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Researchers strive to design 'always-with-you' computers

Wearable Models—They're Coming

■ BY CYNTHIA BOURNELLIS

SAN JOSE, CALIF.—With chips turning up everywhere, so are new ways to use them. Wearable computers, one oasis in the silicon desert of microprocessors, has researchers at both notable universities and corporate R&D labs diligently tinkering on viable solutions to create a new market for the new millennium.

But what exactly are wearable computers? According to researchers at MIT, a wearable computer is one that is always with you, is comfortable and easy to use, and is as unobtrusive to wear as clothing. Furthermore, a wearable computer is always on. It should be able to be used while walking or moving around. And it should contain properties that make it a multi-function device, such as body sensors for detecting blood pressure; cameras for processing and E-mailing digital images, and even microphones for hands-free communications.

Today's market for wearable computers is small—it's measured in thousands as opposed to millions of units. Most devices are found in the commercial, industrial, financial and medical industries. But researchers have high hopes

of increasing the need for wearable computers in both the commercial and mainstream markets, as the idea of wearing computers rather than lugging them around sounds more appealing as time goes on.

Yet, the \$64,000 question remains: if you build them, will people wear them? That depends on the application(s). The universe of possible designs is as limitless as the imagination of the inventors themselves. Some ideas make practical sense, while others are just flights of fancy. A wearable computer can be a pair of glasses that has a tiny monitor mounted on it (MIT has a model that runs on 486 or Pentium 133MHz chips). Or, it can be a head-mounted display that has a night-vision scope for viewing movies. It can even be a laptop computer small enough to hug one's waist.

The latter exists as a prototype at the IBM Research Lab in San Jose, Calif. There, Ted Selker, a chief technologist and IBM Fellow, has rigged together a two-pound wearable version of IBM's ThinkPad 760 notebook. Worn on a belt, the prototype was built from off-the-shelf circuit boards (4 inches wide by 11.5 inches long) and connected together as a flexible printed circuit board (PCB), so that it curves to

the human form. Mr. Selker ditched the battery, disk and floppy drive found in standard-size 760s and replaced them with a PCMCIA hard disk. He made a standalone battery unit that resides elsewhere on the wearer's belt. The wearable 760 fits into the small of someone's back. A separate 8.5x4-inch keyboard attaches to a belt, hanging low on a user's thigh. There is also an accompanying head mount for hands-free communication. "(At this point), you're looking pretty much like a geek," laughed Mr. Selker.

Nonetheless, wearable computers are slowly worming their way into society. Some devices already in use include the Xybernaut 133P system from Xybernaut Corp. (see photo, page 42). The 133P is for users who need to access large volumes of technical data without having to turn away from tasks or use their hands. In this get-up, one looks like a premature version of the alien Borg race from the *Star Trek: The Next Generation* television series. A lighter-weight, smaller 133P is due out in September.

In this business, size is everything. Therefore, design is a critical element. Because wearable computers are the epitome of mobility, they need to fit the

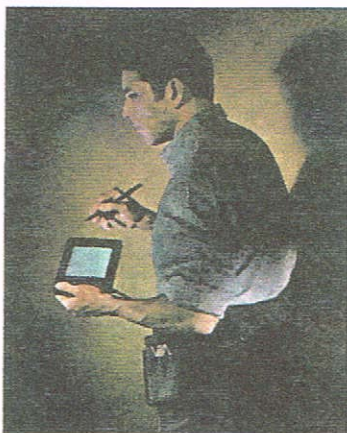


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human form as much as possible, advised Dave Carroll, CEO of ViA, Inc., a maker of wearable computers in Minnesota. The three-year-old company just rolled out its second-generation wearable, the ViA II, a one-pound PC that is worn around the waist (see photo). ViA II, which is smaller and lighter than its predecessor, the ViA I (which debuted in 1996), is a flexible motherboard that utilizes multichip modules from Cyrix in order to reduce the number of components and the cost of the device. But the price isn't cheap. Because ViA II services a niche market (Ford Motor, Boeing and a major food-service company are some customers) prices range between \$2,600 and \$4,500, depending on the configuration.

The ViA II works with various interfaces, such as pens, tablets and voice recognition. Some analysts applaud ViA for its unique approach to interface technologies. "Their work in voice recognition systems stands them in good stead if the user is simply reciting part numbers, etc.," said Mike McGuire, an industry analyst at Dataquest. ViA's voice technology sits on top of dictation and continuous speech systems from companies such as Dragon Systems and IBM. The technology is designed to handle pitches in voice, from loud to soft, in real time.

For times when a user can't wear an external keyboard or mouse, or use voice input, ViA is developing a highly reflective thin-film transistor (TFT) display that contains a "bleed through" keyboard. Within a very thin display lie pixels that, when activated, creep to the surface of the screen to form a keyboard. The integrated keyboard is transparent so the user can see other open applications.



The 18-ounce ViA II wearable computer can be used with either a headset for voice recognition input or a tablet for pen input (shown here).

Price is important in wearable computing technology, but it isn't as critical, yet, as is design: for now, most devices are used for fairly specialized applications.

There are products well below \$1,000 today, but they are more pocketable than wearable and for the most part appeal to business professionals. For instance, there is the StarTAC cellular phone from Motorola, which can be attached to the body via a neck strap, hip holster or purse. PC companions from such companies as Starfish, 3Com and others can be stored in shirt pockets or handbags. But researchers don't view these as truly wearable computers.

Many of the same factors that apply to wearable computers for niche markets, hold true for consumers. For the average Joe to blow his discretionary income on a wearable, the device has to be very small, comfortable and multifunctional, and come with a choice of interfaces. The weight of the system should also be spread out around the body. The waist is a good place to start, since most people are used to wearing belts, said Mr. Carroll.

Of course, the wrist is another popular place, particularly for products based on cellular phone technology. ViA is developing a Dick Tracy-like watch, for use by the Defense Advanced Research Projects Agency. The multifunction watch can be used for wireless communications, dictating and sending voice messages, and sending text files via E-mail.

Meanwhile, across the Pacific Ocean, two students at Kanazawa Industrial Design Institute in Kanazawa, Japan, have come up with two unique designs. One is a wearable Universal CD Player, which can be attached to a belt, for both hearing and hearing-impaired people. The other is the Parasite Phone, which sends E-mail and faxes. The body of the phone, which is worn around the wrist, looks like an oversized bracelet. It attaches to a two-way cord, which acts as the handset and clips onto the thumb and pinky finger so that users can raise their hands up in an "L" fashion to the side of their face when talking on the phone.

But for wearable computers to make it in the consumer world, they should not be intrusive and should be inconspicuously worn in social situations, said Mr. Selker.

There isn't a magical position for designing wearable computers. Perhaps, Mr. Carroll sums it up best: "If you want to accomplish an advanced means to using microprocessors to support human endeavors, you really need to make it (product) comfortable and intuitive." And what will set one company apart from another is a willingness to invent new products. Of course, some reliance on existing technologies is encouraged and acceptable. ♦

