

Creatively employing RFID tags previously used to identify livestock, the European Commission's Joint Research Center collaborates with technologists and advocacy group on guided paths.

By Rhea Wessel

Feb. 4, 2008—Three RFID-enabled walkways in Italy are helping the blind move around in unfamiliar environments. The paths are part of a European Union-funded research project, dubbed SESAMONET (Secure and Safe Mobility Network), designed to improve the lives of visually impaired citizens.

In the city of Laveno Mombello, the path's developers have installed RFID tags in a 2-kilometer stretch that leads straight from the city's railway station to the banks of Lago Maggiore, makes a loop in a park near the lake and also extends across intersections. About 10 people, both blind and sighted, are testing the system using custom-designed canes that serve as interrogators for 125 kHz passive tags encased in a ceramic material and buried in the path. Test users are providing the walkway's designers with feedback to improve the system.

Tags Lead the Way for Blind in EU-Funded Pilot

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The SESAMONET path in Laveno starts at the railway station and runs 2 km along the lakeshore.

When a blind person passes a tag, his or her cane reader interrogates that tag (the reader's antenna is built into the cane's tip, while its body, power source and Bluetooth transmitter are integrated near the handle). The tag's unique ID is sent, via a Bluetooth transmitter, to the user's PDA, which runs a special software application that determines that individual's location based on the tag ID. The software quickly generates directions (by means of a text-to-speech program) or various audio signals, which are then transmitted to a wireless earpiece worn by the tester.

The user must be trained on how to interpret the audio signals. "A beep sounds for tags read on the right, and a bop sounds for tags read on the left," says Marco Sironi, head of the European Commission's [Joint Research Center](#) (JRC), which developed the prototype. The JRC initially developed the SEASONET platform in collaboration with the [RFID Lab](#) at the [Sapienza University of](#)

Rome.

A tag is buried every 60 centimeters on each side of the trail, with burial points staggered so that if the first tag is buried on the right side, the next one a walker passes will be on the left, 30 centimeters past the first, and so forth. Each tag is buried approximately 4 centimeters beneath the ground, and can be read from up to 20 centimeters away.

As a walker nears the end of the path—or some type of obstacle or hazardous area, such as a stairway or crosswalk—the ID from a nearby tag will trigger an appropriate message to play (such as, "you are approaching a stairway; turn left to continue on the path"). When the software receives the tag ID of a special tag buried near an intersection and deduces, based on the order of the collected tag IDs, that the walker is approaching an intersection and plans to cross it, the PDA transmits a signal, via Wi-Fi, to a receiver inside the traffic light to stop oncoming traffic and allow the person to safely cross.

The other two RFID-enabled paths are in a northern Italian regional park called Prealpi Giulie, where 10 individuals are testing the path with the custom-designed canes. One is a 600-meter-long nature trail in the park's Pian dei Ciclamini section, while the other is located at an information center housed in one of the park's hostels. The nature trail had already been equipped with signs in Braille. The text on each of those signs was recorded for the RFID pilot, and is played back for people passing RFID transponders buried near the signs. The path within inside the hostel is designed so blind guests can use the audio signals and prerecorded information to orient themselves.

A total of 2,500 tags were embedded in the project's three pathways. Sironi says it cost under €100,000 (\$148,280) to build the system, but that the expenses would have been much higher were it not for some creative recycling of RFID tags. The SESAMONET project recycles tags compliant with the ISO 11784 and 11785 standards and originally used to track livestock. The tags, designed to be swallowed by animals and remain in their bodies throughout their lives, are removed at the slaughterhouse. Due to health codes, the tags can not be reused on other animals.

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SESAMONET user components consist of a walking cane, earphone and PDA.

Beginning next year, the European Union will enact a law requiring all livestock intended for slaughter in the EU to be given one of these tags. That will generate 50 million tags each year, providing a ready supply of tags for SESAMONET and other programs that might need to use them for purposes other than tracking livestock. Aside from being readily available, the 125 kHz tags are well suited for the guided-path application because they work well when covered with water or snow.

Costs related to the tags came from cleaning them (to remove a strong odor acquired while inside the animal) and shipping. Costs associated with burying the tags—which came to €2,000 (\$2,965) for the Laveno Mombello project—would be considerably lower if the system were installed when walkways and roads were newly constructed.

Project partners spent about €25,000 (\$37,060) developing the first 10 cane readers with a partner company in France. With prototyping complete, the second set of 10 cost about €6,000 (\$8,900)—or €600 (\$890) apiece. Sironi says he expects the cost per cane to eventually drop to a few hundred euros.

According to Sironi, the project partners needed extra time to find the proper material for the cane—they ultimately decided on plastic—and to tune the antenna at the cane's tip. "We had to adjust the antenna in such a way so that it could read the

transponder but ignore whatever else was in the ground, such as steel and cables," he explains. The PDAs and earpieces cost €200 to €400 (\$297 to \$593) each.

A final major cost factor was the development of the database that maps the path and stores other location-based information. The database cost about €20,000 (\$29,650) to develop for the first kilometer, with each additional kilometer costing roughly €2,000 (\$2,965).

The software developers were faced with a number of hurdles, Sironi says. The application needed to be small enough to run on a PDA's operating system and quickly generate a direction command, since the user is in motion and needs to react fast to the surrounding environment. The software also needed to be able to ascertain the user's location and direction by reading just two tags, so the smaller the database, the faster the software could identify each tag ID. The team decided to store the database for each RFID-enabled path onto an SD card that users insert into the PDA, based on which particular

RFID-enabled path they traverse.



An antenna in the cane's tip reads the pathway's embedded transponders.

This model should make scaling the system easy, if additional paths are built in Italy or elsewhere in Europe. Users will be able to download the databases they need to their PDAs using a Web interface, and the databases can be thus updated to reflect construction work or changes in services, such as bus schedules.

Once the guided-path trial is over—most likely in 2008, Sironi says—the JRC plans to contact the business communities in and around the pilot sites, to see if the technology could also be adapted for commercial applications. These could include using the tags as part of an electronic tour-guide application in PDAs for tourists—a service that a wireless carrier could offer. Sironi says some companies have shown an early interest in such an application, but that they have not yet been convinced about its profitability.

Unless the RFID paths find double usage as both guides for the blind and tools for commercial applications, Sironi notes, they won't likely be expanded or receive the support needed for expansion.

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The European Commission financed the system's development, but once the trials are complete, the JRC's involvement in the project will end. "If we don't get industrial support or support from the local authorities," he states, "this will be a dream in a drawer."

Project partners, which include the city of Laveno Mombello and an Italian association for the blind—[Unione Italiana Ciechi](#) (UIC), in the city of Udine—worked together for about a year before the first path was demonstrated in Laveno Mombello, in October. That city plans to expand the path to lead the blind to important services and stores, such as pharmacies. Deimos Engineering Srl, an IT services company, contributed to the Prealpi Giulie project.