

A Scalable Multiplatform Educational Kit for Teaching Electronics and Programming Using a LEGO-Type Approach

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Abstract—This paper presents the design and development of a scalable multiplatform modular educational kit based on a LEGO-type approach, aimed at improving the teaching of electronics and programming across different educational levels. The proposed system integrates multiple control boards, including Arduino Nano, Raspberry Pi Pico, and PIC16F877A, allowing adaptability to diverse learning environments and instructional needs. The system is based on a modular architecture composed of interconnectable boards using standardized header pin interfaces, which facilitates assembly, expansion, and component reuse. This design enables students to interact in a hands-on manner with concepts related to digital, analog, and power electronics, as well as sensors, actuators, and communication protocols. Furthermore, the LEGO-type approach promotes active and meaningful learning by supporting intuitive and progressive project development. The system is designed to be scalable, allowing the integration of new modules compatible with different microcontroller platforms. The results demonstrate that the proposed kit provides an accessible, flexible, and low-cost solution that enhances technological skills and encourages innovation in engineering education.

Index Terms—Modular educational kit, electronics education, microcontrollers, STEM education, embedded systems.

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