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THE IMPORTANCE OF SOFTWARE ENVIRONMENTS IN MICROPROCESSOR SYSTEM DESIGN

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Abstract: Enhancing the education system to align with global standards has become a priority, leading to the adoption of innovative teaching methodologies and modern educational materials. In higher education, integrating pedagogical and information technologies has introduced advanced learning tools, including virtual laboratories and multimedia platforms. The Microprocessor Systems course plays a crucial role in equipping students with practical skills in system design, programming, and hardware implementation.

Keywords: Education system improvement, Higher education, Teaching methods, educational materials, Pedagogical technologies, Information technologies, Virtual laboratories, Multimedia educational programs, Training platforms, Specialist training, Microprocessor systems, Programming techniques, Hardware implementation.

Currently, significant efforts are being made to enhance the education system in our country, aiming to bring it to the level of developed nations, with noticeable positive results. In higher education institutions, there is a growing emphasis on organizing effective teaching methods and developing modern educational materials. These materials are designed to not only provide content but also support students' independent work, facilitate structured learning processes, and ensure consistent mastery of academic subjects.

The integration of pedagogical and information technologies into the education system introduces a new generation of teaching tools and innovative learning methods. Today, traditional teaching techniques are supplemented by virtual laboratories, multimedia educational programs, and training platforms, which enhance the learning experience.

Improving the quality of specialist training is of utmost importance. Future professionals should be able to apply their theoretical knowledge to real-world problems, analyze tasks effectively, and acquire new skills. In this context, the Microprocessor Systems course aims to educate students on the design stages of microprocessor systems,

programming techniques, and the process of uploading and executing programs on physical devices. Students are provided with hands-on experience in a virtual environment, where they learn programming stages, loading programs onto hardware, and executing them successfully.

The exponential growth in computing power has led to the development of powerful software environments and programming tools. Simulators with various kinematic, physical, and graphical libraries enable independent system design and testing. The primary function of software environments is to allow extensive use of hardware components while providing pre-evaluation capabilities before actual implementation. Currently, several design environments exist, including Open HRP, Gazebo, Webots, Sim8085, and EMU8086; however, these platforms have certain limitations.

V-REP Simulator: One of the most powerful design environments, V-REP, offers extensive universal design capabilities, including:

1. Executing control code on an external robotic system.
2. Running control code within a simulated environment, distinct from physical modeling.
3. Implementing control code within a robot, ensuring real-time execution.

Figure 1. Devices Used in the V-REP Environment.

The V-REP environment utilizes various modeling features and supports the design of different types of robots. Even if a user lacks access to a physical robot, V-REP allows for comprehensive simulation, significantly saving time. The environment also provides a 3D visualization of developed projects.

One of the key advantages of V-REP is its ability to observe simulations through external applications or devices. The API contains hundreds of functions that can be accessed via communication sockets.

The development process within V-REP is divided into several stages:

- Mathematical model creation
- Algorithm development
- Writing the program code
- System design
- Project preparation
- Testing and validation

V-REP is recognized as a powerful and universal design environment, offering various programming methodologies for controllers, customizable scene setups, and efficient simulation modeling. Its user-friendly interface makes it accessible even for beginners. Currently, V-REP is widely used in research on robotics, automation, and industrial control systems, contributing to system testing, algorithm optimization, complex simulations, enterprise automation, and robotic equipment development.

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