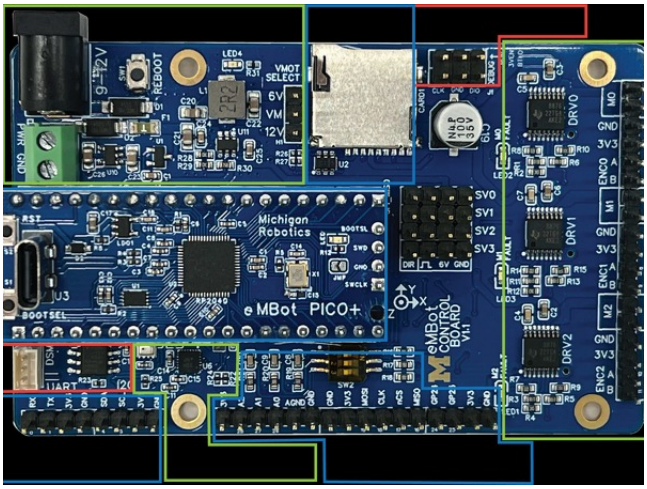
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

MBot Control Board

TECHNOLOGY NUMBER: 2025-330



OVERVIEW

A versatile control board enhancing educational robotics capabilities and data logging.

- Integrates motor control and sensors with RP2040 microcontroller for educational robotics enhancements
- Used in educational robotics, data logging, sensor fusion, and hardware/software debugging

BACKGROUND

Educational robotics has long been a platform for engaging students with STEM learning, combining elements of programming, electronics, and mechanical design. Historically, educational robotics kits have been limited by their hardware, often featuring basic components that restrict the complexity and capability of student projects. Many traditional control boards lack advanced integration of sensor feedback and data storage, thus limiting hands-on learning opportunities in understanding real-world applications of robotics. Moreover, existing setups often require complex peripheral integration, which can overwhelm beginners and educators alike, leading to less effective educational experiences. As more sophisticated robotics applications emerge, there is a growing need for educational tools that allow for advanced data handling, versatile motor control, and seamless integration with modern microcontrollers. This necessitates improved systems capable of providing comprehensive feedback and control, helping educators to bridge the gap between theoretical concepts and practical robotic applications.

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Category

Hardware

Engineering & Physical Sciences

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INNOVATION

The MBot Control Board represents a significant advancement in educational robotics by integrating an RP2040-based microcontroller compatible with Raspberry Pi Pico modules. It supports control of three brushed DC motors with precision feedback systems, ensuring accurate motor operation through current and relative position feedback via quadrature encoders. With its ability to configure channels for driving hobby servo motors, the innovation broadens potential applications. Beyond motor control, the board is equipped with a Bosch-based nine-degree-of-freedom MEMS Inertial Measurement Unit and barometer, enabling comprehensive pose and altitude estimation for robotics projects. Its nonvolatile memory and SD card support facilitate vital data logging and parameter storage, enhancing the learning process. The built-in ports for standard serial protocols and debug functionalities improve the ease of integration with external sensors and support complex software development. Through this versatility, it finds application in academic programs, robotics competitions, and educational demonstrations, where deep learning through practical engagement is essential.