



(From left) Doctoral student Ananta Narayanan Balaji, wearing the pH Watch, with Assistant Professor Shao Huilin, Dr Wang Bo and doctoral student Chen Yuan, who is holding the pulse oximeter and pH sensor. The team of researchers from the National University of Singapore created the device after a year of research. ST PHOTO: MARCELLIN LOPEZ

Track your health with sensor integrated into smartwatch? No sweat

Adeline Leong

Less than a drop of sweat is needed for a newly developed pH sensor to tell if the user is dehydrated, low on sugar or at risk of skin infection, by measuring how acidic or alkaline the sweat is.

The device, comprising a colour-changing pH sensor that is read and interpreted by an algorithm, was created by a team of five researchers from the National University of Singapore (NUS) after a year of research.

Doctoral student Ananta Narayanan Balaji from NUS' Department of Electrical and Computer Engineering and the team came up with a system prototype, named the pH Watch, which integrates the pH sensing function into a smartwatch with an inbuilt pulse oximeter.

Measuring 2x2cm and 4mm thick, its pH sensor is fabricated from polyaniline – an inexpensive, durable and flexible plastic that changes colour when it comes into contact with different sweat pH.

“Sweat is a readily accessible bodily fluid composed of a wide array of biochemical markers that can be used to monitor the well-being of individuals in a non-invasive manner,” said Mr Ananta, 25.

He also wrote the algorithm that analyses the colour changes of the pH sensor and interprets them into the pH level of the sweat, displayed on a mobile phone app he created.

Costing less than a dollar to manufacture, the sensor can be integrated easily into existing fitness trackers and smartwatches at a low cost, and offers round-the-clock, personalised and non-invasive assessment of the user's well-being.

The pH Watch leverages on the existing pulse oximeter chip in the smartwatch to simultaneously monitor a user's heart rate, blood oxygen saturation value and sweat pH value in real time.

A pulse oximeter uses light sensors to detect the heart rate and oxygen saturation levels. It can also detect the colour changes of the pH sensor, and this data is then inter-

preted by an algorithm to measure sweat pH. The team said the pH reading has a 91 per cent accuracy.

Adding the pH sensing function to a fitness tracker or smartwatch will have little impact on its battery life, as the pH sensor material does not require a power source, and the algorithm uses less than 0.01 per cent of the total power consumption of a smartwatch, said Mr Ananta.

The sensor can be readily added to any wearable device – say, an arm band, chest strap or headband – positioned under the pulse oximeter, in contact with the skin.

The researchers said that as far as they know, this is the first pH sensor that can be integrated into smartwatches with pulse oximeters. As polyaniline is washable, the sensor is suitable for long-term daily use of up to a year.

“A balanced pH is essential for skin health. If our skin is too acidic or alkaline, skin conditions such as dermatitis and acne can occur,” said Mr Ananta. “When the body is dehydrated, there will be an increase in the concentration of sodium in sweat, which is indicated by a higher pH value,” he explained.

The team has begun talking to manufacturers, and hopes to see the integration of the pH sensor into existing fitness as well as new-generation trackers and smartwatches within three years.

adeleong@sph.com.sg