Airport Monitoring System Combines RFID With Video

A European consortium is designing a system involving video cameras and battery-powered RFID tags to improve airport efficiency, security and passenger flow.

By Rhea Wessel

Sept. 18, 2006—A consortium of European companies and a university is developing a system to track travelers inside airports. The system is intended to increase security and safety, and to speed boarding times. Called Optag, it would employ panoramic cameras and active 5.8 GHz RFID transponders with a 10- to 20-meter read range. Tags would likely be attached to passengers' tickets and read by interrogators placed throughout the airport's checked-passenger waiting areas. The system could track passengers with an accuracy of 1 meter and update location data once per second, based on passengers' movements, its designers say.

Optag would work by integrating data from the RFID system with images from the digital panoramic camera system. The camera system would overlay tag locations onto images.

"Think of it as a network of panoramic Web cams inside an airport," says Paul Brennan, an associate professor working on the project at University College of London's (UCL) Department of Electronic and Electrical Engineering.

The project is being funded by the European Union. Partners include U.K.-based Innovision Research & Technology, an auto-ID specialist that is developing the tags and would bring the solution to market; Debrecen Airport, an airport on the border between Hungary and Russia that will test the solution by the end of the year; Longdin & Browning, a U.K. surveyor that will position the system for the trial and work with UCL's Department of Electronic and Electrical Engineering and Geomatic Engineering to develop the camera system and software; and Photonic Science, a U.K. company that is supplying high-resolution cameras.

Innovision and UCL are developing the tags from scratch. The tags will need to send long-range signals, be interrogated rapidly, be deployed in mass within a small area and be cheap and reusable, says Brennan. "It's partly a research project, and we want to have control of it," he says.

It is unclear whether tags will be attached to tickets or given to passengers to clip on like a credit-card-sized ID badge. Tags could even be worn around passengers' necks, or built into wristbands, though Brennan thinks passengers might find these types more intrusive. If an airport chose a system based on disposable tags, the tags would include a small and cheap button-cell battery. If tags were to be reusable, they would include rechargeable batteries.

The designers of the system chose 5.8 MHz because the frequency isn't too crowded. "We like 5.8 because, at the moment, there isn't too much interference and the antennae size is small, so it makes the tag and reader more compact," says Brennan. "We could make it work on other frequencies [as well]. It's not critical." He added that consortium members are also developing their own readers with extra functionality to locate

individuals based on triangulation.

Each tag will send out a pulse twice per second. The pulse will be received by at least two readers. Prototype readers include four antennas and a microprocessor, which will perform computations to determine the direction of the signal. With two or more bearings for the same tag, the computer system can be programmed to triangulate, calculating the position of one tag based on the angle of arrival of the signal. Personal information in an airline's system, such as the passenger's name, age, gender and flight number, can then be linked to the tag's unique ID number.

The consortium initially considered calculating the location of a person carrying a transponder by measuring the time difference between when the device transmits a signal and when the reader receives it. However, Brennan said such a technique would be more difficult to implement because it would require greater transmission bandwidth. The data rate currently planned is 1 megabit per second, which would take 1 MHz of bandwidth. If a time-difference analysis were to be conducted, 150 MHz of bandwidth would be needed because the range resolution (how accurately you can pinpoint the range of something) varies with signal bandwidth.

The final component of the system, the user interface, is also being developed in-house, with the help of UCL's Geomatic Engineering Department. Plans are in place to create a simple interface using the C++ programming language.

"With enough development time, we could make a sophisticated interface that could be used to archive location information to be reviewed later if there was some kind of safety or security incident," Brennan says. "This could be a project in itself."

The simple interface currently planned will allow video output to be panned and zoomed for easier use, says Phil Bacon, a project consultant for Europus, which puts together and manages multidisciplinary research-and-development projects in Europe. Bacon helped the consortium win funding for the project by bringing together partners and managing the grant-application process. He continues to work with the project within a limited scope as a project manager.

In the future, when the system is on the market or a specific customer requests it, security officials could use Optag in combination with facial-recognition software. Still, this step is beyond the scope of the current project. Optag will be able to provide the real-time location of individual passengers, analyze traffic and the behavior of individuals, and observe and record suspicious behavior.

Brennan says that using Optag to increase security is more challenging than it would be to use it for raising an airport's efficiency, or for improving safety.

"We might know where people are, but we can't tell what a person's intentions are," he says. "We hope to enhance security, but the system relies on compliance. Someone planning something wouldn't carry a tag." Brennan believes the system wouldn't work well if it were voluntary.

"It could be voluntary in the sense that if a passenger doesn't want to carry a tag, he or she won't be able to board the plane," he says.

The Optag project was started about two and a half years ago, with funding secured for three years. Testing at the airport in Hungary will be performed toward the end of this year. Bacon expects the system to go to market in about two years. He adds that the consortium is in talks with Airbus because the system could also be used to expedite boarding processes in the gate area. Missed take-off and landing spots caused by slow boarding may become a problem for airlines once they begin flying Airbus' super-jumbo jets and have to load

up to 700 passengers.

The system could help by generating a list of passengers located far from the gate at boarding time. Airlines could then send runners to specific areas to find stray passengers and hurry them to the gate—which, in turn, could help the airlines avoid hefty fees for missing take-off slots.