2D/3D Imaging and Display Systems

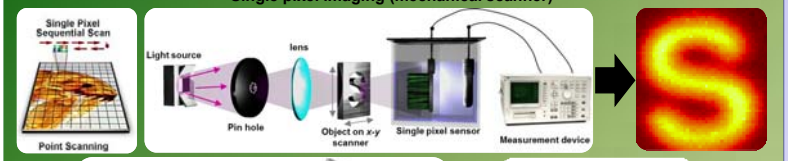
Min-Chul Park* and co-workers

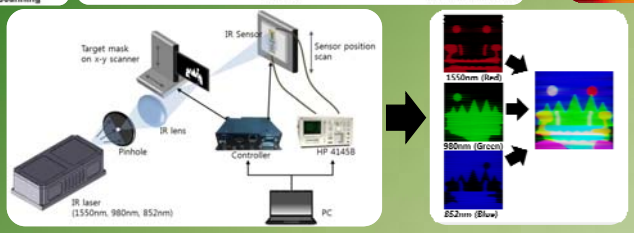
Center for Opto-Electronic Convergence Systems, Korea institute of Science and Technology, Seoul 136-791, Korea

* minchul@kist.re.kr

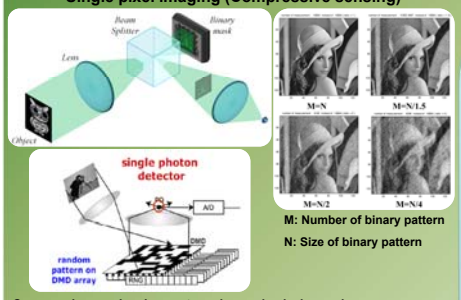
2 Dimensional Imaging system

Single pixel imaging (mechanical scanner)





Single pixel imaging (Compressive sensing)



M: Number of binary pattern

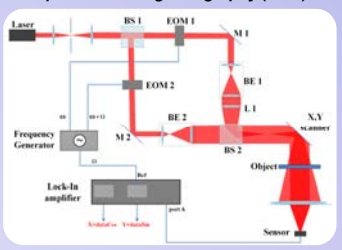
N: Size of binary pattern

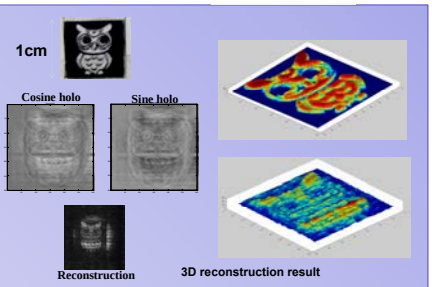
Compressive sensing does not require mechanical scanning.

Several measurement are taken for different binary pattern displayed by the SLM.

3 Dimensional Imaging system

Optical Scanning Holography (OSH)

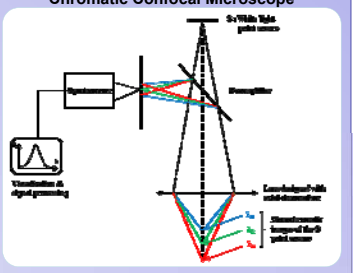




An optical wave is described by its amplitude and its phase. The principal of holography is to generate an interference pattern so that the intensity captured in a given plane contains both amplitude and phase information. It is then possible to reconstruct a 3D scene.

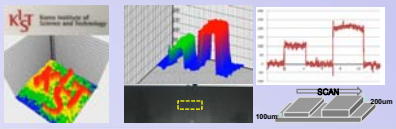
Optical scanning holography (OSH) is a technique to record complex hologram from a real object with a single pixel senor.

Chromatic Confocal Microscope

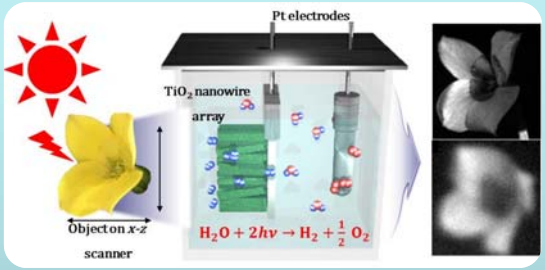


Chromatic confocal microscope : It is possible to use depth of focus generated in the microscope by using spectrometer

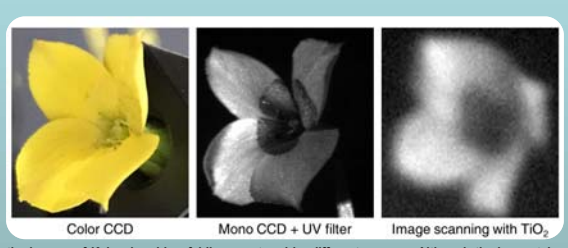
Single point confocal microscope + 2D linear stages → 3D imaging of the samples



Emulation of plant's vision by artificial photosynthesis



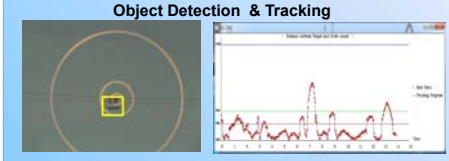
Artificial photosynthesis properties of TiO_2 nanowire array was exploited to emulate plant's vision



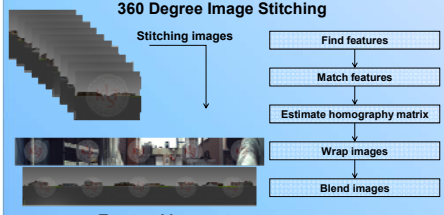
the images of Kalanchoe blossfeldiana captured by different sensors. Although the image taken by the proposed image scanning with the TiO_2 nanowire array presents lower resolution as compared to the images taken by the two different CCDs, the UV absorbing pattern is clearly seen.

2 Dimensional image processing

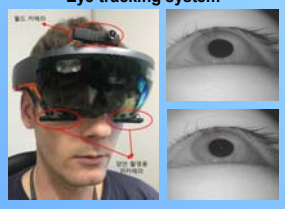
Object Detection & Tracking



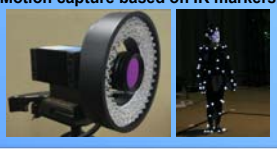
360 Degree Image Stitching



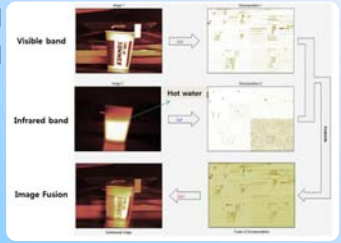
Eye tracking system



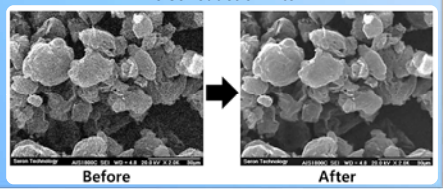
Motion capture based on IR markers



Multi-wavelength band fusion

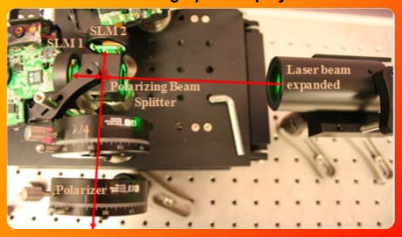


Noise reduction filter

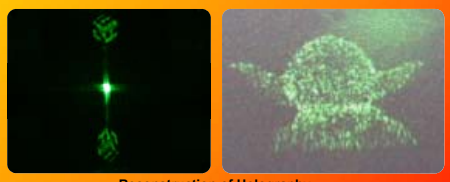


3 Dimensional contents display

Holographic display



Set-up for Reconstruction of Holography

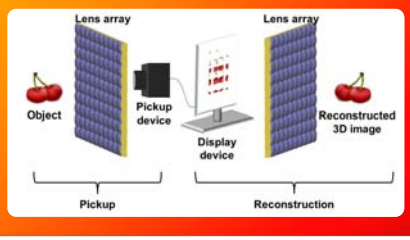


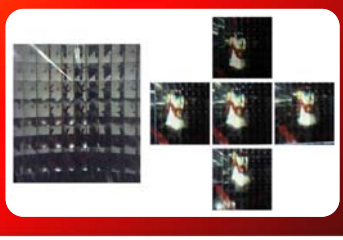
Reconstruction of Holography

In the reconstruction process, the hologram is illuminated by laser beam and this beam is called reconstruction beam. This beam is identical to reference beam used in construction of hologram.

The hologram acts a diffraction grating. This reconstruction beam will undergo phenomenon of diffraction during passage through the hologram. The reconstruction beam after passing through the hologram produces a real as well as virtual image of the object.

Integral imaging display





Conclusion

- 2D or 3D images can be obtained with a single pixel sensor by proposed several imaging systems.
- 2D/3D imaging system can be exploited to verify the imaging capability of prototype image sensors fabricated in laboratory level.
- Any types of photo sensitive sensors to various wavelength (from UV to IR) can be tested by a designed imaging system.
- Quality of primitive images obtained by the imaging system can be enhanced with various signal processing algorithms.