A New Sensor Could Reduce the Cost of Groceries and Increase Farming Efficiency

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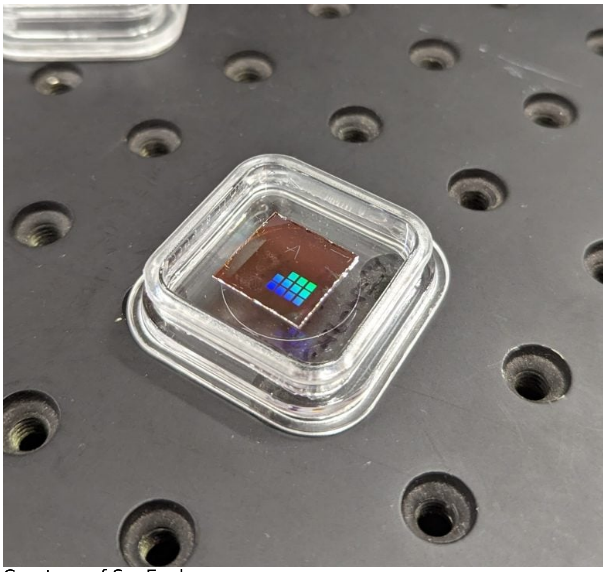
Courtesy of SynEvol

A lightweight, portable sensor system with infrared imaging capabilities that can be quickly installed on a drone for remote crop monitoring has been created by an international team of engineers.

In a number of industries, this flat-optics technology may take the place of conventional optical lens applications for environmental sensing.

Because farmers would be able to identify which crops need fertilization, irrigation, and pest control rather than adopting a one-size-fits-all strategy, this innovation may lead to lower grocery prices while also potentially increasing harvests.

The sensor system does not have to generate vast amounts of data or use heavy external computers in order to quickly flip between edge detection, which involves photographing the shape of an object, like a fruit, and extracting detailed infrared information.


Courtesy of SynEvol

When the remote sensor detects possible pest infestation locations, farmers may be able to gather additional information by switching to a comprehensive infrared image. This is a new breakthrough in the field.

Published in Nature Communications, this study was conducted by engineers from the ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), RMIT University, University of Melbourne, and City University of New York (CUNY).

TMOS Chief Investigator Professor Madhu Bhaskaran and her team at RMIT in Melbourne developed the prototype sensor system, which consists of a filter built with a thin layer of a substance called vanadium dioxide that can switch between edge detection and detailed infrared imaging.

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"The processed image shifts from a filtered outline to an unfiltered infrared image because the vanadium dioxide changes from an insulating state to a metallic one when the temperature of the filter is changed."

These materials have the potential to be very useful in the development of futuristic flat-optic devices that can take the place of technologies utilizing conventional lenses for environmental sensing applications. This makes them perfect for usage in satellites and drones, which have to be small, light, and power-efficient.

For its process of creating vanadium dioxide films, which could find use in a variety of fields, RMIT has been granted a US patent and is currently pursuing an Australian patent application.

The system's capacity to transition between processing tasks—from edge detection to taking in-depth infrared images—was important, according to lead author Dr. Michele Cotrufo.

The majority of the devices that have been demonstrated thus far are static, however a few recent demonstrations have used metasurfaces to perform analog edge detection. According to Corufo, a researcher at CUNY, "their functionality is fixed in time and cannot be dynamically altered or controlled."

However, in order for metasurfaces to compete with digital image processing systems, they must be able to dynamically alter processing activities. What we have created is this.

The University of Melbourne's Shaban Sulejman, a co-author, stated that the filter's design and materials allow for mass production.

It can quickly transition from research to practical use since it can integrate with commercially available systems and operates at temperatures that are consistent with regular production procedures.

Flat optics technologies have the potential to revolutionize numerous industries, according to Ann Roberts, the chief investigator of TMOS, who is also affiliated with the University of Melbourne.

For a long time, the barrier halting further device downsizing has been traditional optical elements. Thin-film optics' capacity to supplement or replace conventional optical elements allows for the removal of that barrier.