



# Dual Handheld and Video Otoscope

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**Client:** Dr. Lara Tomich

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# Presentation Overview

- Background Material
- Problem Statement
- Product Design Specifications
- Previous Work
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- Future Work
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- References

# Client - UW School of Veterinary Medicine



Figure 1: Photo of Dr. Lara Tomich [Tomich, 2023]

Dr. Lara Tomich

Department of Medical Sciences, Dermatology

- Teaches dermatology to preclinical students
- Educates fourth year students, interns, and residents



Figure 2: Photo of Dr. Amy Nichelason [Nichelason, 2023]

Dr. Amy Nichelason

Department of Medical Sciences, Primary Care

- Research goals are to help create tools that enhance clinical decision making
- Clinical assistant professor heavily involved in clinical teaching.

# Background Material



Figure 3: Welch Allyn Pneumatic Otoscope [3]



Figure 4: Welch Allyn Pneumatic 3.5V Otoscope Handle [4]



Figure 5: Endo World Video Otoscope [5]

## Handheld Otoscope

- Utilize lenses to display inside of ear optically
- Portable, does not need external display, easy to use.
- No video taking ability

## Video Otoscope

- Require external monitors and power source
- Clear display of inside of ears using digital methods
- Have potential video recording capacity for later review

# Problem Statement

- Traditional otoscopes do not allow for live video of the examination to be viewed from a remote device
- Design a handheld otoscope with live video capabilities

U.S. Patent Feb. 8, 1977 Sheet 1 of 2 4,006,738

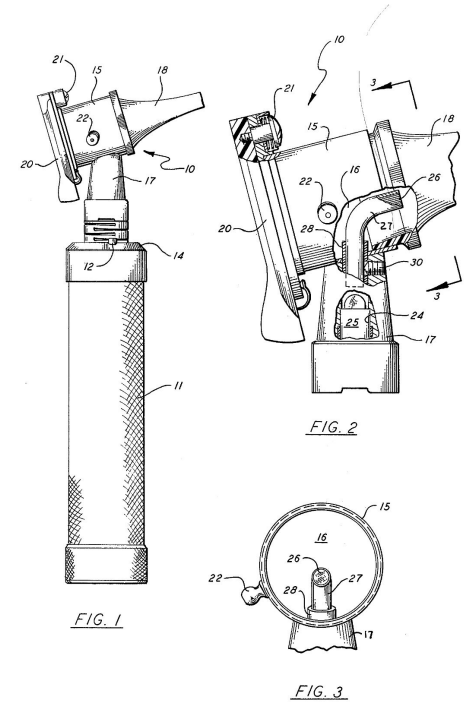


Figure 6: US Patent US4006738A [Moore, 1977]

# Product Design Specifications

- **Client Requirements:**
  - The otoscope resembles features of a traditional handheld otoscope (lenses)
  - The otoscope has video relay ability for distant view
  - External light source that are bright
  - Go wireless (bluetooth)
  - Maintain expenses below the budget
  - Easy to use for new veterinary students

# Competing Designs



Figure 7: Wispr Digital Otoscope [7]

## Wispr Digital Otoscope[7]:

- Adjustable Specula
- Same handle design
- No optical lens



Figure 8: Welch Allyn Veterinary Otoscope [8]

## Welch Allyn MacroView Veterinary Otoscope[8]:

- large, sharp, nearly full view of the tympanic membrane
- Adjustable focus
- Does not have video capacity for assessment

# Previous Work



**Beam Splitter** - Split image into two view frames

**Magnifying Lens** - Enlarge image

**Camera** - Captures image to external monitor

**Button Switch** - LED control

**Battery (3V)** - LED power

Figure 9: Otoscope prototype from Fall2023 BME



# Result from Last Year

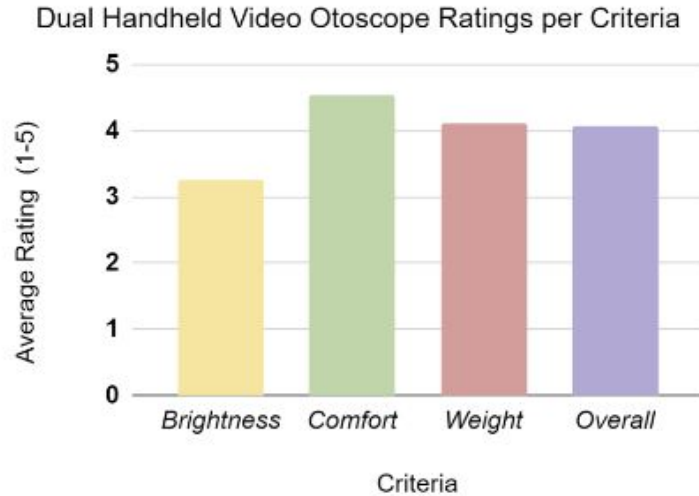


Figure 10: Otoscope prototype Survey Fall2023 BME [9]

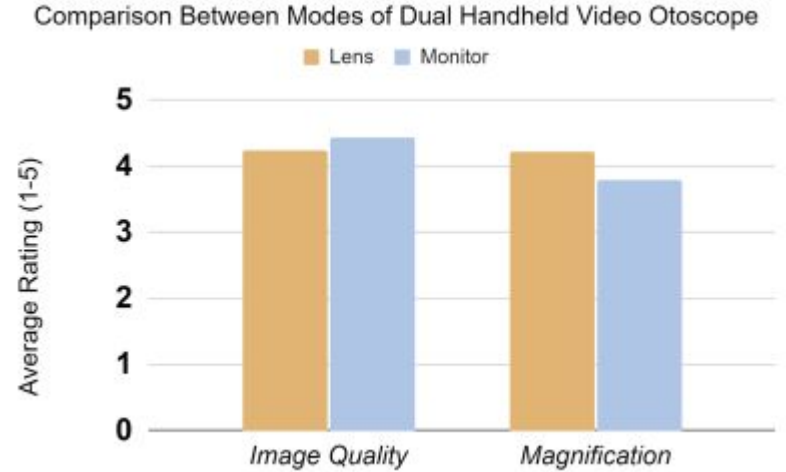


Figure 11: Otoscope prototype Survey Fall2023 BME [9]

# Design 1: Optical fibers

- Uses optical fiber to redirect light
- Hidden LED
- Wireless Camera Design

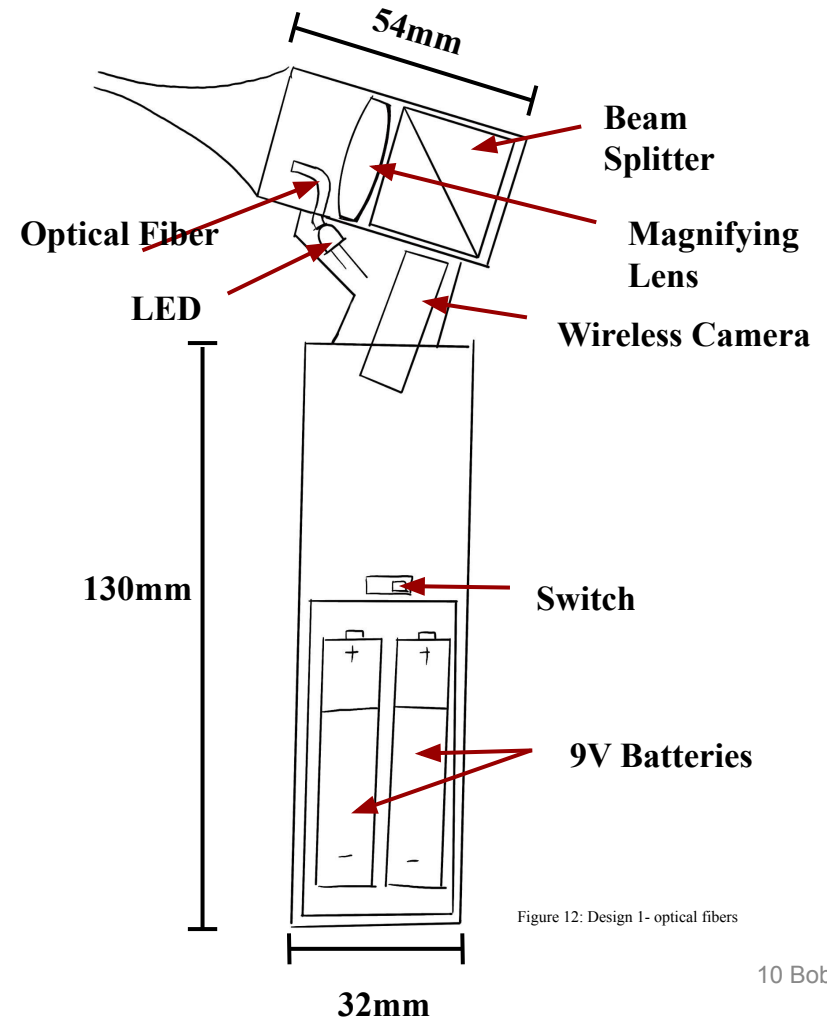


Figure 12: Design 1- optical fibers

# Design 2: Mirrored Light Source

- Uses mirror to redirect light instead of optic fibers
- Hidden LED
- Less interference with viewing

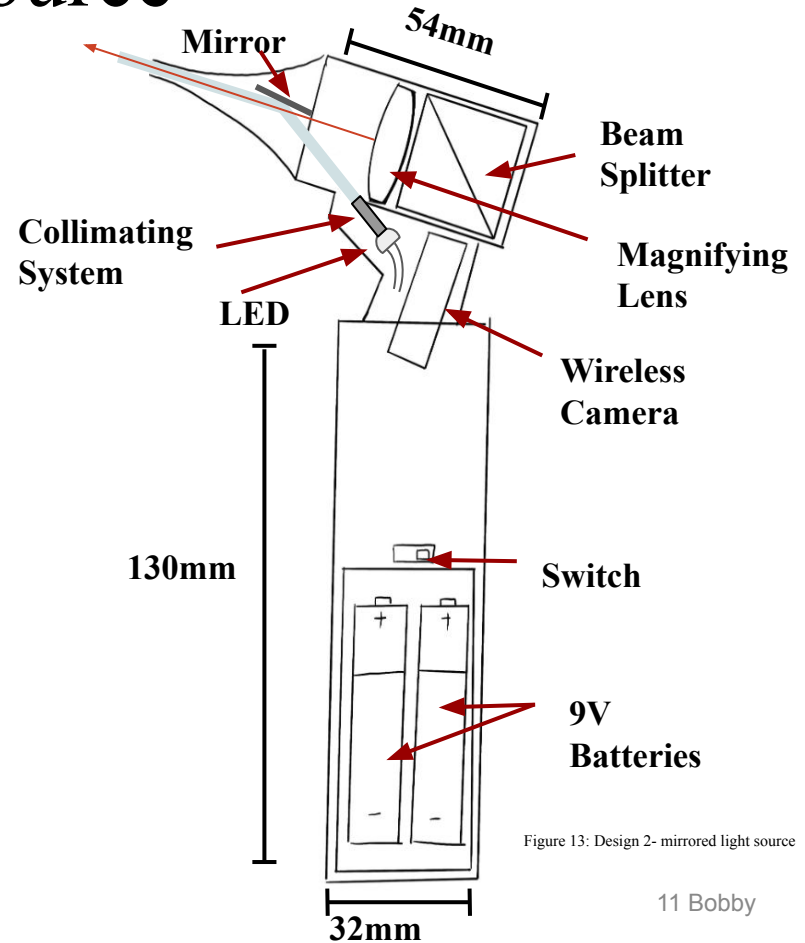


Figure 13: Design 2- mirrored light source

# Design 3: LED built-in speculum

- LED at the tip of the speculum
- New Specula designs that is removable for cleaning
- No obstacle in viewing

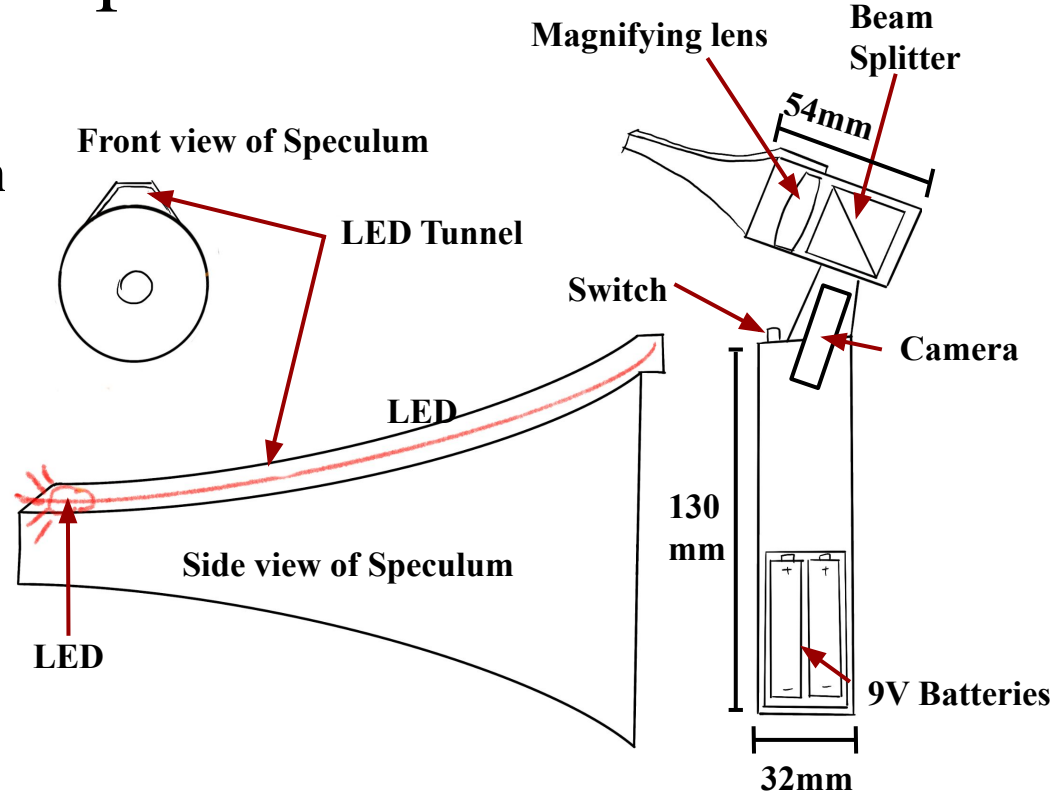


Figure 14a) Front view of speculum, b) side view of speculum, c): Design 2- LED built in speculum design

# Design Matrix

	<b>Design 1: Optical Fiber</b>	<b>Design 2: Mirrored Light source</b>	<b>Design 3: LED built-in Speculum</b>
<b>Criteria (Weight %)</b>			
<b>Effectiveness (30)</b>	27/30	25/30	25/30
<b>Ease of Fabrication (20)</b>	15/20	10/20	15/20
<b>Ease of Usage (20)</b>	18/20	18/20	15/20
<b>Adjustability (15)</b>	15/15	10/15	5/15
<b>Cost (15)</b>	10/15	10/15	13/15
<b>Total = 100</b>	85/100	73/100	73/100

Table 1: Design Matrix (Dual Handheld and Video Otoscope, 2023)

# Testing

- **Brightness:** The brightness of the illuminating source will be quantified using a lux meter, ensuring comparable illumination to existing otoscope devices in use.
- **Image Quality:** Optical distortion will be quantified using grid.
- **Durability:** Durability will be assessed through simulated extensive use.



Figure 15: Fluke 941 Light Meter

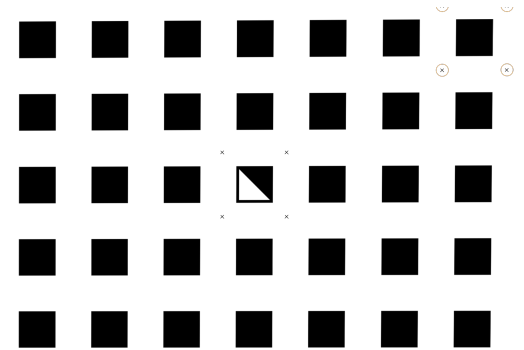


Figure 16: Camera Calibration Grid

# Conclusion & Future Work

- The team is moving forward with design 1.
- Other designs can be incorporated with design 1 as well.
- Tackle brightness and conversion from wired to wireless
- Next steps
  - Optical Fibers
  - Bluetooth Cameras
  - Super Bright LED

# References

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<https://adcopros.com/products/welch-allyn-pneumatic-3-5v-otoscope-71000-a-3-5v-power-source-bundle> (accessed Oct. 04, 2023).
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**Thank you!**

**Questions?**