

ANALYSIS OF THE SOFTWARE COMPLEX FOR ROBOTIC SYSTEMS ON THE ARDUINO PLATFORM

Narzullayeva Zarina Khidirkulovna,

Lecturer at the Department of Digital Technologies, Navoi State University

Annotation The paper presents an analysis of scientific sources by researchers related to the use of microcontroller boards in modern scientific and technical research in the fields of programming, robotics, and electronics. Furthermore, an open platform for writing software code in the Arduino environment is recommended. In addition, this thesis includes an analysis of the Arduino Uno board and its associated software complex.

Keywords: Board, electronic platform, Arduino Uno, interface, prototyping, software, input-output pin, memory, voltage, and processor.

Introduction. The Arduino board is intended for use in software development projects and provides the capability to write program code for various electronic devices. This study presents a review of methodological literature focused on the detailed analysis and comparison of prototyping processes using the Arduino board. The obtained results can be applied in research aimed at selecting effective technologies for developing prototypes based on Arduino [1]. In addition, the Arduino board can be utilized by users who wish to receive practical guidance on prototype development.

Main part: Research on improving the efficiency of the Arduino platform for robotic systems, as well as its application in programming and robotics, has been conducted by scholars such as Sudha Ellison Mathe [1], Suseela Vappangi [1], A. B. Evstifeev [3], B. Kitchenham [5], M. Pautasso [6], and J. Hernando Barragán [10].

In their studies, these researchers have theoretically and practically demonstrated that Arduino and similar platforms serve as modern educational tools in the fields of computer technology, programming, and electronics for teaching and implementing prototyping techniques.

Although the works of these researchers have presented various approaches related to the Arduino programming language and its boards in the fields of technology and programming, insufficient attention has been paid to the development of students' logical and algorithmic thinking in the use of Arduino boards applied in robotics. Therefore, the proposed research is considered one of the relevant and pressing issues in the modern context.

Nowadays, various information and educational environments, as well as sets of software tools, have been developed to help students learn programming in the Arduino environment, and these resources are being widely used. As an example, the platform <http://arduino.cc/> can be mentioned. This environment represents an open-source electronic board that is convenient for use in the fields of electronics, mechatronics, and robotics. It includes beginner kits and open-source software designed to facilitate the rapid development of interactive electronic devices [2].

The platform was developed by a group of researchers who positioned it as a means for quickly implementing small-scale projects. These programming environments provide students and learners with the opportunity to work within the Arduino programming environment, i.e., to write program codes for Arduino boards. This, in turn, allows them to easily create the necessary applications for their projects.

By analyzing the Arduino Uno, we can explore its structure and functional capabilities. Currently, there are several types of Arduino boards used in the field of technology. Some of them are employed by engineers and hobbyists, with the most widely used one being the Arduino Uno (1-picture)



1-picture. Arduino Uno,

The Arduino Uno board mentioned above serves as an efficient tool in the development of VLSI test benches, particularly for sensor applications. The main advantages of the board lie in its high processing speed and simple interface, which make it a valuable platform for rapid prototyping and experimental implementations.

Today, as open-source software and hardware platforms are being increasingly adopted in the fields of robotics and electronics, the Arduino board provides the ability to perform complex processes efficiently. The Arduino Uno is arguably the most popular Arduino board in both the commercial and industrial markets.

Currently, the Arduino Uno board, equipped with an Atmega328 microcontroller running at a frequency of 16 MHz, is widely used. It features 32 KB of flash memory for program storage, 2 KB of SRAM, and 1 KB of EEPROM. Although these parameters do not make it the most powerful board, users appreciate its simplicity and reliability, often overlooking the limitation of having only 14 digital input/output pins.

The Arduino Uno also includes six analog input pins, as well as 5V and 3.3V power supply circuits, making it an emerging industry standard for rapid development platforms. This connector design allows the Arduino Uno to be compatible with many other widely used development boards. Additional components such as displays and sensors can be connected through headers to expand the functionality and capabilities of the board.

Each Arduino Uno is equipped with a dedicated power connector. With dimensions of 69 mm in length and 54 mm in width, the board is compact and suitable for a wide range of project applications. Moreover, the presence of four mounting holes enables designers, hobbyists, and engineers to securely attach it to their desired locations, ensuring stability and ease of integration.

As a communication device, Arduino can be used for prototyping hardware communication systems. Hardware communication refers to the transfer of digital or analog data signals from a source device to a target device through components such as telecommunication technologies, network interface cards, Wi-Fi modules, and access points.

Communication systems in satellite technologies have proven to be essential in providing valuable information that helps us better understand our world and enhance connectivity itself. Hardware communication devices are always in high demand due to their versatility and wide range of applications. Therefore, prototyping platforms such as Arduino play a crucial role in the engineering community, enabling the design, testing, and optimization of various communication systems.

In conclusion, developing students' logical, algorithmic, and creative thinking skills related to working in the Arduino environment is

one of the important educational objectives. The Arduino environment plays a crucial role in the remote control of devices. Therefore, it is essential to place special emphasis on teaching the Arduino programming language to future information technology specialists.

In the future, the demand for using Arduino boards and related software will continue to increase, as they are widely used for creating application prototypes. Although challenges may arise in using Arduino for engineering project prototyping, with continuous improvements and innovations, Arduino will remain a highly advantageous and effective platform for prototyping in the field of technology.

References

1. Hari Kishan Kondaveeti, Nandeesh Kumar Kumaravelu, Sunny Dayal Vanambathina, Sudha Ellison Mathe, Suseela Vappangi, A systematic literature review on prototyping with Arduino: Applications, challenges, advantages, and limitations // Computer Science Review 40 (2021) 100364.-p.1-2
2. Arduino. (n.d.). *Official Arduino Website*. Retrieved October 24, 2025, from <http://arduino.cc/>
3. Evstifeev, A. V. (2006). *Microcontrollers of the AVR Classic Family by Atmel* (3rd ed.). Moscow: Dodeka-XXI Publishing House..
4. Atmel Corporation. (n.d.). *AVR Microcontrollers*. Retrieved October 24, 2025, from <http://www.atmel.com/products/microcontrollers/avr/default.aspx>.
5. Kitchenham, B. (2004). *Procedures for performing systematic reviews* (Vol. 33, Technical Report TR/SE-0401). Keele University, Keele. ISSN 1353-7776, pp. 1–26.

6. M. Pautasso, Ten simple rules for writing a literature review, PloS Comput. Biol. 9 (7) (2013) e1003149, <http://dx.doi.org/10.1371/journal.pcbi.1003149>.