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THE ROLE OF THE ARDUINO PLATFORM IN TEACHING ROBOTICS ELEMENTS IN THE EDUCATIONAL PROCESS

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Abstract. This article examines the pedagogical and practical significance of the Arduino platform in teaching robotics elements within the educational process. The study highlights Arduino's potential for developing students' algorithmic thinking, programming competence, engineering literacy, and creativity. In addition, the article analyzes the role of STEAM-based instruction in robotics education and substantiates the advantages of Arduino-supported project work in improving the quality of learning.

Keywords: robotics, Arduino, STEAM education, programming, microcontroller, innovative technologies, algorithmic thinking, educational technology.

РОЛЬ ПЛАТФОРМЫ ARDUINO В ПРЕПОДАВАНИИ ЭЛЕМЕНТОВ РОБОТОТЕХНИКИ В ОБРАЗОВАТЕЛЬНОМ ПРОЦЕССЕ

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Аннотация. В данной статье рассматривается педагогическое и практическое значение платформы Arduino в преподавании элементов робототехники в образовательном процессе. В исследовании подчеркивается потенциал Arduino в развитии алгоритмического мышления, программной компетентности, инженерной грамотности и творческих способностей студентов. Кроме того, в статье анализируется роль STEAM-обучения в робототехническом образовании и обосновываются преимущества проектной деятельности на основе Arduino в повышении качества обучения.

Ключевые слова: робототехника, Arduino, STEAM-образование, программирование, микроконтроллер, инновационные технологии, алгоритмическое мышление, образовательные технологии.

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Introduction.

In the era of rapidly developing digital technologies, the introduction of innovative approaches into education has become one of the most urgent tasks. In particular, teaching the fundamentals of robotics plays an important role in developing students' technical thinking, practical skills, and readiness for modern professions. The use of the Arduino platform in robotics education creates broad opportunities for organizing effective, interactive, and practice-oriented learning. Arduino is an open-source electronics platform that combines hardware and software solutions based on microcontrollers. Due to its simplicity, affordability, and user-friendly environment, Arduino has become one of the most widely used platforms in educational institutions around the world. It is currently applied in schools, vocational colleges, and higher education institutions to teach the basics of electronics, programming, and robotics. The growing demand for specialists in automation, programming, artificial intelligence, and engineering further increases the importance of integrating robotics into education. Therefore, introducing Arduino-based robotics projects into the curriculum can significantly contribute to the development of students' modern competencies and digital literacy.

Main Part.

Teaching robotics through the Arduino platform provides several pedagogical and methodological advantages. First, Arduino enables students to combine theoretical knowledge with practical activity. By working with sensors, LEDs, servo motors, and ultrasonic modules, learners gain hands-on experience while strengthening their understanding of mathematics, physics, and computer science. Arduino-based robotics projects also help develop algorithmic thinking and problem-solving skills. During the programming process, students learn logical sequencing, analytical reasoning, testing, and debugging. These skills are essential not only for robotics, but also for mastering other scientific and technical disciplines. Another important aspect is the integration of the STEAM model, which combines Science, Technology, Engineering, Art, and Mathematics. Robotics projects based on Arduino bring several disciplines together within a single learning activity. For example, when students design an automatic irrigation system or a smart home prototype, they apply mathematical calculations, engineering principles, programming knowledge, and creative design simultaneously. Such interdisciplinary learning increases students' motivation and active participation in the educational process.

In addition, Arduino supports project-based learning. Students are encouraged to design, build, and test their own projects independently, which enhances creativity, teamwork, and research skills. Teachers can use Arduino kits to organize laboratory work, practical tasks,

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competitions, and innovation-oriented activities that make lessons more interactive and practice-based.

Economic accessibility is another major advantage of Arduino. Compared with many other robotics platforms, Arduino components are relatively inexpensive and widely available. Moreover, the platform has a large global community that provides open-source software, tutorials, project examples, and educational resources. This makes Arduino especially suitable for educational institutions with limited financial resources. The implementation of Arduino in robotics education also contributes to career orientation. Students become familiar with technologies related to automation, embedded systems, and intelligent control, which are highly demanded in the modern labor market. Consequently, robotics education based on Arduino helps prepare learners for future professional activities in engineering and information technology fields.

Conclusion.

In conclusion, the Arduino platform is an effective educational tool for teaching the fundamentals of robotics in the modern educational process. It contributes to the development of technical thinking, algorithmic reasoning, creativity, and practical competence among students. Arduino-based learning integrates theory with practice and supports the implementation of STEAM education principles. Furthermore, the affordability and accessibility of Arduino make it an appropriate platform for educational institutions at different levels. The integration of robotics and Arduino technologies into education can improve the quality of teaching and help prepare students for future technological challenges. Therefore, expanding the use of Arduino in educational practice is an important direction for the modernization of contemporary education systems.

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