Presenting: Henry

iPhone Virtual Reality Model for Microsurgery

BME 301

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Presenting: Henry

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Background - Microscopes

Surgical Microscope

- Very high resolution
- Depth perception
- Expensive
- Uncommon

iPhone

- High resolution
- Minimal depth perception
- Less expensive
- Commonly accessible

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Background - Past Design

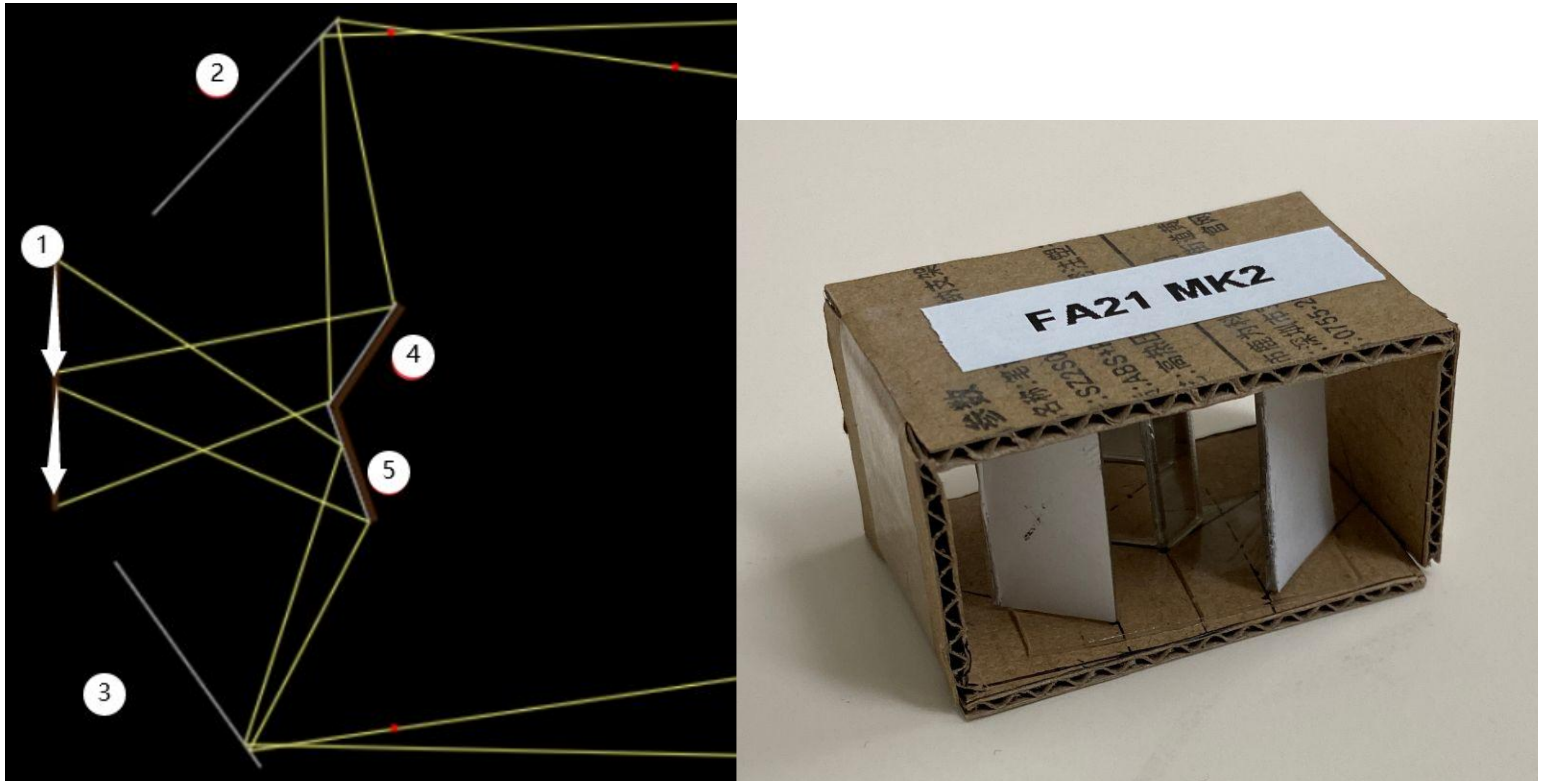

Figure 1: *(Left) Optic simulation. Light from the subject gets reflected by the outer mirrors (2), (3) onto the inner mirrors (4), (5). Then, light will be directed through the camera lens (1), forming two identical views of the subject. (represented by two upside-down arrows). Arrows will be converted upright by the camera lens. (Right) Prototype from last semester.*

- Mirrors send two images to camera sensor side by side, allowing for stereoscopic vision
- Prototype was taped onto iPhone over the camera
- Mirrors were difficult to align and vision in headset was blurry

Presenting: Nicholas Jacobson

Competing Designs (Nicholas)

- Orbeye 4K 3D Orbital Camera System
  - 26x magnification
  - Stereoscopic camera and display
  - Removes the constraints of an optical microscope [1]

Figure 2. *Orbeye 4K 3D Orbital Camera System*

- Mitaka MM51
  - Optical Microscope
  - Non-stereoscopic display for viewing subject
  - More restrictive for the surgeon [2]

Figure 3. *Mitaka MM51 Optical Microscope*

Presenting: Nicholas Jacobson

Problem Statement

- Design a cost-effective microsurgical training system that utilizes a smartphone camera and outputs a stereoscopic image.
  - Current imaging technologies are expensive
  - Not readily available for a large amount of trainees
  - Unable to be brought home for practice

PDS Summary

Design Requirements

- Mounted on a adjustable stand
- Light Weight; < 4.5 kg
- Transmit video footage from camera to a stereoscopic display

Performance Requirements

- Creates image with high zoom and resolution to see sutures (0.070 mm in diameter) clearly [3]
- Streaming resolution of at least 10.2 megapixels
- Stream delay of no more than 0.5 seconds

Presenting: Emma

Grey Pro Resin

- Precise, 50 microns[4]
- Inexpensive, $0.26/mL[5]
- Lightweight, 1.08g/cm^3[6]
- 2.6GPa Tensile modulus[4]
- Repeated use
- Smooth Finish

Figure 4: Example of 3D printed Grey Pro Resin from Formlabs [4]

Presenting: Emma

Tough 1500 Resin

- Precise, 50 microns[7]
- Inexpensive, $0.26/mL [5]
- Lightweight, 1.07g/cm^3 [6]
- Tensile Modulus: 1.5 GPa [7]
- Pliable
- Not recommended for fine features

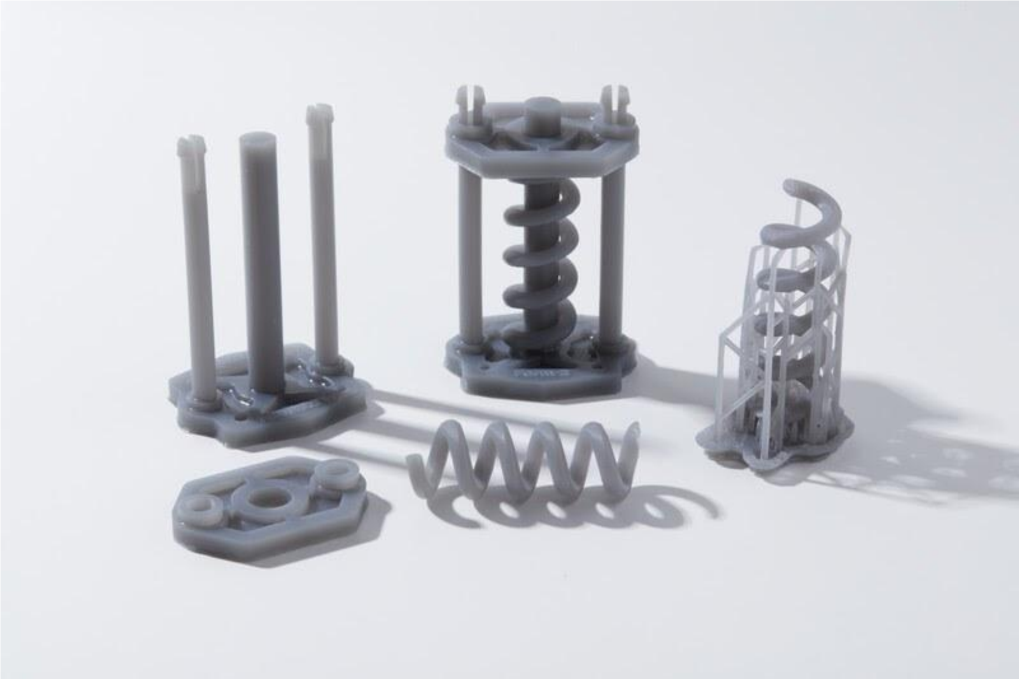

Figure 5:examples of Tough 1500 Resin from Formlabs [7]

Presenting: Emma

Laser Cut Acrylic

- More Precision (10.5microns)[8]
- More expensive, $10.75 (18x25 x1/4)[9]
- Lightweight, 1.19g/cm^3 [10]
- Young's Modulus: 2.8GPa [11]
- Manually assemble

Figure 6: Universal Laser Systems ILS95.150D [8]

Presenting: Haochen Wang

Design Matrix

Criteria		Grey Pro Resin (Foamlab)		Tough 1500 Resin (Foamlab)		Acrylic (Laser Cut)	
	Weight	Raw Score	Score	Raw Score	Score	Raw Score	Score
Quality (Precision)	30	4/5	24	4/5	24	1/5	6
Durability (Strength)	25	5/5	25	3/5	15	5/5	25
Ease of Fabrication	20	3/5	12	3/5	12	5/5	20
Cost	15	4/5	12	4/5	12	2/5	6
Stability	5	5/5	5	5/5	5	1/5	1
Safety	5	4/5	4	4/5	4	5/5	5
Total	100	25/30	82	23/30	72	19/30	63

Table 1: Design matrix of proposed materials. The criteria assigned with a full score are highlighted in yellow. And the highest total score is highlighted in green.

Presenting: Frida Albiter

Future Work

- Durable housing for lenses
- Decrease the blind spots/gap between mirrors
- Allow for easy attachment to phone camera
- Finalize lens angles and stabilize their positioning

Figure 7: Visual of workspace through lens with rectangles outlining the slight blind spot in the middle of the image

Presenting: Frida Albiter

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Presenting: Frida

References

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