

A Portable Smartphone Adapter for Imaging the Anterior & Posterior Segments of the Eye

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Clinical Need

Eye-related complaints are common in the ED, but timely assessment is limited by the need for ophthalmology consults and the lack of rapid, reliable diagnostic tools (1). Evaluations are often delayed due to limited ophthalmologist availability (2). With many cases being non-urgent (3), (4), the inability to quickly determine severity leads to prolonged wait times.

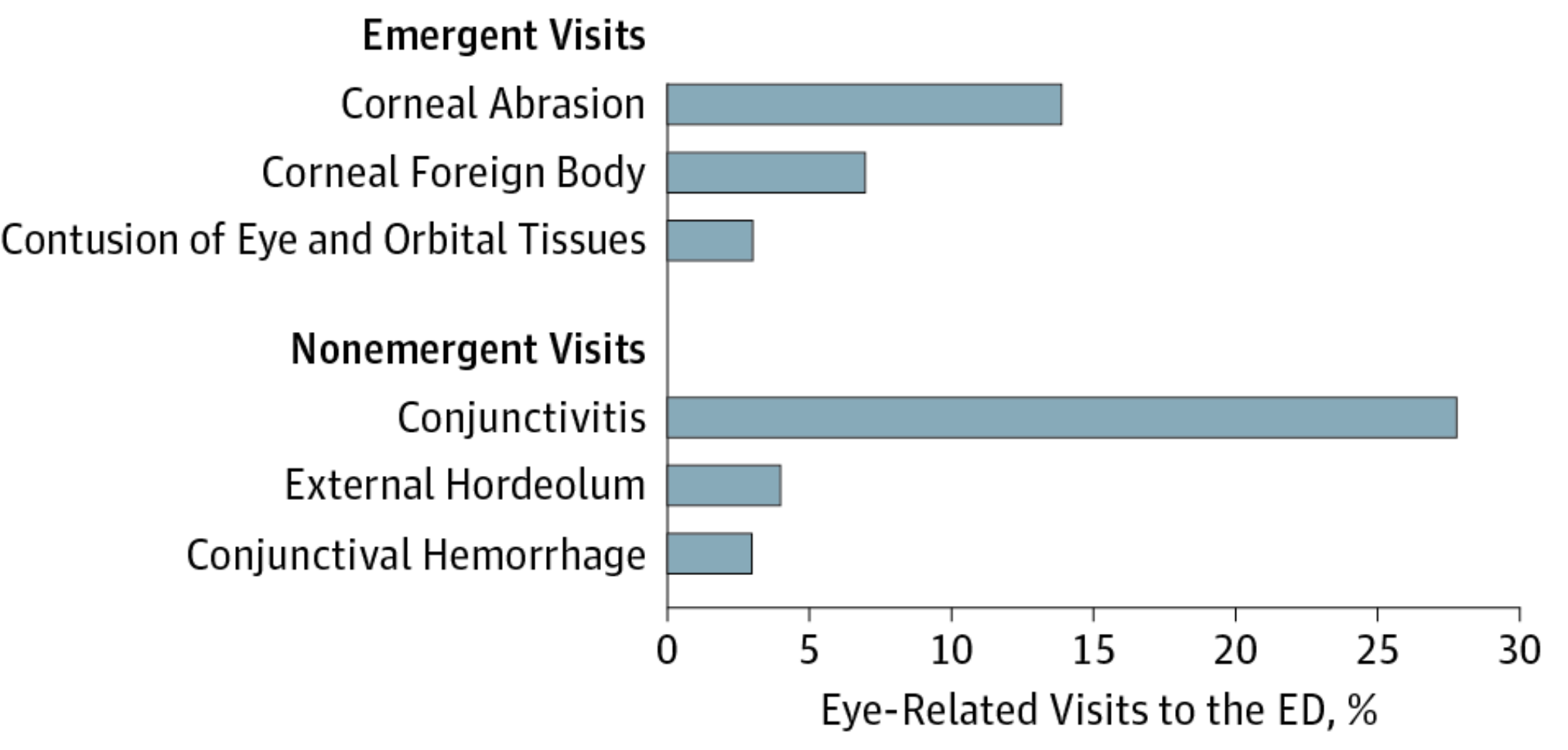


Figure 1. Emergent and non-emergent eye-related visits to ED in the US between 2006 and 2011, by the ultimate diagnosis. Figure adapted from (3).

Selected Design Concept



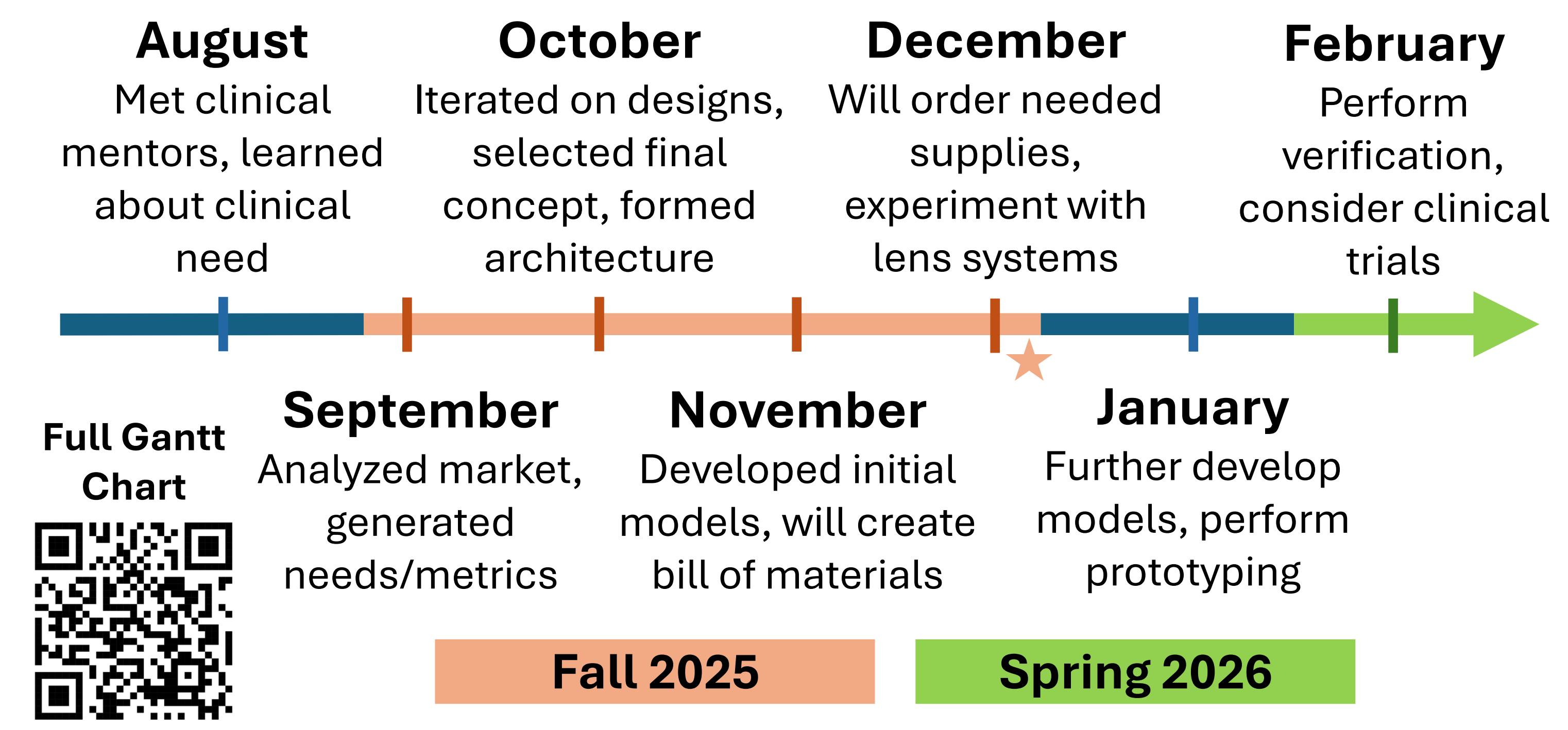
Figure 2. Initial design concept for integrated device.

Design for Manufacturing

The device is optimized for low-cost fabrication using 3D-printed structural components and simple magnetic attachments. Materials were selected for durability, optical stability, and ease of maintenance. Early cost estimates place the unit at about \$100 to \$250 at a small batch scale.

| Major Components | Cost (USD) |
|-------------------|------------|
| Voice coil motor | \$50-200 |
| Optics | \$20-30 |
| 3D print material | \$8-12 |
| Magnets | \$1-2 |

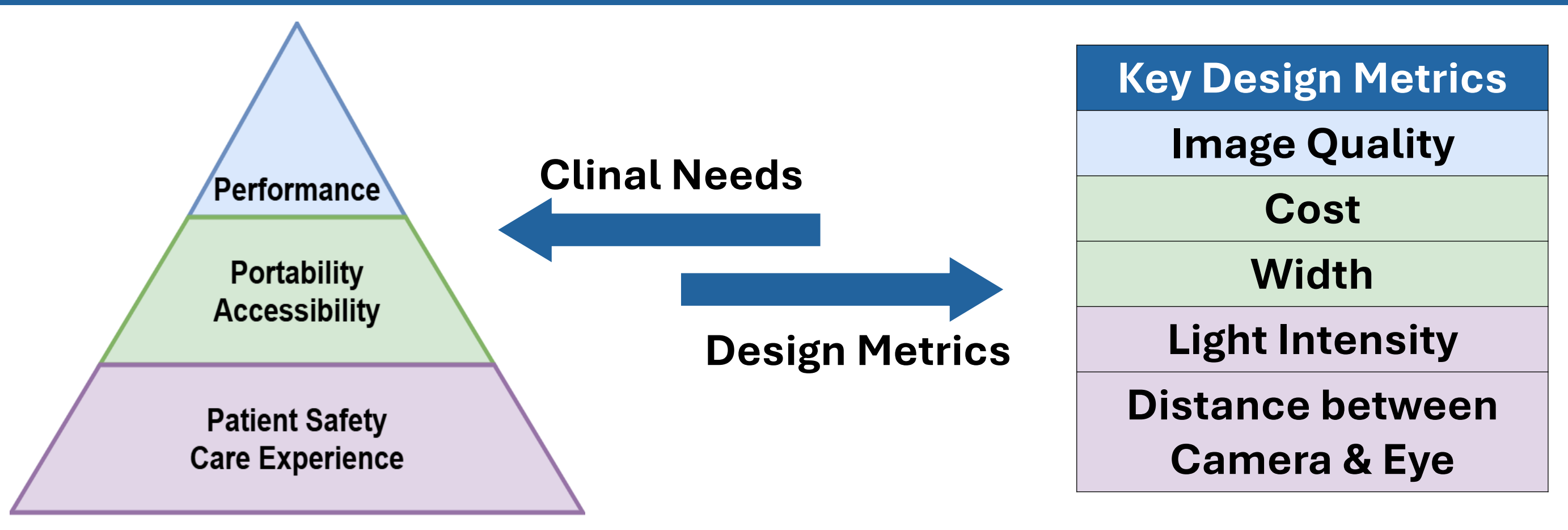
Project Planning/Timeline



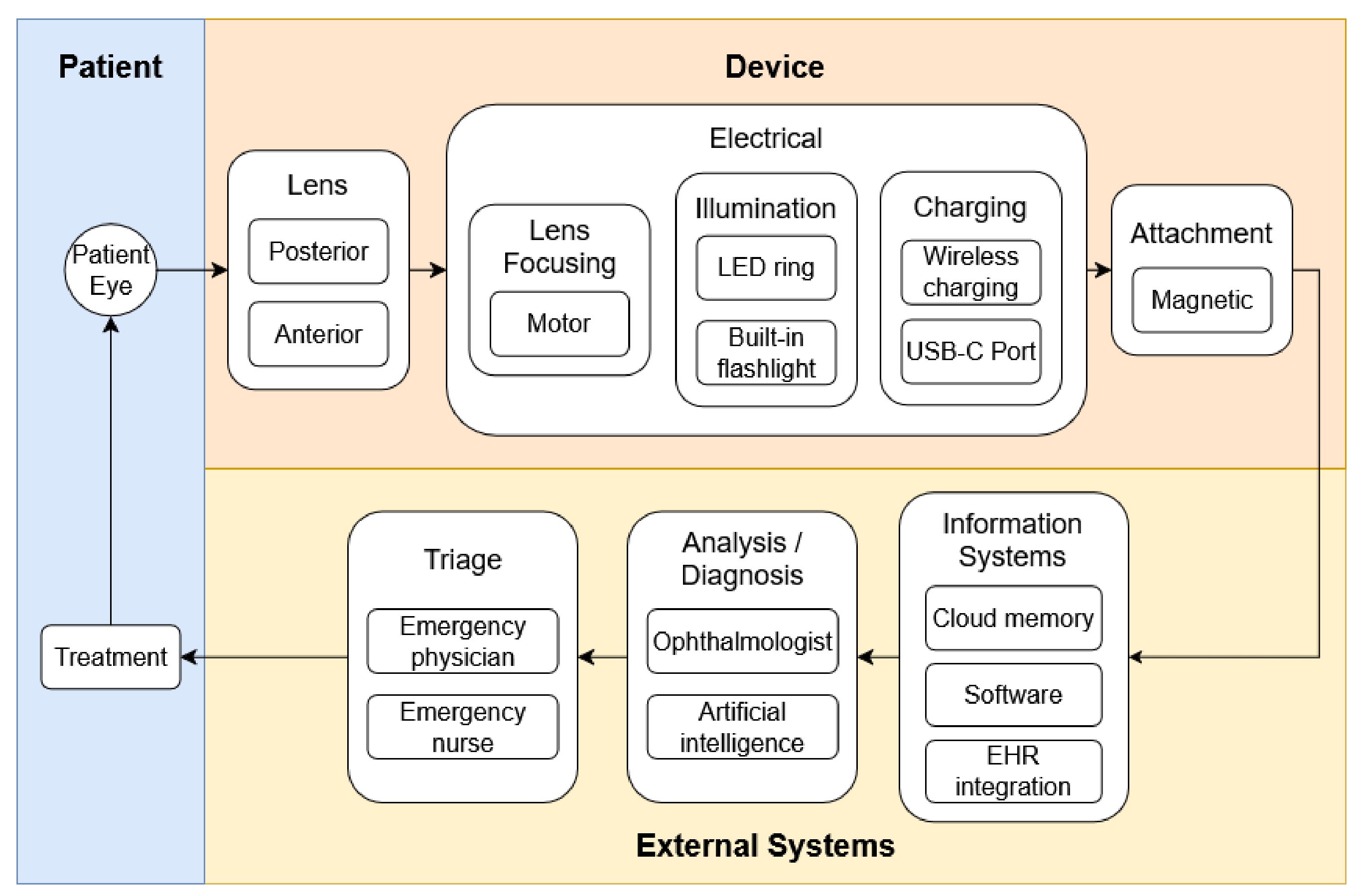
Mission Statement

The Visioneers have the honor of continuing TeleVision's mission to enhance the accessibility, efficiency, and accuracy of ophthalmic care in resource-limited settings by developing a smartphone-compatible imaging device that captures high-quality, standardized images of the anterior and posterior eye segments

Design Inputs



Product Architecture



Target Specifications

| Key Metrics | Value |
|-------------------------------|------------------------|
| Diagnostic Accuracy | 90% |
| Cost | ≤ \$200 |
| Width | < 0.5 in |
| Light Intensity | < 24 kJ/m ² |
| Distance between Camera & Eye | ≥ 100 mm |



Initial Technical Models

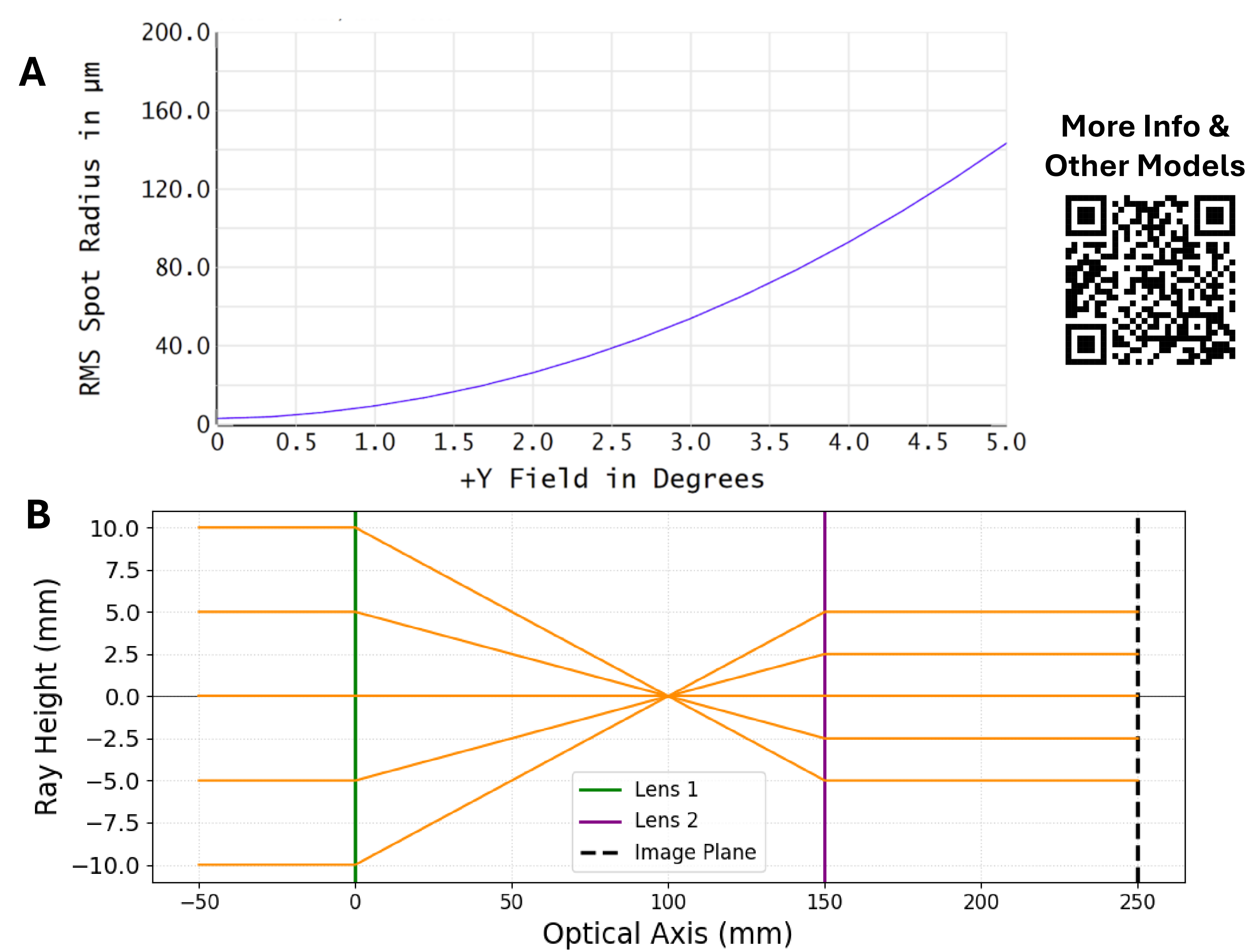
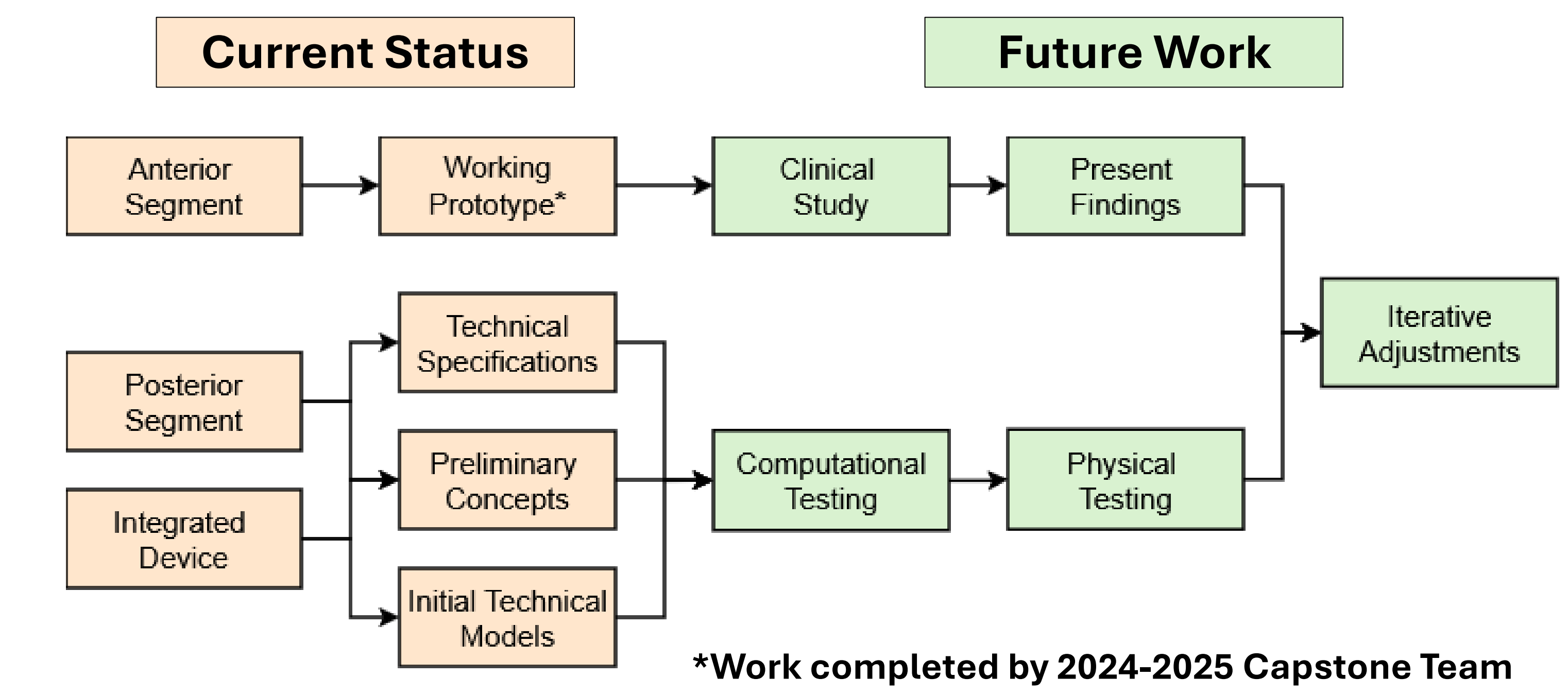


Figure 3. Initial modeling for (A) anterior & (B) posterior optical systems. Current models are largely proof of concept.

Design Status & Future Work



Acknowledgements

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References

- J. D. Deaner et al., *Ophthalmology*. **128**, 471-473 (2021).
- R. S. Rai, N. Mehta, R. Larochelle, S. Rath, J. S. Schuman, *Sci Rep*. **11**, 3823 (2021).
- R. Channa et al., *JAMA Ophthalmol*. **134**, 312 (2016).
- S. Kim et al., *The American Journal of Emergency Medicine*. **54**, 279-286 (2022).