

# SENSE, THINK, ACT

Mechatronics students  
engineer automation  
solutions for Mohawk

*By Joëlle Walls*



KSU students Kayleb Garmon (left) and Patrick Yelverton (middle) observe their robotic gripping solution handling product with faculty mentor Matt Marshall.



The sense-think-act paradigm is used in robotics research to describe how sensory data is processed and distributed through the system so that the robot can make the appropriate action decisions based on the data. Mechatronics engineering students in KSU's Southern Polytechnic College of Engineering and Engineering Technology are using this mental model as they are designing automation solutions for Mohawk Industries, the largest flooring manufacturer in the world.

"Industry-leading companies are always looking for process improvements to drive productivity and stay competitive. Some of this improvement has been limited due to lack of technological applications," explained Chris Behrends, vice president of supply chain and logistics at Mohawk Industries.

With a three-year \$250,000 grant from Mohawk, including student scholarships to cover tuition, Matt Marshall, assistant professor of mechatronics engineering, is leading a team of students to improve elements of the company's flooring manufacturing processes with the latest industrial technology.

At the center of this collaboration are two Universal Robots (UR-10) mechanized arms, each weighing 63 pounds and outfitted with six pivot points and a 51-inch reach. Mohawk purchased these cobots or collaborative robots, which are more conducive to work in shared spaces with humans, to loan to the University for use in the Marietta Campus lab.

"The mutually beneficial partnership helps the College provide educational opportunities to engineering students that will enable them to serve our society as it changes," said Marshall.

"Dr. Marshall is handpicking projects and giving his students the opportunity to experiment with new technologies like vision systems and collaborative robots

to simplify work. We love the ideas and enthusiasm from both the KSU teams and the Mohawk teams collaborating on these projects," added Behrends. "Mohawk is excited about this program not just for bringing real solutions to the table, but also for providing a connection with our future leaders as we continue to grow our team."

Since the project began in fall 2017, the students have been engaged in various aspects of three tasks requiring automation. These tasks included improving a specific step in the carpet production process; the making of machining parts in-house for Mohawk's operations; and automating the process of producing carpet sample books that consumers peruse in retail stores.

Marshall organized the students into three sub-teams to work on the tasks. Martika Johanson-Murray, a senior from Atlanta, was part of the team focused on automating the operation of a computer numerical control (CNC) machine. The CNC machine is responsible for the automated control of machining tools such as drills and boring tools via a computer in which the CNC machine transforms a piece of material such as metal or wood to precise specifications.

"The project was centered on having a UR-10 load and unload raw rectangular blanks of aluminum into/out of a CNC machine," explained Johanson-Murray. "Mohawk could fabricate parts they currently order in-house to cut back on costs since those parts break frequently with use."

Last November, the team, in collaboration with KSU mechanical engineering technology students, had the opportunity to demonstrate their project at FABTECH, the largest event in the U.S. for the metal fabricating industry. The event is attended by manufacturing and engineering professionals and business owners from major industries such as aerospace

and construction as well as high school students interested in career opportunities in the field.

“At the FABTECH demo, we showed exhibitors our research and explained our solution to other major material companies handling raw materials similar in nature. The MET department helped us with fabrication of parts for the booth at the expo,” said Johanson-Murray, who would like to pursue a career working for an automotive group with their robotic systems on assembly lines.

“Undergraduate research gives me a means to use what I have learned in my mechatronics engineering courses in realistic applications that I can then share with potential employers during job interviews,” she added. “This was the first research-related team I have been a part of and have really enjoyed the experience. Working with Mohawk has opened my mind to more opportunities for post-graduation.”

With the carpet samples team, KSU students Patrick Yelverton and Kayleb Garmon were able to go a step further and install their team’s automation system in Mohawk’s north Georgia factory. The system Yelverton and Garmon installed included adhering the identification labels on the back of the carpet samples.

“Seeing the students’ solution implemented was rewarding, both to them and to the sponsor,” said Marshall.

This university-industry partnership began in spring 2016 when Mohawk reached out to KSU with the purpose of involving students to work on some of their production-related projects. The first project centered on boosting the efficiency of their robotics assembly-line that created carpet sample boards. The boards are used in thousands of retail stores to showcase the various carpet collections Mohawk offers. For customers to accurately compare colors between carpets, Mohawk wanted all the piles or fibers of the carpet swatches on the sample boards oriented in the same direction.

Marshall coordinated with Mohawk to ensure the project would align with the college’s academic program and meet the company’s production needs. With a \$30,000 award from Mohawk, including an extra \$4,000 in student scholarships, Marshall then gathered a group of KSU seniors for the project that they completed through a 15-week directed study during that fall semester.

The students – Johnny Canazon, Cameron Clevinger, Flavio De Paula and Matt Hensley – developed two solutions for the already existing assembly line. One prototype involved a motorized sensor that touched the carpet to detect the direction of the pile. Another device used cameras taking pictures of all four sides to determine carpet pile direction. They also developed a more efficient carousel for even distribution of the carpet swatches to the assembly line.

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Patrick Yelverton (left) and Kayleb Garmon installed their team’s automation system in Mohawk’s north Georgia factory.

“In addition to meeting some of Mohawk’s technological needs, the partnership is helping the College to nurture Georgia’s engineers of tomorrow,” said Marshall. “For the students to get a head start in that, and see the fruits of their labor today, is something we all appreciate.”

