Utilization of Biometrics Authentication Technology for Airport Security

Hirofumi Konishi

With the slogan, "Leading the World in IT Airport Applications - e-Airport", an experimental service was recently conducted at Japan's gateway to the world, the New Tokyo International Airport (hereinafter referred to as "Narita Airport"), to provide on the day flight information about aircraft arriving and departing, as well as railroad access information, which was accessible using a mobile phone, a handheld device or a wireless LAN. The service provided[1] made it possible to collect information, send and receive e-mails with free access to the Internet.

The feasibility experiment of the "e-Check-in", conducted at Narita Airport, which adopted the biometrics authentication technology, that has recently been drawing a lot of attention as a part of the IT utilized for airport security, is described in this paper.

This paper will verify how effective the adopted face-authentication technology is and what was expected to be accomplished with the "e-Check-in" feasibility experiment.

The "e-Airport Concept": Narita Airport as the IT showcase of the e-Japan strategy
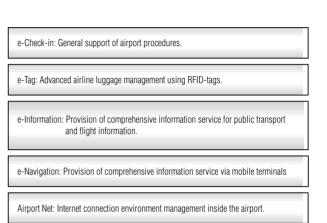
The "e-Airport Concept" project that has been active at Narita Airport since 2001, was planned to turn the airport into a showcase of cutting-edge IT technology.

This project is considered to be a practical project to realize the "e-Japan Strategy" set up by the government, which is comprised of the five systems and services shown in Fig. 1 that together make a strong case in "transforming Japan into the world's leading IT nation".

In other parts of the world, on the other hand, the Simplifying Passenger Travel (SPT) project, driven mainly by the International Air Transport Association (IATA) and International Civil Aviation Organization (ICAO), was launched to realize a one-stop service for passengers by speeding up and increasing the efficiency of the complicated travel procedures of air travelers.

Since the 9-11 series of terrorist attacks, however, enhancement of security at airports has become a subject of interest, with debates taking place on how to sustain security while raising the level of efficiency and speed of procedures for passengers.

For this reason the biometrics authentication technology, a technology providing automatic and positive authentication of passengers based on the physical characteristics (biological identifying information) that can only belong to each individual, is drawing a lot of attention.

e-Check-in: General support of airport procedures.

e-Tag: Advanced airline luggage management using RFID-tags.

e-Information: Provision of comprehensive information service for public transport and flight information.

e-Navigation: Provision of comprehensive information service via mobile terminals

Airport Net: Internet connection environment management inside the airport.

Reference: Narita Airport e-Airport web site (http://www.e-airport.jp/).

Fig. 1   e-Airport concept

Implementation of the biometrics authentication technology is being considered for the efforts relating to the SPT of each respective nation, with feasibility experiments already conducted in Europe and Australia for the purpose of verifying the elemental technology and operations. Further, monitoring systems that use blacklists (facial photograph information) to prevent crimes and terrorist activities have been put into practical implementation in the United States.

Consistent with this movement, Narita Airport, with its "e-Airport Concept" has been looking into the biometrics authentication technology in order to realize the security as well as increase the speed and enhance the efficiency of travel procedures for air travelers. As a verification of elemental technology and operations, a feasibility experiment of the "e-Check-in" has started.

Feasibility experiment of "e-Check-in" aiming to improve the safety of air travel

The "e-Check-in" feasibility experiment, which is being conducted at Terminal 2 of Narita Airport, primarily by the Ministry of Land, Infrastructure and Transport, with the cooperation of the Narita International Airport Corporation, All Nippon Airways Co., Ltd., and Japan Airlines Corporation, aims to realize the digitization and automation of boarding procedures (check in) as well as the authentication of individuals by using the biometrics authentication technology, in response to the trends of standardization of related international standards and effective use of biometrics for international airport security.

The system aims to make it possible for air travelers to utilize the time at the airport as effectively as possible by shortening the time required for procedures at the relevant areas of the airport, while raising the security levels of air travel by preventing the changing of boarding passengers and such through positive individual authentication.

The following items are critical for ensuring a high level of security during check in:

- Passport presented by the passenger must be legitimate.
- Passenger must be the individual described in the passport.
- Authenticated passenger must board the plane and must not be substituted by someone else.

In order to accomplish this, the legitimacy of a passport is verified using a passport reader that is capable of determining the authenticity of a passport, while the face-authentication technology is used to verify the passenger as the individual that appears in the passport. Specific details of the feasibility experiment, in which Oki Electric participated, are as follows (Fig. 2):

(1) Participation registration (Internet)

The "participation coupon" that contains reservation information (secondary code) is sent to the address of the passenger who registered on the air carrier's web site.

(2) Acquisition of biometrics information and the issuing of a boarding pass

Check in is conducted when the participation coupon is held in front of the check-in terminal installed at the check-in counter, which is loaded with the face-authentication function (Photo 1).

The passport is verified and the face information of the passenger is acquired, before a boarding pass is issued and printed with two-dimensionally coded facial information included.

(3) Security check

A security inspection terminal is used at the security check area to authenticate an individual passenger with the two-dimensional coded facial information printed on the boarding pass.

(4) Boarding procedure

At the boarding gate, the passenger is authenticated again by the boarding gate terminal (Photo 2) using the two-dimensionally coded facial information printed on the boarding pass.

The information read is used to conduct boarding gate procedures, the tab of the boarding pass is cut off and the facial information of the passenger is purged after these procedures.

An analysis and a study of the time required by passengers at the relevant areas, as well as the convenience and receptiveness of passengers, based on passenger surveys, were conducted. Analysis and verification of the processing accuracy and speed of the face-authentication technology, which is thought to be the technical element that will realize the positive individual authentication, were also conducted.
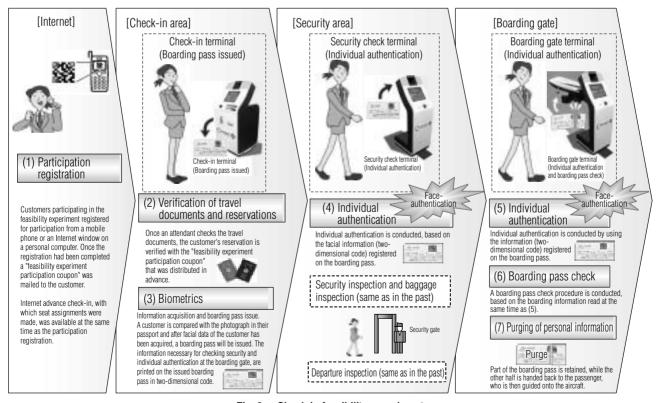

Fig. 2 e-Check-in feasibility experiment

From the results the viability and issues of the system model of the feasibility experiment were clarified in an attempt to form an ideal future image of the "e-Airport", a Japanese version of the SPT that utilizes the biometrics authentication technology, which realizes a high level of security.

"Face Pas", literally
- What is face-authentication technology? -

The biometrics authentication technologies mentioned thus far, which are the keys to assuring security at airports, are not futuristic tales from a world of science fiction movies, such as "Minority Report" (released in 2002, directed by Steven Spielberg and starred Tom Cruise), but a reality that is rapidly developing and becoming embedded in our daily lives.

Let us reiterate here the current status of the "face" authentication technology, which was adopted for the feasibility experiment.

When we meet people in our daily lives, we determine who they are by looking at their faces. Similarly, attendants at the airport can readily verify facial images without having to be aware of any special operations in order to verify individual identities and because it is very convenient for the traveler there is a prospect for the practical application of the "face" authentication technology.

The "face" authentication is conducted by detecting and extracting an image of the face from the image taken by a camera, digitizing the locations and characteristics of certain features, such as the eyes, nose and mouth, which are then collated. The processing of this relatively large image data has been speeded up thanks to the improvements in personal computer capabilities, resulting in an improved authentication speed as well.

With the "e-Check-in" feasibility experiment, we adopted the individual authentication that has both a high level of convenience for users and a high authentication speed out of consideration for the experiment's participants. In general, however, facial authentication is said to have a lower authentication accuracy than other types of authentication methods.

Through aging the shape of the face goes through changes and the angle of sight at the time of authentication or even the difference in hair style at the time, as well as the influence of photographing conditions, such as external light, readily impacts on the process. Even a pair of glasses or a hat can become factors that lower the authentication accuracy.

Since the experiment was administered in such a way so that the check-in operation was basically done by the participants themselves, obtaining good facial information for the registration of facial information was an important point.

Phot. 1 Check-in terminal

Phot. 2 Boarding gate terminal

TIPS [SPT undertakings at airports overseas]

[Australia]

Operating at Sydney Airport since January 31, 2002. The service has been provided for the Qantas Airways crew, where individual authentication is conducted by collating the facial image of the individual against the facial photograph depicted in the passport. Simplified and speedy entry formalities are realized after landing at the airport with the use of the automated entry inspection machine (Smart Gate).

[The Netherlands]

Operating as the "PRIVIUM" service at the Schiphol Airport of Amsterdam since October 2001. An IC card (PRIVIUM Card) is issued especially for passengers who are registered users with EU passports and who have registered their iris information.

Prioritized check-in is possible with the PRIVIUM Card, realizing also a speedy processing with the use of prioritized and automated entry and departure inspection machines loaded with an iris authentication function.

[United States]

Airport surveillance with face-authentication is conducted at the Dallas Fort Worth Airport, etc.

[United Kingdom]

Speeding up of entry and departure inspections is conducted with the use of iris authentication function at London's Heathrow Airport.

To prompt the experiment participant to face the camera in order to obtain and register a good facial image, devices, such as the use of animations and the placing of markings were necessary. Since there were so many unpredictable occurrences with regard to the behavior of customers who used the system, we feel that there are still a lot that can be modified in that respect, including hardware mechanisms.

Further, although the wearing of glasses and hats becomes a cause for reducing the accuracy of the face-authentication, attendants could not insist that the customers using the system take off their hats or glasses, so this remains an issue.

Furthermore, since the structure of Narita Airport is such that even though the facility is indoors, ample outside light radiates into the structure, which resulted in subtle differences in the facial images obtained at various locations where check-in terminals, security gate terminals and boarding gate terminals were installed. It was, therefore, necessary to mount lighting and install visors to maintain constant conditions for acquiring facial images.

Possibilities of IT for airport security

The progress of biometrics authentication technologies for airports and their potential have been described thus far. For the security of "people" in the future, however, it is important not only to implement security measures for passengers but also for staff working within the airports.

Similar to passengers airport staff will also be required to go through a verification process for authority to enter the premises and a positive individual authentication when entering or leaving the airport's facilities. As well as the entry of personal identification numbers or passwords, currently in use, non-contact-type IC cards that identify certain persons to be airport staff and biometrics authentication, involving the iris or face, will need to be combined to realize access control, to achieve a higher level of security.

Even in Japan the "Safety Myth" has eroded and has almost disappeared in the current era, making the enhancement of airport security a mission of the utmost priority.

At Oki Electric, we intend to seek out the fields in which we may contribute to the airport security, from an IT standpoint and engage in such efforts aggressively.

■ References

1) Excerpts from the in-flight magazine of ANA international flights, "Take Off", Winter 2004, No. 105.

● Authors

Hirofumi Konishi: System Solutions Company, Enterprise Systems Solution Div., SE Dept.-1