



SCREENINGEFSOPTICS

OPTICAL DESIGN OF A RETINAL IMAGE ACQUISITION DEVICE FOR MOBILE DIABETIC RETINOPATHY ASSESSMENT

Fundus Camera

A Fundus Camera is a device that allows the observation of the structures and the blood vessels in the ocular fundus, being very useful in the diagnose of many pathologies (like Diabetic Retinopathy).

When compared with other eye examination devices, by the usage of indirect ophthalmoscopy principles, a fundus camera can have, a wider Field of View, more specificity and sensibility and in some cases allow a non-mydriatic acquisition.

The fundus exam importance can be seen in many medicine fields and not only in ophthalmology. Since the retina is the human body structure where the vessels can more easily be seen, fields like Neurology and Cardiology, can also use the capabilities of a fundus camera.

EyeFundusScope

The EyeFundusScope (EFS) is intended to be a hand-held, user-friendly, non-mydriatic, low-cost and smartphone coupled fundus camera. Its main goal is to facilitate the acquisition and



Fig1. ScreeningEFSOptics prototype.

communication of fundus photographs all-over the world which fits perfectly Fraunhofer's values and principles.

Optical Modulation

To test which lens system best suits the efficiency, resolution, Field-of-View and low price desired for EFS, a ray tracing software called BEAM IV was used.

After testing different optical configurations like achromatic doublets, bi-convex lens or only traditional Plano-Convex Lens we understood that the best solution is to use a Best-Form Lens (lenses that can correct optical aberrations geometrically) as an ocular lens, an Aspheric Lens as an objective and a normal Plano-Convex Lens right after the LED, to get an Angular Field of View of 40°.

Contact

Rua Alfredo Allen, 455
4200-135 Porto, Portugal

+351 220 430 300
info@fraunhofer.pt
www.fraunhofer.pt

Light Hazard

It is possible to say that the light hazard measurements proved that the prototype can be classified as a Group 2 instrument, regarding the ISO 15004-2:2007 norm for ophthalmic instruments and the ISO 10940:2009 norm for Fundus Cameras.

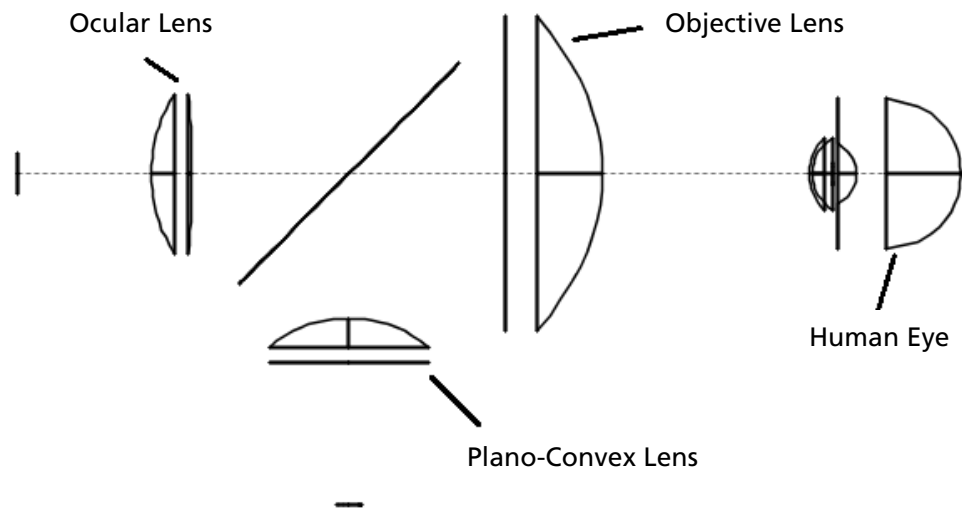


Fig2. Complete Optical System.

Diabetic Retinopathy

Diabetic Retinopathy (DR) is a microvascular disease caused by the virus diabetes mellitus that is responsible for 4.8% of worldwide blindness. It is characterized by the loss of pericytes and by a progressive capillary occlusion that can provoke retinal ischemia and the breakdown of blood-retinal-barrier.

It can be divided in two different stages: Non-proliferative that mostly consists in the leakage of substances from the blood vessels to the retinal epithelium, and Proliferative that is characterized by neovascularization surrounding occluded regions. Since the new blood vessels are much more fragile than the previous ones, the risk of bleeding is higher.

The resolution of the EFS is intended to be sufficient to distinguish microaneurysms, the small structures that most commonly appear in the earliest stages of the DR.

Further Objectives

There are two big further objectives which are:

- The implementation of the new lens system in a new prototype;
- Design of internal fixation points to facilitate pupil alignment at different points.

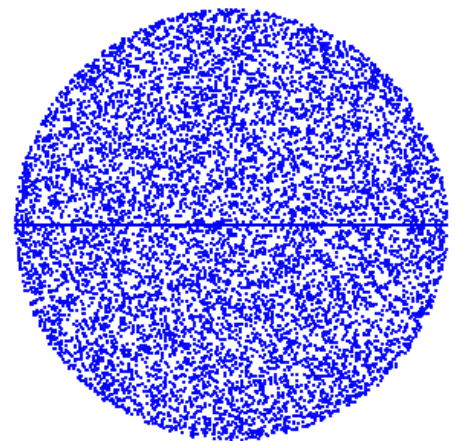


Fig3. Retinal illumination profile obtained with Beam IV.