Dual Handheld and Video Otoscope

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Advisors: Professor Paul Campagnola

Client: Dr. Lara Tomich

Date: 02/07/2025

Presentation Overview

- Problem Statement
- Product Design Specifications
- Previous Work
- Future Work
- Acknowledgements
- References

Client - UW School of Veterinary Medicine

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

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

Dr. Lara Tomich

Department of Medical Sciences, Dermatology

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

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

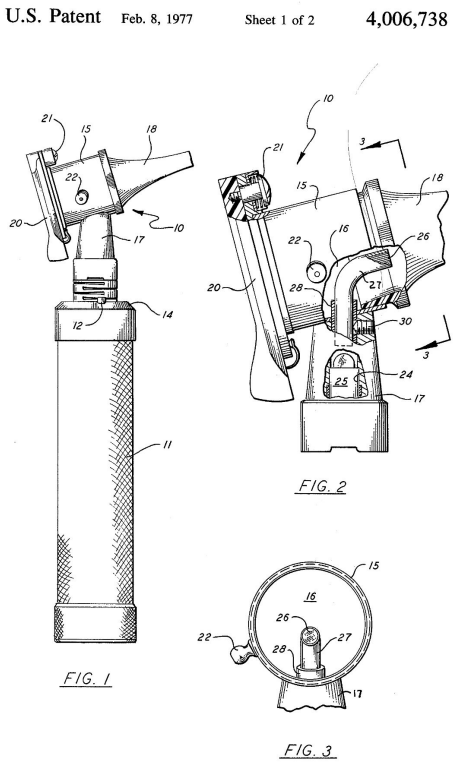

Figure 6: US Patent US4006738A [Moore, 1977]

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, Fall 2023

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

Previous Work, Fall 2024

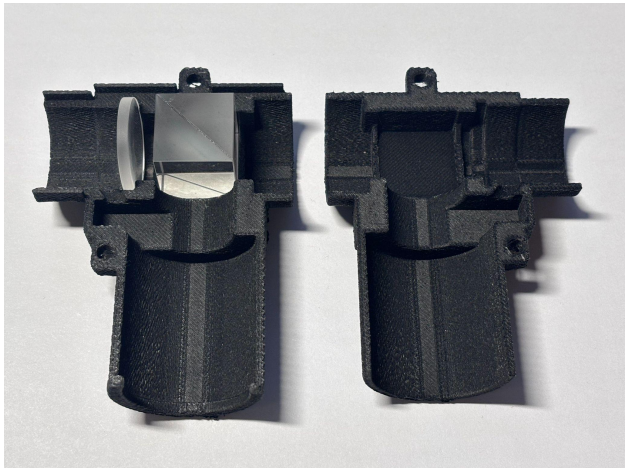

Figure 9: Otoscope prototype from Fall2023 BME

Figure 9: Otoscope prototype from Fall2023 BME

Testing, Fall 2024

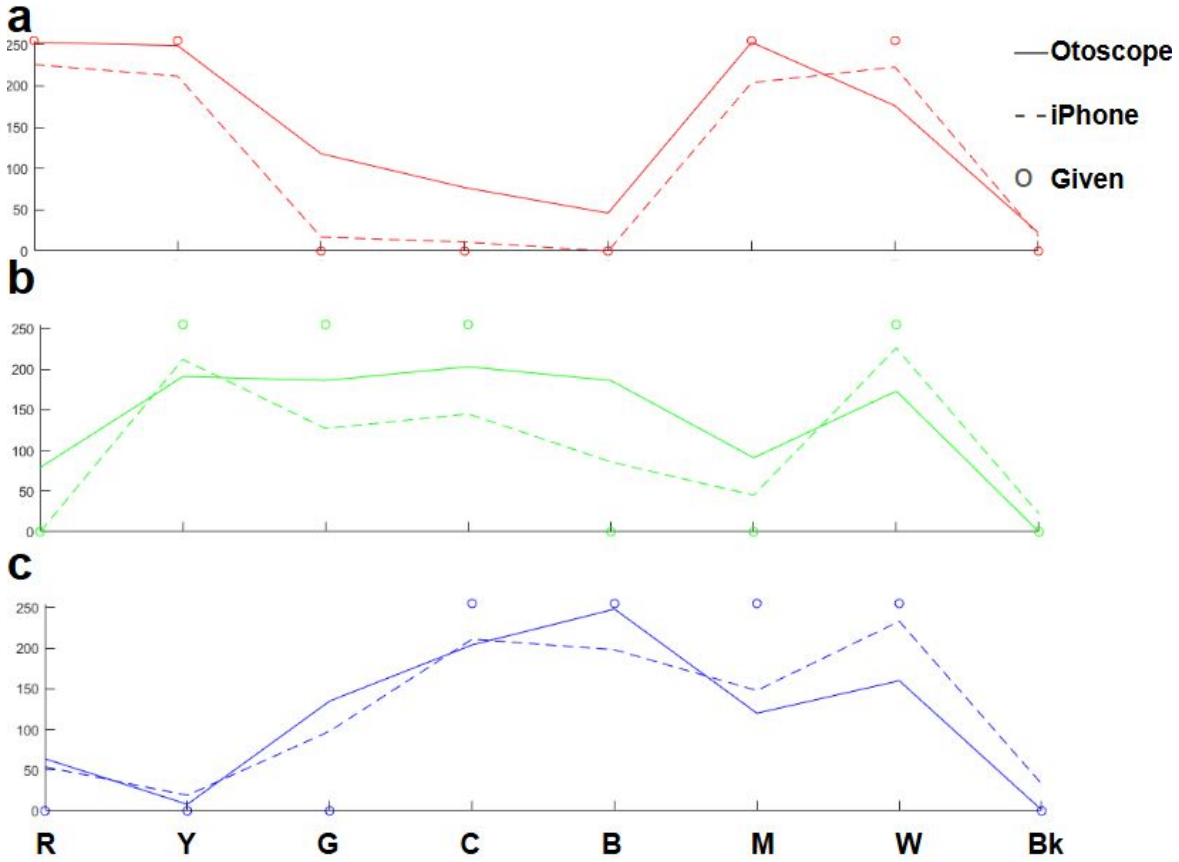

Figure 9: Otoscope prototype from Fall2023 BME

Result from Last Year

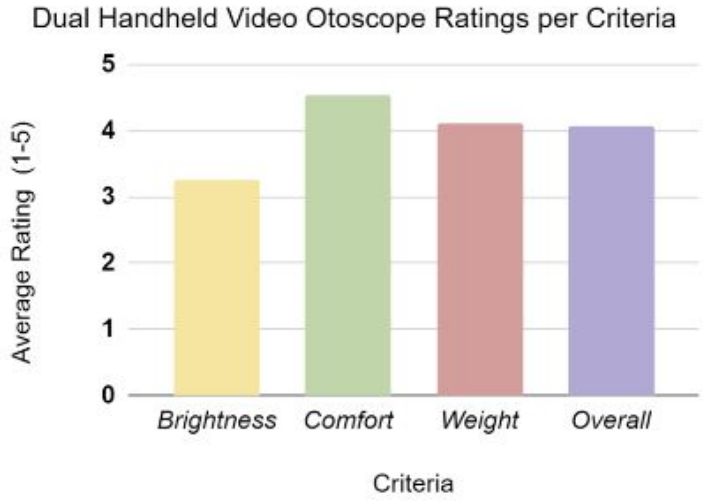

Figure 10: Otoscope prototype Survey Fall2023 BME [9]

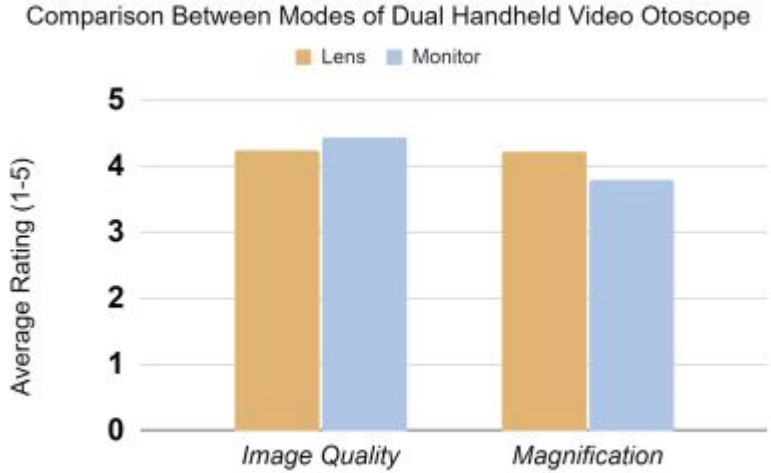

Figure 11: Otoscope prototype Survey Fall2023 BME [9]

Design 1: Optical fibers

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

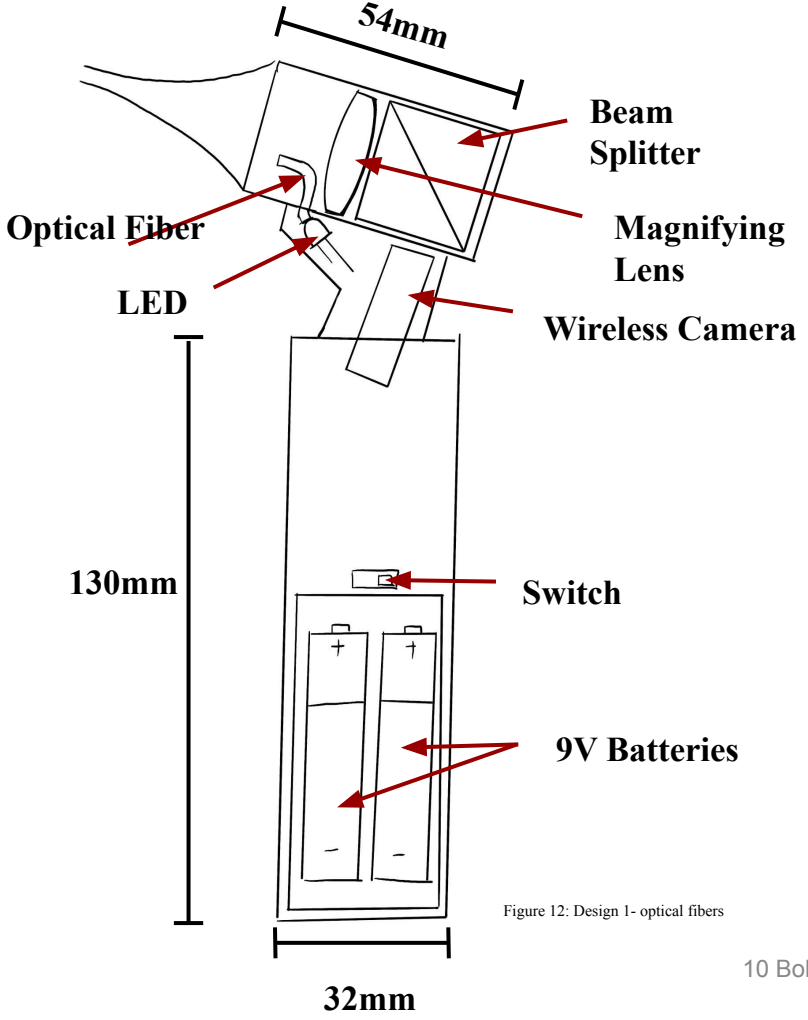

Figure 12: Design 1- optical fibers

Design 2: Mirrored Light Source

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

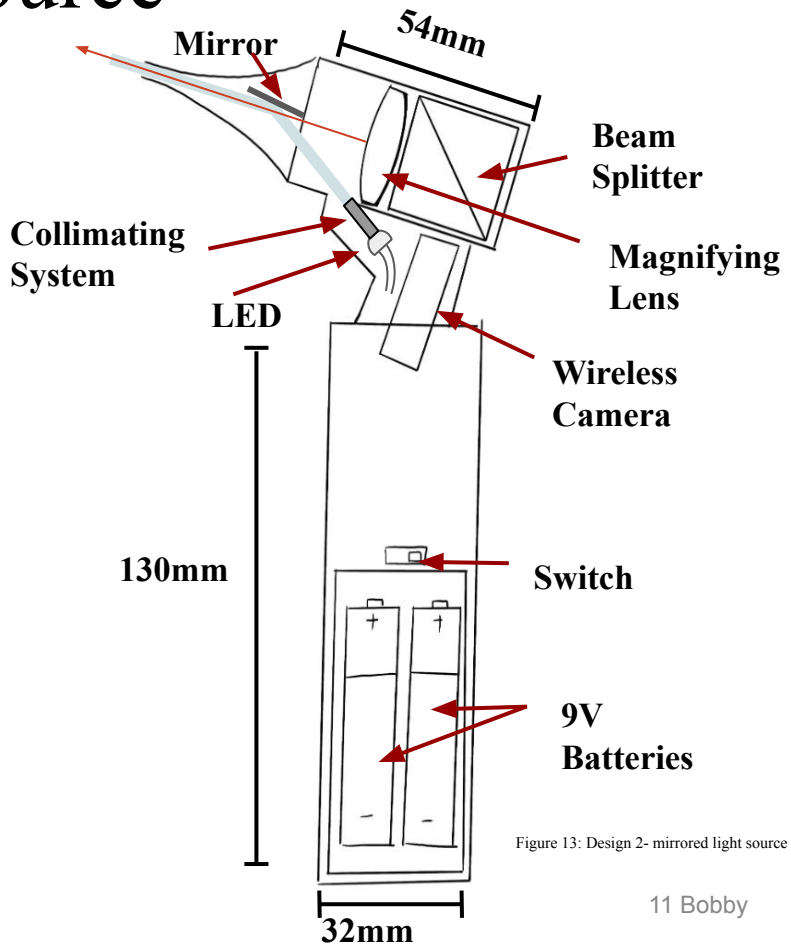

Figure 13: Design 2- mirrored light source

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

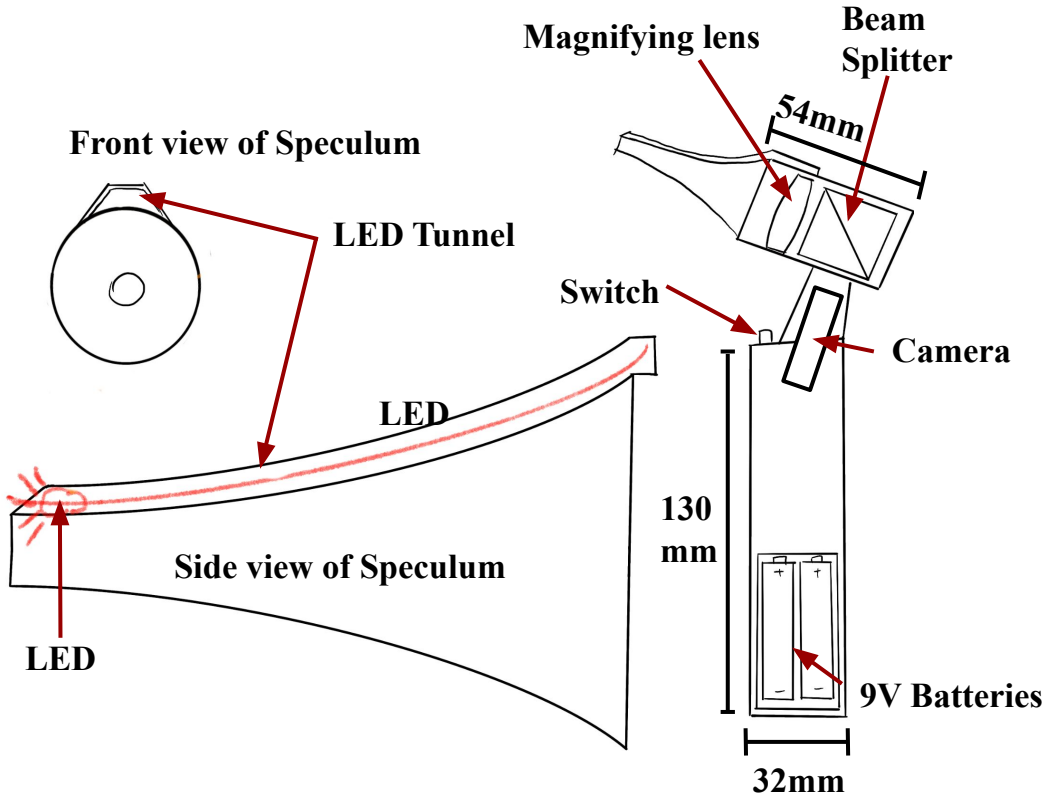

Figure 14a) Front view of speculum, b) side view of speculum, c): Design 2- LED built in speculum design

Design Matrix

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

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

Testing

Conclusion & Future Work

- Order a cuttable optic fiber, and find a method of securing it onto the light source
- Improve and refine the 3D-printed casing design to be more secured and drop resistant, potentially using a 2 layered design
- Improve the virtual image quality either using lenses or replace the handheld microscope with higher resolution one
- Improve optic viewing with magnifying lenses
- Conduct testings to confirm the usability of the design
- Conduct testings to test for if it improves teaching quality
- Finish the report paper

References

[1] L. Tomich, Dr. Lara Tomich. 2023. [Online Image]. Available: https://uwveterinarycare.wisc.edu/people/lara-tomich/
[2]A. Nichelason, Dr. Amy Nichelason. 2023. Accessed: Oct. 01, 2023. [Online Image]. Available: https://www.vetmed.wisc.edu/people/amy-nichelason/
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Thank you!

Questions?