Novel 3D stretchable electronic strip could spark new possibilities for wearable e-textiles

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The strip's 3D structure transforms it from flexible to stretchable. Credit: Nottingham Trent University

Researchers have developed a novel 3D stretchable electronic strip which is expected to open up a range of new possibilities in wearable

electronic textiles.

A team at Nottingham Trent University's Medical Technologies Innovation Facility has led the work, which has paved the way for a new generation of electronic devices which could be embedded in clothing for possible use in health care and elite sports settings.

The research, which also involved industry partner Kymira Ltd, is published in *Scientific Reports*.

The researchers argue that the new strip has significant benefits and functionality over existing technologies due to its ability to stretch and bend with the body.

The strip's 3D structure, whereby the circuitry is twisted to form a helical ribbon, transforms it from flexible to stretchable with the ability to bend in multiple directions—rather than just one—and stretch up to at least half its initial size.

Stretchability is considered important because many textiles are stretchable, such as medical compression garments or sportswear, where clothing must not restrict the wearer's movement.

The researchers demonstrated LED and temperature sensing helical e-strips as part of the study. A rubber cord supports the structure and helps to prevent damage from buckling and consideration was given to compatibility with clothing and washability.

"We have been able to show the potential for a new form of 3D helical strip for embedded electronics in e-textiles," said Dr. Yang Wei, an expert in electronic textiles and electronic engineering at Nottingham Trent University and the principal investigator of the research.

He said, "We have defined the design, developed prototypes, performed mechanical testing and validated the functionality of the concept. This opens up a range of new possibilities for e-textiles for possible future use in health care and elite sports settings."

Lead author Jessica Stanley, a research fellow in the university's Medical Technologies Innovation Facility and Department of Engineering, said, "The basic idea has been around for centuries; it's the same concept as taking a metal wire and making it stretchy by winding it into a spring.

"While helices have already been used in stretchable electronic devices, up to now they have only been used as interconnects—wires that connect parts of a circuit—or single components.

"What sets our work apart is that strips of flexible circuitry containing small components, circuits more complex than a single wire or printed component, are wound into a helix, so that the entire circuit can stretch.

"Because many e-textile products need to be stretchy it is important to have stretchable electronic parts that can move and stretch with the fabric. This study documents our initial work on a new way to achieve this."

The technology has been patented which it is hoped will allow for faster uptake by industry.

More information: Jessica Stanley et al, Stretchable electronic strips for electronic textiles enabled by 3D helical structure, *Scientific Reports* (2024). DOI: 10.1038/s41598-024-61406-7

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