

## **SECTION: MECHANICS AND ELECTRICAL ENGINEERING**

### **USING RASPBERRY PI AND ARDUINO PLATFORMS IN MECHATRONIC MODULES**

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The intensive development of mechatronics as an interdisciplinary field of modern mechanical engineering necessitates the use of open microcontroller platforms for implementing intelligent control functions. Among the most popular worldwide are Arduino and Raspberry Pi, which combine compactness, affordability, and flexibility of both hardware and software. Their application in laboratory setups and industrial mechatronic modules enables the creation of adaptive control systems that respond to changes in technological parameters in real time [1].

The purpose of this work is to analyze the functional capabilities and advantages of using Arduino and Raspberry Pi platforms as part of mechatronic modules in the light industry, particularly in systems for automation of feeding, positioning, and parameter control processes.

The Arduino platform is based on the ATmega series of microcontrollers, features an open architecture, and is programmed through the Arduino IDE using the C/C++ language. Its main advantage lies in its ability to operate in real-time mode, which is particularly important for tasks requiring precise control of actuating mechanisms such as electric motors, servomechanisms, and pressure or position sensors [2]. In laboratory or educational setups, Arduino is often used as the lower level of the control system, where it performs signal acquisition from sensors and transmits control impulses to actuators.

In contrast, Raspberry Pi is a single-board computer with a full-fledged operating system such as Linux or Raspberry Pi OS, which allows for high-level computation, logical control, and even machine learning [3]. Owing to its support for Python, C++, and ROS (Robot Operating System) libraries, Raspberry Pi serves as the “brain” of the system, processing sensor data, analyzing it, and forming adaptive algorithms for the lower control level.

In a typical mechatronic module, the combination of these two platforms makes it possible to build a two-level architecture: Arduino performs the function of the

hardware interface, ensuring interaction with physical devices, while Raspberry Pi controls processes at the level of logic, analytics, and communication. This approach is applied, for example, in smart sewing or packaging machines, where Raspberry Pi performs visual quality control, and Arduino regulates the feed drive’s speed and precision [4].

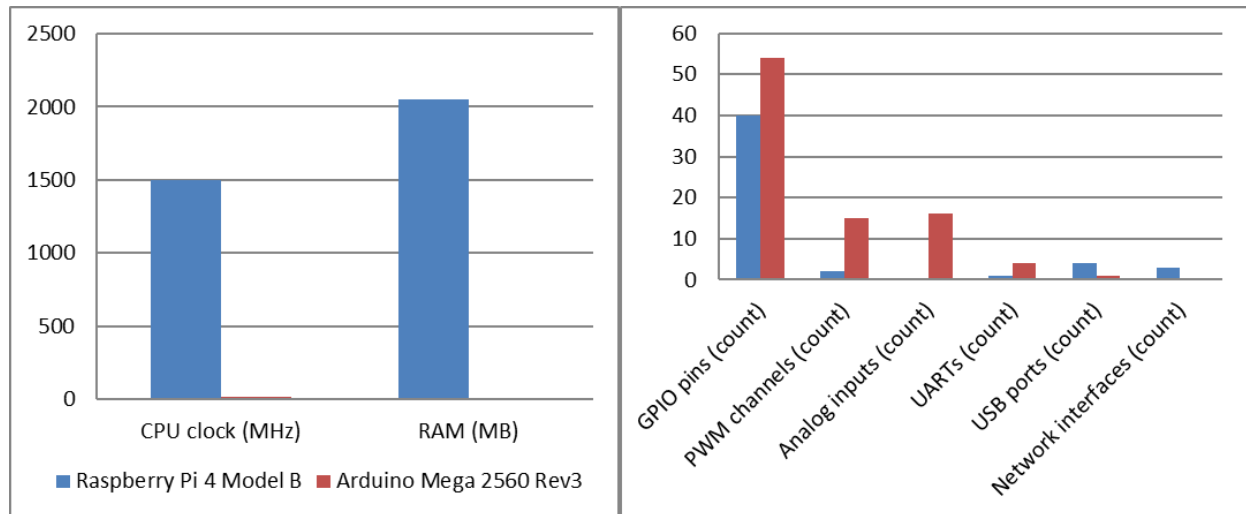


Figure 1. Comparative Chart of Raspberry Pi and Arduino Characteristics.

A comparison of the two platforms shows that Arduino has a simpler structure, lower power consumption, and a shorter response time, which makes it ideal for tasks requiring stable real-time operation. At the same time, Raspberry Pi possesses much higher computational power, greater memory capacity, and supports advanced peripheral devices (Wi-Fi, Ethernet, HDMI, USB). While Arduino functions as the process controller, Raspberry Pi serves as the intelligent supervisor that analyzes data, makes decisions, and interacts with the user or network. Thus, Arduino acts as the “nervous system” of the mechatronic module, ensuring fast responses to sensor signals, whereas Raspberry Pi is its “brain”, implementing logic and adaptation algorithms. Together, they enable the creation of flexible, cost-effective, and scalable control systems [5].

The use of Arduino and Raspberry Pi within mechatronic systems ensures an optimal balance between hardware simplicity and software flexibility. Such systems can be effectively applied in light industry to develop adaptive modules with online feedback, intelligent control, and remote monitoring capabilities.

### References

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