Staying Connected

This connector links modules in soft, flexible electronics without breaking or losing electrical conductivity, even when heavily deformed.

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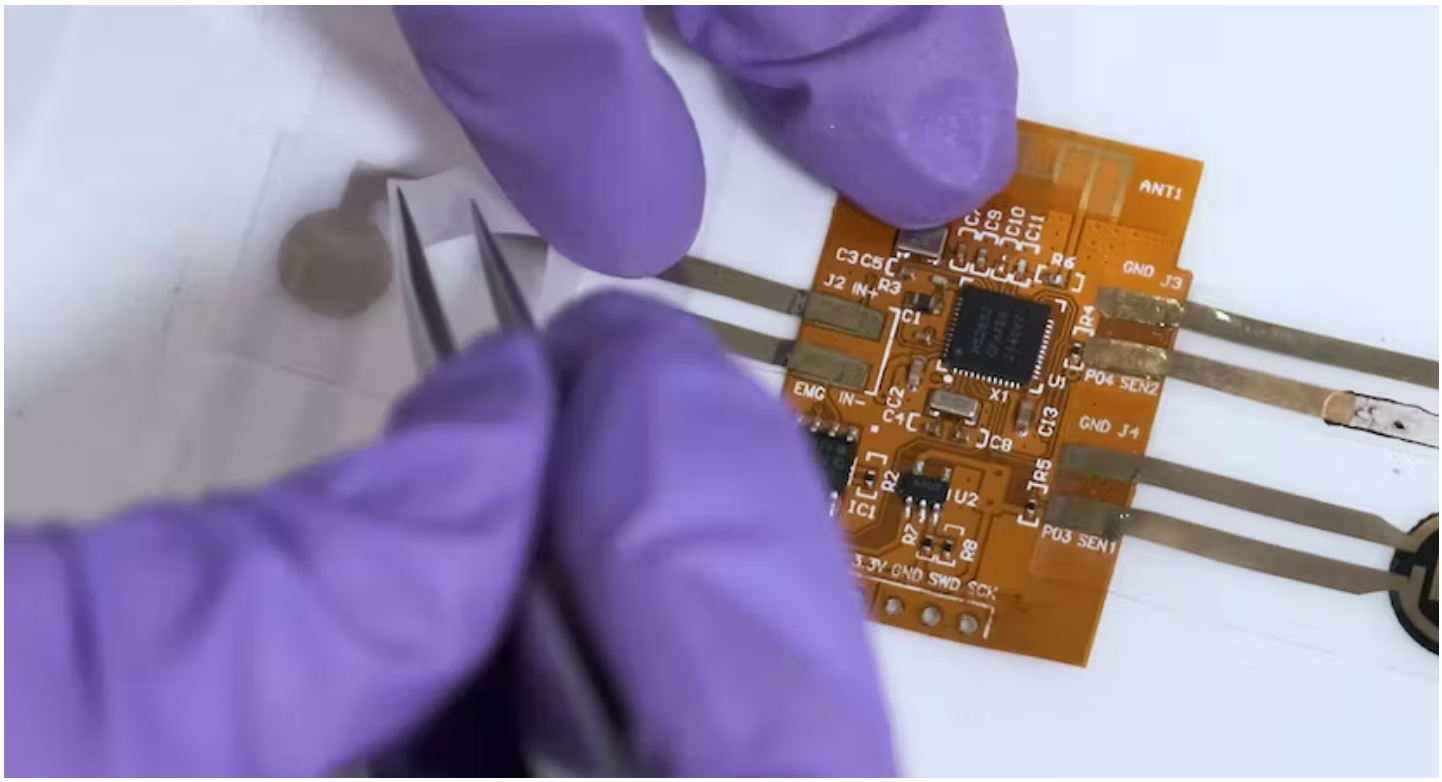

Connecting modules with a BIND interface (📷: Nanyang Technological University)

Soft, stretchable, wearable electronic devices are designed to conform to the contours of the human body, making them more comfortable to wear and less invasive than traditional electronic devices. There are many important uses for this technology — one of the most promising use cases for soft electronic devices is in the field of healthcare. These devices can be used to monitor a patient's vital signs, such as heart rate and blood pressure, and transmit that data to a healthcare provider in real-time. Another potential use case for these devices is in the field of fitness and sports, where they can help individuals track their fitness progress and improve their performance.

But yet, it is fairly rare that soft, flexible electronic wearables are actually seen in the wild. This is clearly not due to a lack of utility, but rather, it is due in large part to the challenges associated with integrating traditional silicon-based electronics with soft, pliable substrates. One area in particular that has presented many challenges is in creating strong, stable interconnects between modules. Complex devices are commonly constructed from multiple modules, each performing a specific set of tasks. But creating soft connections that are mechanically strong, electrically conductive, and durable is easier said than done.

A team led by researchers at the Nanyang Technological University, Singapore has just published the results of their research on stretchable, universal connectors for use in soft wearables and soft robotics, and it looks like it might be what the field needs to take a step forward. Where present commercial solutions fail by breaking or failing to transmit electrical signals when deformed, this new connector stays strong and reliable. And making the connections is as easy as pressing the connectors together with your finger.

The connectors can stretch without breaking (📷: Nanyang Technological University)

The researchers dubbed their creation the BIND (biphasic, nano-dispersed) interface (https://techxplore.com/news/2023-02-lego-like-universal-connector-stretchable-devices.html). To manufacture a BIND interface, conductive gold or silver nanoparticles are embedded in a thermoplastic called styrene-ethylene-butylene-styrene, which is commonly used in stretchable electronics. This creates a robust interpenetrating nanostructure of conductive material inside the connector that maintains end-to-end connectivity even when it is deformed significantly.

BIND connections can be stretched over seven times their original size without breaking, and electrical conductivity remains intact when stretched up to 2.8 times normal length. Connections between modules are also quite strong, with tests showing that the attachment points were 60 times tougher than conventional connectors. It was also discovered that these properties held true whether it was soft, rigid, or encapsulated modules that were being linked by the BIND interface, showing it to be versatile and able to adapt to a wide range of applications.

The technology was put through its paces under real-world conditions in a series of tests where devices were attached to both rat and human skin. High-quality electromyography signals were captured from human subjects, proving that electrical connections remained stable, even when they were being flexed during exercise, or were submerged under water. Further, the validation tests involving rats showed the durability of the system even when it is being tugged at or bumped.

Given the durability and electrical stability of the design, and the fact that modules can be easily connected together just by pressing on a BIND connector for a few seconds, it appears as though the researchers have achieved their goal of creating a plug-and-play system for soft wearable device interconnections.