Wearable Simulator for Enhanced Realism

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Overview

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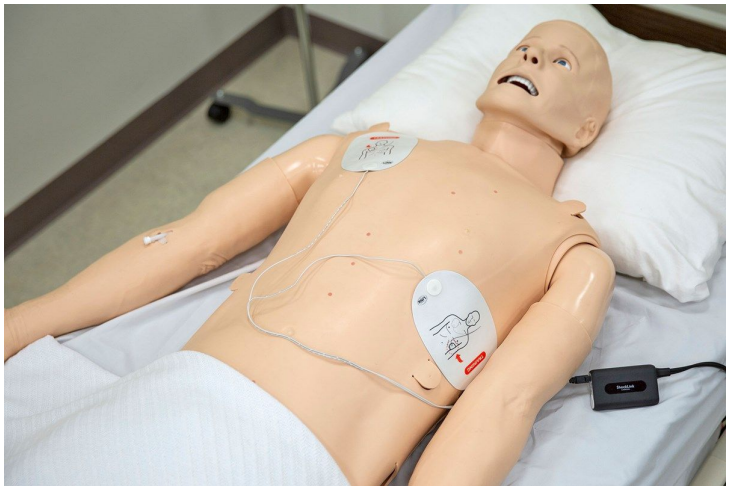
Problem Statement

- A wearable device is needed that can be put on by a person during the recreation of a medical scenario in order to create a more realistic interpretation of the event.

- Current issues with using a mannequin
  - Expensive
  - Inanimate
  - No real feedback



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

Background

- Use in medical simulations [1]
  - Provide opportunity for students to learn and develop skills
  - CPR, surgery, emergencies, basic life support
- High fidelity mannequins [2]
  - Closely resemble human anatomy
  - Can be specialized for specific procedures
- Low fidelity mannequins [2]
  - Little resemblance
  - Repeated practice

https://www.mcrmedical.com/product/K100-ULM-Basic-CPR-Manikin-AED-Training-Kit.html

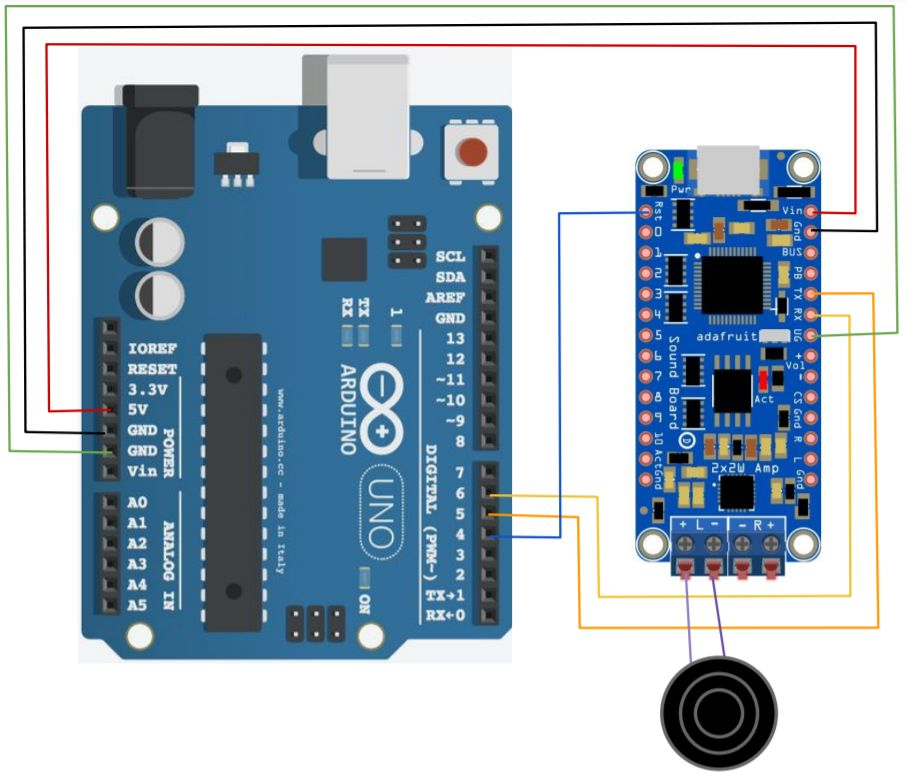
https://www.a3bs.com/medical-simulators,pg_1181.html

PDS

- Adjustable vest of reasonable weight/size
- Simulate heart and lung sounds
- Ability to modify outputs during a simulation
- Maintain integrity when used 4-5 times per month
- Cost less than $500

Electronics

- Successful preliminary testing of circuit
  - Arduino Uno
  - Adafruit SoundBoard
  - Speaker
- Demonstration



Design 1: The Condor

- Structure
  - Tough canvas outside
  - Padded on inside
  - MOLLE design
  - Zipper and buckles
- Adjustability
  - Shoulder straps and side straps are adjustable
  - Marketed to fit M-XL
- Cost: ~$50

https://www.amazon.com/Condor-MV-001-Modular-Vest-OliveDrab/dp/B0072K82TW

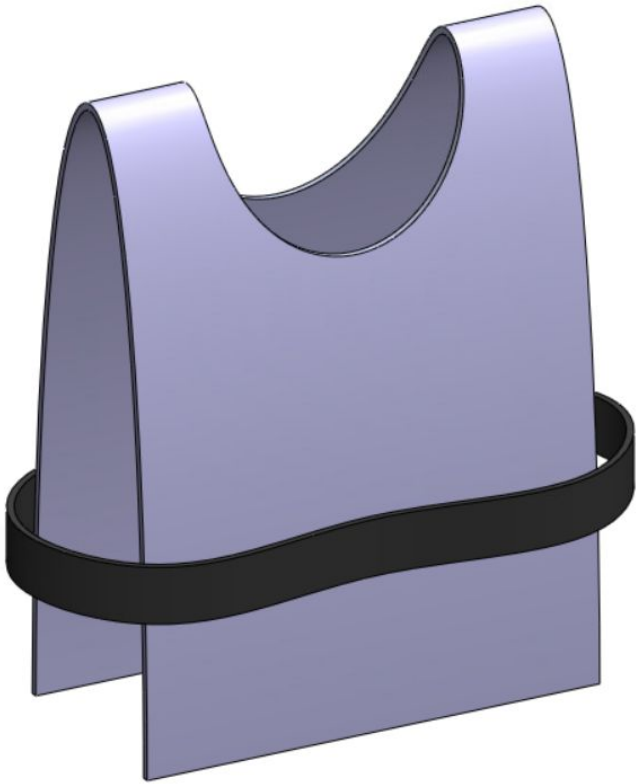
Design 2: The Hyper Vest

- Structure
  - Cotton/canvas blend outside
  - Thin and lightweight
  - Many small pockets intended for weights
  - Zipper and bungee cords
- Adjustability
  - Bungee cords along sides are adjustable
- Cost: ~$220

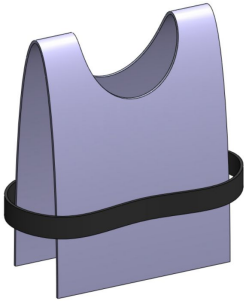
https://www.hyperwear.com/product/weight-vest/

Design 3: Hand Sewn

- Structure
  - Waterproof canvas outside
  - Padded, cotton inside
  - Simple life jacket design
  - Slides on over head
- Adjustability
  - Buckle around body is adjustable
- Cost: ~$75



Design Matrix

Criteria	Weight	The Condor  https://www.amazon.com/Condor-MV-001-Modular-Vest-Olive Drab/dp/B0072K82TW	The Hyper Vest  https://www.hyperwear.com/product/weight-vest/	Hand Sewn 
Ease of Manufacturing	25	3	4	1
Durability	20	5	4	1
Comfort	20	3	5	2
Adjustability	15	4	2	5
Sterilizability	10	4	1	5
Cost	10	5	1	4
Total	100	77	66	50

Future Work

- Incorporate our electronics within the layers of fabric in the vest
- Switch our current electronics system from Arduino to a Raspberry Pi
- Code different scenarios into the vest
- Create interface for an instructor to interact with to control the simulation

Acknowledgements

- Our Advisor: Dr. Ed Bersu
- Our Client: Dr. Michael Lohmeier
- Dr. Puccinelli and the BME department

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. HealthySimulation.com. 2020. High Fidelity Simulation | Healthcare Simulation | Healthysimulation.Com. [online] Available at: <https://www.healthysimulation.com/high-fidelity-simulation/> [Accessed 10 September 2020].

Questions?