

FREE RADICALS

They're everywhere, and they're taking over. Not little green beings from outer space, but computers. They're small, fast, powerful, increasingly inexpensive — and that's just the beginning. Enter the world of "ubiquitous and embedded computing," where you'll have access to computers wherever you go. Other computers — embedded in your house, your office, your car and the highway system, and your appliances — will work unobtrusively in the background to make you more comfortable, more productive, and safer. Your conference room will greet you as you enter. It expected you, and has already adjusted the heat and light settings to your personal preferences after the last group left. It knows Kyle in Cleveland and Wendy in Wichita are part of your team, so it's getting them on the video screen and, if you ask nicely, it'll brew coffee for ten while the other team members straggle in. Everyone plugs in their palm computers to jacks in the conference table, and all automatically receive copies of several documents the room has been holding for them, plus a copy of the graphics from your presentation.

When you leave the room, "wearable computing" will leave with you. Chips, circuits, storage devices, and portable power sources all reduced to tiny sizes and configured to slender shapes, will be worn around your neck, slipped into a pocket, or even integrated into your clothes. Your pants, skirt, or blazer may bear the logo "Intel Inside." You'll be permanently linked to the Internet via wireless transceivers. **Y o u r**

centimeter-thick fax/printer, built into the back cover of a notebook or the cover of your briefcase, will produce 1200 dpi copies at four pages per minute. You'll be able to communicate with anyone, anywhere, while walking down the street or driving to work. (I'm a little leery of this, my car having nearly been sideswiped

wired

by Dale Hall

several times by drivers engrossed in telephone chatter, but technology marches on.)

In my own wearable computing fantasy, I'm sitting along the third base line at the Camden Yards baseball park in Baltimore on a sunny day. I've just finished writing a Free Radicals piece that is due at ECS headquarters the same day, while watching Cal Ripken, who has played in more consecutive games than anyone else in major league history, extend The Most Amazing Streak in Baseball.

Special coatings on my wrap-around "optivisor" allow me to make my final edits as I watch Cal catch a hard-hit line drive to retire the side. Around me, I see stock market quotes streaming across the tops of optivisors, ticker tape style. A kid is watching the twelfth and hopefully last Barney movie on microdisk, and the guy in front of me is watching a golf tournament. The Orioles jog off the field to take their turn at bat, and Brady Anderson, a fine hitter, comes to the plate. I turn from the game, flip up my optivisor, and look around for a vendor to get a beer and a bag of peanuts. Behind me, a collective groan goes up from the crowd.

"What happened?" I ask. "Did Anderson strike out?"

"No," says a young man behind me, fiddling with a small knob on his optivisor, "IBM is down by 1 7/8."

All of this stuff might very well happen, but there will be some glitches along the way. Someday, we'll read in the Lands End clothing catalog: "All of our pants are available with or without cuffs. Note: Windows 08 requires at least 256 megs of RAM and a 32" inseam." Who will be the first to moan, "Oh, man! I told you not to iron my Intel shirt on high heat!" The concept of incompatible clothing takes on a whole new meaning: "Darn! I'm wearing my Mac shirt and my PC pants. Now what am I gonna do?"

Somebody once said that "Clothes make the man." I've never agreed with that, but it'll be hard to argue otherwise when the man is decked out with 900 MHz Decium processor pants, a 10 megapixel optivisor, and 10 gigabytes of data storage in his jacket. For those who work in environments where the tie is still

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de rigueur, the blasted things will finally be useful for something other than cutting off circulation to the brain. There's a lot of room in a tie for chips and vias, and a tie tack makes an excellent hub connection.

Given the many instances of cheating on standardized tests already abetted by various small devices and implements, the ultimate security measure may have to be invoked: students may be required to take the exam naked in the future, when the contents of the Encyclopedia Britannica could be implanted in a belt buckle and beamed directly into a pair of eyeglasses.

In my way of thinking, constant connectivity to the rest of the world isn't the biggest advantage, or maybe even a good thing. What excites me is the ability to capture and work on ideas and thoughts whenever they occur and when the time is best for thinking. The freshness and excitement of a new thought or idea has a shelf life, and it's often pretty short. There are times, too, when what you're doing puts about 90% of your brain on hold and wastefully compartmentalizes your time. For example, I'm supposed to paint the house this weekend, but I'd rather write letters. Imagine being up on the ladder, paint brush in hand, dictating letters or e-mail messages to your mom, your friends, your congressman, and having them recorded, formatted, and even beamed to your printer or Internet connection.

Maybe I don't need all this stuff, or even want it, but it has one big virtue for us: it will provide fascinating employment for a lot of electrochemists and solid state scientists. Wearable computing will add some new design constraints to electronics. Smallness remains crucial, and flatness and flexibility become even more important than they are now. There are big challenges ahead, and big pay-offs, too. Someday Yves St. Laurent will be showing *your* latest design on a runway in Paris.

Très chic. ■