

Design and manufacture a mobile device accessory that can image both the anterior and posterior eye segments.

## Introduction

Ophthalmoscopes are integral to diagnose a variety of eye conditions, however, they often come at a hefty cost and are not generally portable making access limited. With the increase in the prevalence of smart devices and improvements to their imaging capabilities, these devices have the potential to benefit areas where specialized imaging infrastructure is not well established. Smart device cameras alone do not have the capability to replace an ophthalmoscope. However, with the addition of lens and optics, it becomes possible to take diagnostic quality images. The goal is to design a modular system that acts as an adapter to a smart device enabling any user to take both retinal images and corneal images with little to no previous experience.

## Background

There are roughly known devices on the market that replicate the functionality of a direct ophthalmoscope, or funduscope which integrates a smart device into the products, taking advantage of the camera on the mobile device [2][3][4][5][6][7]. In addition to the commercially available products, there are several academic publications replicating such a device. Both the commercially available and academic devices offer similar imaging capabilities allowing for documentation of the macula, optic nerve, and retinal vessels [8]. Many of the devices have the capability to be used in a clinical setting and non-optimal conditions such as emergency rooms, the hospital floor, or abroad [9]. The quality of smart device captured images are limited in comparison to high-end funduscopes, however their widespread availability, built-in wireless data transmission, and point of care use applications outweighs the deficits in image resolution and magnification [1][8].

## Method

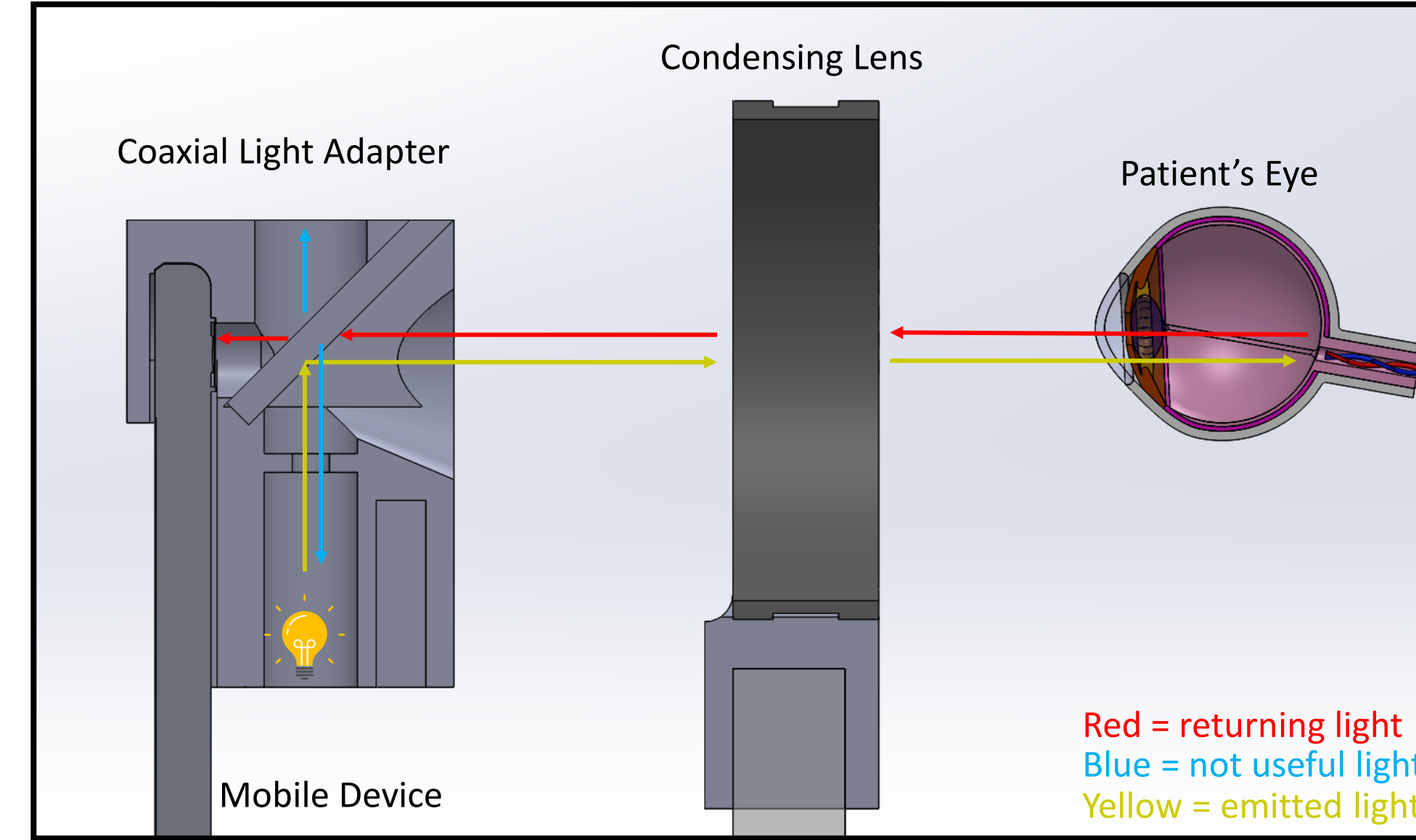
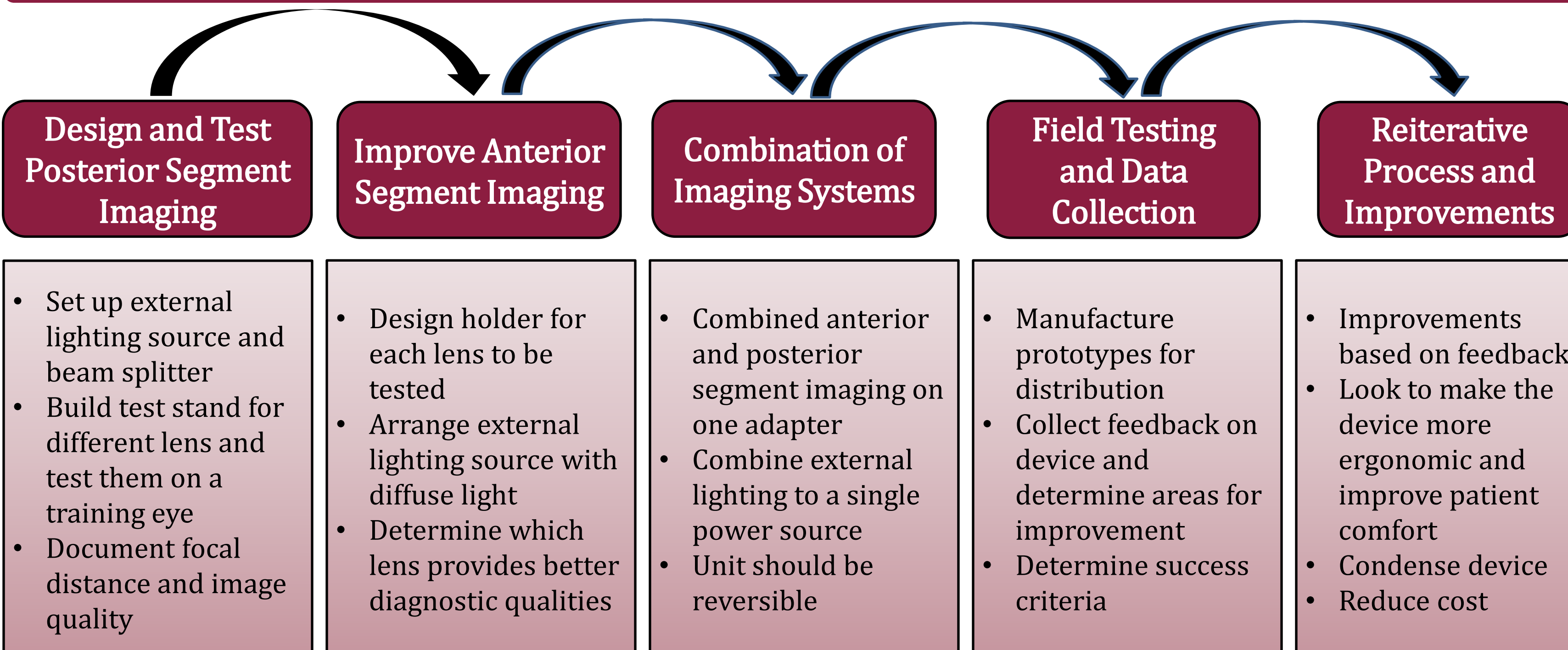


Image: Coaxial light Diagram for Retinal Imaging

## Applications

- Previous design utilizing only anterior segment imaging is currently being utilized in the ED at Mayo Clinic to monitor a patient's status, the addition of posterior segment will help monitor additional conditions
- Telemedicine to document condition or recovery without going into the clinic
- Medical mission trips abroad where there is a lack of specialized equipment or trained personal
- Tool for first responders to track and monitor conditions of injured patients, early documentation for definitive care

## Discussion

- Device does not replace traditional ophthalmoscopes, given limited field of view and imaging resolution
- Useable retina images have not been taken using the current design but show promise
- Limited to retina images of mydriatic (dilated) eyes

## Conclusion and Future Work

- Expand use to miotic (undilated) eyes to provide better patient experience and increase useability
- Increase resolution of image by providing better lighting and beam splitter
- Determine what lens yields the best trade off between magnification and field of view

## References

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