



Department of
Biomedical Engineering
UNIVERSITY OF WISCONSIN-MADISON

Operation Feedback

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Overview

- Gap in Training for IV Placement
- Procedure, Proper Technique, and Mishaps
- Product Design Specifications
- Competing Designs
 - Fake Blood Model
 - Human IV Model
- Design Concepts
 - Wire Circuit
 - Double Feedback
 - Coaxial Needle
- How it Will Work
- Future Work



Problem Statement

- Design a model animal limb that vet-students can practice implementing catheters and IV's into a dog's vein while receiving feedback in real time
- Existing training models used by students do not provide adequate feedback

Background Research

- The procedure we will be replicating will be placing a catheter in a dog's cephalic vein
- The most common complication when placing an IV catheter is muscle and nerve damage
- A catheter should be inserted at 15 to 30 degrees



Product Design Specifications

- Durability: Able to withstand bi-weekly use for two years
- Cost: Under \$350
- Functionality: Should be able to be powered by a laptop or wall outlet
- Portability: less than 15 lbs.
- Client requirements: Dislikes dyed fluid discharge as positive feedback.



Existing Designs

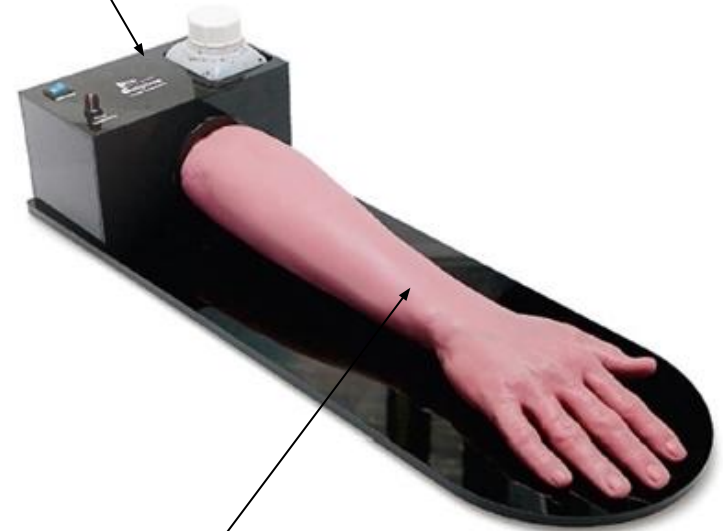
- Utilize fake blood
- Provides no other response



Existing Designs

- Expensive < 1500\$
- Fake blood
 - Messy
- Arm uses a pump to create a pulse
- Replication of human skin
 - Allows for hundreds of injections without damage

Pump mechanism



Fake veins under skin





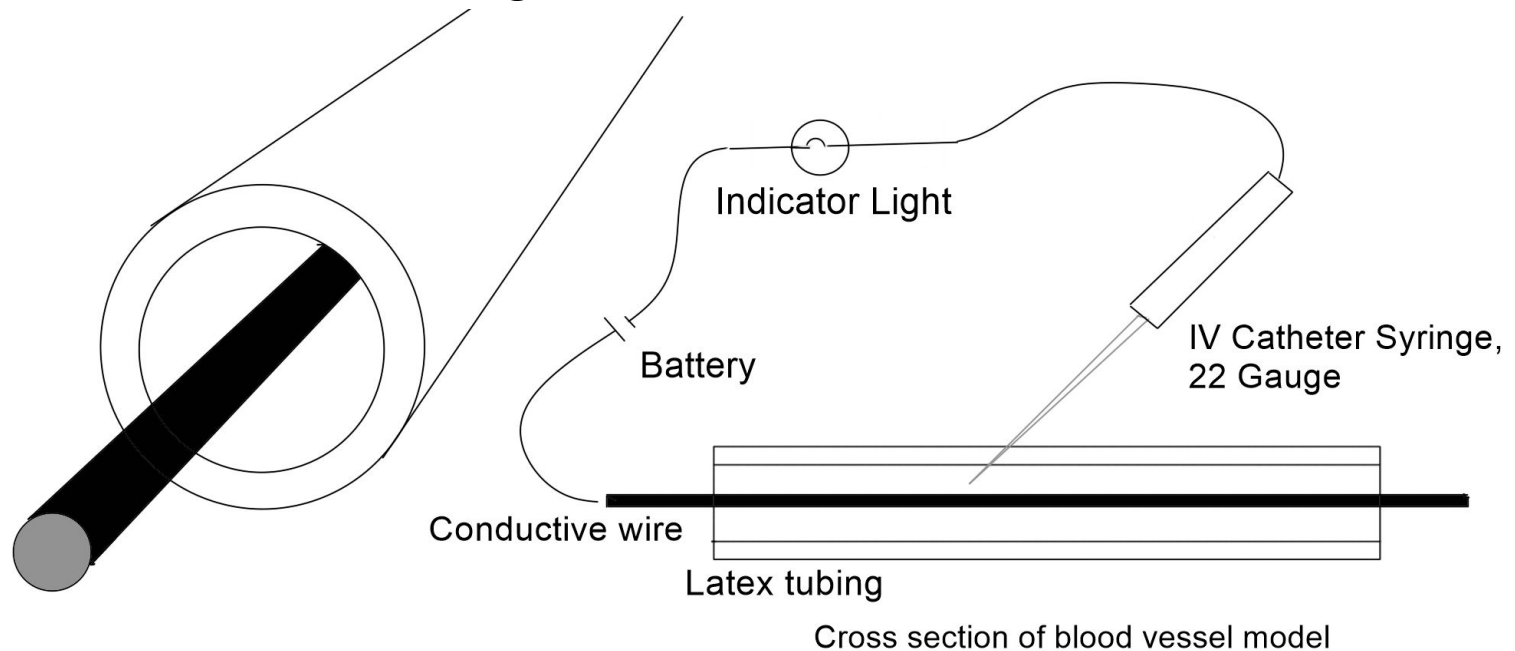
Design Concepts



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Design One: Wire Circuit

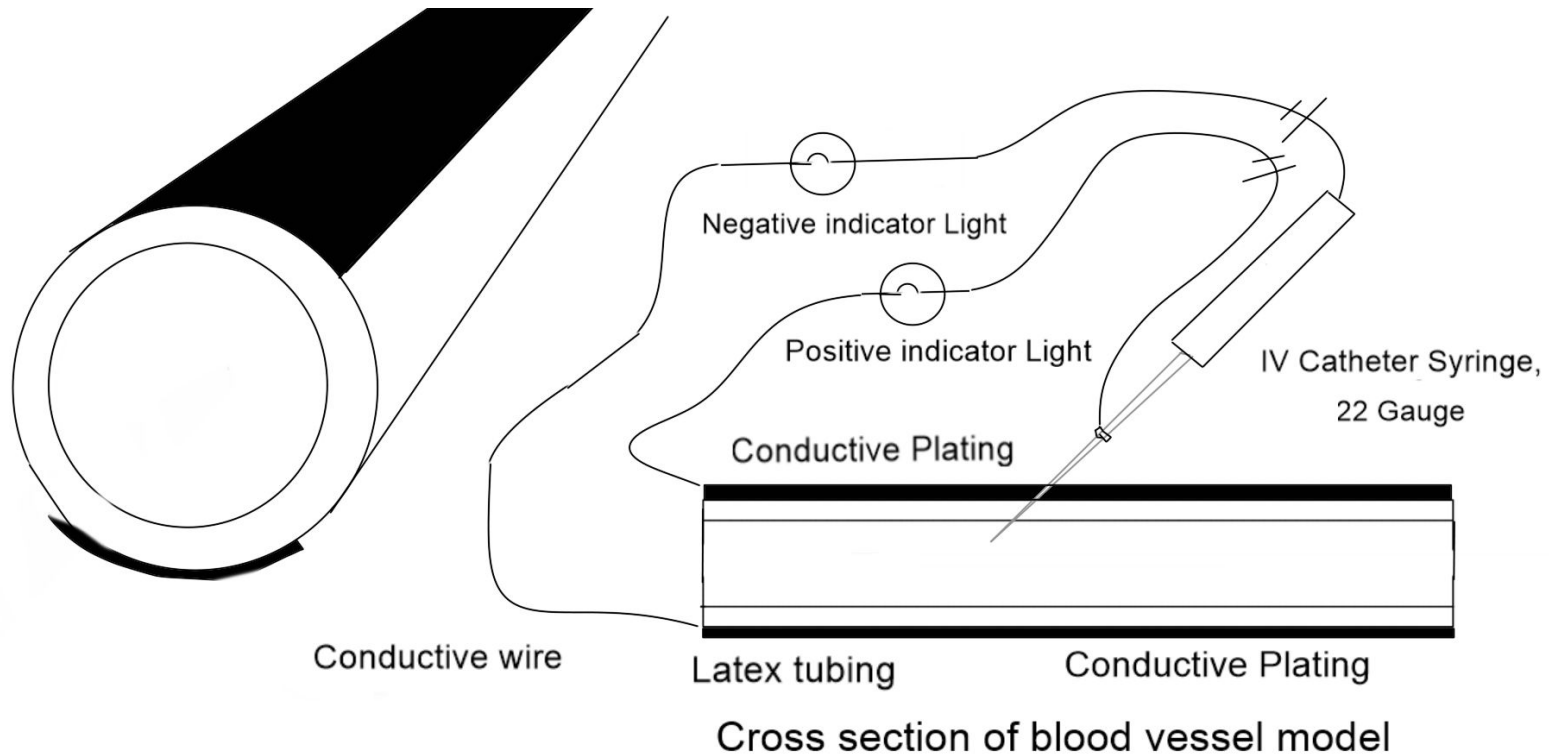
- Thread a wire through the lumen of the vessel



Design 1: Center Wire



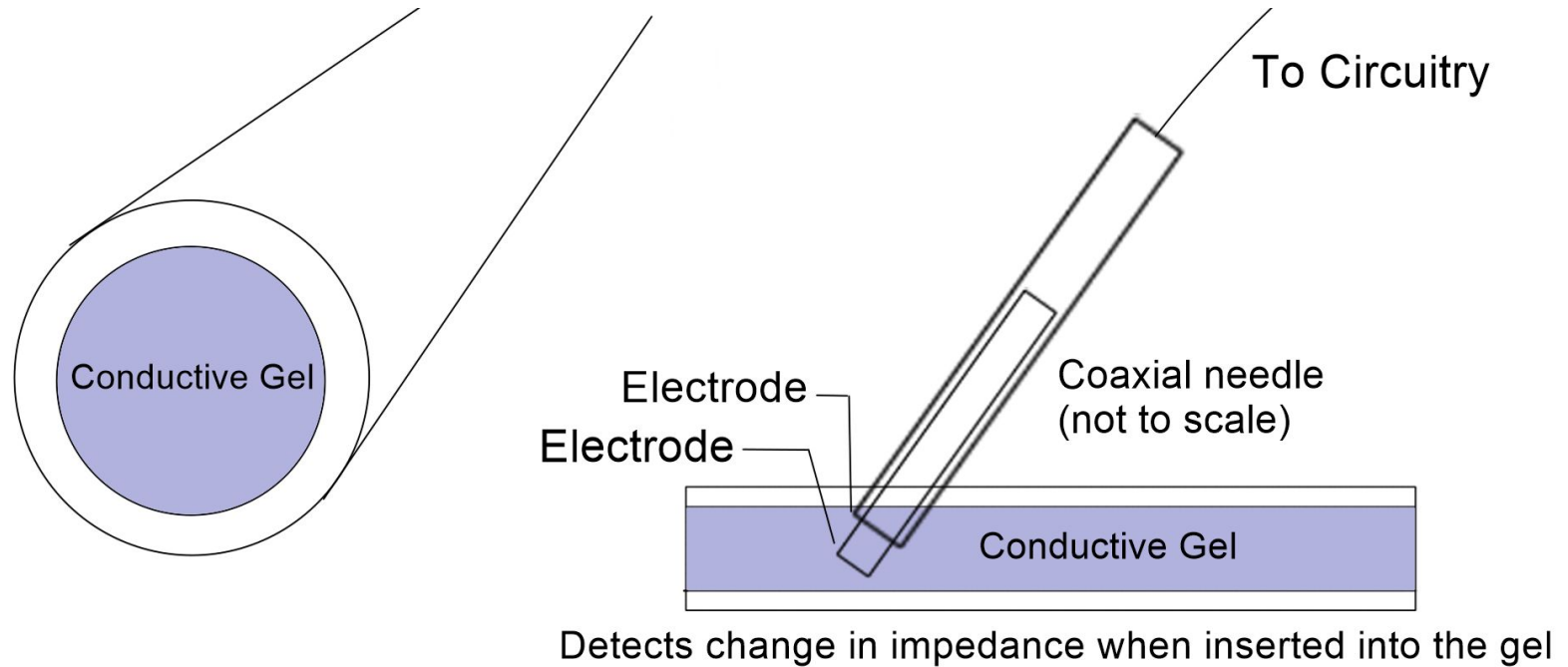
Design Two: Double Feedback



Design 2: Thin Conductive Band



Design Three: Coaxial Needle



Design 3: Coaxial Needle

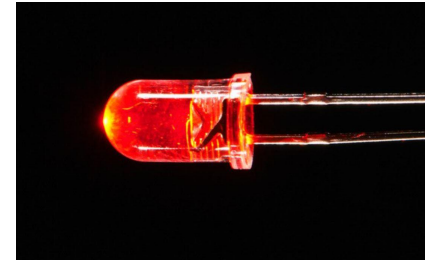
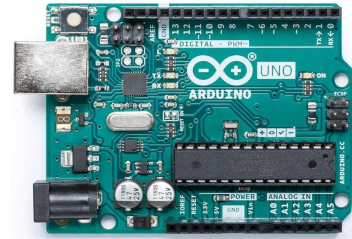
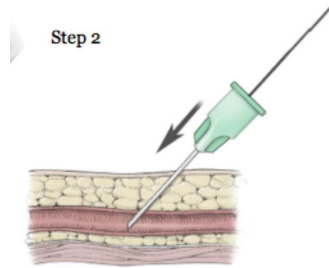
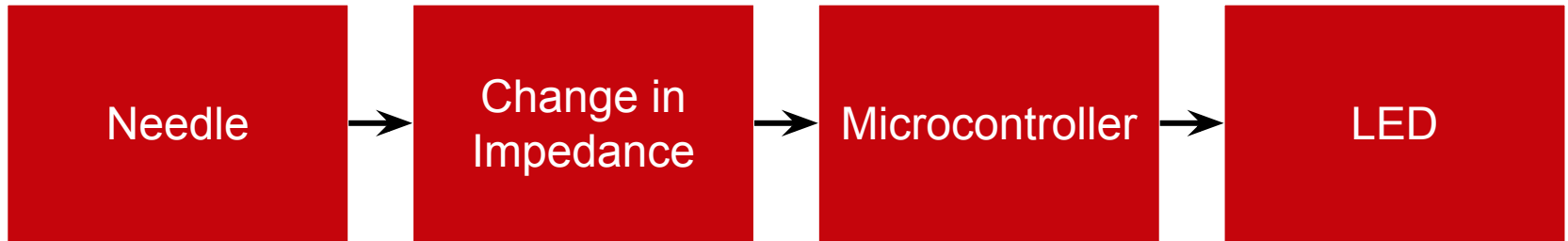


Preliminary Design Matrix

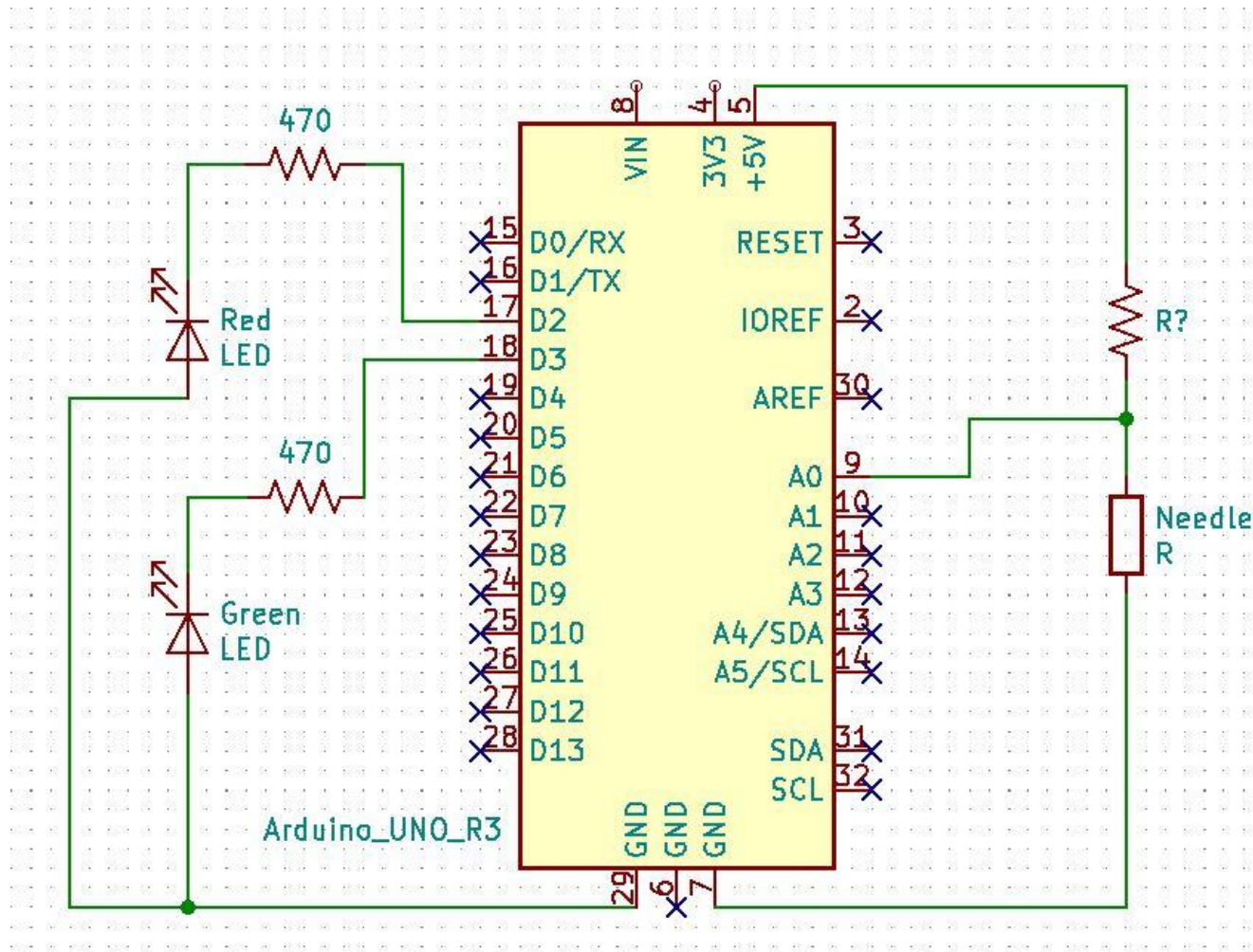
Criteria	Wire Through	Thin Band	Conductive Gel
Cost (10)	9 (0.9)	8 (0.8)	5 (0.5)
Accuracy (20)	5 (1)	9 (1.8)	10 (2)
User friendly (30)	4 (1.2)	7 (2.1)	9 (2.7)
Durability (20)	10 (2)	6 (1.2)	8 (1.6)
Complexity (20)	8 (1.6)	5 (1)	7 (1.4)
Weighted Score	6.7	6.9	8.2



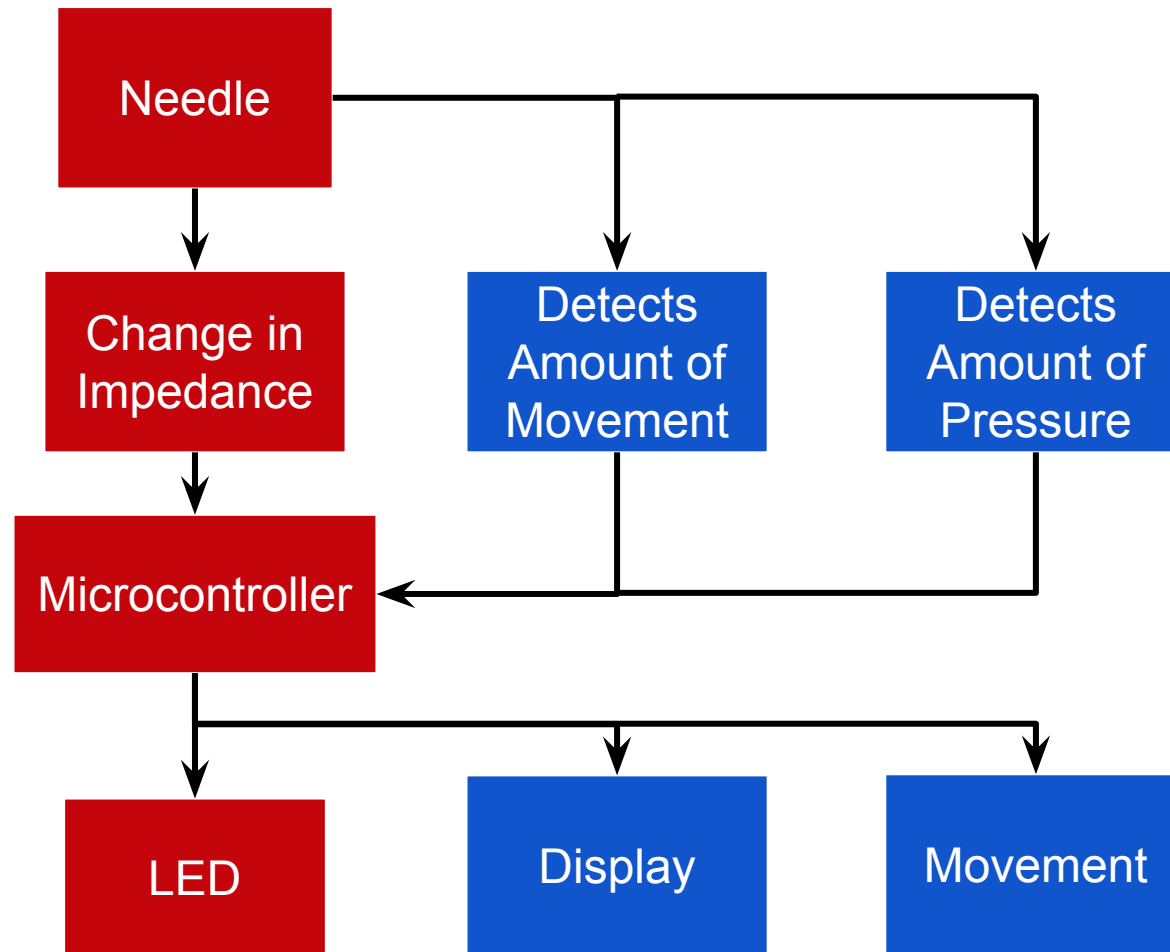
How it Will Work



Circuitry



Future Work



References and Acknowledgements

Thank You to Dr Block and Prof Cooley

- <https://cdns.webareacontrol.com/prodimages/1000-X-1000/3/r/3102016514B.-Braun-Introcana-Safety-FEP-Straight-IV-Catheter-L.png>
- <https://www.ebmconsult.com/articles/seldinger-technique-intravenous-iv-placement>
- <https://www.amazon.com/Arduino-A000066-ARDUINO-UNO-R3/dp/B008GRTSV6>
- <https://www.adafruit.com/product/297>
- <https://pdfs.semanticscholar.org/9414/923265b5bb29a435761b7159f1485f2ac3e1.pdf>
- <https://www.cliniciansbrief.com/article/step-step-peripheral-catheter-placement>
- <https://pdfs.semanticscholar.org/9414/923265b5bb29a435761b7159f1485f2ac3e1.pdf>





Questions



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