Anterior Segment Imaging

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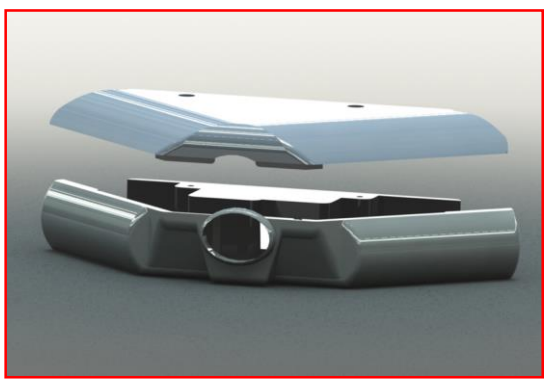
Problem Statement

The ophthalmic slit lamp is a purely qualitative device that is big, expensive and requires a trained physician to operate, making it unsuitable for resource-constrained settings. This project is about developing a low-cost, wearable solid-state device with no moving parts, for 3D reconstruction of the anterior segment of the eye, to exhibit functionality similar to that of a slit lamp.

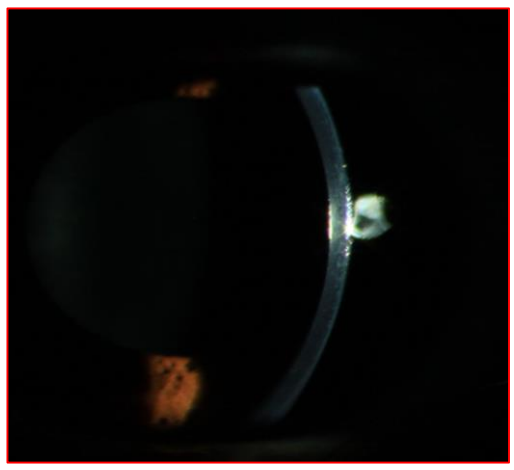
Proposed Approach

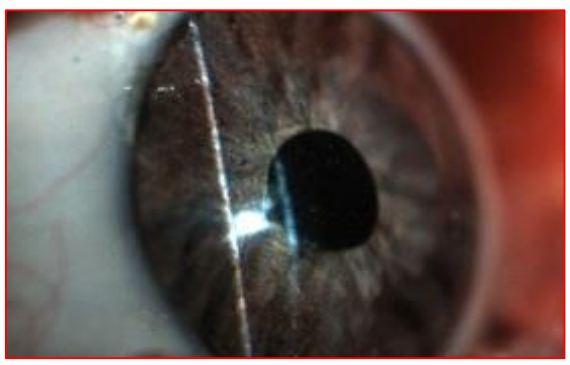
Our prototype consists of two calibrated point-grey cameras and a projector which combines stereo-vision and slit scan approach. Stereoscopic profiles are continuously recorded as 3D surface swept by the slit. We use stereo correspondences for reconstruction and to generate sparse point clouds. These point clouds are then meshed together and rendered on the web interface.

Pipeline

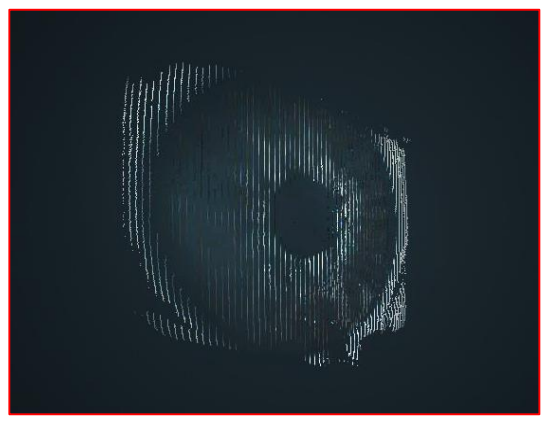


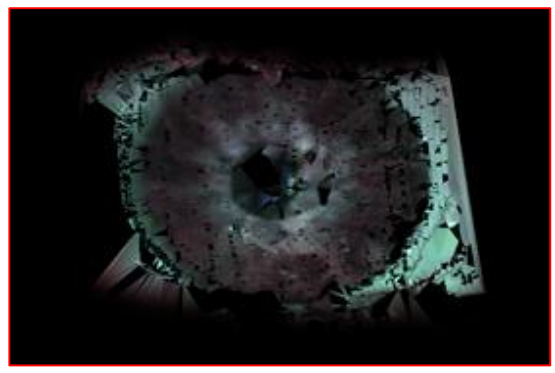
Prototype





Slit scan





3D Reconstruction

Current Prototype and Future Work

At REDx 2015, the prototype design was revised to enhance the quality of corneal images from the slit scan. Data was collected from a high- quality slit lamp and used to further develop the 3D reconstruction software. Future work includes further testing the device and software on a synthetic eye, followed by adapting the device to comply with laser safety standards. Furthermore, the current camera-projector setup will be made more compact and robust. The reconstruction software will also include quantitative analyses of the anterior segment of patients' eyes.

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