Researchers developing robotic prosthetics to help restore balance in fall victims

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Credit: Texas A&M University

We all lose our balance sometimes; we slip, we fall, we get back up. But for some, life is a balance beam, and merely walking around poses great risks of tripping, slipping or falling. Dr. Pilwon Hur, an assistant professor in the Department of Mechanical Engineering at Texas A&M University, has set out to help people with balance issues walk through life with ease. Using biomechanics and neuromechanics, Hur and his team in the Human Rehabilitation Group at Texas A&M are developing

robotic prosthetics and therapy devices to restore balance to those who have lost it through injury, illness or age.

Hur's prior research helped him answer two questions: "Can we predict a fall? Can we then reduce the number of falls?" The data he gathered from test subjects, which he put into his own mathematical model, led him to conclude that a person's fall risk could be predicted.

His research focuses on the biomechanical and neuromechanical aspects of human walking and balancing along with robotics. He's currently applying his knowledge in a rehabilitation setting using a different population of data for the research.

"Human walking and balancing are extremely robust and optimal considering the significant neural delays and information processing times. There are abundant insights that we can learn from human behaviors and motor controls. Bridging the gaps between bio/neuromechanics and robotics is one of the most crucial steps that my research is focusing on to maximize the outcomes from rehabilitation robotics," Hur said.

Hur and his team work with subjects with normal walking and balancing ability who are put into an environment where they experience a controlled fall by walking across an oily surface which causes them to slip and fall. Sensors attached to each muscle collect data on the falls and recoveries by measuring muscle activity.

Because researchers believe it is a neurological command that regulates balance, using this data will help them separate the activity into several subcomponents helping Hur's group to program assistive devices to fit each individual's walking habits.

Hur is one of only a few researchers investigating the possibility of

creating robotics that not only can walk like a human—which can be done—but that can also help in the event of an unexpected slip or trip based on customized algorithms the device "learns" from the human's behavior. Many exoskeleton robotics have been developed to help patients walk normally, but they are bulky and unable to assist a person with an unexpected loss of balance, which means they are not tailored to suit a patient's unique needs. Hur's developments will correct both of these issues.

"I am not limiting myself to only rehab because there are many other areas to which I can apply my knowledge. At this moment however, I want to focus on the rehabilitation side so we can have better, more human-friendly, lightweight and robust robotic prosthetics and exoskeletons," Hur said.

The project is called AMPRO, which stands for A&M Prosthesis. Hur's research group has also completed developing a new prosthesis that is biomechanically more efficient and lightweight. In addition to this project, the group is also working on a balance device. Using similar biomechanical and neuromechanical understanding, this device retrains the balance of patients who are prone to falls. It uses a handheld control which stimulates the skin when the body becomes unbalanced, training the brain to recognize imbalance and correct it.

Provided by Texas A&M University