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Smarty pants

SUITS YOU, SIR. CHRIS RYE SLIPS INTO WEARABLE COMPUTERS AND FINDS A WORLD OF NEW POSSIBILITIES.

**TOP LEFT
A WEARABLE PROTOTYPE FROM ESSEX UNIVERSITY
WEARABLES.ESSEX.AC.UK**

**TOP RIGHT
THE MICROOPTICAL CORPORATION'S EYEGLASS DISPLAY SYSTEM
WWW.MICROOPTICALCORP.COM**

Nothing has dated more than the past's idea of what the future might look like. Twenty years ago, scientists only had to utter the words 'by the year 2000' to conjure up images of bacofoil suits and cities on the moon. Ironically, astronomical budgets prevented cities in the stars from becoming a reality, although with today's cut-price space programme we can explore the cosmos for less than the cost of a cinema blockbuster. But what about those hi-tech suits?

One feature common to many visions of the future has stuck in the popular imagination and is fast becoming a reality in the real world of 1999 — the wearable computer; technology so portable and intuitive that we can slip it on in the morning along with our clothes, bringing a whole new meaning to the term 'personal computing'. We're already seeing the rise of global networks, thanks in part to the hundreds of new communications satellites set to circle the globe by the turn of the

century. These networks may be the big driver for wearable computing, as they allow true international roaming outside the boundaries of national telecoms infrastructures. Throw in a cellular modem and a GPS system, and the world is at your fingertips. The computer could be leaving your desk, perhaps forever, and its horizons may be limitless.

Much of the research into wearables is based in North America, at universities such as Oregon and Toronto. One of the half-a-dozen key figures is Dr Steve Mann, who has worked on his 'WearComp' and 'WearCam' (camcorder/computer hybrid) ideas for 20 years. He began his research at high school and continued it at the Massachussetts Institute of Technology (MIT), where he completed a PhD in 1997. He's now at Toronto.

'Wearable computing facilitates a new form of human/computer interaction, comprising a small body-worn computer (e.g. user-programmable device) that's always on and always ready and accessible,' Mann explained to delegates at the 1998 International Conference on Wearable Computing in Fairfax, Virginia.

Dr Mann, and other American academics at the forefront of this research, such as Bradley Rhodes (also of MIT's media lab), insist their wearable computers are different from the personal digital assistants (PDAs) available on the high street today. PDAs include PC-compatible 'notepad' devices such as the familiar Palm Pilot, and also the host of portable devices that may spring from alliances such as Symbian,

the joint venture of Psion, Nokia, Ericsson and Motorola, which opens up the possibility, say, of your mobile phone and personal organiser sharing an infra-red link.

But today, the difference between the wearable and the PDA, explains Mann, is that a WearComp is 'subsumed into the personal space of the user', while having the full functionality of a computer system 'inextricably intertwined with the wearer.' What this means in practice, is the user having one or more of his senses, even his intelligence, augmented by WearComp or WearCam-style devices, built into familiar-looking items such as spectacles, headsets and, for the less conservative user, baseball caps. There's no available research on whether these should be worn back to front. Head-mounted displays (HMDs) of this kind, where binocular or minocular arrays are built into adapted or specially built headgear, form the bulk of wearable computing prototypes from MIT, Digiman, MicroOptical and other US companies.

If Mann is right about wearables, augmenting human capabilities with the advantages of state-of-the-art computer power, such as rapid calculation, vast databases and information filtering, the future may be so bright, you'll have to wear shades. Nevertheless, for the home and business user, UK-led developments in PDAs and deregulated telecoms might clear the path for the commercial success of these devices whatever the US evangelists say.

Yet for all Mann's talk of wearable computers un-monopolising [sic] the user's attention — i.e. allowing computing to become as automatic to you as breathing, the processing power behind these devices is much the same as you'll find in an ordinary laptop: fast chip, small hard drive, albeit with a modem you can rove with. So the potential is greater than the reality, thanks to the eternal problems of network bandwidth, which is where satellite, cellular and even digital TV and radio networks could help. But the innovation lies in the way wearable devices interact with the human body, networks and each other.

The fact that wearable computers are, like wristwatches, always switched on could be a boon to both home and business users. Instantly, you'd have a 24-hour intelligence resource that flashed information via laser or minute LCD screens into your headset, definitely for your eyes only. And, were the image to be projected onto a pair of transparent glasses, as it is in MicroOptical's prototypes, it would overlay a computer read-out onto your conventional view of the world, something MIT calls 'augmented reality'. So, we accept the watch, the mobile, the Walkman

and the personal organiser; why not the wearable computer? One answer, at the moment, is they're not that wearable. The key to their commercial success is making them unobtrusive and safe, and certainly less bulky. While prototypes like the MicroOptical goggles are slim and lightweight, wearable computing lore demands the user wear them day and night — impractical for even the hardened fashion victim (unless they wear glasses anyway).

Other wearable computers have been developed by MIT's Bradley Rhodes, which are mounted on the side of the head, allowing the user to peer into an eyepiece to access the visual display. But this might alarm a medical community already alerted to the dangers of proximity to low-level, microwave radiation from mobile phones.

Other than efficiency, mobility and privacy, another significant application of making humans smarter with a cool, wearable device could be security. Your security. StartleCam, an evolution of Mann's WearCam prototype, has been developed by Jennifer Healey at the MIT media lab and is another head-mounted device. Activated by sweat when the wearer is frightened (like a lie-detector), the StartleCam could scare off muggers in the street, store audiovisual information about them on a remote server, or even dial 999. This suggests that when wars are won by superior information,

The innovation lies in the way WEARABLE DEVICES INTERACT WITH THE HUMAN BODY, networks and each other

the camera is more powerful than the gun. Helping the wearer by augmenting his or her abilities in this way would lead, say the idea's fans, to a very real form of personal empowerment, and could even let wearers monitor possessions such as their house or car remotely, a sort of social micromanagement for the neurotic 90s. So, if you want to be a photoborg entity, a cybernetic organism always seeking the best picture in all aspects of day-to-day living, go to www.wearcam.org, where you'll feel at home.

Then there are cultural obstacles. In the UK, Neill J Newman, a researcher at our own Essex University [see page 136], explains: 'The computer has become smaller, lighter and more powerful, but the way we use it is still analogous to the large mainframes of yesteryear.' And a lot has changed since then. Intelligent agents (proactive web search software that learns your

NEW DEVELOPMENTS

☛Casio Satellite Watch
In June, Japanese electronics giant Casio will launch worldwide a gadget for fans of the great outdoors 'who have everything but a sense of direction': a wristwatch that pinpoints the wearer's position by satellite, says Reuters. Built as a navigation aid, the GPS transceiver works by using information drawn from 27 satellites to pinpoint the wearer's geographical co-ordinates. 'If you wear this wristwatch, you will never get lost when you go mountaineering,' claims a Casio spokesman.

☛Xybernaut
US vendor Xybernaut, formerly Computer Products & Services, is establishing a network of specialist resellers to move into vertical markets, such as utilities, aviation, medicine and the military with its existing, wearable products. Its web site <www.xybernaut.com> explains the products are targeted at 'data capture, processing, display and communication for mobile individuals', and use a variety of different inputs, including voice recognition, and outputs such as head-mounted displays (HMDs).

☛Sulawesi
Similar in intent to the Xybernaut range of products, Sulawesi is a technology framework for wearables developed by Essex University. The current implementation, Sulawesi 0.1, 'utilises speech recognition, keyboard input and a networked input'. The framework is optimised for Java and, as well as obeying the wearer's commands, it also monitors the user's environment. Sulawesi could work just as effectively with infra-red beacons, says the university, as it can with GPS systems to establish the wearer's location. For more information and downloadable programs, go to www.wearables.essex.ac.uk/sulawesi/introduction.html.

▲**PROTOTYPE INTELLIGENT FOOTWEAR, BY MIT'S REHMI POST. CONTAINS SOFTWARE AND BOARD TO CREATE A 'PERSONAL AREA NETWORK' (PAN), WHICH CONFINES NETWORK ABILITY TO THE WEARER AND ANY DEVICE HE OR SHE INTERACTS WITH. IN THIS WAY A DOOR, FOR EXAMPLE, COULD BE PROGRAMMED TO OPEN ONLY TO THE WEARER OF A PAN-ENABLED WEARABLE DEVICE**

preferences), face and voice-recognition systems, together with the capabilities of a global comms network, all suggest a promising future for the wearable computer.

Consider this: attentive, electronic secretaries that work with you 24 hours a day, recognising your face, obeying your voice commands, retrieving mail or taking dictation at the blink of an eye or the click of a finger (no need for keyboards when you have that spatial recognition interface to read your hand movements).

Add Japanese skills in miniaturising consumer electronics to this, and your wearable computer could have, say, MP3 audio compression, allowing you to download and store large sound files in a device no bigger than, well, an MP3 Walkman. And with recordable disks and digital radio/TV on the upward curve of consumer acceptance, who knows what devices may emerge? NCR has even built web access into traditional household items. Link these to your wearable computer, and your microwave could soon be emailing you to buy chips while you're at the supermarket.

By now, of course, cynical British minds will be finding it difficult to ignore the eccentric side of wearable computing, which isn't helped by the fact that early research models made the wearer look like Robocop. (VR helmet, anyone?) But this sort of prejudice can be overcome in time.

Robocop isn't far from the truth, however. HMDs and HUDs (head-up displays: visual interfaces positioned above eye level) were originally developed for the military, specifically fighter pilots, to enable them to operate complex guidance systems in flight. The result was eye movement-operated weapons and information access. Today's computing power coupled with state-of-the-art miniaturisation is taking these devices out of the cockpit and turning footsoldiers into hi-tech hunter-gatherers in the information war. Certainly DARPA, the US Defence Advanced Research Projects Agency, has funded wearable 'combat management systems', but, as yet, lightweight systems don't count for much against the rigours of the battlefield.

Meanwhile, for the corporate grunt, you may soon be able to take wearability to its logical extreme. MIT is developing intelligent clothes made from woven computer circuitry and operated from a sleek, electronic glove. If these experiments make it past the concept stage, computer clothing, powered by the minute voltages in the human skin, could redefine 'power dressing' and 'smart suits' for the 21st century cyborg about town. Great strides are being made, if you'll pardon the pun, and if the applications are anything more than just a marketing ploy, you'll soon be clinching complex deals with a data-handshake, while stacking that essential corporate data into your ever-expanding shoulder pads. The person in the Terabyte suit? It could be you.

• **Xybernaut** www.xybernaut.com
• **Sulawesi** www.wearables.essex.ac.uk/sulawesi/introduction.html
• **MIT general web site**
www.media.mit.edu/projects/wearables