Researchers helping electric-wheelchair users move more easily

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This is an electric wheelchair. Credit: FSU

Thick gravel, mud, snow, steep ramps or hills... They might get a pedestrian a little dirty or out of breath, but to someone in an electric wheelchair, they could mean terrain that's simply too difficult to cross alone.

To address this problem, researchers at the Florida A&M University-Florida State University College of Engineering are working on technology that will enable electric-powered wheelchairs to detect hazardous terrain and automatically adjust their control settings to maneuver more safely.

Emmanuel Collins is the John H. Seely Professor of Mechanical Engineering at the college and director of Florida State's Center for Intelligent Systems, Control and Robotics (CISCOR). He said that a

device known as a laser line striper, originally developed for military use, has been adapted to classify terrain conditions so the wheelchair control system can self-adjust.

"I'm inspired by the idea of applying technology originally meant for the battlefield to improve the quality of everyday life for injured soldiers and others," Collins said.

Engineers had previously developed automatic terrain-sensing controls for military robotic vehicles, and several four-wheel-drive automobiles now on the market include such controls for improved safety. So, Collins wondered, why not integrate this type of system into electric-powered wheelchairs to provide more mobility and independence for their operators?

Collins' team, working with colleagues from the University of Pittsburgh, began experiments this year to add instrumentation based on current driving control systems. The new technology is designed to enable an electric-powered wheelchair to detect hazardous terrain and implement safe driving strategies while avoiding wheel slip, sinkage or vehicle tipping.

Collins said that, to his knowledge, no one else is working on this type of application.

The U.S. Army Medical Research and Materiel Command's Telemedicine and Advanced Technology Research Center saw the promise in this collaboration and has provided funding and guidance for the researchers to pursue their ideas together. The partnership joins CISCOR, which has worked extensively with control and guidance of autonomous vehicles, with the University of Pittsburgh's Human Engineering Research Laboratories. The latter group has developed several assistive technologies already in use by wheelchair manufacturers

and rehabilitation hospitals nationwide.

The partnership began when Collins heard a presentation by Professor Rory Cooper, director of the Human Engineering Research Laboratories and chairman of Pitt's rehabilitation science and technology department. Cooper has used a wheelchair since receiving a spinal cord injury in 1980 during his service in the Army. He won a bronze medal in the 1988 Paralympic Games in Seoul and has been recognized nationally for his research and leadership efforts to aid veterans and others with spinal cord injuries.

In his presentation, Cooper mentioned the need for terrain-dependent, electric-powered wheelchair assistance. Collins approached him about working together, and the two of them began developing ideas with other collaborators at the National Science Foundation-sponsored Quality of Life Technology Center, an engineering research center affiliated with the Human Engineering Research Laboratories that Cooper co-directs.

Cooper also is the founding director and a senior research scientist of the VA Rehabilitation Research and Development Center of Excellence in Pittsburgh. His laboratory has been collaborating with the Veterans Administration for 15 years, and with the military since 2004, to develop robotic and other advanced assistive technologies. Cooper noted that the lab has a very good relationship with the orthopedic and rehabilitation departments of Walter Reed Army Medical Center and the National Naval Medical Center.

Army Maj. Kevin Fitzpatrick, director of Walter Reed's wheelchair clinic, said, "This technology will provide electric-powered wheelchair users with an increased degree of independence that may significantly increase their ability to participate in recreational and functional activities."

The project is part of the Rehabilitation Engineering and Assistive Technology sub-portfolio, recently managed by Craig Carignan, within the Telemedicine and Advanced Technology Research Center's Advanced Prosthetics and Human Performance research portfolio.

"The Human Engineering Research Laboratories and the Pittsburgh VA center are considered among the top wheelchair testers in the United States, and are playing critical roles in developing international wheelchair standards," Carignan said. "The researchers on this project are excellent investigators, and we are looking forward to the solution they develop."

Collins estimated that if the team develops a strong commercial partner, the technology could be assisting electric wheelchair users in approximately five years.

Provided by Florida State University

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