Global Deployment of Finger Vein Authentication

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OVERVIEW: Finger vein authentication combines ease of use and a high level of security and accuracy, and is already in widespread use in applications such as the ATMs of Japanese financial institutions. Use of finger vein authentication is also spreading among private and public sector organizations in order to take advantage of these features to strengthen security and tighten up on identity verification. Outside of Japan, finger vein authentication is being adopted by public facilities and companies for a range of applications where it is improving convenience as well as security. These include system login authentication, management of visitors to a site, identity verification at reception, and attendance management. Hitachi is deploying its finger vein solutions, which also incorporate techniques such as 1:N sequential fusion authentication and cancelable biometric authentication technology, not only in Japan but worldwide.

INTRODUCTION

WITH threats such as terrorism and crime having escalated in recent years, awareness of security is growing internationally. Biometric authentication has attracted attention as a way of achieving a high level of security.

Biometric authentication is a technology for identifying an individual based on their body or behavior characteristics. In addition to providing accurate personal identification to improve security in applications such as physical entry and exit or access to information systems, biometric authentication is also more convenient for users because it does not require them to memorize an ID (identifier) and password nor carry a smartcard or other identification device.

Hitachi has deployed systems that employ finger vein authentication technology for biometric authentication. These systems are widely used in Japan to strengthen IT (information technology), physical, and other forms of security in public and private sector organizations, including in many ATMs (automated teller machines) belonging to financial institutions. Use of these systems is also growing among public institutions, companies, and other organizations outside of Japan.

This article describes the features of Hitachi's finger vein authentication solutions together with example overseas applications of the technology, particularly in Europe, North America, and Australia where it is used to improve security and convenience in a range of different systems.

OVERVIEW OF FINGER VEIN AUTHENTICATION TECHNOLOGY

What is Finger Vein Authentication?

Like fingerprints, it is believed that everyone has a unique pattern to their veins, which remains unchanged once a person reaches adulthood. Moreover, a

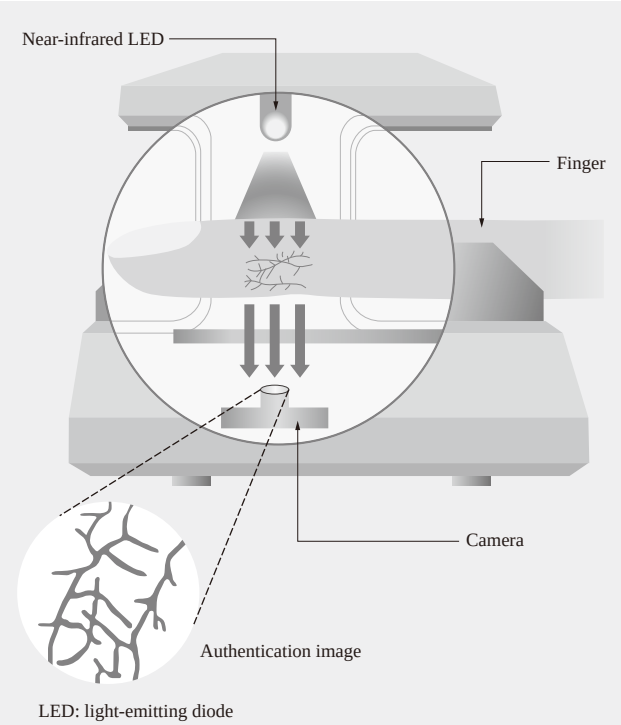

Fig. 1—Acquisition of Finger Vein Pattern.
Near-infrared light is shined through the subject's finger to obtain the pattern of veins.

property of the hemoglobin in veins is that it absorbs near-infrared light. The finger vein authentication technology uses the pattern of veins obtained by passing near-infrared light through the subject's finger to perform identification (see Fig. 1).

Features of Finger Vein Authentication

Finger vein authentication has the following features.
(1) Difficult to carry out spoofing by stealing someone's vein pattern
(2) A high level of accuracy
(3) Excellent ease of use as authentication

Compared to fingerprint authentication, another widely used biometric authentication technique, the advantages of finger vein authentication include: (1) Recognition and authentication accuracy is high and not significantly influenced by conditions on the surface of the subject's finger such as moisture, humidity, or dirt, and (2) Because the finger vein pattern is a characteristic of the inside of the subject's body, it is both difficult to falsify (something that is a problem for fingerprint authentication) and difficult to acquire illicitly in the way it is possible to obtain someone's fingerprints.

Deployment of Finger Vein Authentication

Hitachi commenced the basic research into finger vein authentication in 1997, and started selling physical access control products in Japan in 2002. Use of the technology has grown since then, including ATMs, bank teller terminals, and other applications in the finance sector, and in IT security applications such as PC (personal computer) login authentication. Finger vein authentication units are also widely used as components of other equipment in industries outside finance and physical access control.

Overseas, Hitachi is working with partners from various parts of the world, and physical access control systems are in use in Asia, Europe, the USA, and elsewhere, where they help to provide physical security. Applications such as IT security and attendance management are also spreading among public institutions, companies, and other organizations.

EXAMPLE OVERSEAS APPLICATIONS

The following section describes example applications of the finger vein authentication technology outside Japan.

Use in France

Evidian, a Bull Group company, is a European market leader in the field of ID and access control. It is also known throughout the world as a vendor of single sign-on software.

Access control for corporate business applications requires keeping track of numerous IDs and passwords, with users being required to change their passwords regularly to maintain security. Unfortunately, users often react to this by writing down their passwords or continuing to use the same password for all their applications and this makes it difficult to enforce security policies.

With a single sign-on system, users can use a single ID and password for various different business applications, and it is possible to enforce password policies, monitor access to each business application, and achieve reliable personal identification.

Moreover, such a system can achieve even more reliable personal identification by incorporating finger vein authentication units instead of using an ID and password to validate users and prevent identity theft. This provides more accurate control of access to business applications, and minimizes the risk of information leaks. It also reduces the frequency of calls to the IT help desk by users who have forgotten their password and therefore cuts the associated costs.

Use in Australia

Based near Sydney, TimeTarget provides T&A (time and attendance) and workforce management solutions. Its T&A systems have been installed at more than 3,000 sites in Australia and New Zealand.

T&A systems that use conventional personal identification methods such as a time card, ID and password, or smartcard can be subverted by spoofing or having another person clock in and this has a direct cost in terms of company profits. While biometric authentication can be adopted to counter this problem, a difficulty with fingerprint authentication is that the fingers of sanitation or food and beverage employees, who work with water, are likely to become wrinkled, resulting in an authentication failure.

Finger vein authentication is more accurate than fingerprint authentication, and its operation requires no more than placing a finger on a scanner. TimeTarget has already installed more than 1,000 finger vein authentication units in its T&A systems. The company has customers in industries such as restaurants or supermarkets, where staff work with water and finger vein authentication is earning a good reputation from the employees of these customers (see Fig. 2).

TimeTarget is currently looking at customizing its T&A systems to comply with various different

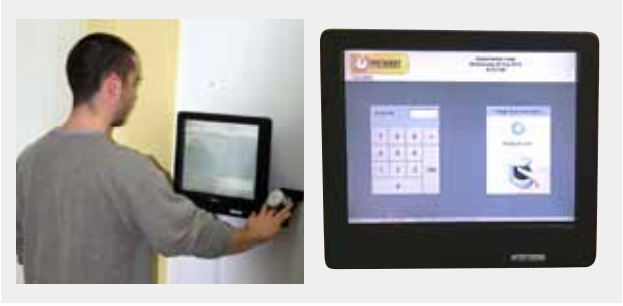

Fig. 2—Attendance Management System in Use (Left) and Example Screen (Right).
After performing a simple set of operations on the touch panel PC (personal computer), the user places their finger on the scanner to record attendance information.

national labor laws with the aim of expanding sales beyond Australia and New Zealand to countries in Europe and North America.

Use in USA

Finger vein authentication technology is also being adopted for various applications in the USA.

One example is from the healthcare industry, where finger vein authentication units have been incorporated into the medical data management systems used at several hospitals in Ohio.

In the USA, growing problems with false claims for health insurance reimbursement involving identity theft and medical errors caused by incorrect medical recordkeeping have made accurate patient identification at healthcare facilities an increasingly important issue. In the past, the Ohio hospitals identified patients by their social security number or by their name, address, and date of birth. However, reliably identifying people this way can be time consuming when family members have similar names or social security numbers.

Using finger vein authentication to identify patients at hospital reception allows this process to happen faster and with greater accuracy.

In this example, finger vein authentication is used to narrow down candidates from the patient database prior to final confirmation. Introducing the system has made the process of admitting patients more efficient, achieved more accurate identification, and cut down on identity theft (see Fig. 3).

Finger vein authentication improves the efficiency of patient identification, and has been so well received at these hospitals that extending the system to medical facilities in other parts of the country is being considered.

Finger vein authentication is also used by public institutions, and the following example describes its adoption at a county jail in Alabama.

Large numbers of people need to enter and exit the jail, including the prison's inmates and staff as well as others such as vendors and visitors who are associated with the prison. Because of the nature of the facility, and in order to maintain security, the entry and exit of these people needs to be subject to strict control.

The facility has a prison management system that features simple operation and provides a record of entry to and exit from the prison in the form of photographs and past activity records. Combining this system with finger vein authentication improves both the security and the operational efficiency of the facility by identifying people entering and exiting the prison with greater accuracy and simplifying the procedures for verifying inmate identity (see Fig. 4).

Installing the system in prisons, police stations, and other public facilities in other states is now being investigated.

FUTURE DEVELOPMENTS

Hitachi has installed physical access control solutions at sites such as private sector companies and public sector financial institutions in China, Southeast Asia, and elsewhere. Finger vein authentication units have also been incorporated into individual products made by access control equipment manufacturers in places like France and the USA which are marketed primarily in Europe and North America.

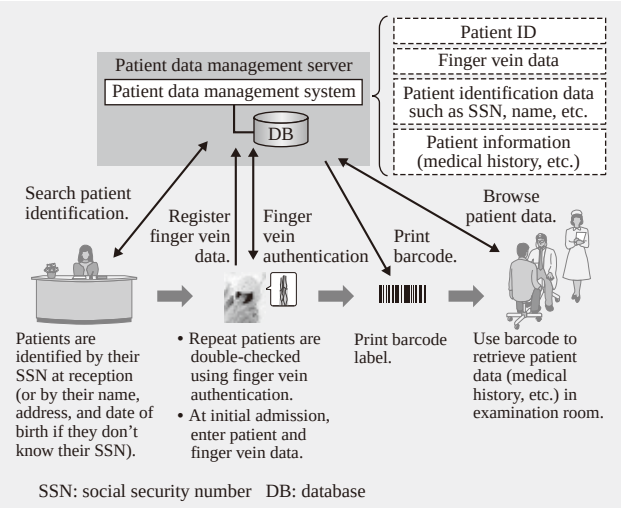

Fig. 3—Integration of Finger Vein Authentication into Patient Data Management System.
Finger vein authentication is used as a double-check on patient identity to improve the efficiency of reception procedures.

Meanwhile, Hitachi is also working on the development of further improvements including enhancing the performance of finger vein authentication and extending its functions.

One example is 1:*N* sequential fusion authentication. There are two types of biometric authentication. 1:1 authentication uses an ID, card, or other mechanism to retrieve the user's biometric data from a database, and then compares this with the biometric data acquired from the user to determine whether they are who they claim to be. In contrast, 1:*N* authentication sequentially compares the biometric data acquired from the user with all entries in the database (where *N* represents the number of entries) to determine the user's identity.

Although 1:1 authentication is fast and accurate, it is less convenient because it requires the user to remember and enter an ID or carry a card. In contrast, 1:*N* authentication provides excellent convenience because it only requires the user to place their finger on a scanner to perform identification. However, because accuracy is poorer than 1:1 authentication, and because the identification process becomes slower the more entries there are in the biometric database, in the past it has only been practical to use it for user numbers in the range of several dozen to several hundred.

1:*N* sequential fusion authentication is a technique that combines the best features of 1:1 and 1:*N* authentication. It identifies people by using vein data from two fingers when the technique is unable to identify a user by their first finger so that it can try again using the second finger. By combining this technique with a separately developed technique for rapid data comparison, it is anticipated that highly convenient finger vein authentication systems, which can identify people simply by having them place their finger on a scanner will become practical even when the number of users is large.

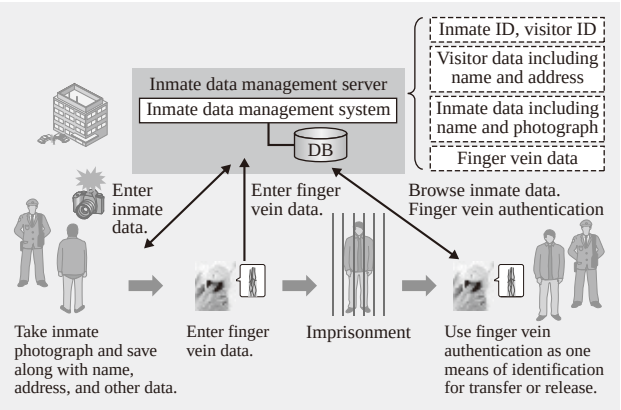

Fig. 4—Integration of Finger Vein Authentication into Inmate Data Management System.
The operational efficiency and security of the facility are improved by using finger vein authentication to achieve greater identification accuracy for inmates and visitors.

Hitachi has also commercialized cancelable biometric authentication technology. The functions of the technology include updating biometric data and comparing acquired biometric data in encrypted form without having to decrypt it. Although biometric authentication is convenient because it uses a person's unchanging biometric data to identify them, unlike other methods such as an ID and password or card, once the information has been stolen or otherwise divulged, it cannot be reissued. With the cancelable biometric authentication technology, on the other hand, the biometric data can be canceled if stolen or divulged by changing the encryption key and re-encrypting the data. This allows the implementation of finger vein authentication systems that provide not only accuracy but also a high level of security in operational terms.

In Japan, Hitachi offers a finger vein authentication service that uses this cancelable biometric authentication technology in the form of a safe, secure, and convenient cloud service suitable for application services.

Outside Japan, Hitachi intends to strengthen further its ties with global partners to develop and deploy finger vein authentication solutions more widely using technologies such as 1:*N* sequential fusion authentication and cancelable biometric authentication technology to differentiate itself from competitors.

CONCLUSIONS

This article has described the features of Hitachi's finger vein authentication solutions together with example overseas applications of the technology, particularly in Europe, North America, and Australia where it is used to improve security, convenience in a range of different systems.

Finger vein authentication is a personal identification technology that combines convenience with a high level of security and offers advantages that are starting to be recognized, not just in Japan, but around the world.

For the future, Hitachi intends to deepen its ties with its overseas partners in a range of different fields to develop and more widely deploy finger vein authentication solutions that suit the way of life and commercial practices of their respective countries and regions.

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