

Electronic Stethoscope

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Overview

- Problem Statement
- Project Background
- Current Methods
- Design Options
- Design Matrices
- Final Design
- Future Work

Problem Statement

- Develop an Electronic Stethoscope that...
 - Allows for listening via a speaker or headphones
 - Receives input from two wireless microphones
 - Powered via wall outlet

Stethoscope Background

- Basic medical diagnostic tool
- Purely acoustical operation
 - Diaphragm picks up vibrations caused by heartbeat/respiratory system
 - Causes bell to vibrate, generating acoustic sound
 - Sound passes up tube to earpiece



Figure 1: Stethoscope Schematic [1]

Current Methods

- 3M Littmann Electronic Stethoscope Model 3100
 - Too Expensive
 - MSRP: \$425
 - Does not allow for multiple listeners
 - Uncomfortable earpieces
 - Only one input microphone
 - Generates sounds different than standard stethoscope



Figure 2: Littmann electronic stethoscope [2]

Last Semester's Prototype

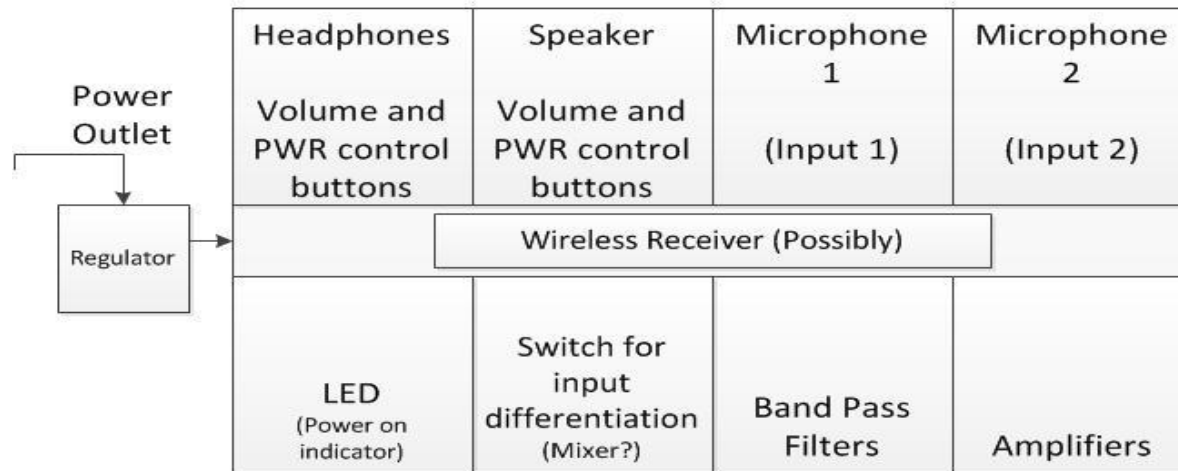
- Input: Microphone attached at the base of an existing stethoscope tube
- Output: Two speakers or a headphone jack
- Considerations:
 - Too large for practical use
 - Only one input microphone
 - Needed large power supply
 - Improved reach of stethoscope but still wired



Figure 3: Spring 2011 final prototype [3]

Prototype Schematic

Main Receiver Box



Microphone 1
(Attached to Patient)



Microphone 2
(Attached to Patient)



Amplifiers

- Digital
 - Very efficient
 - More difficult to implement
 - Available in kits
- Analog
 - Less efficient
 - Lower output power
 - Easier to work with individually



Figure 4: A digital audio amp similar to what we would use.

Design Matrix: Microphones

Weight	Design Aspects	MEMS	Fiber Optic	Condenser
0.3	Size	10	9	7
0.3	Sensitivity/Frequency Response	9	10	10
0.15	Cost	8	3	7
0.1	Power	9	7	6
0.1	Feasibility	8	5	7
0.05	Interference from Medical Devices	7	10	7
	Total	8.95	7.85	7.8

Design Matrix: Wireless

Weight	Design Aspects	Bluetooth Chipset	Purepath	FM Transmitter
0.3	Transmission Quality	8	10	7
0.25	Feasibility	4	7	8
0.2	Cost	8	6	9
0.15	Power	8	9	7
0.1	Size	10	6	5
	Total	7.2	7.9	7.45

Final Design

- Final prototype will consist of:
 - Two wireless MEMS microphones
 - Powered by Lithium coin cells
 - Utilizing Purepath wireless technology
 - Main receiver box
 - Powered by wall outlet
 - One 100W 4" speaker
 - Headphone jack
 - Volume control
 - Purepath wireless receiver



Figure 5: A representation of our final design

Future Work

- Determine connectivity of amplifiers/internal circuitry
- Order supplies
- Assemble prototype
- Test prototype in operating room setting
- Rework based on test results

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- Mark Allie, ECE

References

- [1] <http://www.medisave.co.uk/3m-littmann-cardiology-iii-stethoscope-black-p-1196.html>
- [2] <http://www.bookstores.umn.edu/viewProduct.cgi?categoryID=971&productID=21817>
- [3] Spring 2011 Electronic Stethoscope Team
- [4] <http://www.ti.com/product/tas5705>