CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36693

Project Title

A Device to Detect Diabetic Retinopathy

Abstract

Objectives/Goals

As of 2013, 126.6 million people around the world have developed the eye disease diabetic retinopathy, and this number continues to grow every day. In many areas where people have contracted this disease, there is not enough access to eye care, and these people do not know that they have contracted the disease until they go blind. The goal of my project was to create a device that could easily take pictures of the retina, and then scan those pictures to check for signs of diabetic retinopathy.

Methods/Materials

The materials I used for my project included an iPhone 5, a 3D printer, ABS filament, a double-convex lens with a diameter of 50 millimeters, the Tropicamide Ophthalmic Solution eye drop, the FilmIc Pro app, and the Matlab program. I also used the online services Tinkercad to design my 3D models, and Fictiv and Shapeways to print them out.

A patient's eye was first dilated using the Tropicamide eye drop. I then used the FilmIc Pro app and my device to take a video of the retina. I selected images of the retina from the video, then cropped them so that they only showed the retina and processed the resulting image using my MATLAB program.

Results

I created a device using 3D printing which can be attached to an iPhone, and used it to successfully take images of the retina of several people. I then used the Matlab program I wrote to process the images, and found that my program gave accurate diagnoses of diabetic retinopathy.

Conclusions/Discussion

It is possible to create a low cost device to allow the easy detection of diabetic retinopathy. This device can be used around the world, especially in poor or remote areas of the world to allow easy and early detection of this disease to help prevent blindness among millions of people. Because of its relative ease of use, its portability, and low cost, it can be used by people without medical training to provide care at any location.

Summary Statement

I was successfully able to create a low cost 3D printed device and Matlab image processing program to help detect the disease diabetic retinopathy.

Help Received

I would like to thank the Vision Care Center of the Palo Alto Medical Foundation for providing me with advice and the permission to test patients. I would also like to thank my parents for guiding me throughout my project.

Preliminary