Fully Automated Image Capturing-type Iris Recognition Device "IRISPASS®-M"

Seiichi Itoda Motomitsu Kikuchi
Seiichi Wada

Social interest in security has been rising rapidly in recent years. Experiments for enhancing security at major airports in countries around the world have actively been promoted since the 9-11 terrorist attacks on September 11, 2001. Furthermore, the importance of information security has become recognized widely due to the large number of card crimes and personal information leaks that have been occurring with the growth in popularity of the internet. Under such circumstances biometric identification has drawn a lot of attention as a means of definitively identifying individuals because it is difficult to impersonate someone. Of all identification systems, iris recognition has gained strong support from its users as a highly accurate identification method in comparison with other biometric identification systems.

We took on the iris recognition technology early on and have been engaged in the development of personal identification systems using the iris since 1996[1)]. This time we were able to develop as a commercial product, the IRISPASS®[*1)]-M (**Photo 1**), a fully automated image capturing-type iris recognition device with miniaturized dimensions and accelerated processing speeds and an application program interface (API) that controls the system.

This paper provides an overview of the system and API, as well as an introduction to their application examples.

Photo 1 IRISPASS-M external appearance

Device Overview

The "IRISPASS-M" model is the successor of "IRISPASS-WG" that has been sold since 2002. The new model inherits the fully automated image capturing function, which allows individuals within the recognition range to simply look at the device for the device to automatically detect the position of the eyes and capture an image of the iris to perform recognition. The speed of the new model, however, has been increased to perform identification in about half the time previously required, while the device volume has been reduced to about three-quarters of the previous size and a dramatic reduction in cost has also been realized.

The "IRISPASS-M" is controlled by a personal computer via LAN. Due to this the use of a dedicated control unit, which was required for existing models, has become obsolete resulting in a dramatic reduction in space and cost. Furthermore, a voice guidance function has been incorporated to improve operability, making it possible to access voice guidance in twelve languages aside from Japanese and English, which are already installed as standard features, as well as customizable messages to suit applications. Specifications of the device are shown in **Table 1**.

Table 1 IRISPASS-M specifications

Item	Specification
Image capturing time	One second or less[1].
Identifying time	One second or less[1].
Unauthorized persons acceptance rate	0.000083% or less.
Identifying range	Distance from camera: 30 to 60cm. Height of subjects: 134 to 189cm. (When the device is installed at the recommended height of 140cm.)
External dimensions	328 (W) × 197 (H) × 84 (D) mm.
Weight	5kg or less.
Power supply	AC100 to 240V, 50/60Hz.
Installation mode	Wall-mounted, installation on external housing or desktop installation (requires a stand, available separately).
Environmental conditions	Temperature: 0 to 40˚C; Humidity: 30 to 80%; indoor installations.
External interface	LAN (100Base-Tx).
Software	BioAPI™[*2)].
Recommended specifications for controlling PC	CPU: Intel® Celeron®[*3)] 2GHz equivalent or higher. Memory: 512MB or more. Microsoft® Windows® XP[*4)]. Microsoft® Windows® 2000[*4)]

1: Image capturing and identifying times vary depending on identifying conditions.

(1) Device configuration of IRISPASS-M

As shown in **Figure 1**, the IRISPASS-M is comprised

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*2) BioAPI is a trademark of the BioAPI Consortium.
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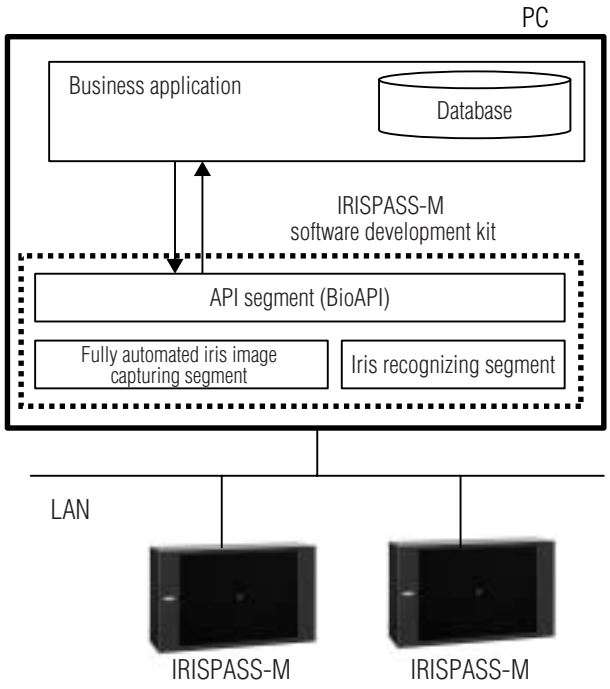

Fig. 1 System configuration

of the main unit, a software development kit that is to be installed on a personal computer and an application. The software development kit consists of an API segment, fully automated iris image capturing segment and iris recognizing segment. The application on the system can call on the API segment to realize iris recognition that has a fully automated image capturing function. There is no need to gain a detailed understanding of functions of the fully automated iris image-capturing segment in order to use the API.

(2) Fully automated iris image capturing segment

The biggest feature of the IRISPASS-M is the fact that registration and verification is possible without any special operations, other than having the individual stand in front of the device and look into the central region of the device. Iris recognition devices available from other manufacturers need adjustments, such as requiring the subject to bend down or change the angle of the device in order to fit the eye of the subject within the image capturing range of the camera built inside the device. Angular adjustments by the subject are no longer necessary with the fully automated iris image capturing function of our device.

The fully automated iris image capturing segment consists of four functional units, the subject detection segment, eye position detection segment, narrow angle camera control segment and iris extraction segment, as shown in **Figure 2**.

The detection sensor used in the respective segments, as well as the wide angle camera used to capture the facial image and the narrow angle camera used to capture the image of the eye are built into the IRISPASS-M device.

a. Subject detection segment

Approaching individuals are detected by the detection sensor.

b. Eye position detection segment

The facial image of the individual is captured using a wide-angle camera and the eye position is detected using a facial image. A newly developed image processing technology is used for detecting the position of the eyes.

c. Narrow angle camera control segment

The angle degree of the narrow angle camera is adjusted appropriately based on the position of the eye detected by the eye position detection segment before the eye image of the individual is captured. The image obtained includes both eyes, which are captured simultaneously.

d. Iris extraction segment

The iris section is extracted from the image of the eye obtained by the narrow camera control segment before the image is transferred to the higher-level process. Extraction of the iris section uses the newly developed image processing technology.

- **Acceleration of iris extraction through simultaneous capturing of both eyes**

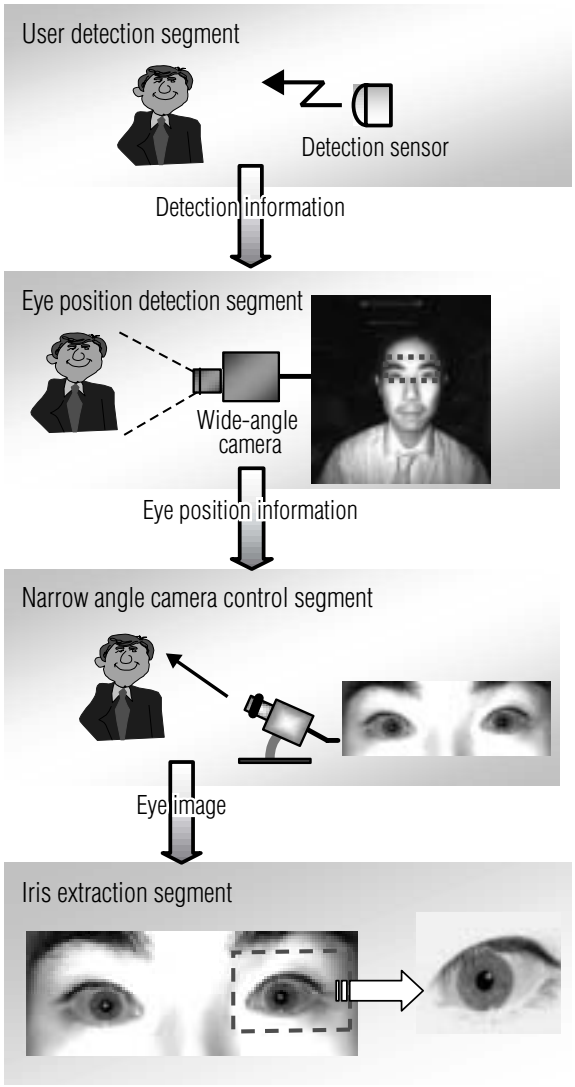

Fig. 2 Fully automated iris image capturing segment

Acceleration of the processing speed was realized in IRISPASS-M through the use of a newly developed technology that simultaneously captures the image of both eyes. Since our existing models captured the image of one eye at a time it was necessary to use a camera with a narrow angle in two separate instances in order to extract the irises of two images. This model, however, uses a single operation to capture an image of the irises of both eyes, extracted by the iris extraction segment. It is possible, therefore, to dramatically reduce the time required for capturing images.

(3) API segment (BioAPI)

The API segment is the portion in which functions called by applications are defined and is provided to application developers as a software development kit. We have adopted the BioAPI V1.1, an established standard specification for biometrics, as the API segment.

- **What is BioAPI?**

BioAPI is a standard API for biometric identification formulated by the BioAPI Consortium. The current version 1.1 is registered with ANSI (registration number ANSI/INCITS 358).

A total of 32 functions are defined for BioAPI, including functions for performing initialization and termination processes, functions relating to registrations and verifications, as well as functions for database operations. Two types of functions are available for BioAPI, those that are required, which must be provided by the vendor of the biometric device and optional functions. Although the provision of the required functions is compulsory for vendors, the decision on the provision of optional functions is left up to the vendors[2].

- **IRISPASS-M BioAPI**

Numerous optional functions are available with IRISPASS-M BioAPI to make application development easier and to facilitate flexible system configurations. Representative supported optional functions are described below.

a. Support for 1: N Identification function

In comparison with other methods the 1:N verification can be executed at high speeds with iris recognition. In order to maximize the iris recognition performance, the IRISPASS-M BioAPI supports the BioAPI Identify, which is a 1:N verification function.

b. Support of Client/Server configurations

In the IRISPASS-M BioAPI, BioAPI VerifyMatch and BioAPI IdentifyMatch, which are defined as optional functions in the BioAPI specification, are supported to provide the comparison between recognition data. It is possible to build a system in a client/server configuration with which the client terminals capture iris images and the server performs identification.

c. Support of screen control functions

A function for displaying screens in a wizard format is an essential function for the registration and verification on BioAPI. On the other hand the BioAPI SetGUICallbacks, a function that controls the screen through an application, is optional. The adoption of the screen control function offered by this application made it possible to build flexible systems, including registration and verification screens, through various screen layouts and the support of multiple languages, etc.

Furthermore, various functions have been realized for the standard wizard as well, including high-speed registrations and verifications that take advantage of the image capturing of both eyes and the support of an additional 12 languages.

About data security

Security for the IRISPASS-M has been seriously taken into consideration, therefore, the data exchanged between personal computers and the IRISPASS-M device, as well as data returned from the API segment, are all encrypted.

Accordingly, there are no concerns for the misuse of biometric information obtained by the IRISPASS-M system.

Application examples

Examples of applications for the system are described below.

(1) Airport security systems

Activities relating to the Simplified Passenger Travel (SPT) intended to simplify various procedures for passage, which realize a high level of security, have been proceeding at airports throughout various countries in recent years. One of the features of this SPT is the application of biometrics as a means of identification for the purpose of airline check-ins and boarding at gates, as well as for immigration control. The International Civil Aviation Organization (ICAO) approved the use of iris recognition (as well as facial and fingerprint recognition) as biometric identification incorporated in Machine Readable Travel Documents (MRTD). In Japan, the Cabinet Secretariat as well as relevant government ministries, such as the Ministry of Land, Infrastructure and Transport, have been conducting a “Validation Experiment for Digitization of Airport Check-in Procedures Utilizing Biometrics” since 2002 as part of the “e-Airport” concept. Oki Electric is also participating in this experiment.

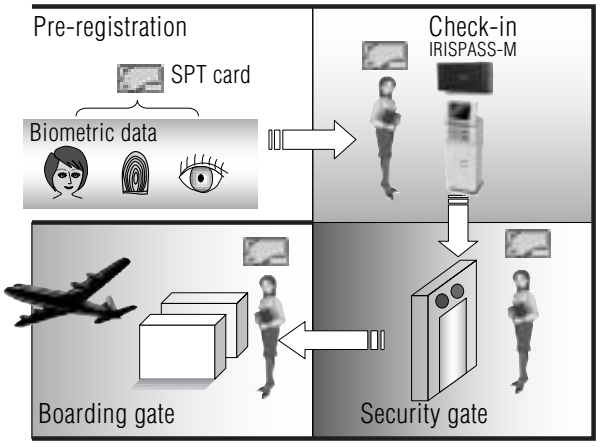

Fig. 3 Airport security

An overview of the validation experiment is shown in **Figure 3.** Biometric data, including iris information, is stored in the IC card known as the "SPT card". Personal identification is carried out using biometric identification at check-ins, security gates and boarding gates, etc. Using biometrics makes it possible to simplify various procedures while assuring a high level of security.

Furthermore, our track record includes the adoption of our existing model, IRISPASS-WG, for the immigration control system at the Rhine-Main International Airport in Frankfurt (Germany).

(2) Gate control system

This system controls physical access to designated areas for the management of important assets and maintains access logs. Iris recognition in particular, even among various types of biometric identifications, makes impersonation difficult and is optimal for controlling access to important areas, as the identification of individuals is critical. This system is, therefore, a representative system for our iris recognition products[3].

An example configuration for the gate control system is shown in **Figure 4**. The basic configuration includes a controlling personal computer, registration unit, recognition unit, IC control device, electronic lock control panel and electronic lock. The devices are connected over a LAN and controlled by the controlling personal computer. The controlling personal computer also manages the access logs as well as the registration and verification tasks.

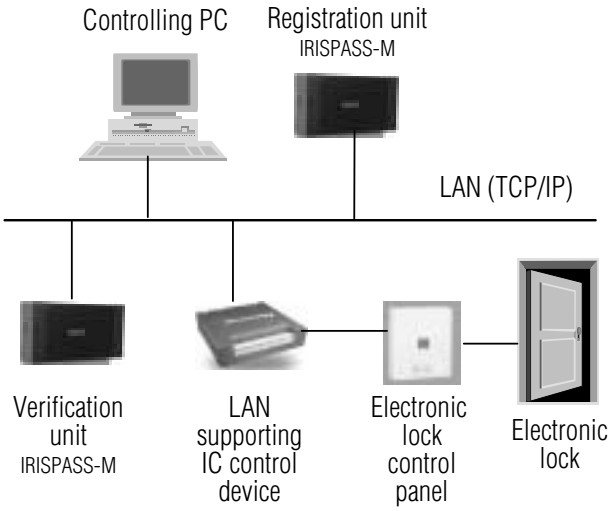

Fig. 4 Gate control system

Conclusion

A system overview of the developed IRISPASS-M and features of the functions as well as application examples have been introduced thus far.

IRISPASS-M provides a fully automated image capturing function that performs iris recognition as an individual simply stands in front of the device. It has evolved to perform at higher speeds for a dramatically reduced price, with miniaturized dimensions in comparison with those of the existing product, IRISPASS-WG. Furthermore, no effort has been spared in the development of the interface, which incorporates a voice output function accommodating multiple languages, as well as a guidance function with text.

In addition, since the system supports BioAPI, which is the standard API for biometrics, a multiple biometrics system can be easily built to incorporate facial recognition devices or fingerprint recognition devices that are used with SPT.

Although airport security and gate control systems were mentioned as application examples it is also possible to adopt the system for other security applications, including various kiosk terminals or employee time-clock management systems.

References

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Authors

Seiichi Itoda: System Hardware Company, System Hardware Development Div., Biometrics System Dept., Development Team-1.

Motomitsu Kikuchi: System Hardware Company, System Hardware Development Div., Biometrics System Dept., Development Team-1.

Seiichi Wada: System Hardware Company, System Hardware Development Div., System Design Dept.-1, Design Team-2.