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Wearable Computer Gives Eyes to Blind
Tracy Staedter, Discovery News

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Aug. 24, 2006 — A wearable computer system that emits audio cues could help guide the visually impaired.

The System for Wearable Audio Navigation, or SWAN, combines global positioning system (GPS) technology with cameras and image processing software to locate a person's whereabouts and "see" details such as windows, doors and corners.

"In the future, we could even use the cameras to recognize people or objects," said Frank Dellaert, who developed the system at the Georgia Institute of Technology with Bruce Walker.

The technology could do everything from lead a blind person through a new neighborhood to help firefighters or soldiers plot a course in darkness.

Since about 2001, visually impaired people have had access to commercial GPS-based navigation systems meant to help them get around.

The technology is available on handheld electronic devices such as laptops or PDAs and is similar to that used in cars. A GPS sensor pinpoints the person on a grid, while the computer's database — which contains street names as well as businesses — matches the information to the location.

Menu choices and directional cues are provided either through a Braille-based readout or a synthesized voice, which can be heard through a speaker or earphones.

But GPS-based systems have some disadvantages, said Dellaert. For one thing, the signal may not come through if a person is walking through a city dense with tall buildings. If the person stops walking but turns, GPS can't tell what direction the person is facing.

Georgia Tech's solution was to incorporate additional sensors on their navigational system — including a digital compass, four cameras, a tilt sensor and a light sensor.

The compass, GPS, and tilt sensors track the direction the user is walking in, or if still, facing.

The cameras image the surroundings, while the light sensor measures the brightness of objects. Computer vision software interprets the scene based on the configuration of shapes caused by features such as corners, edges, light and dark areas, and repetitive patterns.

For example, a particular arrangement of edges, dark space and corners could correspond to a door. The configuration could also be matched with a database of known features to determine what's nearby.

Once the computer finds the user's target location, it maps a route and transmits audio cues to headphones worn behind the ears.

To the listener, the audio beacons sound as if they originate from a few feet ahead. The person walks toward the beacon, which can shift left or right to keep the user on course.

But because visually impaired people rely more heavily on sound, using sound as a directional cue may not be the perfect solution.

"You still have the possibility that the sound will perceptually make it hard to hear other sounds that you are trying to pick up from the environment," said professor Jack Loomis of the University of California, Santa Barbara, who has been investigating high-tech navigation systems for the blind since 1985.

"Maybe future navigational systems should have options, such as Braille, or speech, or spatial sound in earphones, or maybe vibration," said Loomis.

Dellaert and Walker would like to give visually impaired people an option that is inexpensive and lightweight. Currently they are working to shrink the bulky prototype to a system that could be commercialized in a cell-phone-sized package.

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