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Volpe Engineers Use Biometrics to Help Ease Border Crush

Using technology previously reserved for military and other high security applications, engineers from the Safety and Security Systems Division of the Volpe Center have developed a number of automated biometric systems to speed the processing of frequent travelers through United States immigration and to reduce the dependence on manual immigration inspections. These systems, now in use at selected border crossings by the Immigration and Naturalization Service, may serve as the basis for future automated immigration processing developments, both in the United States and around the world.

Ten years ago, the field of biometrics was the stuff of spy movies. But thanks to applied research being conducted at the Volpe National Transportation Systems Center, biometrics is being used to solve everyday problems dealing with the increasing flow of U.S. travelers through the country's immigration ports of entry. (View Photo: *Increasing flow of U.S. travelers through the country's immigration ports of entry.*)

In conjunction with the U.S. Immigration and Naturalization Service (INS), Volpe Center project engineers are working to automate the identification and processing of immigration credentials for frequent travelers. Toward that end, they have introduced a number of pilot programs based on biometric technologies at selected airport gateways and border crossings. These pilot programs portend the future of international travel -- and even international commerce. (View Photo: *Ronald Hays, Assistant Chief Inspector for INS, at INPASS kiosk, John F. Kennedy Airport, New York, Delta terminal.*)

What is Biometrics?

The field of biometrics involves the use of a physical or behavioral characteristic to verify the identity of an individual. Identification systems based on biometric technologies are now being used on an experimental basis by military organizations, government agencies, and private companies as a means of controlling access and gathering important statistical data about users.

Typically, biometric identification systems utilize any one of six different personal characteristics. The systems most commonly in use verify fingerprints or hand geometry, or can authenticate voice patterns. But other more sophisticated systems can check for patterns in the human retina or iris, or in the way a person signs his or her name, or even in how an individual types on a keyboard. The type of system selected generally depends on the level of security required and on the nature of the verification process.

As a tool for identification purposes, biometrics offers significant advantages over manual methods. Biometric identification systems are completely auto-mated and provide accuracy not achieved by manual systems. Such systems also remove the subjective judgment factor that most manual systems employ, at least as a "first line of defense" in the screening process.

Further, biometric identification systems cannot be easily compromised by theft or counterfeiting. Because the metric used by the system to verify identity is a physical characteristic unique to the individual--such as a hand print, a voice pattern, or the composition characteristics in the human eye--it is virtually impossible for a user to pretend to be someone else. Credit cards and other swipe cards can be stolen or forged. Personal identification codes can be overheard or randomly identified. But biometric identification systems rely exclusively on information that only the authorized individual can provide, thereby offering significant advantages over other types of identification systems in high security applications.

In addition to their resistance to fraud, biometric identification systems also can work with surprising efficiency to identify valid users, especially considering the complexity of the task. That's because most biometric systems work on "one-to-one" search principles. Credit card verification systems, for example, must search an extensive database of invalid account numbers, usually maintained in a remote location, to determine whether a particular account is valid.

Biometric identification systems, on the other hand, can match information encoded on the user's identification card with a machine scan of the user's physical characteristics. Because the system is only attempting to determine whether two pieces of information match, verification can take place quickly and accurately.

Facing the Wave of Humanity

In 1993, more than 480 million people gained entry to the United States through one of several hundred immigration stations at airports, ship terminals, and land-based border crossings. INS inspectors are charged with the responsibility of handling this wave of humanity, screening out criminals and international terrorists while providing quick and efficient access to the vast majority of visitors and returning citizens.

To put this task in perspective, INS annually processes two people for every single U.S. citizen--a staggering task. The ports of entry at El Paso, Texas admit more than 42 million people every year. That's more than 100,000 entries each day! And at other border crossings, such as the one at Otay Mesa, California near Tijuana, Mexico, long lines to clear immigration can mean waits of up to two hours.

With the number of annual entries expected to exceed 500 million by the year 2000, INS officials clearly face a growing problem of how to screen larger numbers of people, quickly admitting legitimate travelers while focusing the attention of inspectors on suspect admissions. So INS turned to the Safety and Security Systems Division of the Volpe Center in 1992 to conduct pre-liminary research in how biometric technology might be used

to automate immigration processing.

This collaboration has led to the development of several automated entry systems to address a variety of specific immigration situations, such as vehicular or pedestrian traffic at our numerous border stations along the Canadian and Mexican borders, or arrivals at our international airports. While these systems are still undergoing preliminary testing, the response from INS officials and the traveling public have been sufficiently positive to warrant significantly expanded systems deployment in 1997.

Equally important, the work being conducted by Volpe Center engineers on this project represents some of the most advanced applied research on the use of biometric technology today. It has resulted in a greater understanding of both the advantages and the limitations of biometrics in user identification applications and will help pioneer the more widespread use of the technology in both government and industrial environments.

The Inspass Program

The first automated inspection system using biometric verification developed by the Volpe Center was unveiled in 1993 with the deployment of automated kiosks at New York's John F. Kennedy Airport and Newark International Airport, and at Pearson International Airport in Toronto, Canada. This program, appropriately named INSPASS, is intended to focus on airports with arriving international flights as well as border crossings where high volumes of pedestrian traffic need to be processed by immigration inspectors. (View Photo: *Dr. David K. Sharma, RSPA Administrator.*)

The INSPASS program works like this. Business travelers who fly into the United States at least three times a year can apply for a credit card sized identification card at an INSPASS enrollment center. Then, upon arrival, the traveler inserts his INSPASS card into the kiosk and places his hand where indicated. Once the system has verified the biometric reading of the person identified on the card, it prints a receipt to prove immigration admittance. The entire process takes a fraction of the time that would be required for an immigration inspector to manually review the traveler's credentials. (View Graphic: *The INPASS identification card.*)

Engineers at the Volpe Center designed the kiosks, which incorporate a card reader and a hand geometry reader (one kiosk, designed to read fingerprints, was tried but removed from service because of the difficulty users experienced in positioning their fingers precisely enough for the reader to capture the necessary information). Systems installed during this initial phase of the INSPASS program optically scan the identification card but must verify the biometric information captured by the hand geometry reader with a remote database.

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According to Bill Baron, project manager for the Volpe Center assigned to the INS biometric project, more than 60,000 frequent travelers have registered so far for the INSPASS program, making it the largest biometric identification application anywhere in the world. The INS has already decided to roll out the INSPASS program to at least six other major international airports in 1997, including Los Angeles, Miami, San Francisco, Houston, and Vancouver, as well as a variant of the airport system at a pedestrian crossing at Hidalgo, Texas. Baron anticipates that these additional deployments will add significantly to the current program enrollments.

Portpass Program Speeds Vehicular Commuter Traffic

Although travelers flying into the United States represent the most visible entrants, vehicular traffic carries the majority of the nearly 500 million annual visitors and returning citizens to the United States. Many are workers who routinely cross the border to get to jobs in either Canada or Mexico. Yet they must deal with the same extensive immigration process that less frequent travelers face.

The border crossing at Otay Mesa, California is just one example. Thousands of people pass through this border check every day on their way traveling to and from Tijuana, making it one of the more heavily trafficked border crossings in the country. They include a large contingent of multinational executives who commute daily from homes in Southern California to manage refinishing factories in and around Tijuana.

In this instance, INS required an automatic entry system that could process occupants in a moving vehicle. So Volpe Center engineers assisted INS in developing a prototype system for use in specially marked commuter lanes at the border crossing. As a vehicle drives through, the system first reads information from transponders attached to the vehicle. Because the vehicle may contain more than one occupant, the transponder provides pointers to a database, which retrieves information about all of the prospective occupants of the vehicle. This information is immediately displayed on the terminal of the Immigra-tion or Customs inspector manning the commuter lane, so that a visual check of the vehicle by the inspector can verify whether the facial biometrics match those of the vehicle's occupants on that trip. If there is a match, the vehicle can continue through the border without stopping. Otherwise, the vehicle is directed into other lanes for further processing by inspectors.

According to the Volpe Center's Baron, the initial phase of this program, called SENTRI (Secure Electronic Network for Travelers' Rapid Inspection), also re-quires the driver of the vehicle to pass an identification card through a card reader to further confirm his or her identification. However, Baron says that future phases of the SENTRI dedicated commuter lane program may test substituting voice verification for the identification cards, with handsets installed in each vehicle participating in the program. With the cost of the required handset as low as $150, Baron says that the initial expense for hardware could be easily covered by an annual registration fee for participants. The Volpe Center also plans to experiment with automated facial verification and other biometrics at this port as technologies evolve.

INS is investigating opening additional dedicated commuter lanes under the SENTRI program in 1997 in El Paso, Hidalgo, and Laredo, Texas and in San Luis and Nogales, Arizona. A slightly different version of the system is scheduled to be opened at the border crossings at Buffalo, New York, and Detroit, Michigan.

Portpass Automated Permit Port Works Around the Clock

Although many busy border crossings are staffed 24 hours a day, there are hundreds of ports of entry in more rural areas where limited traffic doesn't justify keeping an immigration crossing manned at all times. Yet, for those travelers who legitimately need to cross the border at odd hours, such closures can often mean tremendous inconvenience, requiring travelers to go out of their way to find a 24-hour crossing station.

This past June, the INS opened its first fully automated entry system at the border crossing between Scobey, Montana and Coronach, Canada. The system allows people enrolled in the INS PORTPASS Automated Permit Port program to travel across the border outside of normal port operating hours.

Here, the engineering team from the Volpe Center designed a system based on voice verification technology that can authenticate the identity of those who want to cross the border. The system, which has been hardened to withstand the elements and extremes in temperature, resembles a roadside telephone booth. According to Baron, a biometric system based on voice recognition is most appropriate for this particular application because its operation is not adversely affected by the extreme environmental conditions.

To use the system, the traveler lifts the telephone handset attached to the system and dials a preassigned four-digit number on the keypad. Then, when prompted, the traveler recites his unique "pass phrase," which was initially recorded when the traveler registered for the program. If the voice prints match, the system prints a receipt verifying that the traveler has been checked and raises the gate, allowing the traveler to proceed. The system at Scobey is also equipped with video transmission capabilities. If travelers experience difficulty in using the Automated Permit Port, they can use the system to contact the border crossing at Raymond, Montana, which is staffed 24 hours a day. There, an inspector can remotely operate video cameras to inspect the traveler and the vehicle, and provide access if approved.

Future Developments in Automated Immigration Processing

The efforts by Volpe Center engineers to develop an automated immigration processing system are being matched by development efforts in other countries, including Canada, Holland, Germany, the United Kingdom, Australia, Singapore, and Hong Kong. Some countries are developing systems based on hand geometry, similar to the systems in use at Kennedy and Newark airports, while other systems are based on fingerprints or, in the case of Australia, facial recognition.

Despite individual development efforts, however, immigration authorities have quickly recognized the need to create a series of uniform compatibility standards for such systems. For example, a tentative international agreement has already been reached on the format for an automated inspection card, making it theoretically possible for a traveler to use a single immigration card at ports of entry around the world.

But the potential of an international immigration card goes even further. In a report on automated immigration processing systems issued earlier this year, Ronald Hays, Assistant Chief Inspector for INS, imagines the prospect of combining the biometric information recorded on an INSPASS-type card with the purchasing power of a credit card. Such a universal card could be used, according to Hays, "to charge your hotel room, access your bank account, make a phone call, and automate your trip across international borders."

Hays notes that Holland's immigration service has already experimented with such a universal card, and will be expanding its own program as automated immigration processing systems are more widely deployed in the United States. "None of this is blue sky thinking," Hays says. "Its power comes from the linking together, in a unique way, of already existing ideas."

Contributor: William R. Baron

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