

# Assignments

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- Designs-garment
- Design matrix
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- Design matrix
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- **References**
- **Acknowledgements**

- 1- Elijah
- 2- Tim
- 3- Gabby
- 4- Caroline
- 5- Emma

- 1- Elijah 1:30**
- 2- Tim 1:45**
- 3- Gabby 1:45**
- 4- Caroline 1:45**
- 5- Emma 1:45**
- 6- Rushabh 1:15**



# Wearable Simulator

Emma Neumann (Team Leader)

Gabby Snyder (Communicator)

Rushabh Tolia (BWIG)

Elijah McCoy (BSAC)

Caroline Gervolino (Co-BPAG)

Tim Tran (Co-BPAG)

Client: Dr. Michael Lohmeier

Advisor: Dr. Ed Bersu

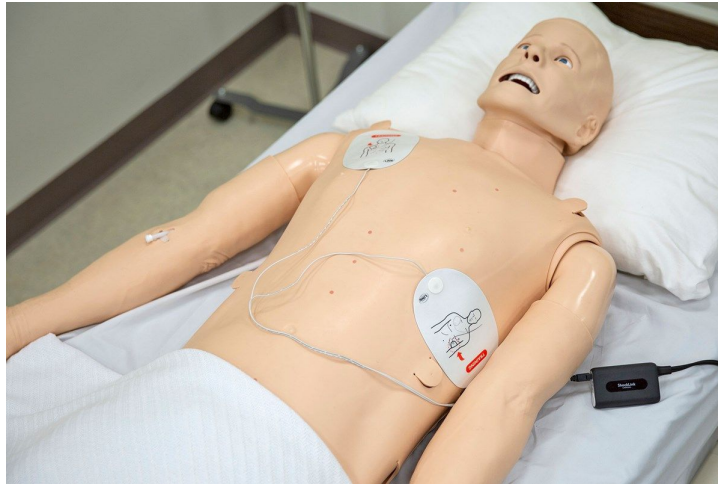
# Overview

1. Problem Statement
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5. Product Design Specification
6. Garment Designs
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# Problem Statement

- Medical simulations are a prominent tool in the medical industry to train students and staff in a safe environment on infrequent and risky scenarios [1].
- Mannequins are inanimate objects that have a hard time representing realistic scenarios [1].



<https://laerdal.com/us/products/simulation-training/emergency-care-trauma/simman-als/>



# Our Goal

- To create a wearable simulation vest to create a more realistic simulation experience
- The vest wearer would be able to more accurately act out scenarios and interact with medical students and staff



<https://www.healthysimulation.com/7290/9-articles-highlighting-the-expansion-of-medical-simulation/>



# Background

- Medical Simulations
  - Education and training for various situations
    - CPR, surgery, emergency rescue, basic life support [1]



# Current Devices

- SimMan [2]
  - Advanced plastic mannequin
  - Equipped with pre-programed scenarios
  - Programmable
  - Wireless



<https://laerdal.com/us/products/simulation-training/emergency-care-trauma/simman-3g/>



# Product Design Specifications (PDS)

## Client / Design Requirements

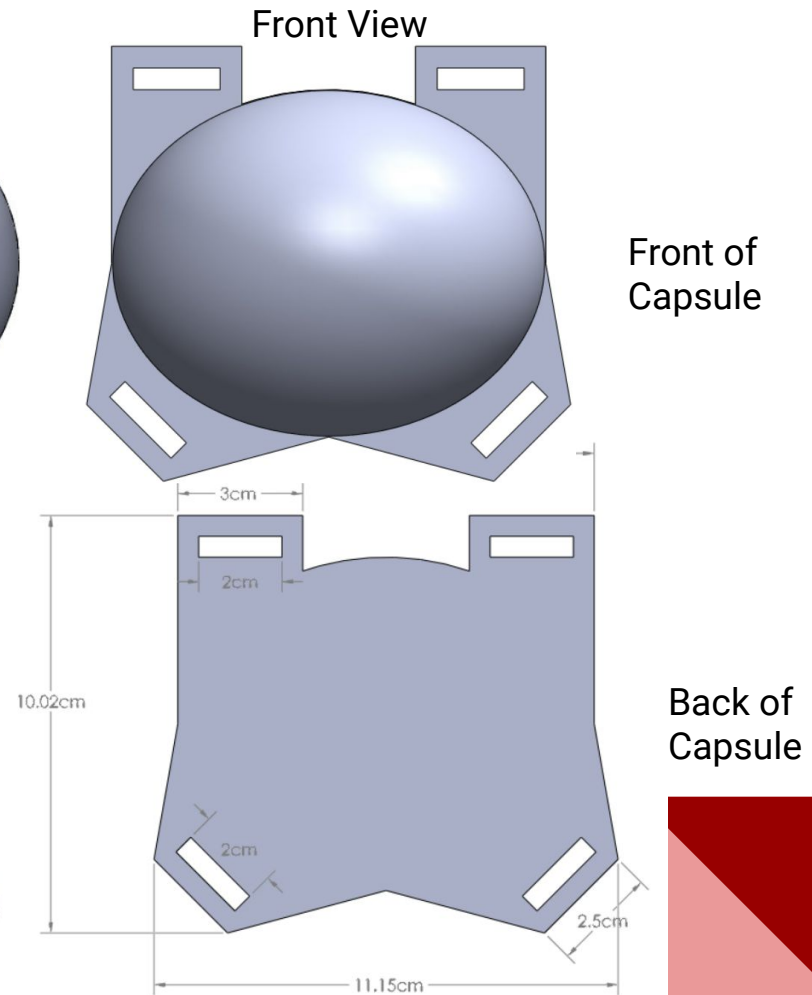
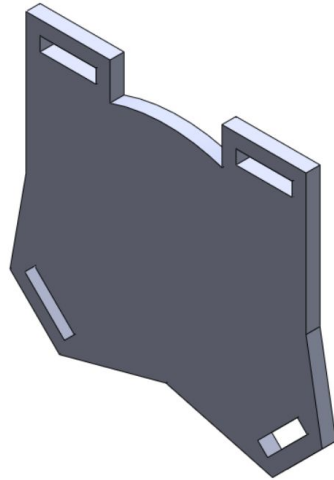
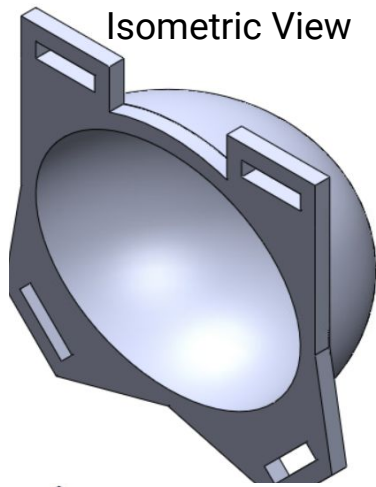
- Simulates heart sounds
- Simulates lung sounds
- Durable (used 12 hrs per week)
- Must be reasonable weight and size for average person
- Easily sanitized
- Portable





# Breast Plate

- Plastic capsule
- Electronics in front
- Criss-cross straps
- Adjustable fabric straps
- Light weight
- Easy to sterilize
- Disadvantage: poor adaptability



# Long Sleeves

- One piece garment
- Zipper down front
- Ability to run wires up neck and down arms
- Easy to add more components in future
- Disadvantages: hard to sterilize



<https://www.wakemakers.com/ronix-supreme-athletic-cut-comp-vest.html>



<https://www.walmart.com/ip/KOGMO-Womens-Long-Sleeve-Solid-Basic-Fitted-Turtleneck-Shirt/715973613>



# Vest

- Similar to life vest/weight vest
- Side mesh
- Buckles for adjustments
- Ability to add more components
- Comfortable

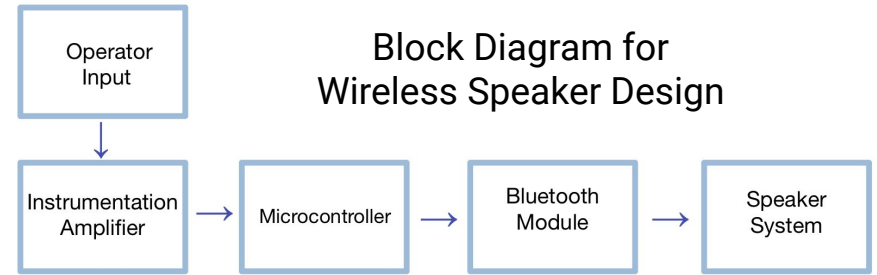


<https://www.outdoorplay.com/nrs-fishing-lifejacket-pfd>



# Wireless Speaker

- Speaker produces heart and lung sounds
- Uses bluetooth
  - No loose wires
- Uses an adaptable app
- Disadvantages:
  - no electrical waves of heart and lung



# Dial Controlled Speaker

- Remote control that fits in garment pocket
- Speaker that is easily adjustable by dial
- Disadvantages:
  - Only produces heart and lung sounds
  - Wires

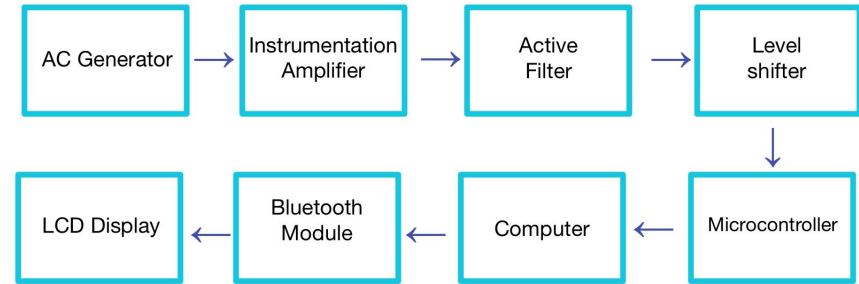
Block Diagram for Dial Controlled Speaker Design



# AC Generator

- Produces electrical waves and sounds for the heart and lungs
- Uses an amplifier and generator
- AC plugin
- Disadvantages:
  - AC generator can be very costly
  - Complex design and parts

Block Diagram for AC Generation Design



# Garment Design Matrix

Criteria	Weight	Breast Plate	Long Sleeves	Vest
Adaptability/Fidelity	30	1	5	4
Ease of Manufacturing	20	5	1	3
Comfort	15	4	3	4
Sterilizability	15	4	1	4
Cost	15	5	2	3
Safety	5	5	5	5
<b>Total</b>	<b>100</b>	<b>70</b>	<b>57</b>	<b>74</b>



# Electronics Design Matrix

Criteria	Weight	Wireless Speakers	Dial-Controlled Speakers	AC Generator
Ease of Manufacturing	25	2	4	1
Safety	20	5	4	2
Accuracy of Output	15	4	4	5
Adaptability	15	4	2	3
Motility	15	5	3	1
Cost	10	4	3	1
<b>Total</b>	<b>100</b>	<b>77</b>	<b>69</b>	<b>42</b>





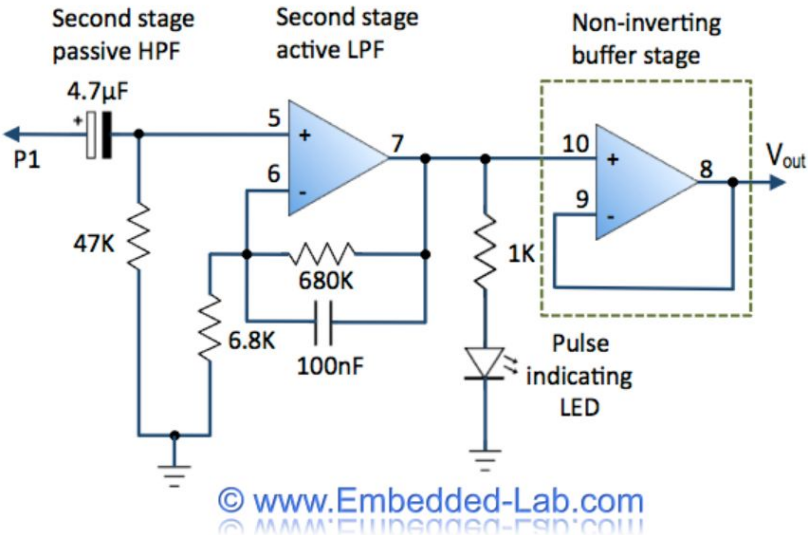
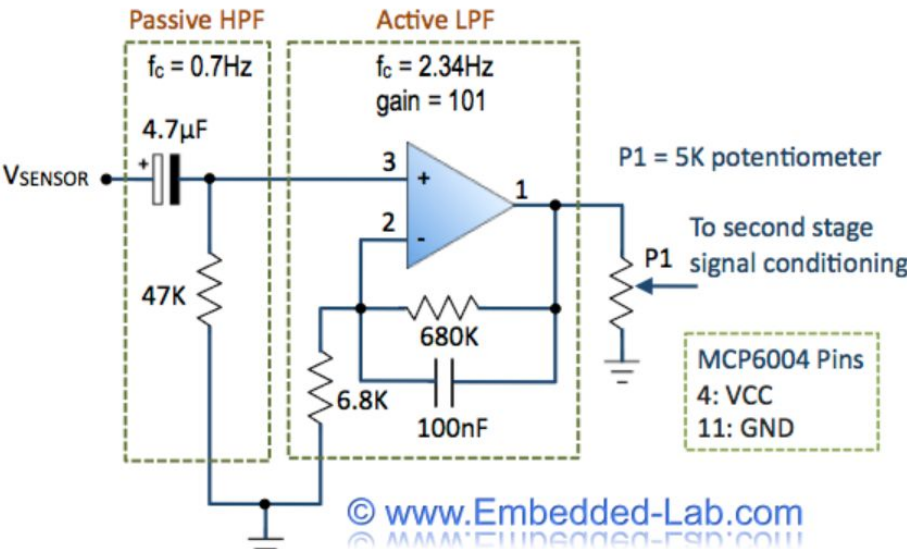
# Final Design: Vest & Wireless Speakers



<https://www.outdoorplay.com/nrs-fishing-lifejacket-pfd>



# Electronic Circuitry



# Future Work

- Add complex breathing and heart mechanisms
- Add circuitry that can interact with an EKG machine to measure actual electrical signals within a circuit in the vest
- Include motion sensor modeling



<https://www.usamedicalsurgical.com/blog/ekg-ecg-machine-buyers-guide/>



# References

- [1] Datta, Rashmi et al. (2012) "Simulation and its role in medical education." *Medical journal, Armed Forces India* vol. 68,2: 167-72.  
doi:10.1016/S0377-1237(12)60040-9
- [2] "SimMan® 3G." (2020) *SimMan® 3G Advanced Patient Simulator Laerdal Medical*. [laerdal.com/us/doc/85/SimMan-3G](https://laerdal.com/us/doc/85/SimMan-3G).



# Acknowledgements

Special thanks to...

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Our advisor: Dr. Ed Bersu

BME Director: Dr. John Puccinelli



Thank you for  
listening...questions?

