

in brief.

Listen Up: Intelligent Fabrics March Forward

By Terry Costlow

Sleeping soldiers dreaming of the day when they don't have to worry about enemies slipping past dozing sentries might not have long to wait. Researchers are working on fabrics that the military could use to create smart tents that would listen for approaching noises, waking soldiers when suspicious sounds were detected.

Researchers involved in a joint project at Virginia Tech and the University of Southern California have devised a fabric that holds a cluster of microphones and processors. While many other programs look at intelligent clothing, this one looks at other places where fabric is used.

"We're trying to advance the science of electronic textiles, looking not just at wearables but putting sensors into tents, parachutes, or camouflage netting," says Mark Jones, an electrical computer engineer at Virginia Tech.

By spreading the microphones over a fair-sized piece of cloth, such as a tent's surface, the researchers can use triangulation to determine a sound's direction and distance. As the technology develops, algorithms will determine what the sound is and whether it's something that bears sounding an alert. Among other tasks, these fabrics could serve as monitoring systems that won't be subject to the diversionary tactics enemies often use to draw the attention of human sentries.

The initial prototype has a few computing clusters comprised of seven microphones linked to a 16-bit Analog Devices digital signal processor chip. In the prototype, a rigid circuit board houses the DSP chip and supporting circuitry, although flexible substrates will be used in later versions.

"Woven into the fabric are wires that link the microphones to the microprocessors, allowing the clusters to talk to each other and distribute power," Jones says.

In the prototype, two dozen wires were woven within three layers of cotton thread. One layer of wires ran horizontally, another ran vertically, and a buffer separated the two to prevent short circuits.

The first test, in which a truck drove past the fabric, showed mixed results. The fabric's components communicated with each other, but the truck noise was not as loud as expected, so little sound was detected. However, Jones remains optimistic. "We've got the hard part done—everything worked. Now it's just a matter of adjusting the gain so we can hear softer noises," he says.

As the hardware evolves, the focus will shift to software. Jones is devising concepts for the necessary algorithms, and he's also looking at an operating system.

The Virginia Tech-USC program is one of several developments in intelligent fabrics. Although the concept might seem a bit like science fiction, developers are certain that fabrics will some day handle part of a person's daily computing chores, doing tasks such as monitoring position or health conditions.

"This is definitely going to happen. First, in the military and industries where people wear uniforms," Jones says. For example, sensors in a uniform could monitor air quality in a chemical plant or battlefield, he adds. In other forms, hospital bed sheets could help monitor patients.

a Big Brother society that some might find incredible. But others note that in George Orwell's vision, technology lay at the heart of the mind-control culture,

and they worry that an unexamined technological evolution could lead us in that direction.

"We are building the infrastructure for

totalitarian control," says Deborah Johnson. A professor of applied ethics at the University of Virginia, Johnson works specifically in the technology, culture, and communication arena. She suggests that the public has so far been willing to accept new pervasive devices or applications without question because of a too-enthusiastic faith in the present commercial and political systems. "Right now, people are not afraid of it because it is not being built by the government. It's being built by the market and by commercial interests," she says. Those commercial interests tout the technology for particular uses, "but once it is all set up in place, it will only take a slight shift in political ideology for it to be used in other ways."

And more concerns exist than just the totalitarian threat. On a deeper level, Johnson worries about the fundamental transformation that pervasive computing could bring to human existence.

On the one hand, we are "making a world in which it is easier and easier for people to do things," she says. But can things get too easy? Could we phase out the need for our own bodies, building "a world in which I sit in my chair and make very small movements and literally everything would come to me?" she asks.

Take it one step further. What if we could embed a device to extend perception beyond the ultraviolet or embed elasticity "so we can jump higher, be more like kangaroos or something," says Herman Tavani, a philosophy professor with expertise in computer ethics at Rivier College in New Hampshire. "It's inevitable with the way things are going that those types of possibilities will be there, and this convergence of biotechnology and nanocomputing ultimately will threaten the whole sense of what it means to be human."

Society might be heading that way faster than we suppose. Bynum points to recent efforts in which computers have been used successfully to "read" a paralyzed man's thoughts—in effect, to convey messages based solely on his mental activities. "That sounds terrific," Bynum says, "but it also means