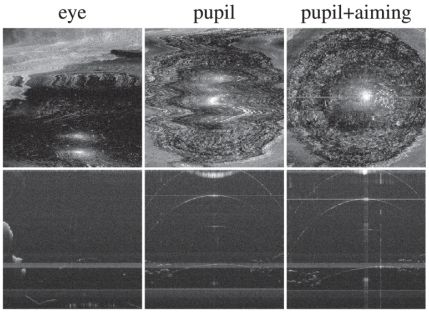
An optical coherence tomography system capable of automatically and accurately imaging eyes without the use of chinrests

Unmet Need

Optical coherence tomography (OCT) has revolutionized structural imaging in the eye’s anterior segment and retina. Ophthalmologists now routinely employ OCT in managing ocular diseases, including age-related macular degeneration, diabetic retinopathy, glaucoma, and corneal edema. However, OCT imaging is restricted to non-urgent evaluations of cooperative patients in ophthalmology care settings due to modern systems’ poor portability, stabilization needs, and operator skill requirements. Efforts are underway to lower these barriers, but the resulting solutions still depend on chinrests for approximate alignment and motion stabilization or are limited by manual alignment and motion artifacts, such that only highly skilled operators with steady hands reliably succeed. There is a need for improved systems and techniques for acquiring eye images, including image of the eye’s anterior segment and retina that can permit an image scanner to be easily interfaced with the patient without operator training. Further, there is a need to provide OCT imaging to acutely ill patients who physically cannot sit upright due to injury, strict bedrest, or loss of consciousness.

Technology

Duke inventors have developed an optical system intended to make OCT imaging more accessible, including for bedbound or unconscious patients. Specifically, this is a robotically aligned swept-source OCT scanner capable of automatically imaging eyes without chinrests. The scanner features eye tracking from fixed-base RGB-D cameras for coarse and stereo pupil cameras for fine alignment, as well as



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Publication(s)

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External Link(s)

• From the lab of Dr. Joseph Izatt
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galvanometer aiming for fast lateral tracking, reference arm adjustment for fast axial tracking, and a commercial robot arm for slow lateral and axial tracking. The technology has been demonstrated to offer highly repeatable imaging of stationary and moving eyes up to 30 mm s^{-1} using a mannequin outfitted with model eyes.

Advantages

- Robotically aligned OCT scanner that does not require operator intervention
- Enables a large functional workspace without compromising fine alignment
- Demonstrates potential for imaging eyes without chinrests with sub-millimeter eye tracking accuracy, 12 µm lateral pupil tracking accuracy, 83.2 ms stabilization time following step disturbance, and 9.7 Hz tracking bandwidth