

Engineering team designs novel multi-field invisible sensor

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A team of researchers from the National University of Singapore (NUS) has invented a novel camouflage technique that effectively hides thermal and electronic sensors without compromising performance. Led by Assistant Professor Qiu Cheng-Wei from the Department of Electrical & Computer Engineering at NUS Faculty of Engineering, the team created the world's first multifunctional camouflage shell that renders sensors invisible in both thermal and electric environments.

Current technologies which make [sensors](#) 'invisible' usually also make them ineffective, while others only work in specific physical fields (i.e. either thermal or electrical). Over the past ten months, the NUS team has experimentally demonstrated that they could hide sensors in both thermal and electric fields without them being detected. The invisible sensors are also able to continue to probe on the environment while 'under cover'.

Asst Prof Qiu explained, "We have designed a camouflage 'shell' that not only mimics surrounding thermal fields but also electric fields, both at the same time. The object under camouflage becomes truly invisible as its shape and position cannot be detected in terms of both thermal and electric images."

In their experiment, they created an ideal invisible sensor by covering it with a thin shell which is made of pure copper. The shell is designed to drastically reduce the perturbation of heat flux and electric current simultaneously. The thickness of the shell is fabricated based on detailed

calculations to allow precise manipulation of external multi-physical fields to insulate the sensor and hence render it invisible and yet allows it to receive incoming signals from outside.

"Our camouflaging shell will open up a new avenue for advanced sensing and security systems. Sensors which are used to monitor current and heat flow in strong voltage or high temperature environments are easily damaged. Our camouflaging shell hence protect such sensors from the harsh environment and at the same time enhance the accuracy of the hidden sensor, as the shell will eliminate any distortion around the sensor. This attribute is significant in our study of other applications such as using the camouflaging shell on special mission fieldtrips. The team is also working on developing multifunctional invisible sensors that have instantaneous stealth ability," added Dr Qiu.

Drawing a comparison with the chameleon, from which the team had drawn inspiration to develop the novel camouflaging shell, Dr Qiu said, "The skin of a chameleon is made up of several layers of specialised cells containing various pigment while the outermost layer is transparent. The cells beneath the skin change colour based on light intensity and temperature as well as the chameleon's mood. Our team's invention can be seen as an improved "skin" for the chameleon such that it will become invisible when it appears in front of thermal and electric signal detectors!"

Provided by National University of Singapore

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