

BIOMETRICS AND ARTIFICIAL VISION APPLICATION IN AIRPORTS SECURITY

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ABSTRACT

Security in airports requires an in-depth study about their users, the different laws in every country, and the access controls used. This article presents an introduction to the access control systems based in biometrics controls in use (or planned to be used) in different airports, introducing some applications, working or planned, of biometrics controls and artificial vision in the passenger flow control and airport staff control. Also introduces a classification of users of the airport, the biometric method recommended for every kind of users identified, and some world wide experiences identified.

1. INTRODUCTION

An airport is a transport infrastructure, with a high influence. Over the airport transits a lot of people and materials for its transport. Those persons could be classified as airport users or airport staff.

Among airport users, we may find all those people that use the airport without being working directly in it, so that they have no access to certain sensible areas and, otherwise, are not taken into account by airport management. Among them, we find passengers, taxi drivers, companions, etc.

As airport staff we understand every person that belongs to any organization assisting in the airport. As examples, we may find air travel companies staff, airport information services, maintenance services, air traffic controllers, or airport shops employees. In general, these people are known by the management and will have access (with restrictions in each case) to more sensible airport areas (as runways).

This access control may be based in biometrics control. But in an airport we find several problems, the first of them, legal problems about privacy. It is a must to remember that we are working passengers with different citizenships, who may be affected by different laws in their origin or destiny countries. Perhaps in these

countries technological development is not wide enough or biometrics controls are illegal.

An airport works as a group of organizations that operates an infrastructure (air space, runway, terminals, parking, etc) in order to get an efficient air transport. This group of organizations is often at least composed by air companies (land staff, aircraft staff, etc...), airport staff (maintenance, management, etc...) and support companies personnel (engineering services, security services, construction services, catering, renting, airport shops, etc). The legal affection of taking biometrics data of all the staff working for these companies and sharing them in a centralized security database controlled by one or more solicitors (even if the controller of this database is a government agency) has not been properly measured yet.

Solving legal matters is not the purpose of this article. It is indeed introducing the experiments that have been carried out in different airports, as well as mentioning a bunch of applications about biometrics or artificial vision that are working nowadays or that are being investigating in some airports.

Applications of the recognition by the fingertip, hand, iris, face or signature are analyzed with real cases of study in real airports, implemented not only as a part of the security system, but also as part of subsystems. Some initiatives from official organizations, like FAA and EU, are analyzed.

2. CLASSIFICATION OF PERSONS USING AN AIRPORT

First of all, it's needed to establish a classification of the persons who uses the airport. We may differentiate between two main kinds of persons: persons not working for the airport and persons involved in any kind of service for the airport.

Among persons not working for the airport, we may find passengers, companions, taxi drivers, etc.

Among persons working for the airport, we may find people from air travel companies, information services, commercial services, airport staff (maintenance, air traffic controllers, management, security staff), etc.

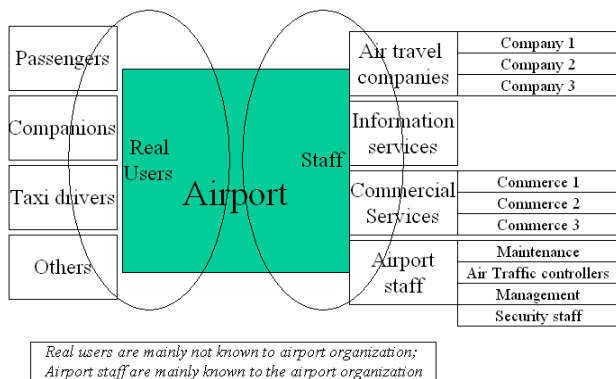


Figure 1: Different persons, different uses of the airport.

Of course, this classification may vary for every different airport. Sometimes, there is not a clear differentiation among subclasses.

Actually, if there's a plan to install a biometric access control in an airport, it's needed to analyze first the kind of user with access to the zone, and the zone to protect with this access control.

3. BIOMETRICS IN AIRPORTS

In almost every airport in the world, the first biometric control without identification provision, the metal detector is working. It's the easiest way to control passengers and airport staff. Usually, it's used with an X-ray system to screen the passengers hand luggage. Again, it doesn't provide identification of the passenger.

Recognition of passenger identity is the next step in the use of the biometry, not only for security matters, but also for other applications, like autocheck-in.

The most used biometrics used may be classified in physiological or behavioral methods. The most used physiological methods are face, fingerprint, hand geometry and iris recognition. Other methods, not used as often, are DNA, ear shape, odor, retina, skin reflectance and thermogram. The most used behavioral methods are signature and voice recognition. Other behavioral methods are keystroke or lip motion [1]

In airports, the most commonly used are face, iris and hand geometry. We are going to analyze where to use which biometric, depending on the zone of the airport, the biometric and the classification of users of the zone.

About the biometrics to use when the user considered is a real user of the airport, it's a must to differentiate between passengers and other non-registered users of the airport (companions, taxi drivers, others). For the passenger, it's possible to use face recognition, even in border control, fingerprint, hand geometry (that slows some controls because of the hand luggage), iris or

signature recognition (used mainly for payment methods or similar purposes). All the biometrics may be inserted in a central database if it is legally possible, or even in the boarding card, associating the boarding card with the passenger.

Real users	Iris	Signature recognition
Passenger	May be inserted in boarding card	Only for payment methods & similar purposes
Companions	No enrollment	Only for payment methods & similar purposes
Taxi drivers & similar	No enrollment	Only for payment methods & similar purposes
Others	No enrollment	Only for payment methods & similar purposes
Airport Staff	Iris	Signature recognition
Maintenance	Adverse meteorological conditions when used in air-side	Use only combined with other methods
ATC	ATCs would not use it	Use only combined with other methods
Management & Engineering	May be inserted in the airport ID-card	Use only combined with other methods
Security	May be inserted in the airport ID-card	Use only combined with other methods
Other staff	Iris	Signature recognition
Air companys	Pilots would not use it	Use only combined with other methods
Information services	May be inserted in the airport ID-card	Use only combined with other methods
Commercial services	May be inserted in the airport ID-card	Use only combined with other methods

In the case of non-registered persons, and as there are no enrollment in the security system, it's possible only to use signature recognition for payment methods and similar purposes.

About airport staff and other staff not form the airport, a more in-depth analysis is needed.

Signature recognition is applicable in every case, but it's not recommend to use it without being combined with another biometric method.

Face, fingerprint, Hand geometry and iris will work well for management & engineering, security, information services and commercial services staff. For air traffic

controllers, all methods will work but the iris recognition, because they do not want to use a system that could affect or even enroll their iris, as they consider it's strictly necessary for their works, and will not risk them. It's the same case than pilots from air companies.

Real users	Face	Fingerprint	Hand geometry
<i>Passenger</i>	May be inserted in boarding card. Good in border control.	May be inserted in boarding card. Good in border control.	May be inserted in boarding card. Slow in security control because of hand luggage.
<i>Companions</i>	No enrollment	No enrollment	No enrollment
<i>Taxi drivers & similar</i>	No enrollment	No enrollment	No enrollment
<i>Others</i>	No enrollment	No enrollment	No enrollment
Airport Staff	Face	Fingerprint	Hand geometry
<i>Maintenance</i>	May be inserted in the airport ID-card	Sensor dirty when entering air-side	Sensor dirty when entering air-side
<i>ATC</i>	May be inserted in the airport ID-card	May be inserted in the airport ID-card	May be inserted in the airport ID-card
<i>Management & Engineering</i>	May be inserted in the airport ID-card	May be inserted in the airport ID-card	May be inserted in the airport ID-card
<i>Security</i>	May be inserted in the airport ID-card	May be inserted in the airport ID-card	May be inserted in the airport ID-card
Other staff	Face	Fingerprint	Hand geometry
<i>Air companies</i>	May be inserted in the airport ID-card	May be inserted in the airport ID-card	May be inserted in the airport ID-card
<i>Information services</i>	May be inserted in the airport ID-card	May be inserted in the airport ID-card	May be inserted in the airport ID-card
<i>Commercial services</i>	May be inserted in the airport ID-card	May be inserted in the airport ID-card	Sensor dirty depending on the commercial service

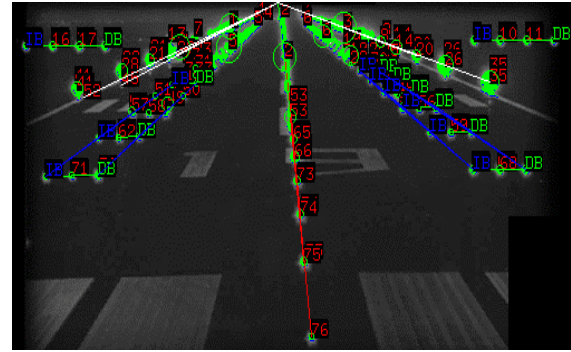


Figure 2: Runway lighting maintenance system prototype, based on artificial vision.

The most extreme case is personnel from the maintenance staff, even from the airport or the air companies, entering and leaving the air-side several times every day or every hour. The sensor used for fingerprint and hand geometry becomes dirty only a few minutes after starting using them. Also, adverse meteorological conditions will affect them when used in air-side.

4. ARTIFICIAL VISION APPLICATIONS IN AIRPORTS

There are a lot of artificial vision applications in airports, affecting to safety, security and other applications. So, it's possible to find automatic docking guidance systems based in artificial vision, semiautomatic runway lighting maintenance systems, automatic handling baggage systems, or tunnel incident automatic information systems.

About automatic docking guidance systems based in artificial vision, the system helps the pilot in the docking movement, using a camera installed in front of the gate [1]. This camera detects the airplane figure, calculates its relative position to the gate, and gives this information to the pilot.

Another system in which artificial vision is used is the handling baggage system [2]. There are two kind of artificial vision methods, one of them for code bar readers and the other one used for security purposes, used for baggage classification and security.

The third system analyses tunnels activities, and reports automatically any incidence in them, like traffic jams or stopped vehicles in public tunnels located under the airports. Associated with them, there also plate number readers, for parking access control and air side access control.

Experimentally, there is a prototype of semiautomatic runway lighting information system used for maintenance [3]. Those systems are able to integrate an image of the runway, detect the visual aids and report any damage in any light. This is a better solution than detection using electric parameters, because the detection is made over the real effect of the light, so the automatic detection of other situations can be made, like an obstruction, for example [4].

[7] S. Pollard, J. Porril and N. Tacker, *TINA Programmer's Guide*, Electronic Systems Group University of Sheffield, 1997.

5. WORLD WIDE EXPERIENCES

World wide experiences have been carried out with biometry and artificial vision. Some examples of international experiences are:

a.- Chicago airport uses fingerprint for its employees. Also uses fingerprint San Francisco, Houston y Oakland.

b.- Oakland airport is using facial recognition for passengers.

c.- In San Francisco and New York, it's been used the hand geometry.

d.- There is an iris initiative in the Heathrow airport, with passenger of British Airways and Virgin.

e.- In Umea airport, Sweden, a combined iris and fingerprint system is in use, based in smart-cards, and without any central database.

f.- In Amsterdam, Vancouver and London an autocheck-in system is been used. Based in iris for passengers previously enrolled. A similar schema is trying to be ported to New York, Washington and Tokio.

i.- In the Spanish airport network, some initiatives with facial and fingerprint recognition are being carried out.

6. REFERENCES

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