inventing the future

PHOTOGRAPHS COURTESY OF IBM

The Wearable Computer

Twinsburg-based Hana Microdisplay is doing its part to usher in the next revolution

BY ANTON ZUIKER

You may remember a thirty-second television commercial that ran during last fall's Olympic games and January's Superbowl. In that commercial, a young man sitting on a bench in what looks to be Venice's St. Mark's Square talks animately into the air while alternately jumping into the air, jolting the pigeons milling around him into a sudden explosion of wings and flying feathers.

"Buy!" barks the young man. "Sell! Up, up, up. Over, over, over." Then, in a closeup, we see that his eyepiece projects a tiny computer screen onto the lens of his glasses, and that his voice is directing the computer's cursor.

Have we arrived at last in the Age of the Wearable Computer? Will myopic pedestrians soon be colliding with one another and dodging taxis that swerve to avoid them with horns blaring – as they try to squeeze in a few last-minute trades on their way back from a power lunch? Will moms, annoyed by distracted "un-hunhs" and noncommittal grunts from the other side of the breakfast table in response to motherly instructions, suddenly notice that junior is playing a video game behind those Ray Bans?

Well, not quite yet, says John Erdmann. But soon.

Current prototypes are still pretty big and bulky, and use monocular (as opposed to binocular) displays, says Erdmann, vice president and COO of Twinsburg-based Hana Microdisplay Technologies; but smaller and better equipment is within sight.

It will probably start, he says, with cell phones.

Numerous models available today already offer small displays for text and reduced Web browsing. Next-generation Internet-enabled phones will include a screen that pops up, Erdmann predicts. And this screen will be powered by liquid crystal on silicon (LCoS) chips, a revolutionary new technology that makes projected images dramatically larger, brighter and, you might say, crystal-clear. The microdisplay itself, for example, may be no bigger than a large postage stamp, but the magnification LCoS technology makes possible will give you an image nearly twice the size of the one on your current desktop monitor. LCoS can do this because it provides dramatically improved resolution, clarity and brightness.

Consider the screen of a conventional laptop computer. Behind that screen are hundreds of ultra-thin fluorescent lights, but the image you see on the screen is only 3 percent of the light generated by that display. The other 97 percent is blocked by microscopic structural gaps in the display surface or lost through the inefficiencies of the transmitting screen.

With a microdisplay, on the other

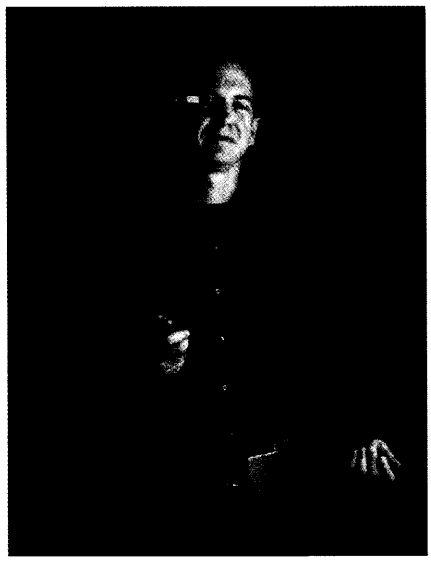
hand, you see 95 percent of the light that shines off the LCoS mirror. And that reflective microdisplay has four to five times more pixels – the tiny units of the visual image – than a laptop screen. Just one more example of an emerging principle of modern technology: Smaller not only equals more convenient, it equals bigger, brighter and better.

It also equals cheaper. "The smaller you can make the optics, the less the product will cost," says Erdmann. Some LCoS chips are no bigger than a dime – and no more than 1,400 microns (1.4 mm) thick. But their potential is huge. Hana manufactures and assembles LCoS chips for corporate customers around the world.

This stunning new technology was made possible, moreover, by breakthroughs and advances made right here in northeast Ohio. Indeed, Hana, a private company owned by a Thai conglomerate, decided to locate in Twinsburg, says Erdmann, in order to be close to Kent State University's internationally recognized Liquid Crystal Institute. Erdmann, who was charged with setting up the production line for Hana (originally called S-Vision Inc.) had earned his Ph.D. at Kent in 1990 and was convinced that "the Institute was the only place we could do this." His team was able to use LCI 's collection of high-tech equipment to develop its first chips while the production facility was being constructed. It is, says Erdmann, the only dedicated production line that combines the semiconductor and liquid crystal display technologies.

Today, the Twinsburg facility turns out 40,000 to 50,000 LCoS chips a month.

Assembled in a dust-free environment by technicians clothed from head to toe in something resembling a surgical suit, these ultra-thin silicon wafers are topped with glass and then filled with a liquid crystal. Tiny mirrors on the silicon wafer – more than a million on each thumbnail-size slice – are activated by electronic circuitry on the silicon, turning them into microdisplays capable of reflecting images of stunning clarity and intensity that can thus be magnified many times without paling or losing sharpness. The first beneficiaries of LCoS technology were television and the projector. Philips, for one, is already manufacturing a large flat-screen television that uses a Hana microdisplay. And Everest Technology employs a microdisplay in one of its



projectors, the kind frequently used for business presentations.

"These projectors are beginning to show up in sports bars amid all the conventional televisions," says Erdmann. "All the guys will be looking over at this one display because it's so much brighter and clearer."

Other devices now in development include binocular displays for gaming and entertainment devices – video games, virtual reality machines and digital videodisc players. (Most of the chips Hana makes go to Asia and Europe for demonstration units of flat-screen televisions, medical headsets to be used by surgeons, and gaming devices not yet available in stores here.) And one day, says Erdmann, LCoS chips will light up miniature display screens you will be able to wear near your eyes. Unlike today's frustratingly small cell phone and PDA displays, though, Hana's microdisplays will project a full-size image, large enough and precise enough to view a full page of Web content. What's more, these screens will be activated by voice commands, which will give you hands-free use of your cell phone and Internet connection.

Hana is now producing chips for Zight, a company in Colorado that is developing the display unit for a prototype voice-activated wearable computer designed by Olympus and IBM – the company that ran that thirty-second spot during last fall's Olympic games.

The context was apt. For, if you follow the business of information technology (IT), you know that the really hot race these days is the one to develop surefire devices for wireless Web access. Just as telephone users everywhere have abandoned their old plug-in handsets for the liberating convenience of wireless cell phones, millions now chained to computer terminals and clumsy keyboards are expected to flock like, well, pigeons in St. Mark's Square to wearable, voice-activated computers the moment they are perfected. Imagine the ability to have almost any information you want displayed instantaneously – in response to your own verbal request – on a tiny screen no farther away than the end of your nose.

"Unfortunately, the first thing people will do," Erdmann predicts, "is wear their headsets while driving." The nascent movement to ban talking on a cell phone while driving may, alas, soon have another problem to address.

"Sorry, officer, I was just checking the NASDAQ." ■

Anton Zuiker covers the frontiers of technology for Live.