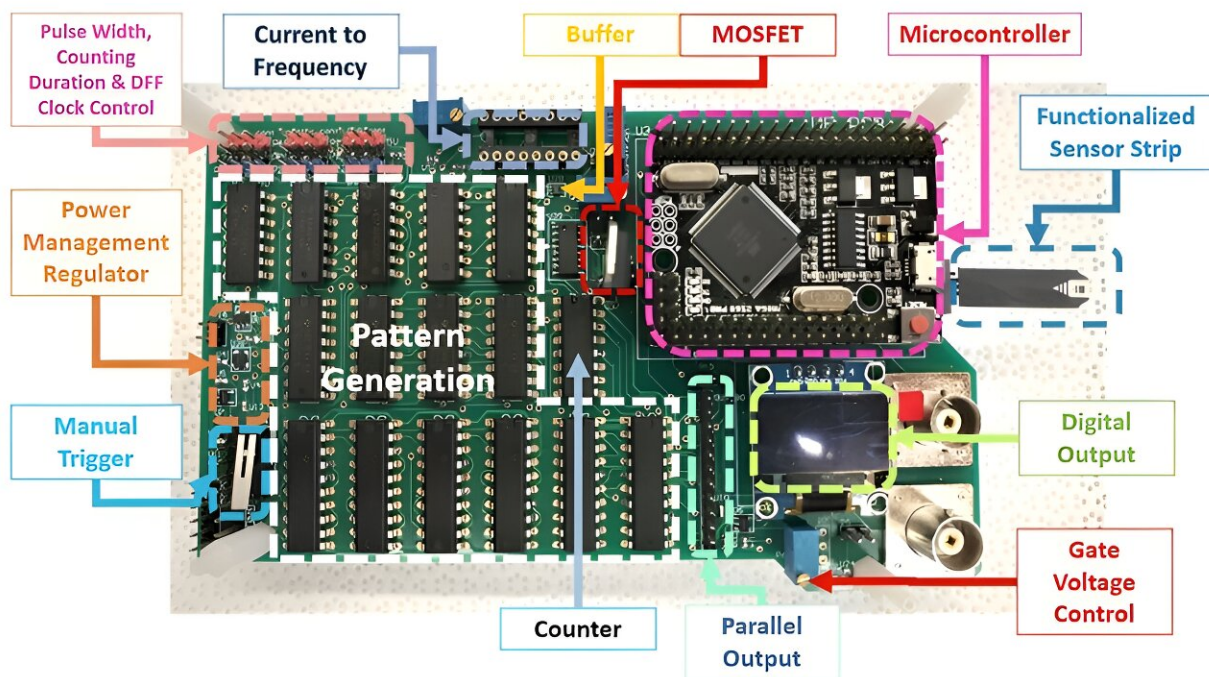


# Hand-held biosensor using saliva sample makes breast cancer screening fast, affordable, and accurate

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The printed circuit board used in the saliva-based biosensor, which can detect breast cancer biomarkers from extremely small saliva samples in about five seconds, costs about \$5. The design uses widely available components such as common glucose testing strips and the open-source Arduino platform. Credit: Hsiao-Hsuan Wan

Breast cancer is on the rise, but new tools for early detection could save lives. In *Journal of Vacuum Science & Technology B*, researchers from the University of Florida and National Yang Ming Chiao Tung University in Taiwan reported successful results from a hand-held breast cancer screening device that can detect breast cancer biomarkers from a tiny sample of saliva.

Their biosensor design uses common components, such as widely available glucose testing strips and the open-source hardware-software platform Arduino.

"Imagine [medical staff](#) conducting breast cancer screening in communities or hospitals," author Hsiao-Hsuan Wan said. "Our device is an excellent choice because it is portable—about the size of your hand—and reusable. The testing time is under five seconds per sample, which makes it highly efficient."

The device uses paper [test](#) strips treated with specific antibodies that interact with the targeted cancer biomarkers. A [saliva sample](#) is placed on the strip, and pulses of electricity are sent to electrical contact points on the biosensor device. These pulses cause the biomarkers to bind to the antibodies and alter the charge and capacitance over the electrode. This produces a change in the [output signal](#), which can be measured and translated into [digital information](#) about how much biomarker is present.

The design is revolutionary compared to its alternatives. Mammograms, ultrasounds, and MRIs are costly and invasive and require large, specialized equipment, present low-dose radiation exposure, and can take days or weeks to return test results.

"In many places, especially in developing countries, advanced technologies like MRI for breast cancer testing may not be readily available," Wan said.

"Our technology is more cost-effective, with the test strip costing just a few cents and the reusable circuit board priced at \$5. We are excited about the potential to make a significant impact in areas where people might not have had the resources for [breast cancer](#) screening tests before."

The biosensor requires just a drop of saliva, and it can provide accurate test results even if the concentration of the cancer [biomarker](#) in the sample is only one quadrillionth of a gram, or one femtogram, per milliliter.

"The highlight for me was when I saw readings that clearly distinguished between healthy individuals and those with cancer," Wan said. "We dedicated a lot of time and effort to perfecting the strip, board, and other components. Ultimately, we've created a technique that has the potential to help people all around the world."

**More information:** High sensitivity saliva-based biosensor in detection of breast cancer biomarkers: HER2 and CA15-3, *Journal of Vacuum Science & Technology B* (2024). [DOI: 10.1116/6.0003370](https://doi.org/10.1116/6.0003370)

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