Purdue startup developing six-axis control system for students to gain hands-on experience in automation, robotics

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A Purdue-related startup is commercializing a six-axis, open source controller and teaching pendant that could allow technology college students an affordable way to gain real-world, hands-on experience in automation and robotics, making them more marketable to future employers.

Robotics is a sub-group of mechatronics widely used in science, technology, engineering, arts and mathematics, or STEAM education.

"Six-axis controllers are one of the most commonly integrated industrial robots on the market today. This is mainly due to their greater range of flexibility, powerful programming software, human-like task management and accuracy," said Larry Himes, a Ph.D. student in Purdue's Polytechnic Institute and past limited term lecturer at Purdue North Central and founder of Didactictron Inc. "Technology is constantly progressing so it's more important than ever for students to have hands-on experience when they leave college and are looking for a job. The Didactictron six-axis controller will allow students to have the desired skills and knowledge to work with the devices they're most likely to encounter in the real world."

Automated machines and robots are able to operate without human assistance and perform specific tasks by utilizing a controller, a specialized computer that coordinates the robot's movements, and a

teach pendant, a hand-held device that allows the robot operator to program and control a robot. Controllers typically have a specific number of axis that determine its range of movement, - the higher the number, the more range of movement.

Himes said the controllers that are on the market are limited in capacity and can be very expensive.

"There are only two-axis controllers available for students to learn with in the classroom. Two-axis controllers only allow simple movements such as moving a toy like car in different driving patterns, whereas a six-axis controller is able to move forward and back, up and down, in a circular motion, raise and lower and manipulate objects," he said. "The six-axis controllers that are on the market are meant for industry use and are extremely expensive. The Didactictron controller would be priced so it's affordable for students."

Six-axis controllers allow students to build something like a robotic arm and have it be able to multi-function, something two-axis controller are unable to do, Himes said.

The controller and teach pendant device, named Syndictron, brings control to one easy-to-manage unit. The teach pendant is linked to the control system so the robot can be programmed or moved. This gives students the ability to observe, control and record the desired movements in real time.

The controller is open source so there is no cost for students to download the compiler software, which is used to modify and customize the source code to become more useful for a specific application they are working on, and any accessories such as motors and sensors attached to it are not proprietary. The device also has Bluetooth capabilities so it can connect to other devices in an easy to use and portable manner.

Himes said the six-axis controller he developed also utilizes a position feedback function, something that isn't widely available to students.

"The feedback function is used to transform a physical parameter into an electrical signal that the controller can send to the motor to initiate movement. Each time there is a range of movement or an action is carried out in an automated system there is a specific number of pulses from the motor that correlate to that movement," he said. "Having this function allows students to know how many pulses are required for each movement so they are then able to enter a specific number of pulses to make the robot move to a specific position or repeat precise positions for repeated tasks.

"The position feedback function can also be used to check the motor condition, so students are able to detect whether the device is running or stalled and take the necessary steps to intervene if necessary."

The teach pendant is equipped with 15 touch pads that can sense when a finger is present. A student can select one of the six axis motors and use the touch pad to move it in the desired direction. The controller monitors how many pulses are needed until the student removes their finger, providing data of the new position of that axis.

The device supports Video Graphics Array output, which allows the user to display data on a monitor.

"Having both the touch pad and VGA output on the pendant allows for a standalone control station. The VGA display also provides controller status and updates to the students, if the controller has been programmed to do so," Himes said.

Himes said the teaching pendant has twice the memory space of typical boards to allow for animated graphics.

"Having more memory space allows the instructor or student to build a 3-D graphical image of their mechatronics project," he said. "It also can support animation of movement on the VGA display while the physical system is moving."

Himes said that he has already tested out the device while teaching an introduction to microcontrollers class at Ivy Tech Community College.

"With my students this semester we used the device to control the OWI 535 robotic arm, an educational robotics kit that is able to carry out multiple movements and functions, and utilizes a gripper that can open and close," he said. "The mechanical parts are very affordable for a student and then with my controller they can control the repeated movement and gain hands-on learning experience to see how it works."

Himes said he plans to further develop the controller and potentially market it through entities such as Pearson's Prentice Hall, which provides educational materials, technologies and assessments so that it can be available at bookstores, and Amazon, so that it could be available to self-learners and hobbyists. Eventually, he'd like to simplify the end user interface so that it can be used by younger children in kindergarten through fourth grade.

Technology used by Didactictron has been licensed through the Purdue Research Foundation Office of Technology Commercialization. Didactictron is a member of the Purdue Startup Class of 2016. Purdue has twenty-seven startups based on Purdue intellectual property that were launched in the 2016 fiscal year. The company is a client of the Purdue Foundry, an entrepreneurship and commercialization accelerator located in the Burton D. Morgan Center for Entrepreneurship in Purdue's Discovery Park. Didactictron went through the Foundry's Launch Box and Launch Pad program to help develop the product and business plan.

More information: www.didactictron.com/home.html

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