Docket #: S12-270

Nanophotonic light-field sensor

The Nanophotonic Light-Field (NLF) sensor enables a new generation of light field cameras capable of high sensitivity, high pixel density and faster shutter speeds. No longer will users have to choose between high resolution images and after-the-fact focusing or 3D rendering, for the NLF sensor gives the user the best experience of traditional digital cameras and existing light field cameras. It provides higher sensitivity and pixel density with a lower f-stop number than existing light field technologies that use microlenses for directional resolution. It also has angle resolution through a very large range of acceptance angles. This novel design eliminates the need for a precise separator between the microlenses and the sensor making it more robust and compact. The ultra-thin device architecture can be readily integrated into non-planar sensor designs for reduced aberration, increased off-axis brightness and sharpness as well as novel compound eye architectures.

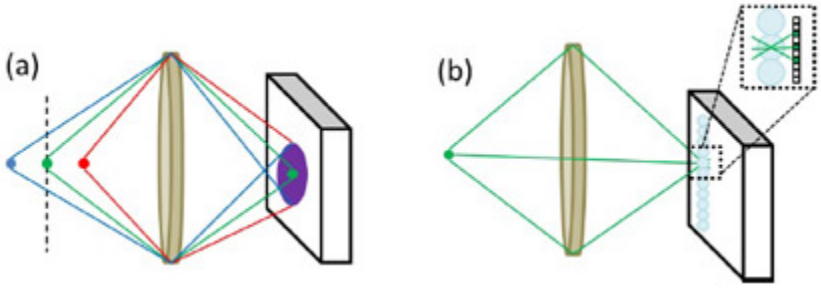

Figure Caption: a) A traditional camera detector captures only the intensity of light falling on each photosite. The light intensity from points in front of or behind the lens's front focal plane is spread over several photosites (purple circle). If the direction of the light rays at the sensor (converging or diverging) could be resolved, the image could be refocused after the fact. **b)** One implementation of a light-field sensor places microlenses at the rear focus of the camera's main lens, thereby separating light from different angles onto different photosites.

Stage of Research

Optical simulations and experiments show that this sensor is simultaneously capable

of high sensitivity, high pixel density, and directional resolution through very large incident angles.

Applications

- Solar cell
- Compound-eye
- Scientific imagining
- Microscopes
- 3D cameras

Advantages

- Image resolution that rivals that of traditional digital cameras
- Faster shutter speeds than conventional light field cameras
- Thin film enables compact design that is compatible with both planar and curved sensors
- Utilizes existing fabrication techniques and equipment
- Reduces crosstalk for high incident angles

Publications

- Vijay K. Narasimhan, Yi Cui, Nanofabricated optical and detector elements for light-field camera sensors, Proceedings of SPIE Volume 8463, 12-16 August 2012.

Patents

- Published Application: 20140043611
- Issued: 9,140,602 (USA)

Innovators

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