Flexible Imaging Technology Could Be Used in Next-Gen Endoscopes

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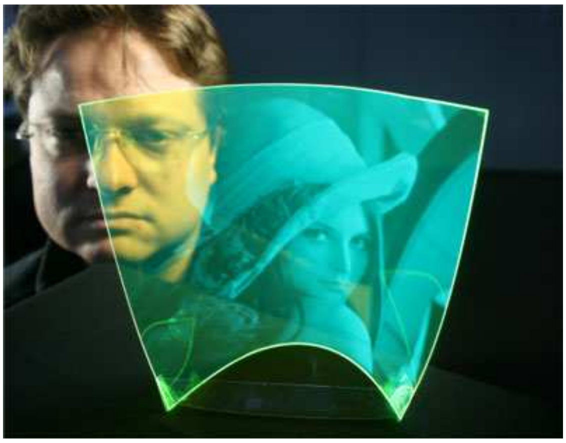
A group of Austrian researchers have developed a new imaging method that makes use of a transparent polymer sheet that is flat and flexible. Conversely, the majority of image sensors are rigid, planar, and opaque. In addition, the novel image sensor does not use integrated microstructures such as circuits.

Developed by scientists at Johannes Kepler University Linz, Austria, the research was recently summarized in an article in *Optics Express (http://www.opticsinfobase.org/oe/fulltext.cfm?uri=oe-21-4-4796&id=249381#r5)* . The thin-film luminescent concentrators (LCs) described in the article are doped with fluorescent dyes that absorb light of a certain wavelength (for instance, blue light), re-emitting it at a longer wavelength (for instance, green light).



The thin-film luminescent concentrator is flexible as well as transparent. The image depicts a Bayer Makrofol LISA Green LC film absorbing blue light and re-emitting it at a green wavelength.

In order to make the luminescent concentrator function as an imager, the researchers calculated where light struck across the film's surface by measuring the relative brightness of light reaching the sensor array. Calculating for light attenuation, they were able to measure the relative brightness of light reaching the sensor array.

In the article, Alexander Koppelhuber and Oliver Bimber explain how the grayscale imaging technology could be used in touchless user interfaces that respond to gestures. Such an application could be valuable for surgeons in the operating room, who are frequently unable to use touch-screen interfaces because of sterilization concerns. The polymer sheet could also be used as a sensor by wrapping them around objects. Because of the relatively low cost of the polymer film, the sensors could ultimately be disposable.

The researchers are also exploring the use of the conjunction with a high-resolution charge-coupled device. By generating two images simultaneously at different exposures, the sensors could be used to optimize the dynamic range or contrast of images.

Koppelhuber points out that luminescent concentrators could possibly be used as artificial receptive fields for building artificial human eyes. "The LC sheet can be brought into any shape (e.g. by deep-drawing). It would therefore be possible to mimic the shape of the human eye," he explained in an e-mail. "Thus, the LC could be used as an artificial retina that is able to restore peripheral vision."

In addition, the ability of the LCs to form hemispherical image sensors enables the creation of cameras that have a wider field of view with lower aberrations than conventional cameras. "This could help to build smaller endoscopes," Koppelhuber says. "It would also be possible to build a lens-less camera (a light field camera) by positioning two LC image sensors behind each other," he adds. "With this, it would be possible to even remove the lens from an endoscope."

Koppelhuber notes that there are ultimately many possible medical applications of the camera but stresses that the LC image sensors are still in an early research phase. While the researchers are not currently working on endoscopic cameras, they may incorporate them in their future work.

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