Sensar. . .Secure^{TM} Iris Identification System

Ted Camus, Ph.D. Ulf M. Cahn von Seelen, Ph.D. Guanghua G. Zhang, Ph.D.
Péter L. Venetianer, Ph.D. Marcos Salganicoff, Ph.D.

Sensar, Inc., 121 Whittendale Drive, Building 2, Moorestown, NJ 08057, USA
E-mail: msalgan@sensar.com

The Sensar. . .Secure^{TM} M765-R1 Iris Identification System uses real-time stereo and eye finding technologies and the subject's unique iris pattern to unobtrusively verify an individual's identity. This biometric system [3] represents an evolution of [1]. It provides improved performance with glasses and operates under a variety of lighting conditions.

Figure 1. Sensar. . .Secure^{TM} M765-R1 Optical Platform

The system uses an active vision paradigm. Custom-designed image pyramid-generating hardware, developed in conjunction with Sarnoff Corporation, generates stereo disparity images in real-time, yielding the average distance to the subject's head (figure 2). The depth map is also used to restrict the system's attention to the closest person out of a possible queue of people.

A face-template matching algorithm is then used to determine the (X,Y) position in image space of the subject's eyes, even if the subject is wearing glasses (figures 3, 4). The eye position, along with the depth of the subject's eye region (Z), is mapped to an (X,Y,Z) location in real 3-D space with calibration tables specific to each stereo camera pair. The eye's 3-D location is used to control a pan/tilt mirror and a fixed focal-length lens to precisely center and focus a high-resolution image of the subject's right or left eye [4].

The system locates the eye in the high-resolution image

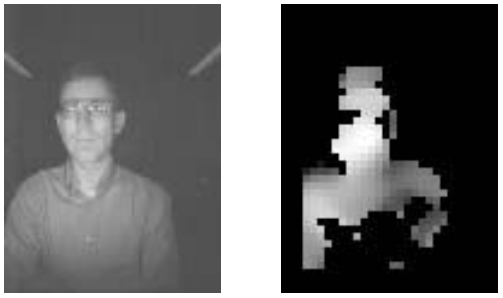

Figure 2. Stereo image and depth map

Figure 3. Face template on a subject

Figure 4. Template on subject with glasses

Proceedings of the Fourth IEEE Workshop on Applications of Computer Vision (WACV'98)
0-8186-8606-5/98 $17.00 © 1998 IEEE

(figure 5) and extracts a 256-byte "iris code", which captures the unique structure of the iris [2] (figure 6). The extracted code is compared to an enrollment iris code stored in a database. This component of the image processing is performed on a standard 166MHz Intel Pentium^{TM} motherboard. This system configuration shows an average verification time of approximately 3 seconds; the only cooperation required from the customer is to gaze at the optical unit while the system is in operation (figure 7).

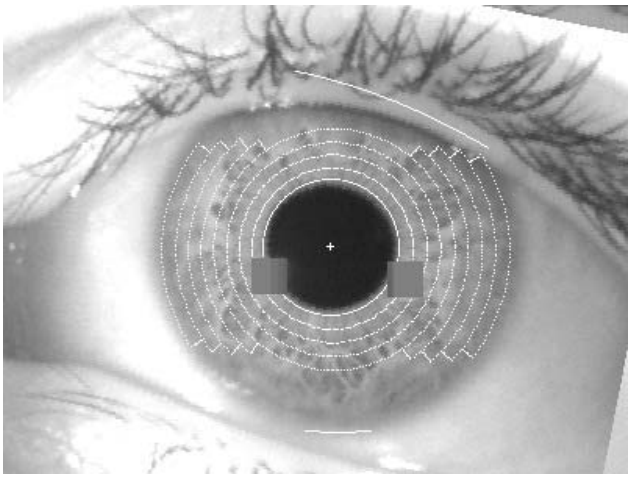

Figure 5. Analyzed high-resolution iris image

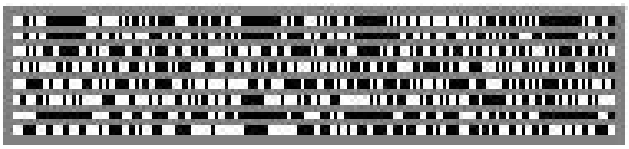

Figure 6. Iris code

The Sensar...Secure^{TM} M765-R1 Iris Identification system is currently being piloted with major banks and automatic teller machine (ATM) manufacturers in England and Japan, and will be piloted shortly in the USA. The customer experience at the pilots has shown neither false rejects nor false accepts.

Acknowledgments

IriScan, Inc. of Mt. Laurel, New Jersey, USA, holds the exclusive worldwide patents on the iris identification concept developed by Drs. Leonard Flom and Aran Safir and the software and process technology invented by Dr. John Daugman, Cambridge University, England. Sensar uses, under license, the iris identification process developed and owned exclusively by IriScan. IRISCAN is a trade mark of IriScan, Inc. of Mt. Laurel, New Jersey, and is used by Sensar, Inc. under license from IriScan, Inc.

Figure 7. ATM with Sensar...Secure^{TM} optical platform (on top) in operation

References

[1] T. Camus, K. Hanna, R. Mandelbaum, D. Mishra, L. Wixson, and M. Salganicoff. Real-time stereo and eye finding for an iris identification system. In *Demo Program of the IEEE Conference on Computer Vision and Pattern Recognition*, page 11, San Juan, Puerto Rico, 17–19 June 1997.

[2] J. G. Daugman. High confidence visual recognition of persons by a test of statistical independence. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 15(11):1148–1161, Nov. 1993.

[3] M. DellaVecchia, T. Chmielewski, T. Camus, M. Salganicoff, and M. Negin. Methodology and apparatus for using the human iris as a robust biometric. In *Ophthalmic Technologies VIII, SPIE Proceedings vol. 3246*, San Jose, CA, 24–30 Jan. 1998.

[4] K. Hanna, R. Mandelbaum, D. Mishra, V. Paragano, and L. Wixson. A system for non-intrusive human iris acquisition and identification. In *Machine Vision Applications*, Tokyo, Japan, Nov. 1996.

Proceedings of the Fourth IEEE Workshop on Applications of Computer Vision (WACV'98)
0-8186-8606-5/98 $17.00 © 1998 IEEE