On a different wavelength: Scientists set out to create 'superspectral' camera

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A team of engineers is setting out to create the world's first camera sensor capable of 'seeing' across a wide range of wavelengths.

Backed by a grant of £1.5m from the Engineering and Physical Sciences Research Council (EPSRC), researchers from the University of Glasgow are starting four years of work to develop the 'superspectral' sensor, which could lead to new developments in security screening and medical imaging.

They aim to build for the first time a single chip which can resolve images from the mid-infrared (MIR), far-infrared (FIR) and visible areas of the electromagnetic spectrum. MIR sensors can provide thermal images of the heat radiated by a person or object; FIR can be used to probe for objects concealed under clothes or skin and visible light sensors capture images similar to those seen by the human eye.

Currently, separate sensors capable of providing information from each of these areas of the spectrum are widely available in consumer, medical and defence products such as digital cameras, clinical imaging devices and airport security scanners.

Professor David Cumming, who is leading the project, said: "The most striking development in optical imaging of the last 20 years has been the emergence of digital imaging using complementary metal oxide semiconductor (CMOS) technology. Camera technology has advanced rapidly, to the point where 10-megapixel sensors are available for £50 or less, and we're starting to see the same increase and quality and reduction in cost in infrared and far-infrared sensors.

"Researchers in our School of Engineering have been working on innovative sensor applications, and the University has recently announced it will be leading the new national Innovation Centre for Sensor and Imaging Systems. We believe we have the engineering expertise and facilities to make the world's first superspectral sensor."

A widely-used process known as 'sensor fusion' already allows data from traditional visible and mid infrared (MIR) sensors to be combined to provide more effective visualisation. The superspectral sensor will provide considerably improved imaging with a wide range of practical applications.

Professor Cumming added: "There are numerous applications for

superspectral sensors in medical imaging and security. For example, the FIR aspect of the sensor could be used to examine blood flow around a skin blemish to determine whether it's a harmless mole or a potentially dangerous cancer, and the MIR could provide visual feedback on a patient's temperature.

"Equally, the sensor could provide valuable feedback for workers in high-security spaces such as airports, where FIR could identify any items under clothes which require further investigation and the visible light capabilities could contribute to facial recognition systems."

The team plans to hybridise two semiconductor systems to integrate efficient photodiode sensors for visible and MIR detection and integrate boletric sensing for FIR imaging. Design and packaging technologies will be used for thermal isolation and to optimise the performance of each sensor type. Hybridised metamaterial and surface plasmon resonance technologies will optimise wavelength discrimination, allowing vertical stacking of physically large FIR sensors with visible and MIR sensors.

Provided by University of Glasgow