Researchers develop high-resolution, high-sensitivity proximity capacitance imaging sensor
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A fingerprint can serve as identification to access locked doors and more, but current scanners can be duped with fake or even similar fingerprints. That may change soon, thanks to a collaborative research team based in Japan.

The group has developed a new proximity capacitance imaging sensor that has such high sensitivity and resolution that a fingerprint scan shows more than the swirls of a fingertip—it detects the sweat pores between the ridges.

The prototype sensor was first presented in December at the 2018 IEEE International Electronic Devices Meeting in San Francisco, California. A paper describing the details of the sensor was published in the Technical Digests of 2018 International Electron Devices Meeting. Last week, the authors presented new materials and results from the study at a conference organized by the Institute of Image Information and Television Engineers (ITE) in Japan.

"The most significant point of the developed sensor is its high capacitance sensitivity," said paper author Shigetoshi Sugawa, a professor in the Graduate School of Engineering at Tohoku University.

Many touchscreen phones and computer trackpads use a less sensitive capacitance sensor, where the differences in electrical properties between a sensor and a conductive tool (such as a finger) allow the device to react to scrolling or double clicking. The capacitance increases when the object is closer—the double-click versus lighter scrolling.

The high sensitivity of this capacitance sensor is derived from newly introduced noise reduction technology, according to Sugawa.

The sensor chip contains pixels to detect the capacitance between the sample and detection electrodes. Each pixel has one detection electrode
attached to it that's capacitively coupled with a
ground wire. These electrical signals are converted
into images of the samples. Previously, the signals
would pick up background noise such as thermal
noise and noise due to variability of electrical
components of pixels, which made for lower-quality
images.

To fix this, the researchers applied reset switches
to the detection electrodes and employed a voltage
pulse to produce a circuit that can follow the source
of noise. The reset switches allow the systems to
detect noise arising at the detection electrodes. The
voltage pulse alternates the two voltage levels after
the reset switches are turned off, effectively
cancelling out and removing noise from the system.

"This development is important to the general
public because it can improve the efficiency of
analysis and control in the fields of electronic
industry, authentication, life sciences, agriculture,
and more," Sugawa said.

Next, Sugawa and the researchers plan to optimize
the sensor for specific applications, such as the non-
contact inspection equipment of printed circuit
boards and flat panels as well as a portable camera
system with the developed sensor chip.

The research team consists of Sugawa, as well as
Rihito Kuroda, an associate professor, Masahiro
Yamamoto, Manabu Suzuki, graduate students
both with the Tohoku University's Graduate School
of Engineering; Tetsuya Goto, an associate
professor with Tohoku University's New Industry
Creation Hatchery Center; Hiroshi Hamori,
president, Shinichi Murakami and Toshiro Yasuda,
at OHT, Inc.

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Capacitance Image Sensor with 16?m Pixel Pitch,
0.1aF Detection Accuracy and 60 Frames Per
Second
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