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By Olga Kharif

Wearable Computers You Can Slip Into

The latest generation of these ever-smarter garments look like ordinary clothes, not something only a cyborg would don

Gauri Nanda sees a wearable computer as a...handbag -- one that's built out of four-inch squares and triangles of fabric, with tiny computer chips embedded in it. Assembled together with Velcro that conducts electricity, these pieces form a bag that looks, feels, and weighs like your typical leather purse.

That's where the similarities end: This bag can wirelessly keep tabs on your belongings and remind you, just as you're about to leave the house, to take your wallet. It can review the weather report and suggest that you grab an umbrella -- or your sunshades. This purse can even upload your favorite songs onto your scarf.

Sure, a computing purse and scarf set may seem like the stuff of science fiction. But these devices, part of next generation of wearable computers, could become commonplace within a few years. Unit shipments of such wearable computers -- purses, watches, shirts -- should rise from 261,000 last year to 1.39 million in 2008, according to the tech research firm IDC.

"VERY CLUNKY." Powering this market are advancements in design and in fabric-embedded electronics. Over the last two years, DuPont (**DD**) created new fibers called Aracon, made of Kevlar, that are superstrong, can conduct electricity, and can be woven into ordinary-looking clothes. And chipmaker Infineon (**IFX**) developed chip packaging allowing wearable computers to be washed, even in the heavy-duty cycle.

As a result, these new wearables are a far cry from the clunky and downright silly versions of the recent past, which often required users to be wrapped in wires, type on their stomachs, and sport an unseemly display on their foreheads. "Cyborg computing was very clunky, very bulky machines that people didn't want to carry around," says Nanda, a researcher at the Massachusetts Institute of Technology in Cambridge, Mass. "Our bags feel and look like bags."

Unlike their predecessors, these new wearable computers also make economic sense. When her bag becomes commercially available in two to three years, Nanda expects it will cost around \$150, which is the price of an average leather purse. Only "it's fun, you can rip apart and put together a computer," she says.

TAKING OFF. Here's how the bag works: You place a special radio-signal-transmitting chip onto your wallet. A similar radio in your purse picks up the signal and notifies you that you've forgotten to take your wallet. In turn, sensors on your purse's handles will notify the computer that you've picked up the purse and are ready to go.

Such unobtrusive, inconspicuous, and fun devices should grab more than 80% of the total wearable computing market by 2008, while cyborgian wearable PCs will remain a niche,

says IDC analyst Kevin Burden. Already, these new kinds of wearables are being adopted for use in markets like auto repair, emergency services, medical monitoring -- and even, increasingly, for consumers at large.

Particularly in health-related applications, wearables are taking off. Consider BodyMedia, a Pittsburgh company that makes a special "smart band." It's worn on the upper arm and collects data on the wearer's physical state, such as the way the body releases heat. It sales should more than double this year, says CEO Astro Teller.

"IT'S TOO EASY." Originally released three years ago as a tool for researchers -- auto makers, for example, used it to understand stress in drivers -- the band is about to enter the mainstream. Later this month, Apex Fitness Group, which distributes fitness products to 1,200 health clubs such as 24-hour Fitness, will begin promoting the band for consumers as a weight-loss monitoring tool.

People who tested the product "say it's like cheating," says Neal Spruce, Apex president and CEO. "It's too easy to diet. It's the best tool we've ever found." By telling them exactly how many calories they expend, the device helped users adjust their diets and physical regimen.

In the next year, BodyMedia also plans to release special bands for monitoring the well-being of infants and the elderly. The idea, Teller says, isn't to turn people into cyborgs but "to make people feel more human."

LESS COSTLY TRIALS. Other wearable computers help address more severe health problems. A special shirt developed three years ago by VivoMetrics in Ventura, Calif., is already used in most of the country's top medical schools and drug companies. The garment, which collects and analyzes its wearer's respiration flow, heart rate, and other key metrics, can allow researchers to see in real time whether a new treatment is working.

Because of the volume of data it collects, the shirt can significantly reduce the number of participants in trials, as well as the trials' duration. In the case of one study for a sleep drug, traditional methods like hooking up patients to various machines at a special sleep lab "would have been at least 10 times more expensive and would have taken 10 times longer," says Steven James, a San Diego consultant to pharmaceutical companies. During this trial, 15 patients simply wore the shirts at home overnight. VivoMetrics sells a set of six shirts and related software and data recorders for \$15,000.

This spring, VivoMetrics plans to release a shirt for emergency-services workers, such as firefighters. It will wirelessly alert commanders that a firefighter's core body temperature or stress levels are reaching critical levels. And in 2006, VivoMetrics expects to introduce an under-\$500 shirt for the consumer market, says President and CEO Paul Kennedy. Such a product would let a mother monitor an asthmatic child.

REVENUE ENHANCER. Wearables are also slowly making their way into the auto-repair market. A company called Microvision ([MVIS](#)) recently introduced its Nomad head-mounted display. It covers one eye, but it's see-through, allowing auto technicians to examine the innards of a car and check them against on-screen computer drawings at the same time. It comes as a baseball cap clip-on, to be more unobtrusive.

So far, it's a hit: At Jim Fisher Volvo dealership in Portland, Ore., which has been testing the system for about seven months, productivity of technicians went up 10% to 20%, says Service Manager John Prosser. Better yet, customers talking to technicians who are wearing these contraptions also are more likely to agree to repairs, pushing revenue up 15% to 18%. Says Prosser: "This makes [technicians] want to get involved and to cross this

bridge of reluctance" in using a new technology.

Indeed, many more people will want to cross that bridge in the coming years -- making for a booming market for wearable computers that don't look like something out of an old *Star Trek* episode.

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