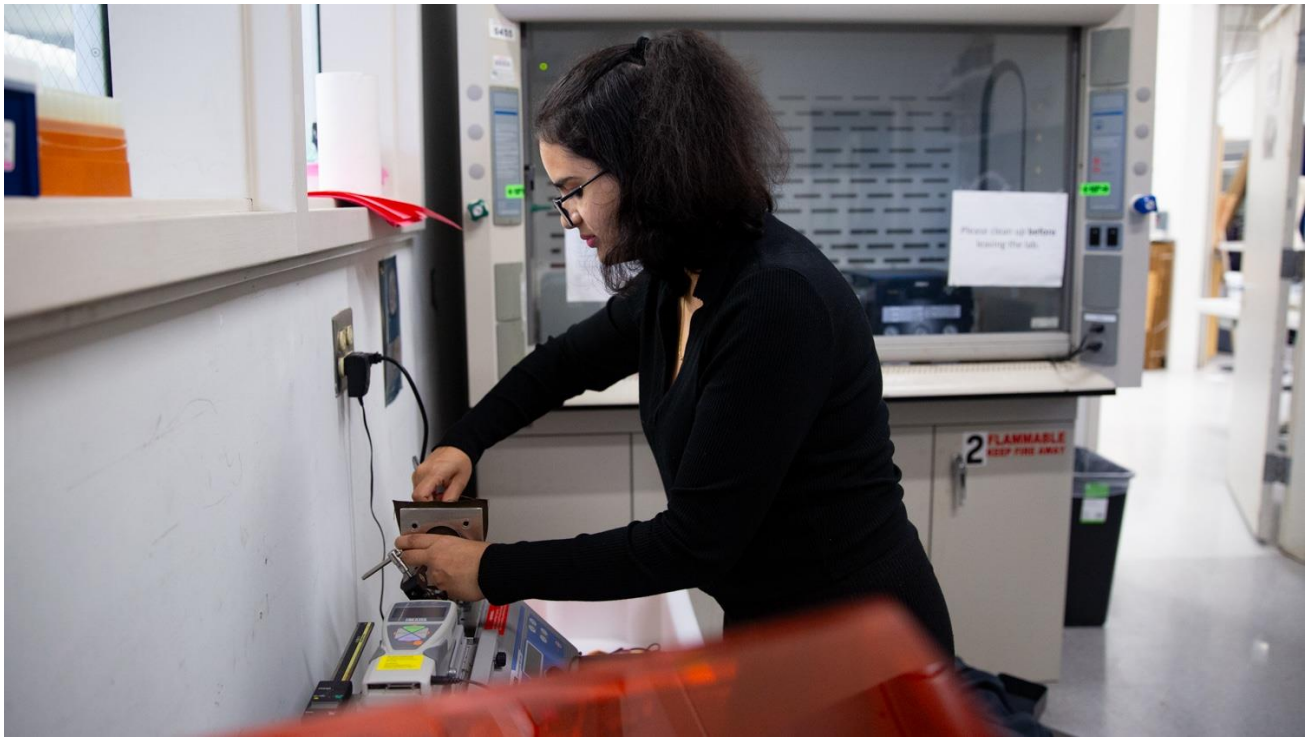
NC STATE UNIVERSITY **Wilson College News**

What comes to mind when you think about “wearable technology?” In 2023, likely a lot, at a time when smartwatches and rings measure heart rates, track exercise and even receive text messages. Your mind might even drift to that “ugly” light-up sweater or costume you saw last Halloween or holiday season.

At the Wilson College of Textiles, though, researchers are hard at work optimizing a truly new-age form of wearable technology that can be proven useful in a wide range of settings, from fashion and sports to augmented reality, the military and medicine

Currently in its final stages, this grant-funded project could help protect users in critical situations, such as soldiers on the battlefield and patients in hospitals, while simultaneously pushing the boundaries of what textiles research can accomplish.



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“The goals set for this research are quite novel to any other literature that exists on wearable connectors.”

Shourya Dhatri Lingampally

Minyoung Suh
Assoc Professor

"The goals set for this research are quite novel to any other literature that exists on wearable connectors" says Shourya Dhatri Lingampally, Wilson College of Textiles graduate student and research assistant involved in the project alongside Wilson College Associate Professor Minyoung Suh.

Ongoing since the fall of 2021, Suh and Lingampally's work focuses on textile-integrated wearable connectors, a unique, high-tech sort of "bridge" between flexible textiles and external electronic devices. At its essence, the project aims to improve these connectors' Technology Readiness Level — a key rating used by NASA and the Department of Defense used to assess a particular technology''s maturity.

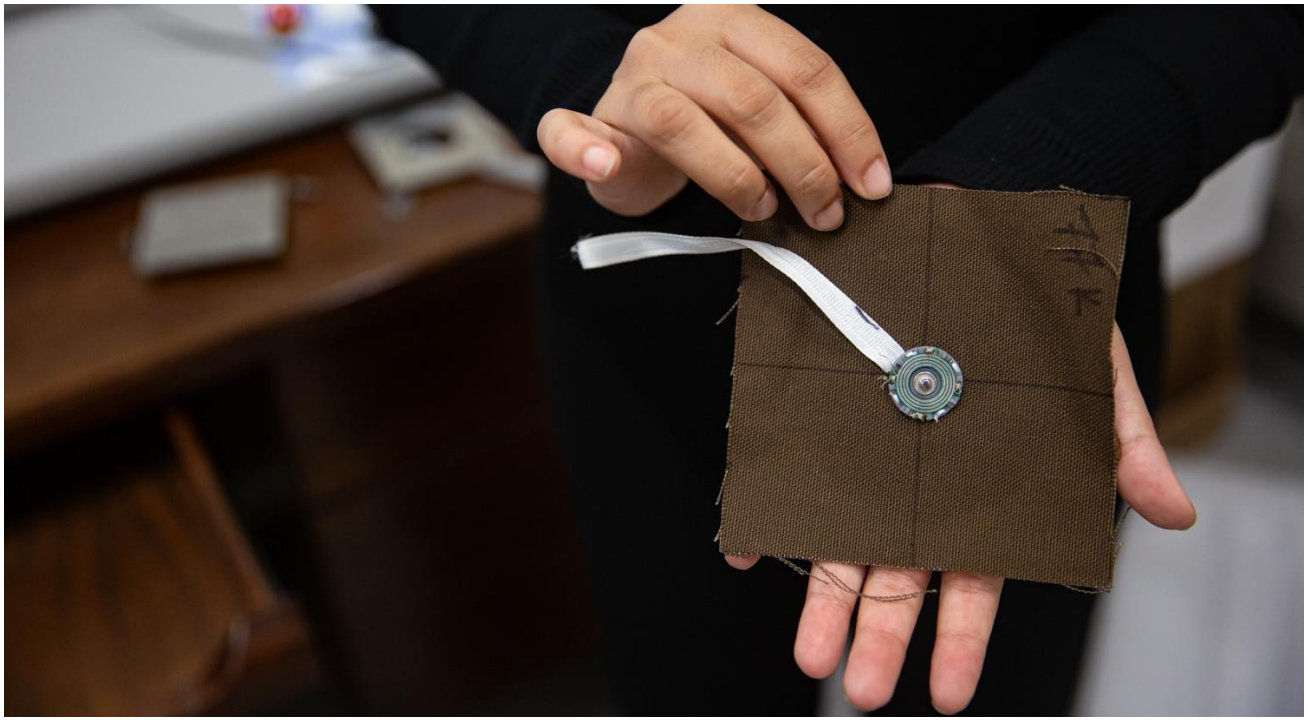
To do this, Lingampally and her colleagues' research examines problems that have, in the past, affected the performance of wearable devices.

Sure, these advances may benefit fashion, leading to eccentric shirts, jackets, or accessories — "to light up or change its color based on the wearer's biometric data," Lingampally offers — the research has roots in a much deeper mission.

Potential benefits to military, medicine and beyond

The project is funded through more than $200,000 in grant money from Advanced Functional Fabrics of America (AFFOA), a United States Manufacturing Innovation Institute (MII) located in Cambridge, Massachusetts. The mission of AFFOA is to support domestic manufacturing capability to support new technical textile products, such as textile-based wearable technologies.

A key purpose of the research centers around improving the functionality of wearable monitoring devices with which soldiers are sometimes outfitted to monitor the health and safety of their troops remotely.



Lingampally shows the snap she developed with Associate Professor Minyoung Suh in order to make health monitoring devices easier to wear. © NC State

Similar devices allow doctors and other medical personnel to remotely monitor the health of patients even while away from the bedside.

Though such technology has existed for years, it's too often required running wires and an overall logistically-unfriendly design. That could soon change.

"We have consolidated the electronic components into a small snap or buckle, making the circuits less obtrusive to the wearer," Lingampally says, explaining the team's innovations, which include 3D printing the connector prototypes using stereolithography technology.

"We are trying to optimize the design parameters in order to enhance the electrical and mechanical performance of these connectors," she adds.

To accomplish their goals, the group collaborated with NC State Department of Electrical and Computer Engineering Assistant Research Professor James Dieffenderfer. The team routed a variety of electrical connections and interconnects like conductive thread, epoxy and solder through textile materials equipped with rigid electronic devices.

They also tested the components for compatibility with standard digital device connections like USB 2.0 and I2C.

Ultimately, Lingampally hopes their work will make wearable technology not only easier and more comfortable to use, but available at a lower price, too.

"I would like to see them scaled, to be mass manufactured, so they can be cost efficient for any industry to use," she explains.

In a bigger-picture sense, though, her team's work is reinforcing the far-reaching boundaries of what smart textile research can accomplish; a purpose that stretches far beyond fashion or comfort.

Pushing the boundaries of textiles research

Suh and Lingampally's work is just the latest breakthrough research originating from the Wilson College of Textiles that's aimed at solving critical problems in the textile industry and beyond.

"The constant advancements in technology and materials present immense potential for the textile industry to drive positive change across a range of fields from fashion to healthcare and beyond," Lingampally, a graduate student in the M.S. Textiles program, says, noting the encouragement she feels in her program to pursue innovation and creativity in selecting and advancing her research.

Additionally, in the fiber and polymer science doctoral program, which Suh does research with, candidates focus their research on a seemingly endless array of STEM topics, ranging from forensics to medical textiles, nanotechnology and, indeed, smart wearable technology (just to name a few).

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In this case, Suh says, the research lent itself to “unexpected challenges” that required intriguing adaptations “at every corner.” But, ultimately, it led to breakthroughs not previously seen in the wearable technology industry, attracting interest from other researchers outside the university, and private companies, too.

“This project was quite exploratory by nature as there hasn’t been any prior research aiming to the same objectives,” Suh says.

Meanwhile, the team has completed durability and reliability testing on its textile-integrated wearable connectors. Eventually, the group would like to increase the sample size for testing to strengthen and validate the findings. The team also hopes to evaluate new, innovative interconnective techniques, as well as other 3D printing techniques and materials as they work to further advance wearable technologies.

Source: North Carolina State University, Sean Cudahy