UNIVERSITY OF PITTSBURGH
innovation
INSTITUTE

Mobility Enhancement Robotic Wheelchair (MEBot) ID: 3480

Featured Innovator: Rory Cooper, PhD

Electric Powered wheelchairs (EPWs) are essential for improving quality of life for those with limited mobility. Currently available EPWs perform well in flat indoor environments, but fare worse when encountering common outdoor conditions such as slick or rocky terrain, steep slopes, and curbs or stairs. Lost stability can lead to falls and serious injuries. The Mobility Enhancement Robotic Wheelchair (MEBot) is a rugged indoor/outdoor alternative that allows users to negotiate natural and architectural obstacles while maintaining a level seat.

Technology Description

MEBot is a dual power system of air and electricity. Its base uses a six-wheel design, similar to many current EPWs. What sets MEBot apart is that the position of each wheel is controlled by six independent pneumatic actuators. The MEBot is also outfitted with sensors and an onboard computer that allow the chair to detect and conquer obstacles automatically. Currently, the MEBot can climb a curb or single step in the laboratory without user guidance. Likewise, when the MEBot encounters a slippery surface that would leave other EPWs spinning their wheels, its sensors activate a program that inches the chair along by picking up the smaller casters, extending them, and placing them down again. While overcoming these obstacles, the combination of sensors and pneumatic actuators maintains a stable, level seat.

Advantages

- Can be used both indoors and outdoors
- Automatically handles slopes, curbs, and challenging terrain
- Maintains a level seat to prevent falls

Applications

- Increasing mobility and independence of wheelchair users in both urban and natural settings
- Autonomous military robots

Stage of Development

The MEBot wheelchair is in transition from prototype to clinical trials where 10 able-bodied subjects will use MEBot to test feasibility and repeatability of the wheelchair while 10 wheelchair users will rate MEBot with their own wheelchair under controlled real-world environments.

IP Status

PCT patent filed on September 23, 2016

Notable Mentions

- Earned the title of “Best New Concept” in the 2016 Blackwood Design Awards in Scotland, with the judges citing that “it was very clear that it was designed by wheelchair users, for wheelchair users”
- Competed in the first ever Cybathlon for Robot-Assisted Parathletes in Switzerland in 2016

UNIVERSITY OF PITTSBURGH
innovation
INSTITUTE

Innovators

Rory Cooper, PhD

FISA & Paralyzed Veterans of America Chair and Distinguished Professor
Rehabilitation Science & Technology
Physical Medicine and Rehabilitation
Bioengineering
Orthopedic Surgery
University of Pittsburgh

Dr. Cooper earned a BS and MEng in electrical engineering from California Polytechnic State University, San Luis Obispo in 1985 and 1986, respectively. He earned a PhD in electrical & computer engineering with a concentration in bioengineering from University of California at Santa Barbara in 1989. He is FISA & Paralyzed Veterans of America (PVA) Chair and Distinguished Professor of the Department of Rehabilitation Science & Technology, and professor of Bioengineering, Physical Med & Rehab, and Orthopedic Surgery at the University of Pittsburgh. Dr. Cooper is Founding Director and VA Senior Research Career Scientist of the Human Engineering Research Laboratories (HERL) a VA Rehabilitation R&D Center of Excellence in partnership with Pitt. Cooper has authored or co-authored over 300 peer-reviewed journal publications. He has 20 patents awarded or pending.

Dr. Cooper is a U.S. Army veteran with a spinal cord injury (SCI) and a Director of the Paralyzed Veterans of America Research Foundation. In 1988, he was a bronze medalist in the Paralympic Games. In 2009, Dr. Cooper was featured on a Cheerios cereal box for his achievements.

Education

PhD Electrical & Computer Engineering
University of California, Santa Barbara

MS Electrical Engineering
California Polytechnic State University

BS Electrical Engineering
California Polytechnic State University

Publications

- Candiotti J, Sundaram SA, Daveler B, Gebrosky B, Grindle G, Wang H, Cooper RA (2017). Kinematics and Stability Analysis of a Novel Power Wheelchair When Traversing Architectural Barriers. Topics in Spinal Cord Injury Rehabilitation;23(2):110-9.
- Sundaram SA, Wang H, Ding D, Cooper RA (2017). Step-Climbing Power Wheelchairs: A Literature Review. Topics in Spinal Cord Injury Rehabilitation;23(2):98-109.
- Pasquina PF, Emba CG, Corcoran M, Miller ME, Cooper RA (2017). Lower limb disability: present military and civilian needs. In: Full Stride (pp. 17-33). Springer, New York, NY.
- Candiotti J, Wang H, Chung CS, Kamaraj DC, Grindle GG, Shino M, Cooper RA (2016). Design and evaluation of a seat orientation controller during uneven terrain driving. Medical Engineering & Physics;38(3):241-7.
- Daveler B, Salatin B, Grindle GG, Candiotti J (2015). Participatory design and validation of mobility enhancement robotic wheelchair. Journal of Rehabilitation Research and Development;52(6):739.
- Chuy O, Collins EG, Ordonez C, Candiotti J, Wang H, Cooper R (2014). Slip mitigation control for an Electric Powered Wheelchair. In: Robotics and Automation (ICRA), 2014 IEEE International Conference (pp. 333-338). IEEE.
- Sundaram SA, Candiotti J, Wang H, Cooper R. (2012). Development and Simulation of a Self-Leveling Algorithm for the Mobility Enhancement Robotic Wheelchair. RESNA Conference Proceedings.

University of Pittsburgh
Innovation Institute

130 Thackeray Ave
Pittsburgh, PA 15260

innovation.pitt.edu

Contact

George Coulston, PhD MBA
Technology Licensing Manager
412-648-2236
gcoulston@innovation.pitt.edu