

# Acrobatic Robots

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A Drexel University-led research team unveiled the newest, most central member of a collaboration with Korean researchers. Jaemi, a humanoid (HUBO), embodies efforts to advance humanoid development and enhance the concept of human-robotic interaction. Credit: Lisa-Joy Zgorski, National Science Foundation

Dennis Hong is living his dreams ... literally ... in a lab filled with wacky robots.

"When I was seven years old, I watched the film 'Star Wars' for the very first time. It just completely blew my mind. All the robots and spaceships," recalls Dennis Hong. You never know where you will find inspiration! For Hong, a [mechanical engineer](#), it was there, on the silver screen.

"R2D2, how it moved, its locomotion, inspired me to study robot locomotion, and C3PO, the human servant robot, inspired me to study human-robot interaction," says Hong. The force has been with him ever since.

Hong's lab, the Robotics and Mechanisms Laboratory (RoMeLa) at Virginia Tech, is filled with robots that would fit right into a "Star Wars" sequel. "From humanoid robots to rolling, climbing, wheel-leg hybrid robots," says Hong, as he points to the row of awards that circle the large rubber robot work out mat on the floor of the lab.

With support from the National Science Foundation (NSF), Hong and his team are creating "Star Wars" inspired robots aimed at lending a helping hand. For example, a Robotic Air Powered Hand with Elastic Ligaments (RAPHaEL) is a relatively inexpensive robot that uses compressed air to move and could one day help improve prosthetics. Another series of robots nicknamed CLIMBeR, short for Cable-suspended Limbed Intelligent Matching Behavior Robot, was built with NASA in mind. The robots scale steep cliffs and are rugged enough to handle the terrain on Mars.

Intelligent Mobility Platform with Active Spoke System (IMPASS) is a robot with a circle of spokes that individually move in and out so it can walk and roll. "So of course, you can use it just like wheels, but by intelligently controlling them, you can use them as legs. So it shows extreme mobility, and the application could be used for search and rescue missions or scientific exploration," explains Hong.

Hyper-redundant Discrete Robotic Articulated Serpentine (HyDRAS) snakes its way up dangerous scaffolding so humans don't have to.

Another upcoming project is a fire fighting robot, says Hong. "The hose itself is a robot. It's a robot snake so it slithers and props up like a cobra

and it can fight fires."

The team is also building a family of humanoid robots, some of which are even learning to play soccer. There's a team of kid-sized robots called DARwIn--short for Dynamic Anthropomorphic Robot with Intelligence. DARwIn robots compete for Virginia Tech in the collegiate RoboCup Competition. "CHARLI (Cognitive Humanoid Autonomous Robot with Learning Intelligence) is an adult-sized robot getting into the game as well," says Hong. "It has two cameras on the head, looks around, searches for the ball, figures out where it is, and based on that, it kicks the ball to the goal."

For another project called the Blind Driver Challenge, the Virginia Tech team developed the first prototype car that can be driven by the blind. The vehicle's name is "DAVID," an acronym for Demonstrative Automobile for the Visually Impaired Driver. Hong dreamed up many of these award-winning robot designs.

"Yeah, many of these wacky [robot](#) concepts originate from my dreams," he explains with a grin. "I go to bed at three or four in the morning and when I close my eyes, I see these weird circles and blocks and lines exploding in my head and some of these assemble and form these weird types of robotic mechanisms."

"Next to my bed, I keep a notepad and a special pen that has an LED light on it because I don't want to wake up my wife by turning on the light. I just jot down and sketch everything and go back to bed. Every morning before my first cup of coffee, before I brush my teeth, I open my journal. Many times, it's empty. Many times, it's all scribbles. But from time to time, I see these really ingenious ideas hidden in my sketches and that's my eureka moment. I type all my ideas into a database on my computer. When we have calls for proposals in robotics, I look at my database of ideas and try to find a match," he says.

Hong is making his dreams come true. Not long ago in a galaxy far, far away, but right here and now--life imitating art.

Provided by National Science Foundation

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