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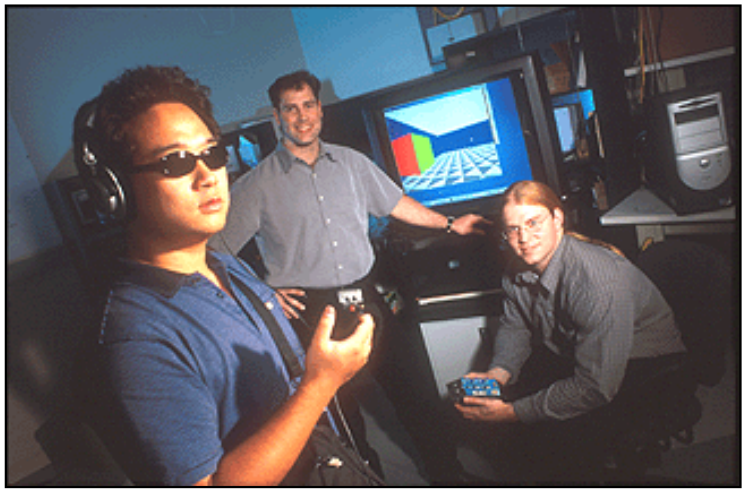
Rehabilitation Engineers' Emphasis on Helping People with Disabilities will Improve Wireless Technology for Everyone

Just as television programs provide closed captioning for deaf people, why not adapt the concept to allow people who are hard of hearing to participate in other activities in businesses, schools, theaters and elsewhere?

That's the idea behind wearable micro-display glasses, one of 14 research projects now under way at the new Rehabilitation Engineering Research Center on Mobile Wireless Technologies for Persons with Disabilities.



Assistant Professor Bruce Walker (center) of the Georgia Tech School of Psychology and College of Computing, and Research Scientist Jeff Wilson (right), of Georgia Tech's Biomedical Interactive Technology Center, are exploring non-speech sonification techniques to assist people with visual impairments. They are developing a virtual reality test bed (shown in background) for simulating sonification techniques and environments. Graduate Student Qiang Fu (left), demonstrates a prototype of the wearable audio navigation system.

Georgia Tech Photo: Gary Meek 300 dpi JPG version

The center's work involves researchers from the Georgia Institute of Technology, the Georgia Centers for Advanced Telecommunications Technology (GCATT) and the Shepherd Center, an Atlanta-based catastrophic care hospital. It is primarily funded by a $5 million, five-year federal grant awarded to GCATT last winter by the National Institute on Disability and Rehabilitation Research (NIDRR). The grant created one of 17 national Rehabilitation Engineering Research Centers (RERC) - this one housed on the Georgia Tech campus.

"With this grant we are able to move from research to real-world applications of technology to address the needs of people with disabilities," says Helena Mitchell, director of GCATT's Office of Technology Policy and Programs, and principal investigator and director for the RERC. "The collaborative, interdisciplinary nature of our team generates dynamic and innovative solutions."

The RERC has two parallel goals: (1) to develop new and innovative ways of applying mobile wireless technologies to help people with disabilities; and (2) to promote the accessibility of new

wireless devices. Although the RERC's immediate constituency is the estimated 54 million Americans with some form of disability, its research and development of user-friendlier technology is intended for the good of the entire population.

Researcher John Anschutz of the Shepher Center, an Atlanta-based catastrophic care hospital, works with patient Renita Bundrage as she uses a Pathfinder augmentative communication device to speak with people. The Pathfinder is integrated with a BlackBerry RIM 950 two-way pager so she can send e-mail messages.

Photo: John Anschutz 300 dpi JPG version

"Everyone benefits if we can help cell phone manufacturers build a product that's easier to use because it has a clearer display, a speaker system, hands-free operation or voice-recognition capability," says John Peifer, co-director of the RERC and research director of the Biomedical Interactive Technology Center (BITC), one of five Georgia Tech research groups involved in RERC projects.

RERC researchers are building prototypes of devices that demonstrate new capabilities. Five of the 14 projects funded are already in development. They include the caption-capable glasses, which work like this:

At a community venue such as a theater or lecture auditorium, spoken words are transmitted locally to a small receiver that may be clipped onto a person's belt or pocket. There, the radio signal is converted into a streaming-text transcription of the audio, which appears on the special lenses of a wearable micro-display wired to the receiver.

The device enables hearing-impaired individuals in businesses, schools or movie theaters "to receive captioning so they can interact with the community like everyone else," explains Leanne West, a research scientist in the Georgia Tech Research Institute's (GTRI) Electro-Optics, Environment and Materials Laboratory. She expects to have a prototype ready by early next year.

The captioning capability may even accommodate random personal interactions if speech-recognition technology can be incorporated into the device.

"This is new technology in the sense of its use, but really it's taking off-the-shelf components and making them work together," West adds.

Meanwhile, Peifer is involved in a project to bring mobile, wireless connectivity to the Telerehabilitation Network, an

Internet-based tool for helping Shepherd Center patients manage their disabilities at home. The network supports remote monitoring of vital signs and lets therapists interact with patients to render counseling and further wellness training, detect potential problems and furnish assistance to prevent secondary complications. In addition, the network gives patients access to individualized health information and health-care routines.

Leading the research of the Rehabilitation Engineering Research Center on Mobile Wireless Technologies for Persons with Disabilities are (l-r) John Peifer and Helena Mitchell of Georgia Tech and and Mike Jones of the Shepherd Center.

Georgia Tech Photo: Stanley Leary

300 dpi JPG version

The application of wireless technologies to mobile health management will allow people with health conditions that might otherwise have kept them homebound to move independently in the community, Peifer explains.

"By providing them with information on how to manage their disability, maintain their health and help manage their own health care, people with catastrophic disabilities can more effectively integrate back into the community and look forward to a better quality of life," he adds.

In another project, Georgia Tech researchers in the Interactive Media Technology Center are identifying interface issues that represent barriers for persons with disabilities, then developing multi-modal interfaces to test with a wireless personal digital assistant (PDA). One approach under investigation relies on a voice-recognition system. Another experimental interface interprets hand gestures.

Researchers at the Shepherd Center are also investigating augmentative communication devices -- special keyboards for creating synthetic speech -- and integrating those devices with mobile wireless technology.

Forgetfulness is a common impairment for people who have suffered a brain injury. A "cognitive prosthesis" under development at the Shepherd Center could make these patients' lives easier to manage by reminding them of daily tasks to perform or provide directions if they get lost.

"They may be able to function independently at home, but they need reminders to take medications, turn off appliances or to leave for work -- the activities they need to perform every day," Peifer says.

One of the challenges facing researchers is how to design a user interface that is operable and understandable by people with significant cognitive impairments.

Reminder systems such as wrist-worn timers already exist. "But with mobile wireless technologies, you can dynamically update those reminders and send them out to people as they move about in the community," Peifer explains.

RERC researchers are also addressing accessibility issues, public policy, professional training, course design for engineering students, and industrial outreach and education.

Accessibility issues include emerging trends in technology and development of products useful to people with disabilities -- larger computer displays, for instance, or different kinds of input devices. And engineers will consult with industry regarding the commercialization and mass production of new products.

Also, Mitchell's GCATT Office of Technology Policy and Programs is examining public policy initiatives that affect the transition of new technology into the marketplace. Good ideas are only useful when they are put to work, Mitchell says.

"One of the strengths of our grant proposal, and what excited the people at NIDRR, was that we included the policy aspect," Mitchell says. "A lot of times awards are given, and great research and great projects come out of them, but the results end up on somebody's shelf. They don't always get to the people who would benefit from this new knowledge, but more importantly, the results don't get to the change agents - legislators, regulators and policymakers at the state and federal government levels."

To encourage industrial interaction, researchers plan to present their findings and prototypes to industry representatives in annual roundtable meetings and a state-of-the-technology conference.

And RERC is leading the creation of universal design courses for Georgia Tech and other students to expose them to disabilities research. Mitchell expects the curriculum to be popular across a range of academic majors.

"Even if you come to it at first only because you have an interest in the technology, the human side really draws you in," Mitchell says. "You're dealing with people whose lives have been totally altered by a catastrophic injury from a car accident or maybe a sports injury. You start to know these people, and you start caring about how technology can make lives better for persons with disabilities."

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