Title:	Optical methods and sensor development for cellular level imaging
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Abstract:	With the developments in the field of photonics, optical imaging plays an important role in biological studies. A few optical techniques that act as the primary steps in cellular level imaging are studied and implemented. Light field image processing allows 3D reconstruction of objects unlike conventional imaging systems [Wu 17]. This opens up the possibility of visualizing biological struc- tures in 3D in real-time. Something that is usually achieved using tomography. A light field imaging system for the 3D estimation of a point beam was constructed. Ultrasound and photoacoustic imaging are non-invasive methods commonly used in medical diagnostics. The former method involves the emission of ultrasound waves and their detection after being scattered by the subject. Whereas the latter uses sys- tems that emit light but detect ultrasound waves that are produced by the subject as a result of optical energy absorption [Xia 14]. Both techniques require the detection of ultrasound waves. Material based (piezoelectric) detectors are commonly used in diagnostics. But they are much less sensitive and have lower frequency bandwidths compared to optical detectors. Photoacoustic imaging of very small objects (in the range of 100 microns) require sensors with a frequency response ranging from a few MHz to well above 100 MHz [Wissmeyer 18]. Such wide bandwidths are possible only using optical methods. In addition, the size of a material based sensor cannot be reduced beyond a certain point as the sensitivity is very dependent on the sur- face area. An optical method for ultrasound detection, namely using a Fabry Perot interferometer, was studied and implemented.
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