'Smart Textiles' for a Phone as Useful as the Shirt on Your Back

Wired Textiles for a Phone as Useful as the Shirt on Your Back

By RITCHIE S. KINGOCT. 24, 2011

John Volakis wants to make the world hands-free.

The director of the ElectroScience Laboratory at Ohio State University, he is trying to end the need for cellphone hardware like the Bluetooth earpiece by fabricating communication devices out of something that most states require we carry with us all the time anyway: clothing.

"You won't have to hold your cellphone to your ear," said Dr. Volakis, an electrical engineer. "We'll eliminate all that. It will be part of your attire."

His effort is part of a broad technological effort to make "smart textiles": wearable fabrics with embedded electronics that can collect, store, send and receive information. His lab is focusing on the sending-and-receiving part, trying to transform military apparel, hospital gowns, even everyday T-shirts into antennas.

Aside from enabling a science fiction luxury — simply speaking into your collar when you want to talk to somebody — antenna clothing could offer covert communication for soldiers, wireless monitoring for the sick and much better reception in general.

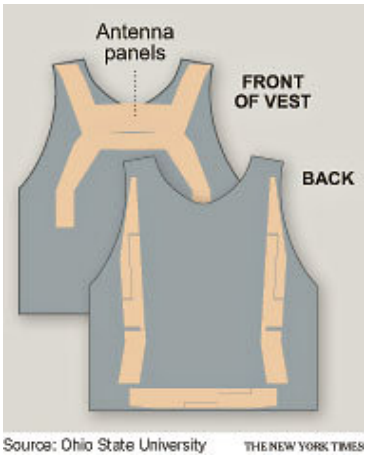
Though it will take at least a year for Dr. Volakis and his team to develop antenna clothing for civilians, his lab built antennas into a United States Army bulletproof vest last summer.

The vest, with a square antenna panel embedded in the front and three in the back, is like "having more sets of eyes or ears," said Chi-Chih Chen, the electrical engineer who led the team that developed it.

Antennas lose reception when blocked by a human body — as evidenced by the static an FM radio spurts out when you walk in front of it — and the cumbersome rod-shaped antennas used by soldiers cannot capture signals from directly above. Communication is severely limited when an antenna goes horizontal, as it does when soldiers duck, crouch or crawl.

"This is where a body-wearable antenna will shine," said Steve Goodall, chief of antenna technology and analysis for the Army's office of communications and electronics research, development and engineering. "You can flare the antennas out to cover a larger area," turning a single one-dimensional rod into multiple two-dimensional panels.

Photo



Dr. Chen is working with Applied EM, an antenna research and development company in Hampton, Va., to commercialize the technology, with the help of a grant from the Army Small Business Research Innovation Program. According to the company's president, C. J. Reddy, each unit will start around $1,000, but the price should come down as production volume rises.

Wearable communications equipment dates back at least to the late 1990s, when a team at the Georgia Institute of Technology developed the Wearable Motherboard, an electronic T-shirt with no antennas but with ports for multiple inputs and outputs — including a thermometer, a microphone, a blood oxygen monitor and headphones — to help monitor soldiers' health.

"If you want information about me, that information has to come from my clothing," said Sundaresam Jayaraman, the textile engineer who led the team. The patents were sold to a private company in 2000, Dr. Jayaraman said, but the technology was never commercialized.

Dr. Volakis shares Dr. Jayaraman's interest in using clothing to monitor vital signs. He is working to develop an antenna hospital gown that can transmit data like heart rates to a health professional's computer. Such wireless monitoring could be used not only in hospitals, but also in people's houses, to remotely keep tabs on the sick and elderly while they move about unencumbered.

"When elderly people stay home, we want to give them independence," Dr. Volakis said. "People are not going to be tied to a wire."

The challenges are different from those of a bulletproof vest, which does not need laundering and whose natural bulk can accommodate antenna panels.

By contrast, an antenna gown needs to flow, so it must be made of threads that not only conduct electricity, but are soft and washable. Dr. Volakis's team is experimenting with high-tech materials like carbon nanotubes and graphene to try to satisfy these requirements.

Beyond that, he says smart textiles could improve the life of anybody who yearns for a stronger cellphone signal.

"We have a huge amount of room on ourselves," Dr. Volakis said; why not cover it with antennas?

"I'll make sure you have five bars all the time," he said. "Not even five bars; let's make it 10."

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