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Eye Scans - Authentication with Biometrics

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Authentication is the process of verifying that a person is indeed who they claim to be. Biometric authentication refers to using a physiological characteristic to perform that verification. Biometrics offer some security advantages over other authentication methods, for example an eye cannot be stolen like a key card or forgotten like a PIN or a password, and biometrics cannot be shared between individuals. At the time of enrollment, documents or other means are used to identify the individual, and the biometric measure is captured and stored for future comparison.

In order for a biometric measure to be useful for authentication, it must be unique to the individual, remain constant over the life of the individual, and be readily available. Biometrics that meet these requirements include fingerprints or finger scans, retinal scans and iris scans.

Successful implementation of a biometric authentication scheme requires cooperation of the participants. Fingerprinting is associated with criminal activity and meets with resistance from the public, whereas eye scans – although Orwellian – are deemed acceptable [Meehan]. There are two types of eye scans in use today for authentication purposes: retinal scans and iris scans.

Retinal Scan technology maps the capillary pattern of the retina, a thin (1/50th inch) nerve on the back of the eye. To enroll, a minimum of five scans is required, which takes 45 seconds. The subject must keep his head and eye motionless within ½" of the device, focusing on a small rotating point of green light. 320 – 400 points of reference are captured and stored in a 35-byte field, ensuring the measure is accurate with a negligible false rejection rate. This compares to 30-70 points of reference for a finger scan. Unfortunately a retinal scan is considerably more intrusive than an iris scan and many people are hesitant to use the device [Retina-scan]. In addition a significant number of people may be unable to perform a successful enrolment, and there exist degenerative diseases of the retina that alter the scan results over time. Despite these disadvantages, there are several successful implementations of this technology [Retina-scan]. There is one vendor, EyeDentify, [Retina-scan] which markets the Icam 2001 device.

Drs. Leonard Flom and Aran Safir researched and documented the potential of using the iris as a unique identifier and were awarded a patent in 1987. Their company was incorporated in 1990 as IriScan, now Iridian Technologies of Marlton, NJ and Geneva, Switzerland [Iridian]. In 1994 Dr. John Daugman of the University of Cambridge in England [Daugman] developed the algorithms used in the generation of the IrisCode® and this process is also patented.

The iris, or colored portion of the eye, consists of several layers with distinctive features such as arching ligaments, crypts, furrows, striations, ridges, and a

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zigzag collarette [Daugman]. In all 240 points of reference are digitized. For initial enrollment the subject looks at the video camera from a distance of 3-10 inches, but subsequent verifications can be done from distances up to 40 inches. The camera first locates the eye then the left and right edges of the iris. The approach is made horizontally because often the eyelid occludes the top of the iris. The scan excludes the lower portion of the iris because of inherent moisture and light reflection. The image is then captured and processed into a 512-byte record, which is stored for future authentication matches. With voice prompt and autofocus, the system is easy to use. The entire enrollment process is less than 20 seconds, and subsequent identifications take 1 - 2 seconds.

Eyeglasses and contact lenses present no problems to the quality of the image, and the system further tests for a live eye rather than, say, a lens with an image printed on it, by checking for the normal continuous fluctuation in pupil size.

Dr. Daugman has shown that the iris texture is a phenotypic feature, not a genotypic feature thus even genetically identical twins have unique iris patterns. This gives iris scan biometrics an advantage over for example facial recognition schemes. The human iris has more than 400 measurable variables of which the Iridian Technologies process uses about 240 [Iridian]. It is astronomically impossible that two individuals would produce the same iris code, the odds are 1 in 10^{52}. Even a sightless eye can be scanned for a unique IrisCode.

The device used for enrollment is housed in a unit measuring 7" x 19" x 10" and operates within a temperature range of 0° – 40° C. A small device for later authentications can be easily installed on a laptop or workstation USB or parallel port. The Authenticam™, enabling both iris scan authentication and video capture, measures 5" x 2" x 3" and weighs less than 16 ounces. As future technological improvements permit smaller and cheaper devices, this method of biometric identification will win a larger market share. One day it will be possible to embed the technology in wireless devices such as cellphones and PDAs [Iridian].

In the past, iris scans and retinal scans have been used for restricting access to highly sensitive government and military sites. Current pilot projects are bringing this technology to a wider public arena. One project of interest is the Bank United's placement of iris recognition ATMs within Kroger supermarkets in Texas. This has resulted in quicker, more secure transactions, and surveys have shown tremendous levels of satisfaction with the new ATMs [Iris-scan]. Another project in the news recently has been demonstrated at Charlotte/Douglas International Airport in North Carolina [Hatcher]. The intent is to use iris scanning at electronic kiosks to identify the traveler and issue boarding passes. EyeTicket is the company marketing commercial applications based on the IriScan technology. EyeTicket deployed their Admission Turnstiles at the 2000 Olympics in Sydney to control access to the German Haus facility. Another airport system is used to control access to restricted areas within the airport, so special revolving doorways have been designed to reduce the likelihood of

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"piggybacking" or following closely an authenticated person to gain access to the restricted area.

Although iris recognition requires a certain level of user interaction and cooperation, it does offer advantages of accuracy and ease-of-use over other biometrics. One potential disadvantage is that there must be a certain level of light for successful imaging. But successful implementation of any biometric authentication scheme does not end with the initial rollout. Network crashes, power failures, hardware failures, and software problems are all possible ways in which a biometric system could become unusable. Security administrators must have plans in place for backup methods of identification in the event of system failure. Possible security breaches that must be protected against include tampering with the database, and interception of the transmitted code.

Iris scanning offers greater accuracy than finger scanning, voice or facial recognition, hand geometry or keystroke analysis. It is safer and less invasive than retinal scanning, an important legal consideration [Nuger]. Any company thinking of using biometrics would do well to ensure that they comply with existing privacy laws. The International Biometric Group's Market Report 2000 [IBG] states that iris scanning accounts for 9% of the $58.4 million in biometrics revenue in 1999. The industry of biometric authentication is moving into new areas with tremendous revenue potential, and will continue to grow rapidly.

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