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Wearable: Researchers say metallic threads provide better reception

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By Dylan Tussel

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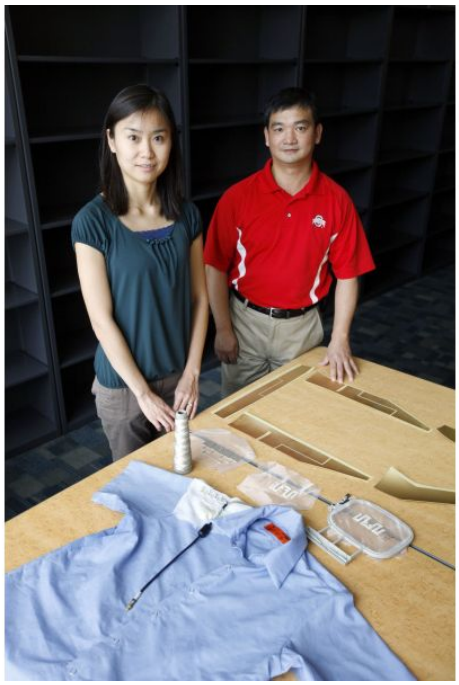
Metal is in.

Within the next few years, many people might wear shirts laced with metallic threads that provide reception for mobile devices, researchers say.

"In essence, these are a new class of antennas that can be woven into our clothes," said John Volakis, an Ohio State University researcher developing fibers that could aid military personnel, firefighters and other emergency first-responders.



Researchers Zhang, left, and Chi-Chih Chen say their antennas could benefit soldiers and first-responders.

Researchers say this type of antenna would have better reception — the prototype's signal was 10 times better than traditional radio devices — and could be concealed within clothing and other machine-washable fabrics.

Two studies are being conducted: one on the antenna itself; the other, on weaving conducting thread into fabric to create antennas. Chi-Chih Chen, an electrical and computer engineer at Ohio State, directed the 2½-year antenna research, which recently concluded.

The Army's Small Business Innovation Research program provided a nearly $1.2 million grant for the antenna research, about one-third of which went to Ohio State. The rest went to Applied E.M., a Hampton, Va.-based antenna-design company.

The idea isn't new, but builds on older work.

As police, firefighters and military personnel kneel, crouch and crawl, they often affect walkie-talkie reception. Wearable antennas would solve that problem, the researchers say.

"Reception of communication could be more reliable, independent of the operator's position," Chen said. "The key is that this antenna should be very flexible so we can wear it on our clothes, so we are not impeding our activity."

Because our bodies can block radio signals from reaching antennas, reception depends on body position and location. Researchers at Applied E.M. say they are developing a way for antenna systems to automatically switch from an area with a blocked signal to another area with better reception.

“The designing is not a big issue,” said C.J. Reddy, president and chief technical officer of the company. “The only issue was conforming it to the body structure so we get the signal in all the different situations.”

The technique already is used in laptops and cellphones with internal antennas.

Chen found that a copper antenna prototype researchers inserted into a vest outperformed traditional antennas. Researchers donned the vest and tested it indoors and outdoors, in different positions, and compared the prototype’s reception to that of a radio antenna attached to their waists.

That test was separate from Volakis’ tests, which are ongoing.

“We know how to design antennas, but we do it with a metalized approach, which is very inflexible,” said Volakis, who directs the OSU ElectroScience Lab. “The question now is how to put the wire in that textile.”

Volakis formed an antenna by tightly sewing conducting thread into fabric to make conducting areas. The thread needs to be as dense as possible to emulate a metal sheet, while maintaining its flexibility. To achieve this, Volakis said, the material had to be made with as many stitches as possible per square centimeter.

“We were amazed how good the conductivity was afterward,” he said. “We are very close to the conductivity of copper, within a few percent.”

To produce the conducting material, Volakis worked with Shirley Harding, a freelancer with Westerville Sew-N-Save. She digitized the researchers’ stitch design and reproduced it on fabric. She spent about a year trying to emulate the design with metal-coated thread and stitch it onto fabric.

Chen said that, within the next three to five years, this technology will be used to create a practical product that others could use. For example, the web of wires hospitals use to monitor patients could be replaced by a piece of clothing.

Volakis added that the reception could be so strong that patients could be monitored at home.

The trend, he said, is that communication is going wireless. He thinks this would make it possible to eliminate external antennas altogether, especially because it would be discreet.

“One day, I hope that, one, we’ll get the antennas off cellphones and, two, we’ll be able to buy functional shirts that are as cheap as the ones you’re buying now,” Volakis said.

The fiber research was funded by a $3.6 million Air Force grant, more than half of which went to Ohio State, Volakis said.

Integrating antennas with clothing is just the start, Reddy said. He sees a future in which clothes contain computer chips and can perform many of the functions people currently rely on smartphones for.

“There is a big push for textile-integrated electronics,” Reddy said. “In the future, it won’t just be antennas. It’ll be complete systems.”

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