

AutoFocals 2: Auto Focusing Lenses for Correcting Presbyopia

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1 Introduction

Presbyopia is a very common side effect of the aging process. It describes the progressively worsening ability to focus on close objects due to the hardening of the eye's lens (Glasser). Currently, the easiest method of correcting this type of degeneration is through the use of reading glasses, or fixed focus lenses that refocus the image for the viewer. However, this is far from a perfect solution. Some drawbacks include that lenses at a fixed focus cannot be used in all situations, and many different glasses are needed for people with varying levels of presbyopia, requiring the user to select from a variety of different types (Family Health Team).

In this project, we aim to create a set of auto-correcting glasses for individuals with presbyopia that changes focus depending on what the user looks at.

This project is joint with EE 390, as it is part of a research project in Professor Wetzstein's lab.

2 Related Work

The "cure" for presbyopia has been long sought - there have been numerous pharmacological methods to control presbyopia, including eyedrops that change optical qualities, eyedrops that change material properties of the lens (Renna et al.), lenses that go inside the eye to correct out presbyopia (Epitropoulos), and of course, reading glasses. This project thus aims to avoid the hassle and potential side effects of pharmacological methods as well as avoid the common problems of using standard reading glasses.

While tunable-focus lenses for glasses are not a new idea (they were even discussed in Dune!) auto-focusing lenses for presbyopia are a relatively new idea; there has only been one similar project with similar end goals.

This project was out of the University of Utah; a professor created a 3d-printed set of auto-focusing glasses that use an IR rangefinder to focus onto where the lenses are pointed (Potenza). However, this project's main focus was not to create these glasses, but to test out the focus-tunable lens (Nazmul et al.).

3 Implementation

This set of glasses will use the sensor from an Intel RealSense camera to get depth estimates for most of the objects in the user's field of view, two eyetrackers from Pupil Labs, a set of focus-tunable liquid-filled lenses, and a custom designed housing in order to mount the device to the user's head with minimal motion, allowing for optimal results.

As the electronics and algorithm has already been mostly designed, this project will focus mostly on creating a more user-friendly prototype that can be both tested more easily and showcased readily. To this end, several prototypes will be created in order to test best methods of both attaching and placing the electronics as well as attachment to the head.

4 Timeline

1. 2/13: Proposal submitted
2. 2/16: Initial head mounting system prototyped and tested
3. 2/23: Initial lens fitment and potential electronics fitment
4. 3/2: Tuning of lens fitment and electronics fitment done
5. 3/7: Cable fitment tuning prototyped and designed
6. 3/13: Project completed

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