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Образовательный процесс в высших учебных заведениях осуществляется в рамках многогранной интегрированной системы, организованной в соответствии с современными формами и методами обучения. При этом каждая форма выполняет поставленные перед собой задачи, а совокупность форм и методов образует единый дидактический комплекс. Реализация этого дидактического комплекса определяется психолого-педагогическими законами образовательного процесса.

Использованная литература:

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RESEARCHING THE OPERATING PRINCIPLES OF PLATFORMS USED FOR AUTOMATIC CONTROL OF PROCESSES IN EMBEDDED SYSTEMS

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Abstract. In our era of rapidly advancing technological progress, humanity is moving faster and faster toward the full automation of production. This article provides an overview of the platforms used in the automatic control of embedded systems and processes, as well as their operating principles.

Keywords: Embedded system, Arduino, Raspberry Pi, Tracduino, Arduino IDE environment, Tracduino environment.

АННОТАЦИЯ

В нашу эпоху стремительного технологического прогресса человечество все быстрее движется к полной автоматизации производства. В данной статье представлен обзор платформ, используемых для автоматического управления встроенными системами и процессами, а также их принципов работы.

Ключевые слова: встроенные системы, Arduino, Raspberry Pi, Tracduino, среда Arduino IDE, среда Tracduino.

Annotatsiya

Tez sur'atlar bilan rivojlanayotgan texnologik taraqqiyot davrida insoniyat ishlab chiqarishni to'liq avtomatlashtirishga tobora yaqinlashmoqda. Ushbu maqolada o'rnatilgan tizimlar va jarayonlarni avtomatik boshqarishda ishlatiladigan platformalar hamda ularning ishlash tamoyillari haqida umumiy ma'lumotlar berilgan.

Kalit so'zlar: O'rnatilgan tizim, Arduino, Raspberry Pi, Tracduino, Arduino IDE muhiti, Tracduino muhiti.

Introduction

Developers of artificial intelligence systems can now equip their creations with GPS navigation, video cameras, and numerous additional detectors, enhancing the capabilities of modern robots.

A system is a collection of interconnected parts or components designed/developed to perform general tasks or to accomplish specific functions for which it was created.

An embedded system is a type of computer system designed to perform multiple tasks such as accessing, processing, storing, and managing data in various electronic systems. At its core, it contains an integrated circuit designed to execute computations for real-time operations.

An embedded system is a computing system designed by integrating both hardware and software to perform a specific task. It can be said that it is a specialized computer system developed for a particular purpose. However, it is not our traditional computer system or general-purpose computers; rather, these are embedded systems that can operate independently or be integrated into a larger system to perform multiple specialized functions. Embedded systems take electrical signals as input, often using sensors or transducers to convert physical phenomena into electrical signals.

Embedded systems range from portable personal devices such as digital watches and MP3 players to larger machines like household appliances, industrial assembly lines, robots, vehicles, traffic light controllers, and medical imaging systems. Often, they form subsystems of other machines, such as avionics in aircraft and astronautics in spacecraft. Large-scale installations, such as factories, pipelines, and power grids, rely on multiple interconnected embedded systems. Embedded systems like programmable logic controllers, which are generalized and customizable through software, often encompass their functional units.

Applications of embedded system fundamentals include smart cards, computer networks, satellites, telecommunications, digital consumer electronics, rockets, and more. Platforms used in embedded systems for automatic process control can also be mentioned.

II. Types of Platforms

Arduino serves as an ideal gateway for individuals interested in studying embedded systems. It provides a practical and engaging learning experience while establishing a solid foundation in low-level programming and hardware interfaces. Despite its limitations and constraints, Arduino remains a valuable platform for educational purposes, prototyping, and hobbyist projects. When students encounter advanced projects, they can explore other microcontrollers and microprocessors that better meet their specific needs and requirements.

Embedded systems seamlessly integrate hardware and software to perform specific tasks within larger systems found in devices such as smartphones, home appliances, medical equipment, and automotive systems.

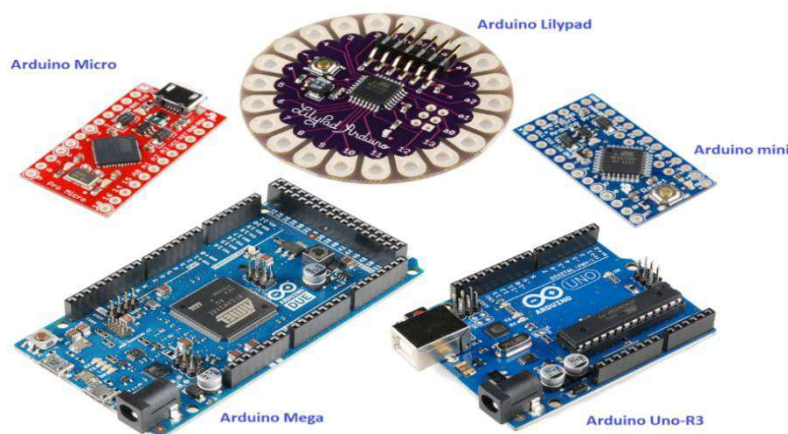


Figure 1. Arduino Platforms

Our specialized team works with the complexities of embedded systems by leveraging experience in low-level programming languages such as C and assembler, alongside real-time operating systems (RTOS). This ensures the development of customized software tailored to meet the unique requirements of each project, focused on efficiency, reliability, and real-time performance.

Raspberry Pi

The Raspberry Pi platform is a popular and versatile microcontroller that can be used for various projects.

The Raspberry Pi microcontroller was created for use in a wide range of electronic applications. It is a single-board computer that can be customized to perform a wide variety of tasks and run several different operating systems. It is compact and easily integrated into various applications.

Applications of Raspberry Pi:

1. **Home Automation:** Raspberry Pi can be used to automate various home appliances and devices.
2. **Robotics:** Raspberry Pi allows the control of various robots and automated systems.
3. **Internet of Things (IoT):** Raspberry Pi can be used to connect many devices and sensors to the internet or IoT.
4. **Media Center:** Raspberry Pi can be used to create a streaming media center for music and video.
5. **Gaming:** Retro gaming systems or consoles can be built using Raspberry Pi.



Figure 2. Raspberry Pi

Therefore, the importance of embedded systems in modern technology cannot be overlooked, as they provide specialized and reliable systems effective for specific uses. This is evident from their application in home devices such as refrigerators, biomedical applications, and industrial applications, where they offer additional advantages to improve the functionality of many systems. Embedded systems are crucial in our lives as they offer automation, enhanced performance, and precision in our daily routines.

Tracduino

In 2020, the "Development" and "RoboTrack" company groups introduced the new multifunctional controller, "Tracduino Pro."

The "Tracduino Pro" multifunctional controller is an electronic device with multiple reprogramming capabilities in two software environments (Python and C++).

The Tracduino Pro platform is based on the STM32 microcontroller, a widely used 32-bit controller in the industry. The selection of a specific STM microcontroller model was made considering the availability of a high-performance 32-bit microcontroller with a floating-point DSP computing system based on the Cortex-M4F core.

Tracduino Pro is a modern multifunctional microcontroller platform based on the STM32F407VGT6 microcontroller.

Due to the high-speed operation and optimized data exchange with memory, the platform can utilize MicroPython as its primary programming language.



Figure 3. Tracduino Platform

This language facilitates the development of prototypes for mobile robots and robotic devices, and it has a low entry threshold, which positively impacts the ability to teach robotics using high-level languages.

III. Working Environments

On the Arduino platform, the Arduino IDE environment is installed, and the code is written in this environment. It appears as shown below.

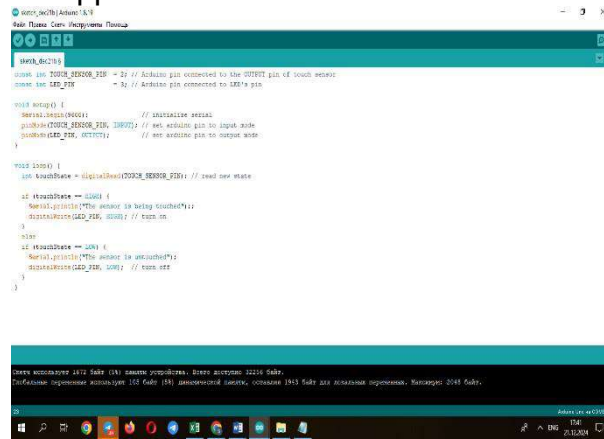


Figure 4. Arduino IDE Environment

The software environment of the Tracduino platform is executed in the following manner:

The Robotrack icon is visible on the desktop, and to launch the program, the left mouse button is double-clicked.



Figure 5. Robotrack IDE Software layer

Two program windows will open:

1. Graphic (visual) environment.
2. Software environment.

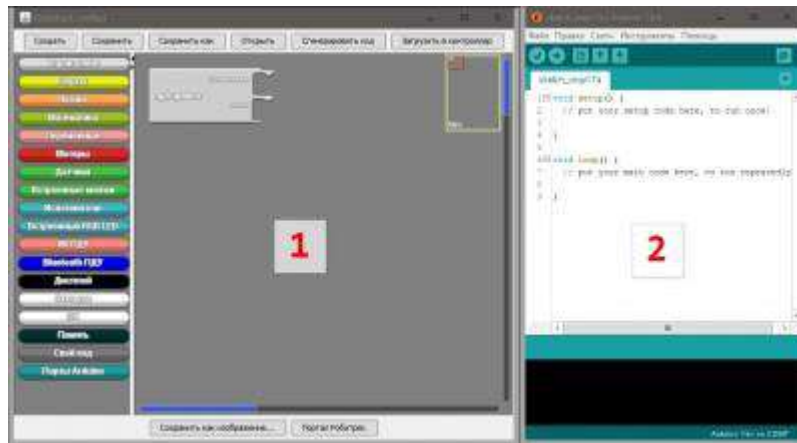


Figure 6. Working Window of Robotrack IDE Software

After launching the software environment for the first time, the following steps should be performed:

1. In the menu bar, click on "Tools - Board" and select "Trackduino."

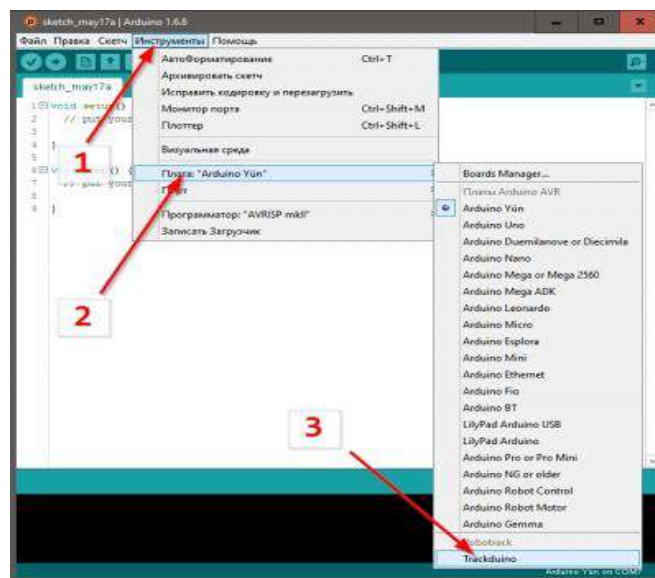


Figure 7. Text Environment Window in Robotrack IDE Software

If no other Arduino controllers are used except for Trackduino, this step should only be performed once after launching the program for the first time.

- 2) Similarly, the "Tools - Port" button is clicked, and the port assigned to the controller is selected.

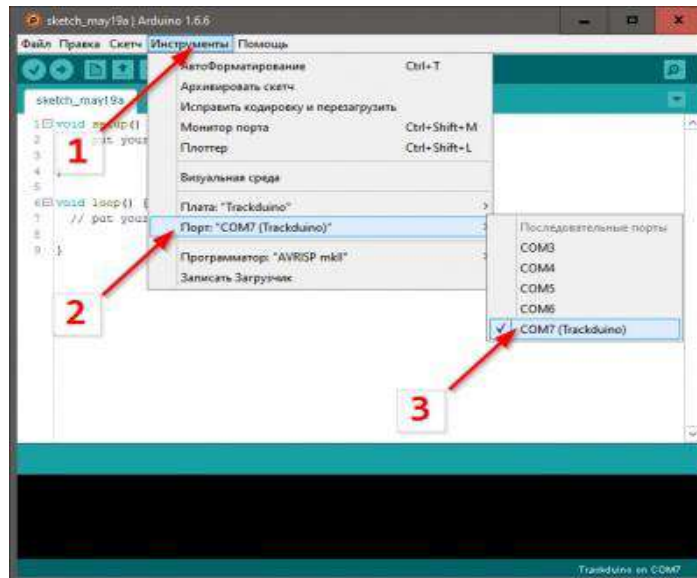


Figure 8. Selecting COM Port in Robotrack IDE Software

It is recommended to perform this procedure after launching the program each time.

Once again, ensure that the correct board and port are selected: the text in the bottom-right corner of the text environment window should display "Trackduino on COMx," where "x" corresponds to the port assigned to the controller.

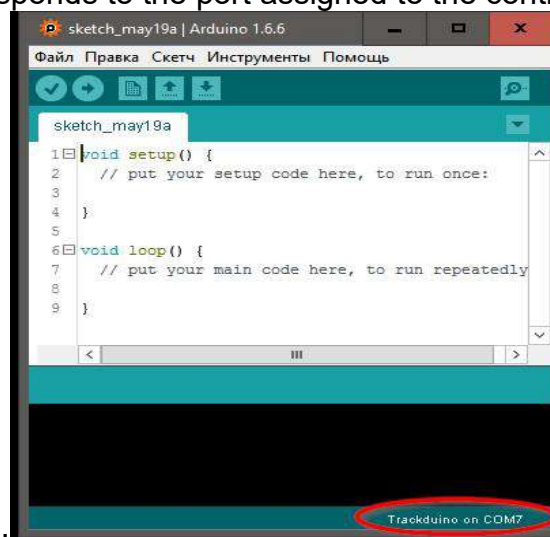


Figure 9. Selecting COM Port in Robotrack IDE Software

Conclusion

Thus, embedded systems are frequently used in both simple and complex devices. The applications of embedded systems are present in various devices in our real lives, such as microwave ovens, calculators, television remote controls, home security systems, and traffic control systems in neighborhoods.

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