical Devices: Class II (Special Controls), Silver Spring, MD, USA: FDA, 2023. [Online]. Available: https://www.fda.gov/medical-devices

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