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WHAT'S NEXT

Is It Really You? A Scanner Delves Beneath Fingerprints

By IAN AUSTEN

FOR all their electronic sophistication, fingerprint scanners like those being installed by the Department of Homeland Security at airports have a major shortcoming. Even the company that makes many of them acknowledges that the devices cannot tell whether they're scanning an actual finger.

"Nothing is spoofproof," said Timothy L. Murray, the chief operating officer of Cross Match Technologies, which has supplied scanners used at 115 airports and 15 seaports. "So there's a market niche that cares an awful lot about whether the thing on the reader is alive."

Both Cross Match, in Palm Beach Gardens, Fla., and another company, Lumidigm, in Albuquerque, now believe the best way to answer that and other questions about the devices is to introduce fingerprint readers that go beyond skin deep. The companies have developed different technologies to let scanners examine the pattern of blood vessels immediately below the skin's surface, as well as the internal structure of the skin itself.

Current fingerprint readers are fairly straightforward. When a finger rests on a transparent or gel-like platen, a light emitting diode sends light at an angle off its surface. Some of that light is reflected toward a digital imaging sensor that determines the fingerprint pattern.

Silicon casts, latex rubber models and, famously, patterns made on Gummi Bear candies can trick typical scanners, Mr. Murray said. For situations where a scanner is used under supervision, such tricks are of limited value. But Mr. Murray said that several users, including the Department of Homeland Security, need to install readers in places where they will not be supervised, leaving them vulnerable.

Even real fingers can sometimes fool the devices. Robert K. Rowe, a co-founder and the chief technology officer of Lumidigm, said that variations in skin can prevent readers from picking out fingerprint patterns. Some Asians, those whose skin is unusually dry or moist, some elderly people and even manual laborers with rough hands, he said, are frequently blocked by the electronic gatekeepers.

"That causes long delays and long lines," said Dr. Rowe, a former optics researcher at Leica of Germany and the Sandia National Laboratories.

Dr. Rowe's interest in fingerprint reading developed while he was looking at methods of using multiple wavelengths of light to measure blood sugar. The concept, which is still under development, was aimed at creating a measurement device for diabetics that did not require a blood sample.

While doing that research, Dr. Rowe discovered that the each individual's skin spectral pattern, when illuminated by different wavelengths of light, is unique. Moreover, the skin-probing light can also make the fine network of blood vessels near the surface visible. "It follows the fingerprint pattern," Dr. Rowe said.

With partial financing from the military, he has switched his attention to biometrics from blood sugar measurement. On Tuesday he presented a paper at the annual meeting of the Optical Society of America, in

Rochester, outlining how to turn his idea into a technology that can be adapted for use in current fingerprint readers.

Unlike the off-angle lighting method of current readers, Lumidigm's device aims the light from its six L.E.D.'s directly at the skin. The diodes rapidly illuminate the skin at five different wavelengths, or colors, and the light is polarized - that is, the waves are all oriented in the same direction - so that it will penetrate the skin.

Each of the different wavelengths of light travel a different distance into the skin before being reflected back to the reader's digital camera. After five pictures have been taken, software analyzes how the wavelengths of light were changed by their trip through the skin and calculates the finger's "spectral signature," as Dr. Rowe calls it.

With financing from the National Institute of Standards and Technology, researchers at Cross Match were simultaneously developing their own under-the-skin method. But instead of analyzing the effect skin has on light waves, the Cross Match system sees what happens to extremely high-frequency sound waves when they make a similar journey.

While the ultrasound system works, Mr. Murray said, it is such a dramatic change in approach that developing products based around it will take time.

Lumidigm has run into delays as well. While the company clearly demonstrated that its system could distinguish human fingers from fakes, it was also clear that the idea of substituting spectral signatures or blood vessel patterns for surface finger prints will take some time to gain acceptance.

Through a licensing agreement, the two companies have found what they hope will be a short-term solution to their problems. Cross Match plans to build a hybrid reader that will examine fingerprints the traditional way while using the Lumidigm technology to expose fakes. Because it uses standard components, Mr. Murray said the device should be available for sale next year. At the same time, because it also relies on the traditional method of matching fingerprint databases, the new device can be used with current security systems with little modification.

Mr. Murray at Cross Match predicts that while the device will initially be of interest to government departments like homeland security, corporations will ultimately be its biggest market. Businesses that require criminal background checks are increasingly using fingerprint scanners as part of the hiring process, he said.