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DEVELOPMENT OF INTERACTIVE GAME-BASED EDUCATIONAL SYSTEMS FOR STUDENTS USING SUPERCOMPUTER MODELING

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Abstract
This article discusses the development of interactive educational systems based on supercomputer modeling and their impact on students' learning processes. The high computational power of supercomputers allows for the simulation of complex processes, enabling students to study real-life scenarios in a virtual environment. Interactive games increase students' interest in lessons and ensure their active participation. The article outlines the stages of developing such systems, the technologies and algorithms used, and presents examples from both Uzbekistan and international practices. In conclusion, it is emphasized that the integration of supercomputer-based modeling and interactive game-based educational systems contributes to making the learning process more effective and engaging.

Keywords: Supercomputer, modeling, interactive game, educational technologies, artificial intelligence, AR/VR, individualized approach.

Introduction

The introduction provides a brief overview of the concepts of supercomputers, modeling, and interactive games. The high computational power of supercomputers enables the analysis and modeling of complex systems, helping simulate processes that are difficult to study under laboratory conditions. At the same time, game-based educational methods play a significant role in increasing students' motivation and active participation.

Main Body

In the main body, the capabilities of supercomputer modeling, the role of interactive game-based educational methods in the learning process, the stages of creating such systems, and the advanced technologies and algorithms used are discussed.

Capabilities of Supercomputer Modeling

This section highlights the ability of supercomputers to simulate complex scientific and technical processes with high accuracy. For instance, at Kent State University's School of Architecture, students are given the opportunity to model the lighting, movement, and material properties of building interiors with full precision using supercomputers. This enables them to test and refine their designs multiple times, allocating more time for project improvements. Such powerful computational resources provide students with practical experiences by allowing them to render and enhance their projects at a high quality.

The Role of Interactive Game-Based Educational Systems

This section discusses how educational methods based on interactive games can significantly increase students' interest and learning efficiency. Research shows that teaching through games considerably enhances students' motivation, engagement, and information retention during the educational process. In particular, studies conducted in Central Asia have observed that game-based teaching in ESL (English as a Second Language) classes improves students' language acquisition, communication skills, and critical thinking abilities.

Developing Game-Based Educational Systems Using Supercomputers

Design: In the first stage, the objectives, educational tasks, and visual appearance of the educational game are defined. For example, a game scenario is created, and a conceptual design of the game environment is developed.

Programming: Based on the defined design, coding is carried out. This stage involves developing technologies that enable connection to a supercomputer network and creating algorithms for processing large volumes of data.

Testing and Evaluation: The development team regularly tests the game system, identifies and corrects errors, and improves the system by taking into account feedback from teachers and students.

Technologies and Algorithms

Artificial Intelligence and Machine Learning: AI-based algorithms analyze students' activities to identify their strengths and weaknesses. This allows the system to create customized lesson plans and exercises for each student, tailoring educational content to individual needs. Such an approach makes the learning process more engaging and effective for each learner.

Augmented Reality (AR) and Virtual Reality (VR): AR and VR technologies allow students to experience educational content through 3D models and virtual environments. For example, when viewing a textbook image through a smartphone, interactive indicators can appear, enabling deeper exploration of the material. Such immersive environments capture students' attention and make learning easier.

Personalization and Individual Approach

This section discusses the creation of educational systems adapted to the individual needs and knowledge levels of each student. AI-based systems analyze students' capabilities and previous results to adapt the complexity and content of lessons to suit each learner. As a result, each student receives personalized materials, test questions, and supplementary resources, leading to more effective learning. Additionally, the system provides real-time feedback and extra explanations in areas where students struggle.

Practical Examples and Existing Projects

360ed (Myanmar): This company develops interactive textbooks using augmented and virtual reality technologies for school students and teachers. During daily lessons, students can use smartphones or simple VR glasses to bring 2D textbook images to life in 3D. Over 5,000 teachers in Myanmar have been introduced to 360ed technologies, expanding their ability to conduct innovative lessons.

Xsolla and IT Park (Uzbekistan): In 2024, a collaboration agreement was signed between the international video game platform Xsolla and Uzbekistan's IT Park. According to the plan, the Xsolla IT Park Academy will open in Tashkent in 2025 to train game developers and talented youth in Uzbekistan. This initiative encourages young people to enter the gaming industry.

Digital Generation Camp (Uzbekistan): Organized in 2019 by Inha University in Tashkent and the Youth Union of Uzbekistan, this summer camp program provided 90 young participants with practical training in five fields: programming, robotics, design, and media technologies. Under the guidance of international and local specialists, participants worked on their own projects, including innovative solutions with gaming elements.

UNESCO Educational Project (Uzbekistan): In cooperation with UNESCO and UNICEF, the government of Uzbekistan is implementing a large-scale program to digitize the education sector. Within this project, significant attention is given to improving teachers' skills in artificial intelligence and modern technologies. For instance, by early 2025, training sessions were held across the regions to enhance teachers' digital competencies, laying the groundwork for the effective implementation of interactive learning tools.

Conclusion

The conclusion discusses the prospects and practical recommendations for implementing interactive game-based educational systems built on supercomputer modeling. Experts recommend applying advanced technologies, familiarizing teachers with modern digital tools, and expanding practical projects. For example, the experience of Kent State University demonstrates that using supercomputer resources prepares students to understand complex systems deeply and participate actively in innovative projects in the future. Overall, the widespread adoption of such interactive teaching methods can enhance

students' interest in education, develop their practical skills, and strengthen the competitiveness of the national education system.

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