Fingers do seeing in research project

University of Guelph researchers are working on a special glove for the blind

GUELPH

By Murray Tong

Prof. John Zelek is looking at the world with a fresh pair of eyes—literally.

At the University of Guelph, he's leading the development of a stereo-vision system, a mini-camera-assisted navigation system for the visually impaired, a technology he calls "the logical extension of the walking cane."

The system provides visually impaired individuals with tactile feedback about their immediate environment. Two small, webcam-sized video cameras wired to a portable computer – all of which can be worn on the user's body – feed information into a special glove, worn by the user. The glove has vibrating motors (buzzers) sewn into each finger; they send impulses to the wearer, warning of impediments and terrain fluctuations ahead.

"Traditional navigation systems provide auditory feedback, and they usually have a steep learning curve and overburden the auditory channel," says Zelek. "We wanted our system to be intuitive for the user."

Here's how it works. Images from the cameras are processed in the computer, and translated into information about the location of obstacles within the camera's range, up to 30 feet. Then, the buzzer on the finger corresponding to the direction of that obstacle is activated. For example, if the glove is worn on the left hand, an obstruction lying straight ahead would trigger the buzzer on the middle finger. If the obstacle is just to the right of centre, the buzzer on the index finger would buzz.

"The stimulus on their fingers is used to direct the user around obstructions in their path," says Zelek, who is also investigating possible new methods of conveying terrain information through a subset of the buzzers.

Zelek's technique of acquiring information about the environment is unique because of his use of dual cameras, which perceive depth like a pair of 3-D glasses. Traditional techniques of information-gathering usually employ sonar or ultrasound waves, which are bounced around objects in the room, similar to a bat's method of navigation. But these methods of sensing can be easily foiled by complex surroundings, such as a room full of people, where movement creates multiple signals and provides little useful information about obstacles.

"In the case of sonar, busy environments cause multiple signals to get back to the user, which can get confusing," says Zelek.

As well, sonar and ultrasound systems consume a lot of energy and need to be recharged every few hours. Zelek and his research team decided their navigation system had to be wearable, comfortable and affordable. "If it isn't comfortable, no one is going to want to use it," he says. "The system can't intrude on the user's daily activities."

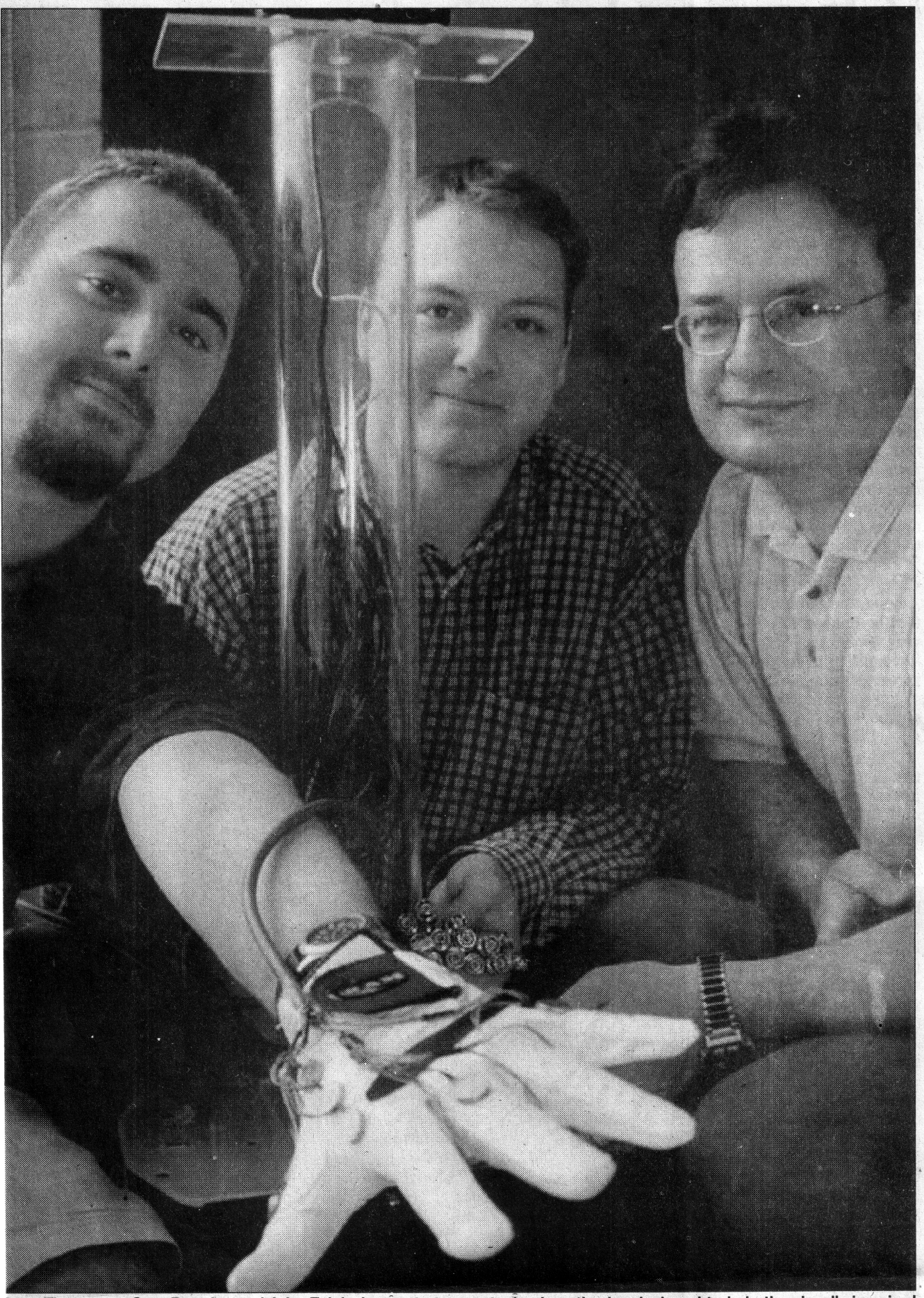
So, the stereo-vision prototype is built from inexpensive, off-the-shelf components. And new technology -- mini-cameras, in particular -- will allow the navigation system to be very discreet. Advanced technology allows the computer to be small, about the size of a deck of cards, and consume very little power. The cameras can be mounted on shirt buttons, and the whole unit can be sewn into a jacket.

For Zelek, the ultimate test for stereo-vision will come from trials with individuals who are visually impaired. "The trial stage will determine how useful this system is," says Zelek. "In the end, it's the user who decides whether or not this system will work."

The Waterloo office of the Canadian National Institute for the Blind (CNIB) already has a group of visually impaired people who are eager to try out the prototype device.

Other researchers involved in this project include U of G Ph.D candidate Sam Bromley, undergraduate student Dave Thompson, and former undergraduate students Jeff Bassett, John Hayes, Glenn Guthrie, Mike Ruthuen, Richard Audette and Jocelyn Balthazaar. This research is sponsored by the CNIB and the Natural Sciences and Engineering Research Council.

• *Murray Tong is a student writer at the Office of Research, University of Guelph*



Dave Thompson, Sam Bromley and John Zelek demonstrate new technology they've designed to help the visually impaired get around. Their system provides visually impaired individuals with tactile feedback about their environment.