



# Wearable Simulator For Enhanced Realism

Preliminary Presentation

October 15th, 2021



# Team Members

**Client:** Dr. Michael Lohmeier

- Section Chief EMS at UW Health, board certified in Emergency Medicine

**Advisor:** Dr. Krishanu Saha

**Team Leader:** Francisco O'Neill Rodríguez

**Communicator:** Sierra Reschke

**BSAC:** Sami Matloub

**BWIG:** Jessie Hunt

**BPAG:** Sami Matloub

# Problem Statement

Simulations and mannequins that exist today are able to mock human injuries in impressive and accurate ways, however they are unable to simulate an actual human.



# Background

- Purpose and use
- Specific conditions for the vest to simulate
  - Heart conditions: bradycardia, tachycardia, and heart murmurs
  - Lung conditions: Rales, fluid in the lungs, different sounds from right versus left lungs
- Previous design progress

# Client Requirements

- No more than \$500
- Must be a wearable simulator of reasonable weight and size to fit the average person
- Can be used 4-5 times a month
- Outputs can be modified during simulation to respond to interventions
- Simulates heart and lung sounds and pulses

# Product Design Specifications

- ❖ The vest should be comfortable, durable, and easy to use for incoming medical staff
- ❖ There will be a single prototype of this medical simulator involved in this project
- ❖ Should produce accurate sounds to allow trainees to detect irregularities within heart or lungs
- ❖ Vest should be only used within the correct environment
  - Hospitals or medical clinics

# Existing Devices/Competitors

- SimMan/3G/Plus
  - ◆ Laerdal Medical
- Simulaids Smart STAT Basic with iPad
  - ◆ Universal Medical
- HAL S3201 Advanced Multipurpose Patient Simulator
  - ◆ Gaumard Scientific



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



<https://www.medicaldesignandoutsourcing.com/gaumard-to-show-new-touch-screen-wireless-simulation-interface-at-aha-scientific-sessions/>

# Vest Designs

## Condor Ballistic Vest



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

- Exterior tough canvas
- Inside padding
- MOLLE design
- Various built-in pockets

## Long Sleeve Vest



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

- Able to run wires up neck and arms
- One piece garment
- Provides trainees with more areas to detect vitals

## Add-On Vest



<https://uarmprotection.com/product/groin-armor-module/>

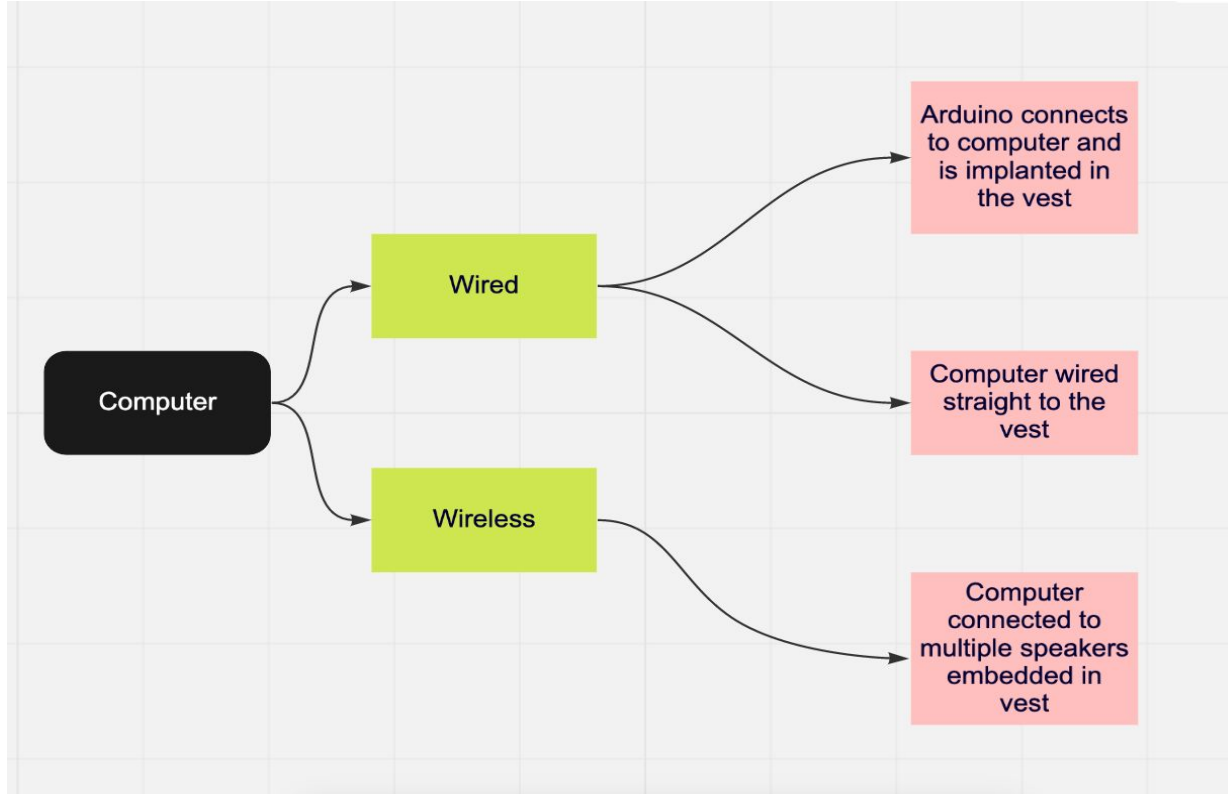
- Malay system for vest
- Very module and mobile
- Adaptable to wide range of add ons
- Space for extensive wiring



# Design Matrix- Vest Design

Design Criteria	Weight	Condor Ballistic Vest		Long Sleeve Vest		Add-On Version	
Durability	30	5/5	30	3/5	18	4/5	24
Output potential	15	4/5	12	4/5	12	5/5	15
Adaptability	15	3/5	9	2/5	6	5/5	15
Feasibility	10	5/5	10	2/5	4	3/5	6
Safety	10	5/5	10	4/5	8	4/5	8
Comfort	5	3/5	3	3/5	3	2/5	2
Aesthetics	5	2/5	2	4/5	4	3/5	3
Sterilizability	5	5/5	5	2/5	2	3/5	3
Cost	5	5/5	5	2/5	3	2/5	2
<b>Total</b>	<b>100</b>		<b>56</b>		<b>42</b>		<b>54</b>

# Electronic Designs

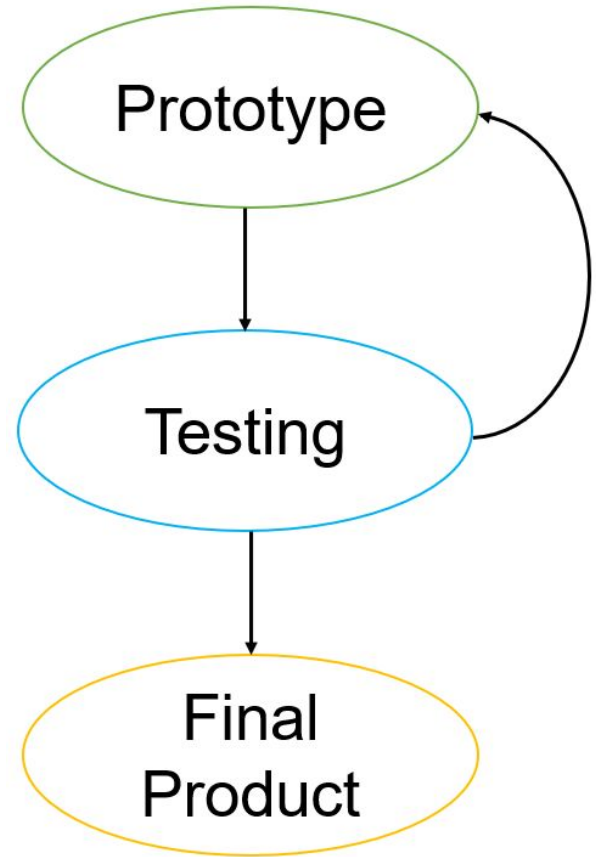


# Design Matrix- Electronics

Design Criteria	Weight	Dial Controlled Speakers		Wireless/Bluetooth		Wired to Computer	
Ease of Use	25	3/5	15	5/5	25	3/5	15
Output Accuracy	20	4/5	16	4/5	16	4/5	16
Durability	15	3/5	9	4/5	12	3/5	9
Feasibility	15	2/5	6	4/5	12	3/5	9
Adaptability	10	3/5	6	3/5	6	3/5	6
Cost	5	3/5	3	3/5	3	4/5	4
Motility	5	4/5	4	5/5	5	2/5	2
Safety	5	3/5	3	4/5	4	2/5	2
<b>Total</b>	<b>100</b>		<b>62</b>		<b>83</b>		<b>63</b>

# Future Work

- Visit and tour the ER and Sim Man
- Conduct further research on wireless electronic components
- Order necessary materials
- Begin prototype and testing



# References

- [1] US Department of Health and Human Services (1997, February). Good Guidance Practices: Labeling Regulatory Requirements for Medical Devices. HHS Publication FDA89-4203. <https://www.fda.gov/files/medical%20devices/published/Labeling---Regulatory-Requirements-for-Medical-Devices-%28FDA-89-4203%29.pdf>
- [2] National Institute of Justice, "Current and Future Research on Body Armor," January 1, 2010, <https://nij.ojp.gov/topics/articles/current-and-future-research-body-armor>
- [3] Bally Ribbon Mills. n.d. Polyethylene | Bally Ribbon Mills. <https://www.ballyribbon.com/fibers/polyethylene>
- [4] Total Security Solutions. 2016. Today's Police Body Armor: Overt, Lighter, Smaller. - Total Security Solutions <https://www.tssbulletproof.com/blog/todays-police-body-armor-overtlighter-smaller>
- [5] INACSL Standards Committee (2016, December). INACSL standards of best practice: Simulation SM. Clinical Simulation in Nursing, 12(S), S5-S47. <https://www.inacsl.org/INACSL/document-server/?cfp=INACSL/assets/File/public/standards/SOBPEnglishCombo.pdf>.
- [6] Center for Devices and Radiological Health. (n.d.). *Classify your medical device*. U.S. Food and Drug Administration. Retrieved September 23, 2021, from <https://www.fda.gov/medical-devices/overview-device-regulation/classify-your-medical-device>.
- [7] *Simman 3G Plus - immersive training for emergency care procedures*. Laerdal Medical. (n.d.). Retrieved September 23, 2021, from <https://laerdal.com/us/products/simulation-training/emergency-care-trauma/simman-3g/>.
- [8] "Simulaid's SMART STAT Basic with iPad." Universal Medical, [www.universalmedicalinc.com/simulaid-s-smart-stat-basic-with-ipad.html?campaignid=1049828359](http://www.universalmedicalinc.com/simulaid-s-smart-stat-basic-with-ipad.html?campaignid=1049828359).
- [9] Gaumard Scientific. (n.d.). Retrieved October 14, 2021, from <https://www.gaumard.com/advanced-hal-s3201>.

# Acknowledgments

We would like to thank:

- Department of Biomedical Engineering
- Dr. Michael Lohmeier
- Dr. Krishanu Saha