

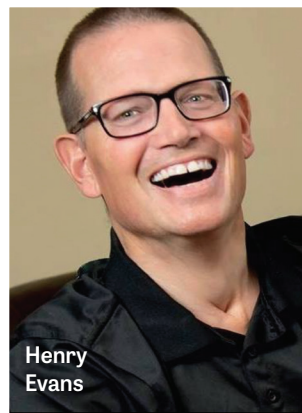
A HIGH-TECH Helping Hand

How robotics are changing the quality of life for the disabled community

BY AMY MEADOWS

In late 2021, Henry Evans set out to help his wife, Jane, do some meal planning. He searched the internet for a recipe that sounded good to him, printed it out and handed her the sheet of paper. And while it may seem like a mundane task that people do every day, it was the first time Henry had been able to give Jane a dinner suggestion since 2002. It was on August 29 of that year that, at age 40, he suffered a paralyzing stroke that left him with quadriplegia and the inability to speak. The father of four suddenly found himself bedridden, and his beloved high school sweetheart became his full-time caregiver.

Nearly two decades later, he was finally able to physically



Henry Evans

present her with a piece of paper — this time with the help of the Stretch RE1, a lightweight research robot created by Dr. Aaron Edsinger and Dr. Charlie Kemp, founders of Hello Robot. The autonomous, customizable machine can perform an array of tasks in a simple and

intuitive manner, and it shows how far robotic technology has come in recent years in terms of assisting individuals with severe physical disabilities and limited mobility issues. It's the kind of breakthrough that has the potential to change the quality of life for so many people around the world, which has always been the main goal of scientists, researchers and engineers in this burgeoning arena.

The Progression of Assistive Robotics

For decades, assistive technology has provided new options and possibilities for disabled individuals. From advanced prosthetic limbs to innovative wheelchairs that can be controlled with eye-gaze technology, scientists and researchers have created an array of solutions that are designed to meet the unique needs of those





The Stretch RE1, a lightweight research robot by Hello Robot, can intuitively perform an array of simple tasks.



Charlie Kemp



V Nguyen



Chad Jenkins

PHOTOS: TOP COURTESY OF CHARLIE KEMP; CENTER COURTESY OF V NGUYEN; BOTTOM COURTESY OF CHAD JENKINS

with physical disabilities. In more recent years, laptops and smartphones also have become critical tools for the disabled population, allowing for more fluid communication and social connection. Yet, the technology in this area appears to be entering a new phase, as a variety of advancements have propelled the industry forward with the evolution of assistive robots.

“Technology is an extremely

important part of my life. Using a headtracker and a modified mouse, I am able to access a computer using tiny head movements. It is my window to the world, and I spend countless hours socializing, exchanging ideas, writing songs, designing things, watching YouTube, meeting new people, shopping and more,” says Henry Evans, who in recent years has been able to go beyond those

endeavors by collaborating with scientists and researchers like Charlie Kemp, as well as occupational therapy consultant V Nguyen and Chad Jenkins, professor of computer science and engineering and leader of the Laboratory for Progress at the University of Michigan’s Robotics Institute, among others. In fact, in 2015, Henry began a project with Jane called Robots for Humanity, which

chronicled his quest to find robotic solutions for his needs and the needs of others with disabilities. His search has led to a variety of opportunities that he never expected.

“There have been many successes. Shaving myself, shaving Dr. Kemp 3,000 miles away, self-feeding, scratching my own itches, handing out Halloween candy, operating a printer in another room, playing cards,

writing software, flying drones with my head and ‘walking’ on stage and giving talks all over the world while lying in my bed in California,” he says of his experience with such robots as Stretch, which features open source software so researchers everywhere can work with and manipulate it to achieve autonomous function.

And for Henry, that’s just the beginning. “My biggest dream is that we can use brainwaves — either noninvasive EEG or invasive brain implants — to directly control assistive robots to improve independence,” he notes. “Thus, I could guide the robot using only my mind — the ultimate body surrogate. This is not far-fetched. Various labs have already demonstrated proof-of-concept brainwave (both non-invasive and invasive) control of cursors and stationary mechanical arms. So why not body surrogate robots?”

To Market, To Market

Of course, the challenge today is not only developing the robotic technology itself, but also inventing autonomous machines that can be commercially viable to those who need them most.

“A variety of commercial robots are available, such as desktop robots for feeding assistance and wearable robots for rehabilitation,” explains Kemp, who not only co-founded Hello Robot, but also is an assistant professor of biomedical engineering and the founder of the Healthcare Robotics Lab at the Georgia Institute of Technology. “My lab has focused on mobile manipulators, which are an emerging technology with the long-term potential to help. A mobile manipulator is a robot that can both navigate and manipulate, which includes



walking humanoid robots and wheeled mobile robots with arms. Mobile manipulators are versatile and have the potential to improve the quality of life for people with diverse impairments because this type of robot can perform a variety of tasks and doesn’t need to be worn or fixed to a wheelchair.”

Of course, mobile manipulators typically are large, heavy and expensive. This includes one of Kemp’s original devices, the PR2, which intrigued Henry Evans when he saw it on CNN in 2010 and prompted him to reach out to Kemp, leading to their longtime collaboration. However, Stretch, Hello Robot’s flagship product, will have a hand in changing that. Originally developed by Kemp with graduate student Henry Clever and in collaboration with Dr. Aaron Edsinger, Stretch weighs only 51 pounds and is agile in real-world environments thanks to its compact footprint and slender body. Since July of 2020, the research edition of the robot has been purchased for use in labs at such renowned institutions as the Massachusetts Institute of Technology and

Carnegie Mellon University. Yet, there’s still more that needs to be done before Stretch can be made available to the general public.

“Robots are becoming more intelligent and better able to interact with people, so I’m optimistic that robots that benefit people with disabilities will become more capable, available and affordable over time,” Kemp says. “That said, robots are harder to commercialize than software, so promising innovations will take time to reach the public.”

One product that is heading in that direction is the Labrador™ Retriever from Labrador Systems, Inc., an early-stage robotics company that aims to help people be independent at home through the use of next-generation personal assistive robots. Co-founded by Mike Dooley, CEO, and Nikolai Romanov, CTO, the company launched its efforts to invent the Labrador Retriever nearly five years ago. The concept was inspired by Dooley, who recognized something about his aging mother while she was visiting him in Pasadena.

“When I saw my mom using a cane or a walker, I realized



Mike Dooley

◀ The Labrador Retriever pictured here is a personal assistive robot that can be used throughout the home to free up the hands of those with disabilities.

that her hands were becoming her extra pair of legs. That’s what was being used to stabilize her,” Dooley recalls. “If you’re using your hand to brace yourself, you shouldn’t be trying to carry something like a laundry basket. When we look at the issues of people with disabilities, people tend to think about what they can’t do. But we should be looking at what extra they have to do. What are the jobs they are taking on that are more complicated? That’s when it started to click for me. If we have the technology and can make it affordable, then everybody should have the option to use tools that work for them.”

For Labrador Systems, the key to the Labrador Retriever is the navigation system it uses to move within a home space. Backed by a grant from the National Science Foundation, Dooley and Romanov began looking at technologies found on the consumer market — including augmented reality sensors — that could be used as the foundation for their product. They played off of the concept of simultaneous localization and mapping to create an

autonomous modular robot that could navigate in tight spaces, taking smooth turns around corners and furniture using an array of algorithms.

What's more, the robot can actually be trained to learn the environment in which it is working. It ultimately serves as that extra pair of hands as it moves large loads from place to place and even picks up and delivers items to its user with the help of automatic retrieval trays. For the last several years, the Labrador Retriever has been involved in in-home product trials, and the company recently partnered with Nationwide to take the system on tour to introduce it to health care, insurance and therapeutic professionals around the country. What's more, with a refundable \$250 deposit, individuals can reserve their own Labrador Retriever, which should be in full production by the second half of 2023 and will cost \$1,499 plus a monthly \$149 subscription fee (the base model, which does not retrieve items, will cost \$99 per month).

"We saw this as a natural fit as something that could be really helpful for people with a variety of issues that are interrupting their daily activities," Dooley says, adding, "Our mission is to help people stay active and to make this kind of product affordable."

The Full Picture

According to V Nguyen, OTD, OTR/L, who began working with Henry Evans and Hello Robot in August of 2021 as part of her doctoral capstone project at Pacific University, the advancements in technology for the disabled community are exceptional, helping both patients and their caregivers. However, one of the biggest issues facing that community today is accessibility.

"Growing up in the Bay area, I've been around a lot of technology, but I've also understood that it's not accessible. A lot of people in the disabled community don't have access to these really innovative devices — even something as simple as a letter board. If that simple form of communication is not accessible, how are people going to access something really high-tech like a robot? We call it occupational justice," says Nguyen, who, as a nonclinical occupational therapist, is working to encourage the use of all kinds of technology in the occupational therapy arena. She often speaks at conferences to share her perspective and her firsthand experiences with tech in the OT realm. "My role as an OT is expanding and really focusing on bringing awareness to practitioners," she adds. "How do we make technology available for the people who don't have access to those resources? For the people in rural areas or un-

derserved populations, how do we get those resources to them? That's where my passion lies."

Chad Jenkins, who also worked with Henry Evans several years ago, leading the team that created the interface that allows Henry to fly a camera-mounted drone, agrees. "We need to think about the equity that exists across our nation and what we can do for people who don't have the resources that someone like Henry has," he says. "We need to think about how robots can improve our productivity and enhance our quality of life across the socioeconomic spectrum. And that starts with education."

In addition to his research work in the areas of mobile manipulation and human-robot interaction, which recently has focused on how robots can learn from human demonstration, Jenkins is dedicated to making sure there is a diversity of people in the room creating the technology that will be used in the future. "We have to invest in educating future generations so that we can get more people to understand the different perspectives and needs that the technology is going to serve."

With that in mind, in his role as associate director of the Michigan Robotics Institute, his objective is to create the country's first undergraduate program in robotics at a major

research institute. He states, "This new major is meant to help educate students regarding the needs of the 21st century and to help them understand not only the analytical and technical nature of what we do, but also the value of human dimensions and the considerations for how we can make things more equitable." Jenkins has received approval to launch an official department of robotics at the University of Michigan and is currently awaiting approval from the state so the institution can begin offering classes in the fall of 2022. "This is taking everything to the next level," he says. "Computing and artificial intelligence are becoming a new literacy."

For Henry Evans, these kinds of developments are exactly what he wants to see on behalf of the disabled community. He also hopes that more individuals become involved themselves in the research aspect like he did so many years ago, as it is something that has changed his life. "The first thing to do is educate yourself about what is possible and available. Then think about how it could be applied to your own situation, as every disability is different. Then find a robot and give it a try," he concludes. "Robots can bring independence and enrich the lives of both the patient and the caregiver." ■

A NEW SPIN ON WORKING FROM HOME

In mid-2021, a new café opened in Tokyo, Japan. But it was no typical café. DAWN, or the Diverse Avatar Working Network, is staffed entirely by robots that are controlled by homebound or bedridden individuals with severe physical disabilities. The "pilots" of the OriHime robots, which were invented by Japanese tech startup Ory Laboratory, use a mouse, a tablet or a gaze-controlled remote to move their avatars around the café as they interact with and serve customers.

Through the opportunity, the employees earn a living wage from home and are given the chance to be part of the local community. And while the award-winning café began as a social experiment to address the isolation felt by the nearly 34 million people in Japan who are housebound because of physical disabilities, mental illness or advanced age, it actually has placed a spotlight on the overall quality of life of the disabled population and shown how robotic technology can have an extraordinary impact on people around the globe.