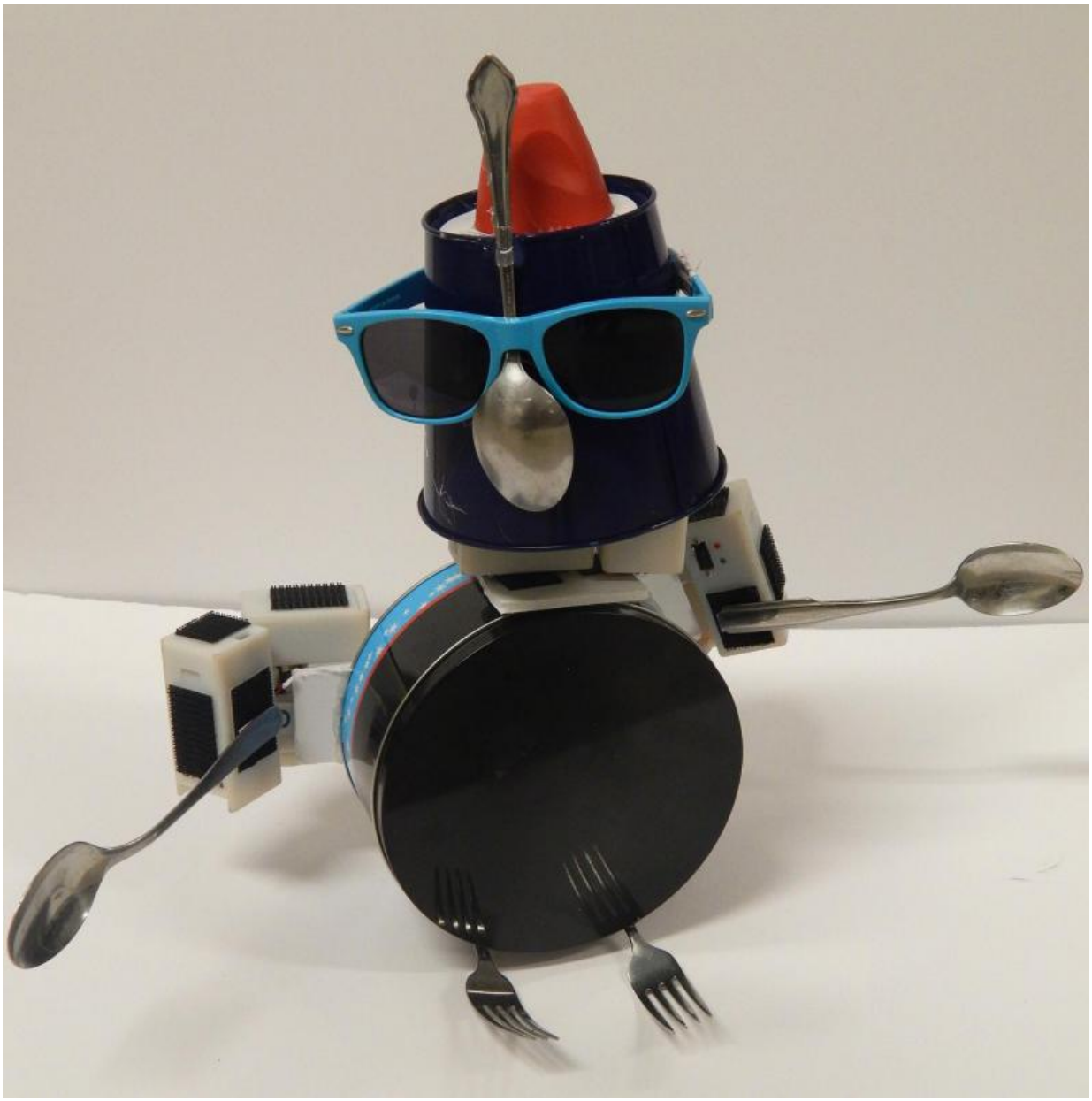
Toy-building kit allows children to create robots and control them remotely

April 19 2016



Research at Purdue University has led to development of a new kind of toy-building kit that allows children to create robots and control them remotely like a puppeteer. Here, the system is being used to control a small rover. Credit: ZeroUI image

Research at Purdue University funded through a National Science Foundation grant has led to development of a new kind of toy-building kit that allows children to create robots and control them remotely like a puppeteer.

The new kit, called Ziro, was developed in research led by Karthik Ramani, the Donald W. Feddersen Professor of Mechanical Engineering and co-founder and chief scientist of the company ZeroUI, with locations at the Purdue Research Park and in San Jose, California.

Ziro is the first commercial application of ZeroUI's gesture-based Natural User Interface technology platform. Sensors in a "smart glove" communicate with wireless motorized modules, enabling users to direct the robotic creations with the lift of a finger or flick of a wrist in real-time. (Ziro is pronounced ZYE - rhymes with eye-row).

Research funding was provided as part of the NSF grant to both the university as well as through the Small Business Innovation Research program, designed to move innovations from discovery to commercialization. The NSF is nurturing a national innovation ecosystem through development of technologies, products and processes that benefit society.

"An innovation ecosystem consists of many integrated components, including academic research, the business and investor community,

industry and the commercial marketplace," Ramani said. "The NSF funding was critical to starting and nurturing the work that led to this product and resulted in a success story."

Ramani has been teaching a popular toy design class at Purdue for 18 years, refining ways to make toys both educational and playful.

"Ziro is a way for students to learn about physics and engineering while still having fun," Ramani said. "They encounter ideas around physics as they are engaging in the design work and then they are more receptive when they get a mathematical formula that describes what it is that they've just seen."

The new kit was recently showcased during the Consumer Electronics Show in Las Vegas, where it was named a "Best at CES 2016 Finalist" in the best maker-friendly technology category by Engadget, an online magazine that promotes new and promising technologies to the public.

"The best validation for a new concept is how well it is accepted by the business community," Ramani said. "Ziro passed the acid test of CES with flying colors."

The system originally was called HandiMate and was later commercialized as Ziro. It appeals equally to both genders, representing an unbiased tool for encouraging both girls and boys to learn about science and engineering through robotic puppetry and building.

Ziro uses motorized "joint modules" equipped with wireless communicators and micro-controllers. Children create robots by using Velcro strips to attach the modules to any number of everyday materials and objects such as cardboard, metal cans and foam board, a departure from conventional kits that contain primarily prefabricated mechanical and structural pieces that children fit together.

"Anytime you have mostly prefabricated building blocks that come together in a certain number of combinations you are limited in what you can do, and research shows you are not going to attract the interest of girls with the vast majority of these kits," Ramani said. "The thing about Ziro that is more open is that you can use virtually any material and you are not limited to these prefabricated pieces."

Information about the system was reported in a paper presented last year during the Interaction Design and Children conference.

"The important point here is that you are not just decorating a robot with craft materials," said Kylie Peppler, a co-author of the paper and an associate professor of learning sciences at Indiana University. "The crafting actually becomes part of the robot design and construction."

Some toy-building kits on the market target girls through product packaging and decorative features, but they still rely primarily on prefabricated pieces. This "pink-wrapping" approach fails to address the fundamental reasons that traditional building kits don't appeal to girls, Peppler said.

"What we are finding in our research is that kits intended for girls actually appeal more to boys," she said. "It is pink wrapping traditional boy toys instead of fundamentally changing the toolkit to integrate crafting or other girl-friendly practices that invite participation. The cool thing about HandiMate is that the kids are putting it right in the center. So it's not too boy and its not too girl, and that is really rare."

The research involved 32 children ages 6-15. Of the group, 15 were girls. The children performed "gender-sorting" tasks where they rated several commercial kits and assessed whether they would appeal more to boys or girls. The researchers also performed statistical tests to evaluate HandiMate and other kits, pinpointing gender-oriented preferences

among the children.

"We wanted to see for the first time how kids perceived these kits," Peppler said. "A lot of times we ask adults whether they would buy this for their child, but we don't actually ask the kids whether they would want to play with it even if it were purchased. We were really trying to understand this from the perspective of the kid."

The materials include cardboard that can be cut and crafted as well as robotics pieces that can be computer programmed.

"What children are doing with the glove component is to treat it like a puppet and to think about the context in which these robots are then going to be interacting," said Ramani, director of Purdue's C Design Lab. "Not only is the glove controller amenable to puppeteering and storytelling, but it's also sort of a natural extension of your body. It's a lot more natural to operate than conventional joystick controllers."

Another natural element is the crafting itself.

"Crafting is an inherent activity that children are involved with from a very young age, so it only makes sense to integrate craft-oriented functions in a kit," said graduate student Ansh Verma.

HandiMate dovetails with goals identified in Next Generation Science Standards, based on the Framework for K–12 Science Education developed by the National Research Council of the National Academy of Sciences, Ramani said.

"These Next Generation Science Standards contain a whole appendix on engineering design, and that's the first time I have seen such a big emphasis on design for teaching science," he said.

Provided by Purdue University