Point-of-care biosensor rapidly detects oral cancer

December 13 2022

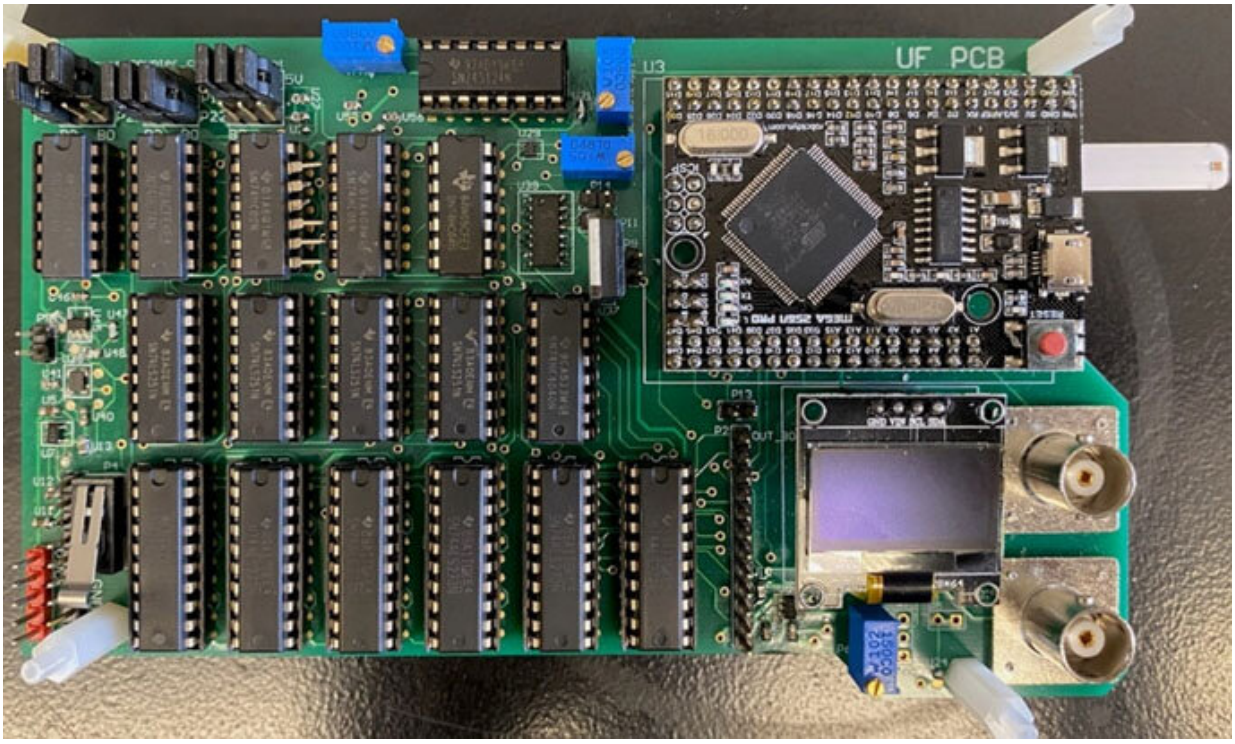

Photo of the group's circuit board for the biosensor. Credit: Minghan Xian, Jenna L. Stephany, Chan-Wen Chiu, Chao-Cing Chiang, Fan Ren, Cheng-Tse Tsai, Siang-Sin Shan, Yu-Te Liao, Josephine F. Esquivel-Upshaw, and Stephen J. Pearton

Oral cancer is the 13th most common type of cancer globally, and oral squamous cell carcinomas (OSCCs) account for more than 90% of oral

cancers. An estimated 300,000 new cases and 145,000 deaths worldwide were attributed to oral cancer in 2012.

Since oral cancer occurs in one of the most accessible sites in the body, it can be easily treated if detected promptly. If caught early in the disease state, oral cancers that remain localized and are 2 centimeters or smaller can be cured and five-year survival rates exceed 90%.

In the *Journal of Vacuum Science & Technology B*, researchers from the University of Florida and National Yang Ming Chiao Tung University in Taiwan report a breakthrough hand-held biosensor that enables quick and accurate detection of oral cancer.

"Oral squamous cell carcinomas are one of the most common lip and oral cavity cancer types," said Minghan Xian, co-author and a researcher at the University of Florida. "It requires early detection via various medical technologies to improve the survival rate. While most detection techniques for OSCC require histological testing in a lab to confirm the presence of cancer and cancer type, a point-of-care detection technique is preferred for on-site use and a quick result readout."

The group's biosensor consists of a sensor strip, similar to a glucose strip, and a circuit board (a hand-held terminal like a glucometer) for detection.

"Typically, test fluid is introduced into a small liquid channel on the tip of the sensor strips," said Xian. "A few electrodes sit within the liquid channel, and the surface of these electrodes contain antibodies to specific proteins present within human oral cancer lesions. Short electrode pulses get sent through these electrodes during detection, and then the circuit board module analyzes this signal and outputs a four-digit number that correlates to its concentration."

As far as applications, there's tremendous interest within the sensor and medical communities to develop semiconductor- and electrochemical-based biomarker detection. The team is now looking forward to demonstrating their integrated solution for cancer and other disease detection via a hand-held point-of-care device with a short detection time and low detection limit. They also hope their work will inspire further research into this topic.

"The next step in this continuum is to conduct the analysis using in vivo samples of CIP2A—a biomarker of OSCC—in oral cancer and non-oral cancer patients with biopsy as a gold standard," said Xian.

The article, "High sensitivity CIP2A detection for oral cancer using a rapid transistor-based biosensor module," was published in the *Journal of Vacuum Science & Technology B* on Dec. 13, 2022.

More information: High sensitivity CIP2A detection for oral cancer using a rapid transistor-based biosensor module, *Journal of Vacuum Science & Technology B,* DOI: 10.1116/6.0002175

Provided by American Institute of Physics