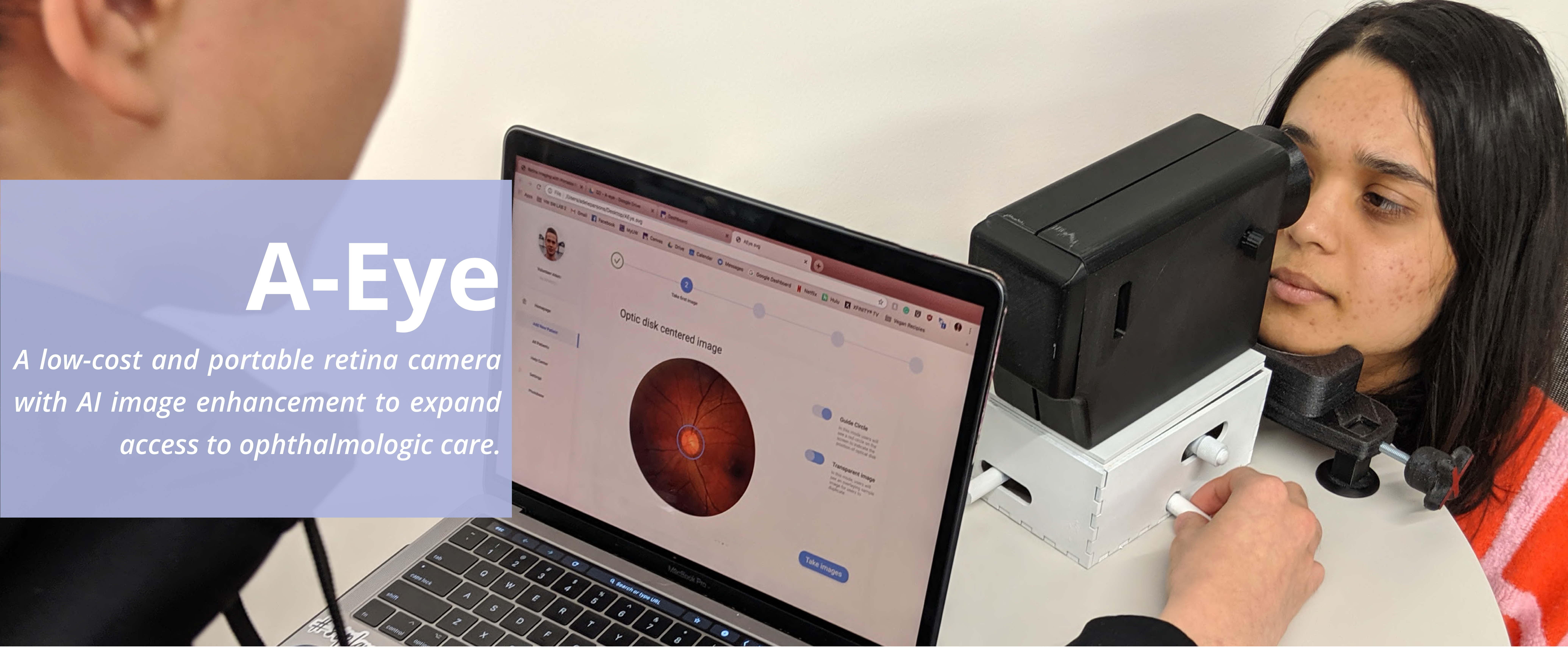


A-Eye

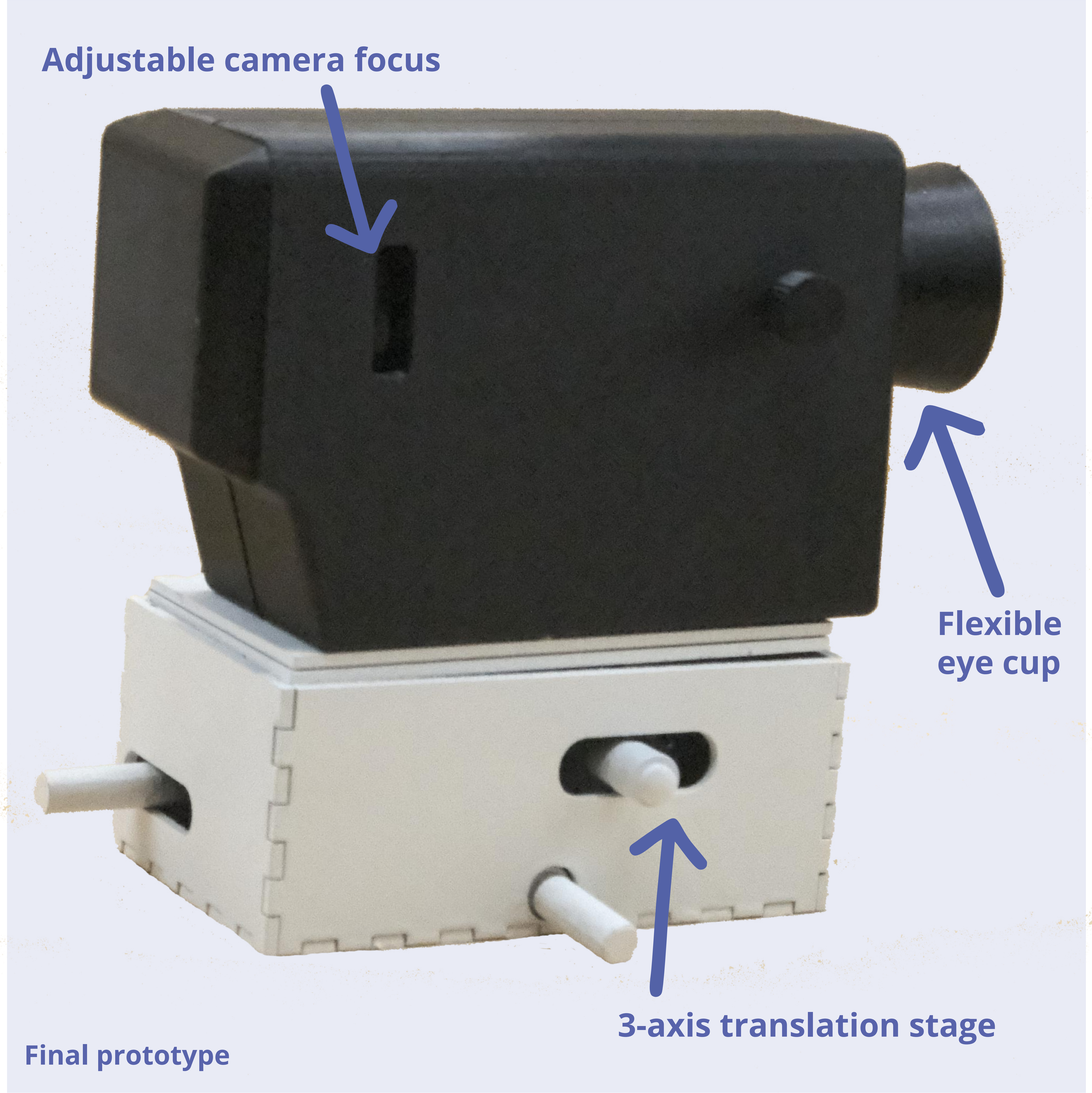
A low-cost and portable retina camera with AI image enhancement to expand access to ophthalmologic care.

PROBLEM

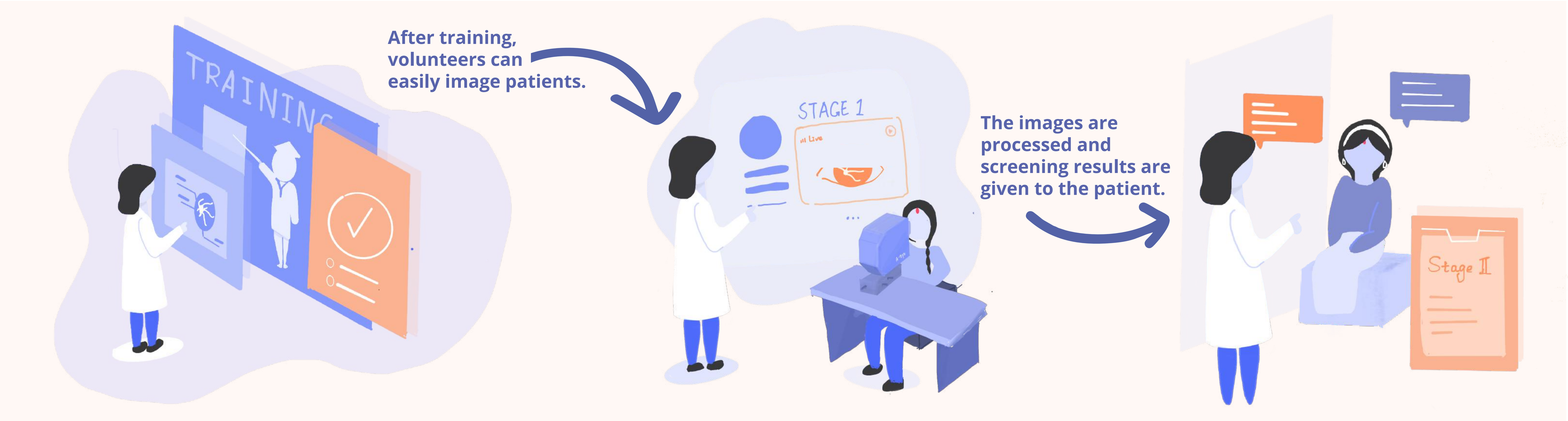
Over **370 million people in the world suffer from an eye disease**, most commonly diabetic retinopathy, macular degeneration, or glaucoma. When detected early, the likelihood of **preventing blindness can increase as much as 95%**. Each of these eye diseases can be detected and diagnosed with a retinal camera. However, detection and diagnosis currently require a **highly trained ophthalmologist and a clinical fundus camera costing over $20,000** on average making ophthalmology highly inaccessible in developing parts of the world. Currently, there exist some low-cost retina cameras, but they still require ophthalmologists to operate or **fail to capture high enough quality images** for AI automated screening.

SOLUTION

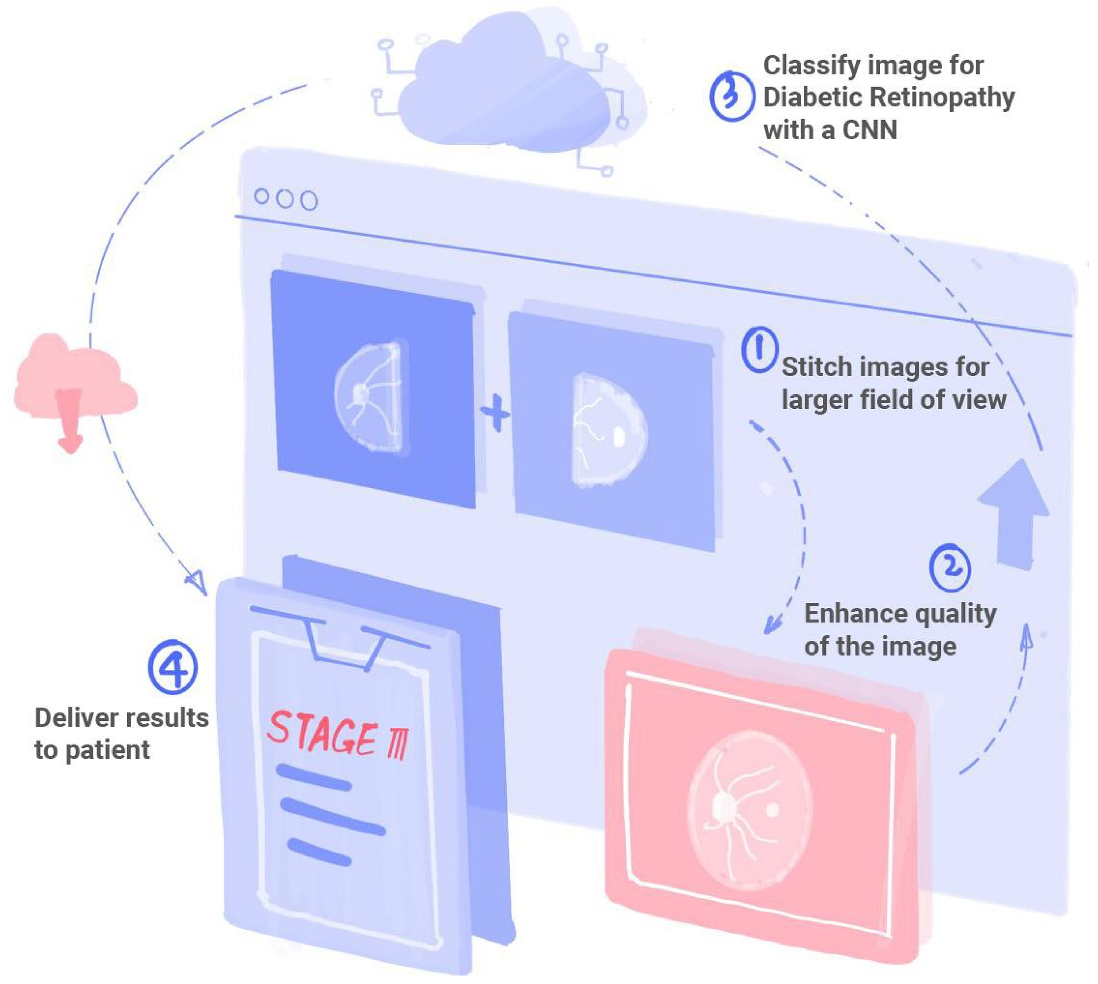
A-Eye is a mobile retinal camera designed for users **who are not medical professionals**. It utilizes unique software and hardware techniques to capture **high-quality fundus images at a low cost** eliminating the need of ophthalmologists for retinal imaging. The camera is able to achieve at least a 40° view of the retina and utilizes **computer vision techniques to enhance the image** through stitching different views of the fundus and removing glare. The processed image is able to utilize the screening capability of a classification model trained on high-quality images obtained from a clinical-grade dataset. The processed image is then passed through a Convolutional Neural Network for **screening results of diabetic retinopathy**.



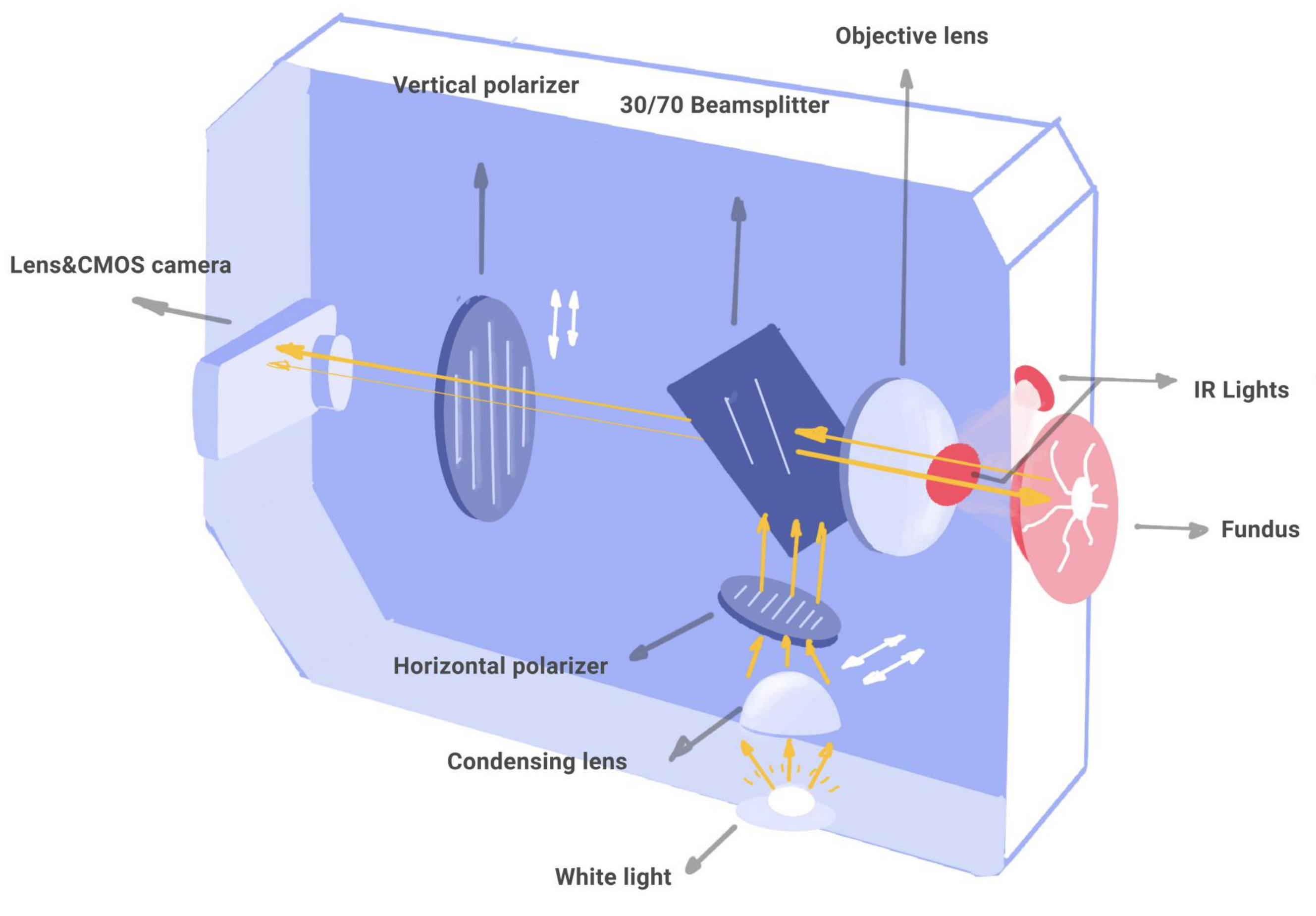
Final prototype



SOFTWARE



HARDWARE



PROCESS

We approached this problem by first **understanding the constraints** defined by our stakeholders. Then, we **prioritized the features** of the camera considering the cost, resources needed, and impact on quality. Using an iterative approach, we **conducted usability and functional testing** to continuously improve the prototype.

We worked with **ophthalmologists and optical engineers** to design an optical path to maximize illumination and minimize glare. This was done with a combination of polarizers and a condensing lens. An important step in our prototyping phase was **working with an optical bench** with which we were able to optimize the lighting and imaging paths.

Since there was a quality difference between the device image and the dataset for CNN, we experimented with a variety of pre-processing techniques. We found that **multicolor segmentation obtains reliable screening results**.

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