The technology to recognise fingerprints is here. Nik Rawlinson investigates the case in hand.

Pointing the finger

It may all sound like something taken from the pages of Orwell's *1984*, but governments and the military have been developing an efficient means of singling out a person based on bodily characteristics. Recognition of this type is called Biometrics, a technique for measuring a physical human attribute and comparing it to a database of registered characteristics for identification purposes.

Biometrics incorporates everything, from hand geometry and vein pattern recognition to retinal and iris scans, and the analysis of voice patterns. Perhaps the most useful aspect, though, is fingerprint analysis. It has been used worldwide for many years in tracking criminals, but the technology is now beginning to pay dividends for the ordinary bod on the street as a way of bolstering currently inadequate PIN or password-based security systems. In Spain, the government is currently extending an extensive trial of smart card technology. Initially rolled out across a sample of a million citizens, the card, bearing a fingerprint, provides access to social security and healthcare benefits. In the States, the military is constructing a similar system at its base at Fort Still. A smart card, access to which is controlled through print recognition, will give recruits access to a maximum of $250 spending money a week.

The BioAPI consortium (Compaq, IBM, Microsoft, Identicator, Miros and Novell) have set out to develop a standardised way of analysing fingerprints so that the technology can be built into everything from network log-ons to protecting documents in applications like Microsoft Word. When Digital TV takes off, manufacturers see biometrics as a way of protecting the set-top box — particularly useful for barring adult channels from children.

Two products, from Compaq and Shuttle Technology, will bring this type of fingerprint recognition to the desktop. Their smart, small devices hook up to the PC's parallel port, scan the skin surface pressed to the lens and reduce the complicated tangle of creased skin to a mere template of key points. These are the points where the lines change direction, merge or end. Around 40 of these points are marked, and the rest of the image is discarded. Forty may not sound like much, but it should be remembered that in most countries only 12 matching points are necessary

▲ **Quicker than a keyboard, pass first time with a nifty fingerprint reader like this one from Compaq**

for a fingerprint to convict a criminal in a police investigation. These points are encrypted and passed to the domain server that then compares the points to a database of registered users, only granting access to matching prints.

But how accurate is such a system? Compaq's setup process allows the system administrator to select the level of accuracy, ranging from one mistake in 1,000 (i.e. a valid user is rejected or someone without authority gains access) to one in 100,000. The fact that no user will ever place their finger in exactly the same place twice has also been taken into consideration. Shuttle Technology claims its

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product will allow for a 30-degree alteration in angle between the finger and the comparison pattern. Ah, you say, but what about fingers changing with age? Sorry, they've beaten you there, too. Your fingerprints just don't change. Al Capone tried to evade capture by dipping his fingers in acid to destroy his prints. It worked… for a while. Little did he know they would grow back with exactly the same pattern as before.

futures

Toby Howard reports on how a net user can have a physical presence at a web site.

Remote control

Being there is not an experience we normally associate with browsing the web. Although we speak of "visiting" a web site, it's actually the other way around: we stay exactly where we are — it's the data that comes to visit us. But two researchers at the University of California want to change all this. They're experimenting with what they call "tele-embodiment" — giving a surfer a real physical presence at a remote web site, in the shape of a remote-controlled mobile robot. John Canny and Eric Paulos call their robots "Personal Roving Presences", or PRoPs <www.prop.org>. The idea developed from previous experiments with robots they called "space browsers", or blimps, small helium-filled

> **PRoPs will bring a new dimension to global comms ... THE 'OUT-OF-BODY' EXPERIENCE may soon become a technological reality**

remote-controlled balloons. An operator, controlling the blimp using a radio link and a Java applet in a web browser, would "pilot" it around a roomful of people, engaging them in conversation using the camera, microphone and speakers attached to the blimp. The idea was perfect for "happenings" at Electronic Art festivals, but the weight of the batteries and the instability of the balloons made them impractical. Next, Canny and Paulos came down to earth, experimenting with "surface cruisers", small-scale mobile robots again with a wireless connection to the web. Their latest PRoP looks a bit like a high-tech version of the dancing broomstick from Disney's Fantasia. The base is a small motorised cart with steerable wheels. On the cart is a battery pack and a PC with a wireless link. The cart supports the PRoP's "body", a thin vertical shaft 1.5m tall. At the top is the "head", comprising a video camera, microphone and speaker, and an LCD screen. There's also a small, motorised arm intended not for manipulating objects, but for

▲NASA's Sojourner Mars lander has demonstrated that telerobotics is essential for space exploration

"gesturing". The operator controls the PRoP via a simple web interface, moving and steering it with the help of real-time images from the PRoP's "eye". A video camera pointed at the operator's face sends the image to the LCD panel on the PRoP's head. The idea is that the operator, embodied as the PRoP, wanders around the remote scene, meeting people and chatting with them, or just "hanging out", as the Americans say.

Canny and Paulos believe that the future lies with very simple robots with a few basic behaviours: moving, watching, listening, speaking, and displaying a video image of their web operator. The future, they say, is "telepresence for the masses". And they're not alone in wanting to go beyond the passive browsing that mostly characterises the web. Several tele-robots already attached to the web let you experiment with telepresence. Try to pick up some blocks with the simple robot at University of Western Australia <telerobot.questacon.edu.au>, for example; then zoom across to the opposite side of the planet, to the Carnegie Science Center's Online Telerobot <csc.clpgh.org/telerobt/>. You can even paint with a robot at "Puma paint" <yugo.mme.wilkes.edu/~villanov/>. The robot at this site holds a paintbrush which it can dip into one of four different pots: you choose the colour, tell the arm how to move and even how much pressure to apply to the canvas. Closer to home is the Bradford Robotic Telescope, high on the West Yorkshire moors <www.telescope.org>.

Much of the cutting-edge research is coming from NASA <ranier.oact.hq.nasa.gov/telerobotics.html>, where the goal is to develop efficient telerobotic interfaces to control landers on future space missions. NASA demonstrated with the Sojourner Mars lander that telerobotics is essential for space exploration, and its future plans rely heavily on the "Interplanetary Internet" project (*see "Futures", PCW November 1998*). There's even a project coordinated by Carnegie Mellon University to allow public control of a lunar rover <www.ri.cmu.edu/lri/>.

PRoPs and telerobotics will bring a new dimension to global communications, and instead of being a New Age myth, the "out-of-body experience" may soon become a technological reality.