A Robotics Learning Platform for a Hands-On Laboratory Based Approach in an Introductory ECE Course

The field of Electrical and Computer Engineering (ECE) is continually increasing in complexity and demand. However, attrition rates and an aging workforce are creating a shortfall that undergraduate programs are struggling to fill. As a result, undergraduate educators must work to design courses that not only provide skills needed for professional engineers, but also increase motivation and engagement to improve retention. Hands-on, project-based learning not only increases performance in STEM courses, but also enhances motivation, engagement, and retention in technical undergraduate majors.

This paper presents BeyerBot, a robotics learning platform used in an introductory ECE course to teach fundamentals. Students build the BeyerBot from the ground up and experiment with different skills such as soldering, circuit design and troubleshooting, 3D printing, pulse-width modulation, control systems, computer programming, and sensor integration. The course culminates with students programming their robots to use line following and distance sensors to compete in a maze solving competition. The BeyerBot implements a modular design that enables students to explore adding different components such as a camera to provide first-person view video or a remote control to drive their robot through the halls. Both affordable and customizable, the BeyerBot provides hands-on experience to first-year students to increase motivation, engagement, and retention in the ECE program.