Breakthrough Leads To World's First Flexible, Flat, Fully Transparent Image Sensor

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Image Caption: This shows the world's first flexible and completely transparent image sensor. The plastic film is coated with fluorescent particles. Credit: Optics Express.

Brett Smith for redOrbit.com – Your Universe Online

Imaging sensors are typically rigid and opaque, but a team of scientists from Johannes Kepler University in Linz, Austria has developed a new imager based on a flat, flexible, transparent and potentially disposable polymer sheet.

"To our knowledge, we are the first to present an image sensor that is fully transparent – no integrated microstructures, such as circuits – and is flexible and scalable at the same time,"

said Oliver Bimber, who co-authored a report on the device that was recently published in the journal *Optics Express*.

The imager uses a polymer film known as a luminescent concentrator, which is permeated with small fluorescent particles that can absorb a particular wavelength of light and then re-emit it at a longer wavelength. For example, it can absorb blue light and re-emit green light.

While some of the re-emitted light is scattered out of the imager, a portion of it travels to the film's outer edges where it is captured by arrays of optical sensors. The sensors then send information to a computer that creates a gray-scale image.

For the luminescent concentrator to work, the scientists had to determine precisely how light was hitting the surface of the film. Because the polymer sheet isn't divided into individual pixels like a smartphone camera, the team needed to find a way to determine where exactly each ray of light entered the imager.

They found they could use light attenuation, or dimming, to construct an image. Because light traveling through the polymer film becomes dimmer the longer it travels, the team found that measuring the relative brightness of light when it reached the sensor array allowed them to calculate where it entered the film.

After scaling up the light attenuation principle using the sensor arrays, the scientists were able to reconstruct the captured image by using a technique similar to the one used in medical CT scanners.

"In CT technology, it's impossible to reconstruct an image from a single measurement of X-ray attenuation along one scanning direction alone," explained Bimber. "With a multiple of these measurements taken at different positions and directions, however, this becomes possible. Our system works in the same way, but where CT uses X-rays, our technique uses visible light."

The researchers believe that this new technology could have a wide range of uses, including a touch-free, transparent interface that would overlay a television, computer or smartphone. This could potentially allow users to control their devices using body gestures but without the need for built-in cameras or other motion-tracking devices.

The imaging film could also be wrapped around objects, giving them sensory and imaging capabilities. The researchers say they are also currently looking into attaching their new sensor to the front of a regular, high-resolution smartphone camera. This would allow for the capture of two images at the same time at two different exposures.

"Combining both would give us a high-resolution image with less overexposed or underexposed regions if scenes with a high dynamic range or contrast are captured," Bimber said. "I think there are many applications for this sensor that we are not yet aware of," he concluded.

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