Present Status and Prospects of Biometric Products and Solutions

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Abstract

NEC possesses world leading fingerprint authentication and face recognition technologies. This paper introduces some of our products that are used in applying these core security technologies, namely, the fingerprint authentication solution SecureFinger and the face recognition development kit NeoFace. In addition, of the solutions NEC provides for more than 480 customers in more than 30 countries worldwide the paper focuses on HANIS, which is a citizen ID system supporting the public services of the Republic of South Africa and explains its future role in that country.

NEC contributes to the public safety of countries all over the world by offering solutions supporting applications from criminal investigations to public services.

1. Introduction

Since the start of R&D into fingerprint recognition in 1971 and the world's first success in the development of a latent fingerprint matching technology, we have been leading the world in the R&D of this field. We have actually achieved top recognition accuracies several times among the leading vendors in benchmark tests held by the U.S. National Institute of Standards and Technology (NIST). In the field of face recognition technology, too, we succeeded in gaining the top position by scoring much higher than the second placed vendor in a similar benchmark test held in 2010.

As witnessed by the above facts, we are the sole enterprise in the world possessing a couple of biometric authentication technologies that has won the world-top positions in the benchmark tests held by a third-party organization.

In the following sections of this paper, the author will introduce our products for applying fingerprint and face recognition technologies as well as discussing actual cases of the solutions that we have provided for our customers.

2. Biometric Product Lineup

2.1 Fingerprint authentication product SecureFinger

The fingerprint authentication product SecureFinger is a combination of; 1) sensor technology based on the intra-finger scattered light scanning method that is free from the adverse influence of individual finger abnormalities; 2) the AGC function that acquires the best fingerprint images automatically of a finger placed on the sensor, and; 3) the matching technology evaluated to have world leading accuracy by third-party benchmark tests (see **Fig. 1**). All of these core technologies were developed independently by NEC and are continuing to be researched, developed and improved.

For example, with a dry finger that is frequently found among old aged people or a wet finger that is frequently found with younger people, sensors based on other methods are sometimes unable to image the features of the fingerprint satisfactorily. However, as shown in **Fig. 2** , fingerprints that are often obscured or blocked out in imaging using the optical prism and semiconductor chip methods, may actually be imaged clearly with the intra-finger scattered light scanning method. This is proof that the method is effective for persons
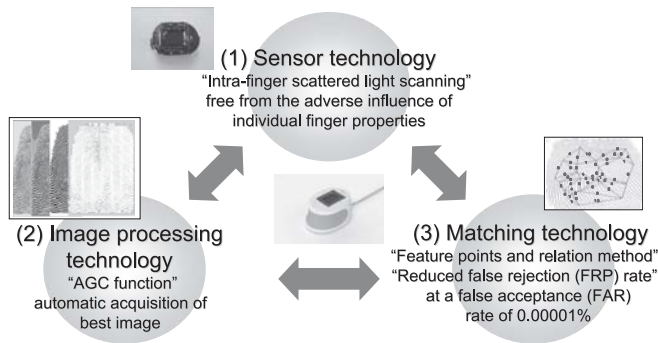
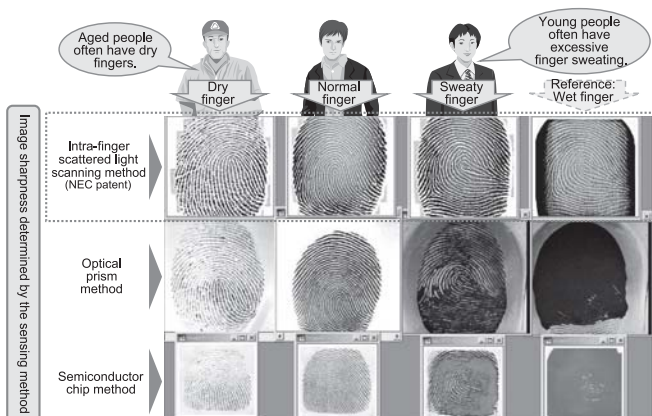Fig. 1 Features of the fingerprint authentication product SecureFinger.

Fig. 2 Stable fingerprint information acquisition with an intra-finger scattered light scanning method.

Photo PU900-10 fingerprint sensor with intra-finger scattered light scanning method.

who pose difficulties when traditional methods are used.

Photo shows the PU900-10 sensor based on the intra-finger scattered light scanning method.

SecureFinger supports the Windows Active Directory as well as 1-to-1 matching using an ID card, etc. and 1-to-N matching with which multiple accounts are switched based only on finger information without any ID cards or passwords.

In addition, multiple authentication servers can be installed to distribute the workload. We also offer a development kit so that our highly accurate fingerprint authentication technology may be embedded easily in various applications.

Since the start of shipment, SecureFinger has been adopted by a wide range of customers, including national and local government agencies. For example, Hashimoto Municipal Hospital uses it for the protection of highly confidential electronic medical chart information and the Oigawa Municipality (at present merged into the Yaizu Municipality) uses it for authentication of terminals accessing the municipal administration system. In terms of the number of fingerprint recognition units, we have already shipped more than 300,000 units for supporting citizen safety and security.

2.2 Face Recognition Development Kit NeoFace and Its Related Products

NeoFace is a development kit for use in embedding our face detection/matching algorithms in various applications. Among the related products applying this solution, we are currently introducing FaceMonitor, which is a biometric authentication tool that makes use of facial features.

The use of biometric authentication technologies based on fingerprints and veins necessitates a conscious act of the user, such as placing the finger or palm of the hand on the sensor. Since authentication is performed using the information the sensor reads at this time, authentication is not possible if the finger or palm is not placed on the sensor. On the other hand, facial data can be captured continuously with a camera while the authenticated person is not conscious of being filmed. Authentication is thereby possible so long as the targeted person stays in front of the camera.

Fig. 3 outlines the operation of FaceMonitor. With an automatic terminal lock when the user leaves the seat, an automatic terminal unlocks when the official user returns and an automatic alarm notice being generated when a non-registered person sits on the seat. This arrangement provides a highly secure terminal environment that cannot be implemented with other biometric authentication methods or
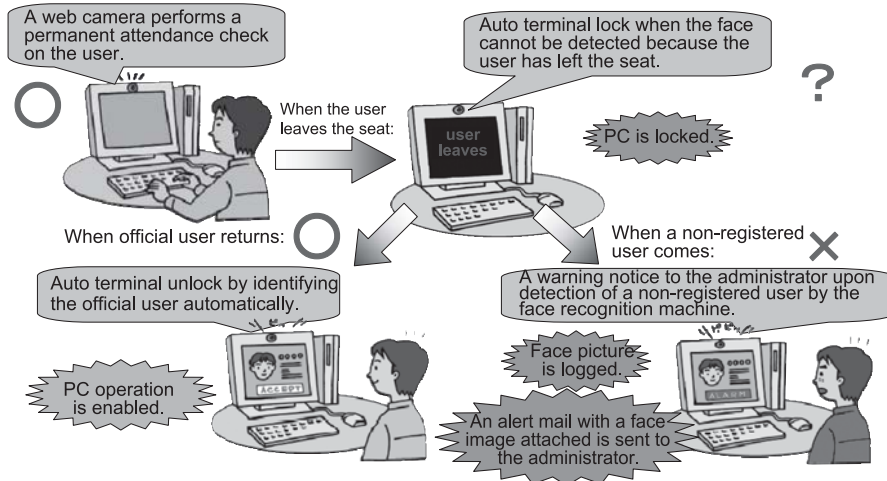
Fig. 3   FaceMonitor with a permanent terminal user authentication capability.

technologies based on passwords and ID cards. The system may also be applied to produce safety and security at higher levels.

3. Actual Cases of Biometric Solutions

NEC's biometric solutions are in use by more than 480 customers in more than 30 countries. **Table** shows the range of solutions and their representative overseas users.

The core of the biometric solutions, AFIS (Automatic Fingerprint Identification System) was named originally by NEC. Since then, it has become the generic name for systems of this kind and its applications have expanded considerably from its beginnings. In addition to the traditional field of criminal AFIS, the Civil AFIS field is rapidly expanding applications usage. In areas for which the authentication of specific individuals is central such as: citizen ID systems, IC passports, border control and electoral IDs. This trend is an expression of the rise in expectations for public safety and for the need for safe and secure systems in the public domain worldwide.

Below, we introduce a large scale data base citizen ID system that is being applied in the Republic of South Africa. This country is located at the southern end of the African Continent. It is known as a production district of gold and diamonds and is attracting attention by its rapid economic growth, which is comparable to that of China. In order to allow the people composed of various ethnic groups to utilize the public services equally, the South African Government issues ID

Table   Solutions and representative overseas customers.

Solution	Customer
Criminal investigations	Netherlands: Ministry of Justice
	New Zealand: New Zealand Police
	Philippines: Philippine National Police
	Taiwan: Criminal Investigation Bureau
	Turkey: General Directorate of Security
	USA: California Department of Justice
	USA: Illinois State Police
	USA: Texas Department of Public Safety
	USA: Western identification Network (WIN)
	Venezuela: Aragua Police Department
Citizen ID	Brazil: State of Rio Grande do Sul
	Macau: Multifunctional National ID Card Solution
	South Africa: HANIS (Home Affairs National Identity System)
Electoral ID	Democratic Republic of the Congo: Voter Registration System
IC passport	Hong Kong: Biometric passport
	Singapore: Biometric passport of Immigration & Checkpoints Authority (ICA)
Immigration	Hong Kong: Drive-through multi-biometric border control solution
	Singapore: Immigration and border control for work visa holders
	Chili: Border control system
Foreign resident registration	Portugal: Foreign resident registration solution

booklets for all of its citizens aged over 16. These ID booklets are used in many situations other than in the public services, such as for the purchase of vehicles or rental of video disks, and they are now considered to be indispensable in aiding the people to lead secure everyday lives.

The ID booklets have been adopting the personal authentication by fingerprint technology. However, such authentication has taken a large amount of labor and time because of the scale of the manual checking operation. As it was feared that the operation of the ID booklet system would face issues if the database continued to expand, the government decided to introduce an automatic authentication technology.

In 2002, the South African Government introduced a citizen ID system named HANIS (Home Affairs National Identification System). With HANIS, all of the existing fingerprint data that had been stored on paper and the newly registered fingerprints were converted into a digital database and NEC's fingerprint recognition technology was adopted. This policy has made it possible to process authentication of 70,000 persons a day correctly and quickly and to smoothly operate a citizen ID system at the world's largest scale that can deal with 45 million people. In addition, in 2007, a system enabling service continuity even in emergencies and including disaster situations was additionally introduced.

From a citizen viewpoint, the HANIS system shortens the time required to issue an ID booklet or authentication and significantly reduces the risk of ID or personal information theft, thanks to the fingerprint authentication providing a high level of identification accuracy. In other words, the HANIS system has allowed the people to benefit from public services more smoothly at the same time as enabling safety and security in their everyday activities.

In addition, this particular citizen ID system has offered huge social benefits for the people of South Africa: Previously, the South African people were divided according to their ethnic and religious groups. Today, all of the people are integrated under a single database and are identified only by fingerprints, which is information that is common to all humankind instead of specifically to differentiated ethnic and religious groups. This policy has tended to lower the barriers and prejudices of people, who have been thereby helped to realize that all of them belong to a single nation.

4. Conclusion

In the above, we introduced the SecureFinger and NeoFace products that apply the world leading fingerprint authentication and face recognition technologies of NEC, our universally deployed solution businesses and the HANIS of South Africa as a representative example.

At NEC, we are proud that we are able to support a safe and secure global society via our biometric authentication technologies. Just as AFIS that was initially used exclusively in investigations was able to expand its application to the national public services and to foreign travel control systems, the biometric authentication solution is also expected to expand its applications further in the future. Meanwhile, AFIS is also expected to be used in a wider range of scenarios by incorporating new technologies such as multi-modal finger recognition and DNA recognition devices in addition to face recognition. We intend to enhance our efforts for the development of associated technologies and with their help to contribute to world wide public security.

*Windows and Active Directory are registered trademarks or trademarks of the Microsoft Corporation in the USA and other countries.

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