BME 400

iPhone VR Training Model for Microsurgical Practice

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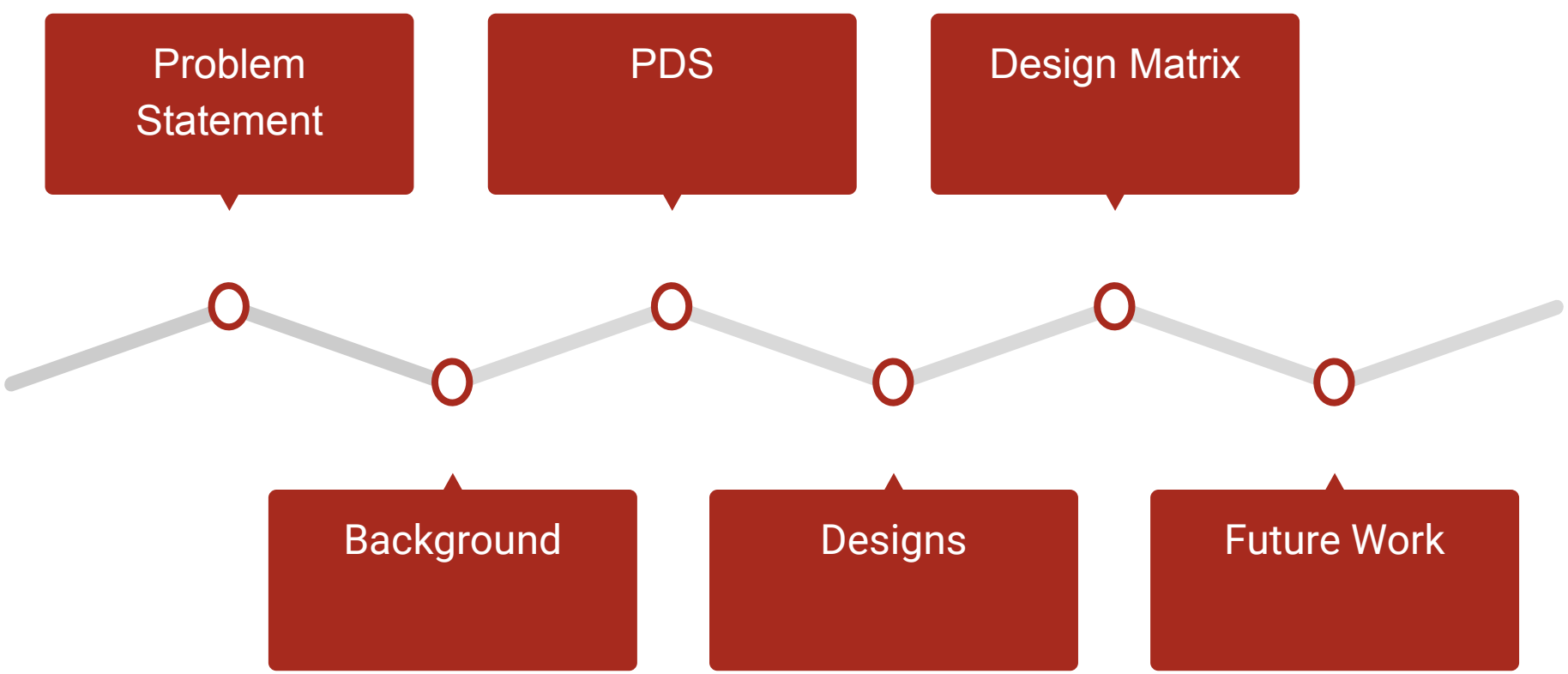
Overview


Problem Statement
PDS
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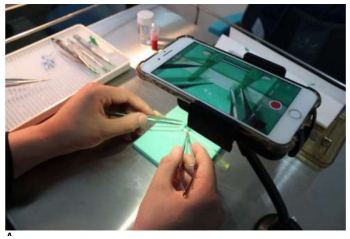
Problem Statement

Challenge

Lack of microsurgical practice due to limited resources

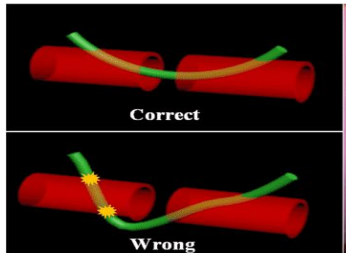
Solution

iPhone camera provides comparable magnification to microscopes



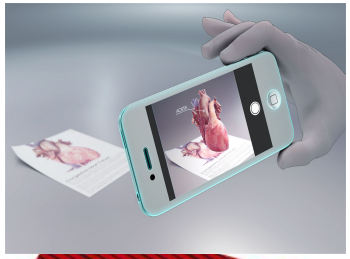
Problem

1. Inadequate depth perception by iPhone alone
2. Too much delay



Proposal

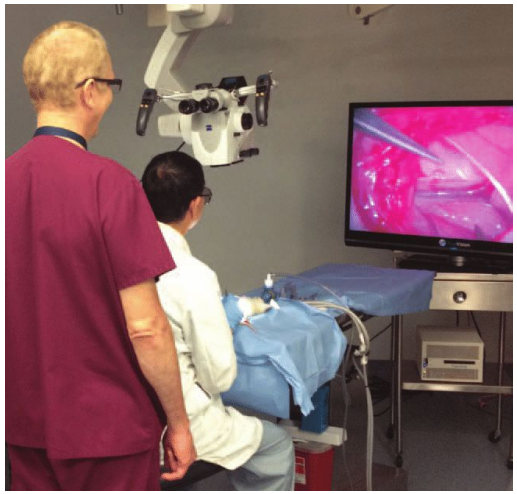
Streamlined real-time iPhone VR training model with little time delay



Background

Microsurgery:

- Surgeons prefer to look straight ahead as they work [1]
- Special medical systems can cost over a hundred thousand dollars [2]
- A simplified training setup can help with microsurgery education



Client Prototypes:

- iPhone on stand connected to Macbook
- VR App on iPhone creating two images
- iPhone on stand connected to Macbook with Google VR cardboard glasses

Product Design Specifications (PDS)

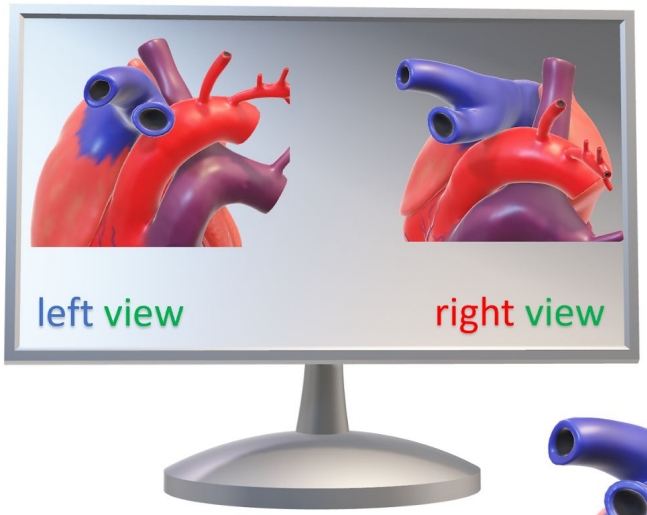
- Perform a mock surgery at home, so it should use as many materials available at home as possible. iPhone clamped on the mount and connected to a MacBook Pro, and another iPhone wirelessly connected to a MacBook and placed in the Google cardboard.

- Improve the VR viewing experience
  - Minimize display lag between devices

- Minimize unnecessary visuals to the user's eyes
  - Not overly bright, no sudden flashes, reduce motion blur

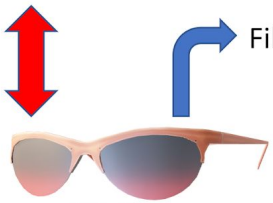
- Minimize the number of devices used

Design 1 - 3D Glasses Model

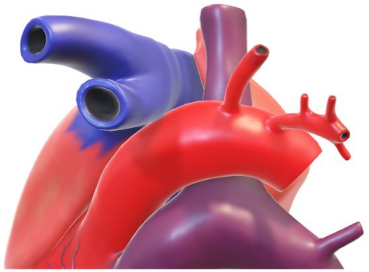


Filter that only passes light from right image

Filter that only passes light from left image

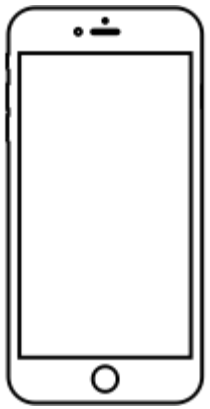


3D Glass



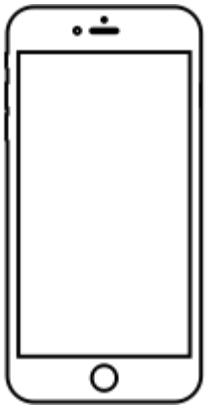
combined view

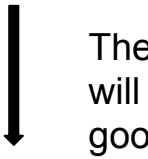
Design 2 - VR Goggle Model



The MacBook cast cropped video to another iPhone

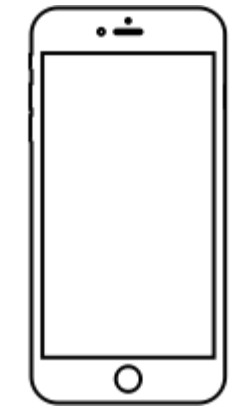
Video taken by the first iPhone via VR compatible app will cast to MacBook





The second iPhone will be placed in a google cardboard

Design 3 - Webcam VR



The MacBook cast the video to the iPhone

Video taken by the VR cam will transferred to MacBook

The iPhone will be placed in a google cardboard

Design Matrix

	3D Glasses		VR Goggles		Webcam VR	
Efficiency (30)	5/5	30	2/5	12	4/5	24
Complexity (25)	4/5	20	2/5	10	2/5	10
Feasibility (20)	3/5	12	4/5	16	4/5	16
Quality (15)	3/5	9	3/5	9	5/5	15
Cost (5)	5/5	5	3/5	3	4/5	4
Safety(5)	4/5	4	3/5	3	3/5	3
Total (100)	80		53		72	

Future Work

- Near Future
  - Purchase of 3-D lens attachment
  - Software production
  - Purchase materials

- Far Future - Testing
  - Software Bug Removal
  - Long Exposure Evaluation
  - Resolution Comparison
  - Effective Latency
  - Depth Perception Effectiveness

Acknowledgements

- Thank you to:
  - Dr. Ellen Shaffrey
  - Dr. Willis Thompkins

References

[1] “Microsurgery Essentials: Intra-Operative Technique,” *Plastic & Reconstructive Surgery*. https://plasticsurgery.stanford.edu/education/microsurgery/intraoperative.html (accessed Oct. 01, 2020).

[2] “Highest Resolution Microsurgery Microscope | MM51,” *Mitaka USA*. https://mitakausa.com/mm51/ (accessed Sep. 18, 2020).