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'Spider-Man suit' can track posture, temperature, fatigue

NUS researchers tap smartphone to power suit and display data from sensors in outfit

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Researchers from the National University of Singapore (NUS) have developed a smartphone-powered suit that can track one's temperature, posture and movements at the same time.

Bearing a close resemblance to Spider-Man's costume, the suit's design consists of a recurring pattern of web-like threads, which are key in connecting the smartphone to sensor chips placed around the body.

Sewn with conductive silver threads, the patterns act as hubs relaying the smartphone's near-field communication signal to the selected locations around the body.

Assistant Professor John Ho, who led the team of researchers from the NUS Institute for Health Innovation and Technology, said: "Our smart suit works with most modern smartphones, which act as both the source of power as well as the display to view the sensor data.

"The creation of a smart suit which can be powered using built-in smartphone wireless technology is a major breakthrough."

The research findings were published in scientific journal Nature Communications in January.

To better understand and experience the novelty of this technology, I wore the smart suit.

The complete prototype suit has three separate pieces – a jumper, a dry-fit tee and a pair of tights, all of which are able to support up to six sensors at the same time.

I started with the jumper.

Orange-coloured sensor chips were then stuck to circular hubs located around the suit.

To activate the sensors, the smartphone has to be carefully aligned to the suit's epicentre, which is the largest hub located prominently across the chest.

The phone buzzed and the LED lights on the sensors turned blue, indicating that the connection was successful.

I checked my temperature by gently pressing the sensor node with my index finger.

I observed a graph on the phone app as the sensor monitored my body temperature. It climbed steadily and eventually peaked at 34 deg C.

This is because our body temperature, when taken from the fingers, tends to be a little lower than usual.

The complete prototype suit has three separate pieces – a jumper, a dry-fit tee and a pair of tights.
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Next, I tried a running gait function, which tracked my movements over time and detected any signs of fatigue.

To activate these sensors, the smartphone was placed in a pocket behind my right thigh where the hub was located, and the sensors on my tights lit up.

To mimic running movements, I bent my knee repeatedly, and the data was recorded on the app.

Prof Ho explained that the sensors are able to continuously record data during the span of a run, and detect any variability in one's running stance.

High variability would indicate possible fatigue and over-exertion.

Finally, I looked at my spinal posture.

I changed into the dry-fit tee, which has a small pocket on its right sleeve where the phone is placed.

A sensor chip was stuck onto the back of my neck to facilitate easy demonstration.

As I bent my neck repeatedly, the app continuously tracked and recorded my movements.

Ideally, the suit should be used to monitor one's posture over the course of a day, with sensors placed along the spine to detect how frequently the back bends, giving an indication of posture.

This can help clinicians better understand patients who face chronic back pain, using the insights for diagnosis and treatment, said Prof Ho.

The team is looking to improve the app interface so that all sensor data can be displayed at the same time for easy tracking.

The researchers also plan to develop new sensors to increase the range of data collection, including for sweat detection, which indicates possible dehydration, and blood oxygen levels to detect early signs of respiratory distress.

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