Будущее языков программирования, по всей видимости, будет определяться дальнейшей интеграцией различных парадигм и активным развитием доменно-специфичных языков (DSL). Такие языки позволят точнее решать специализированные задачи в областях биоинформатики, финтеха, интеллектуальных устройств и многих других, где важна не только скорость и производительность, но и высокий уровень надежности и безопасности. Помимо этого, ожидается, что дальнейшее развитие аппаратных средств и совершенствование алгоритмов будет способствовать созданию языков, которые смогут автоматически адаптироваться к новым условиям, оптимизировать ресурсы и минимизировать человеческий фактор при разработке программного обеспечения. В этом контексте важно отметить, что историческая динамика языков программирования всегда была тесно связана с изменениями в компьютерной технике и требованиями к методам решения вычислительных задач, и эта тенденция, скорее всего, сохранится в будущем.

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APPLICATION OF MIXED REALITY TECHNOLOGY IN STUDENT LIFE SIMULATION GAMES

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Abstract. *Mixed reality or MR is a technology that combines both virtual and augmented reality When a person connects to MR, they find themselves in a mix of real and computer-generated worlds. Mixed reality technology is used in games, medicine, manufacturing, architecture, and education. The article discusses how mixed reality technology works.*

Kevwords: mixed reality, information system, augmented reality, Meta Quest 3.

Mixed Reality (MR), as an important branch of extended reality (XR) technology, creates an interactive space where virtual and real are interwoven by dynamically integrating virtual objects with the real environment. Unlike augmented reality (AR), which only superimposes virtual information, MR emphasizes the two-way interaction between virtual content and the physical world. For example, virtual objects can perceive the light and shadow changes in the real environment, or provide real-time feedback on user actions. Compared with fully immersive virtual reality (VR), MR retains the user's ability to perceive the real environment, making the transition between the virtual and real boundaries more natural. This feature makes it unique in education and training, industrial design, medical simulation and other fields. In recent years, with the performance breakthroughs of head-mounted display devices – such as the high-precision spatial sensors, 4K display modules and low-latency tracking systems equipped in Meta Quest 3 - MR technology has gradually moved from the laboratory to large-scale applications. Its core value lies in the visualization of abstract concepts and the visualization of complex processes through a virtual-real symbiotic environment, thereby improving users' cognitive efficiency and practical ability.

In the field of education, traditional teaching often faces challenges of scene limitations and insufficient participation. For example, it is difficult for students to understand the working principles of three-dimensional mechanical structures through two-dimensional teaching materials, or lack collaborative training opportunities in real situations. Mixed reality technology provides new possibilities for educational innovation by constructing interactive three-dimensional scenes. Taking engineering education as an example, students can observe the disassembly process of a virtual engine through MR equipment, and use gestures to rotate parts to observe the internal structure; in language learning, virtual characters can be projected according to the actual layout of the classroom to achieve situational dialogue exercises. This "scene as a teaching aid" feature makes MR technology an important bridge connecting theoretical knowledge and practical applications.

This project is a student life simulation game developed based on the Meta Quest 3 platform. It is designed to achieve the need to improve students' self-management ability through gamification learning. The system builds an interactive framework for virtual-real integration through three core technologies: First, the SLAM (Simultaneous Localization and Mapping) algorithm is used to capture physical space information in real time, build a coordinate system for the virtual scene, and enable virtual objects to be accurately superimposed on the real environment. For example, in a real campus scene, the user walks to a classroom with a spatial anchor point and triggers the task mechanism through gesture recognition. Gesture recognition technology is based on a deep learning model and supports users to manipulate virtual objects through natural movements, such as dragging a schedule or adjusting task priorities. At the same time, the system integrates multimodal perception feedback, such as controller vibration to prompt task timeouts, or spatial audio to simulate environmental sound effects, to further enhance the user's sense of immersion. The synergy of these technologies provides a basic framework for the construction of complex educational scenarios.

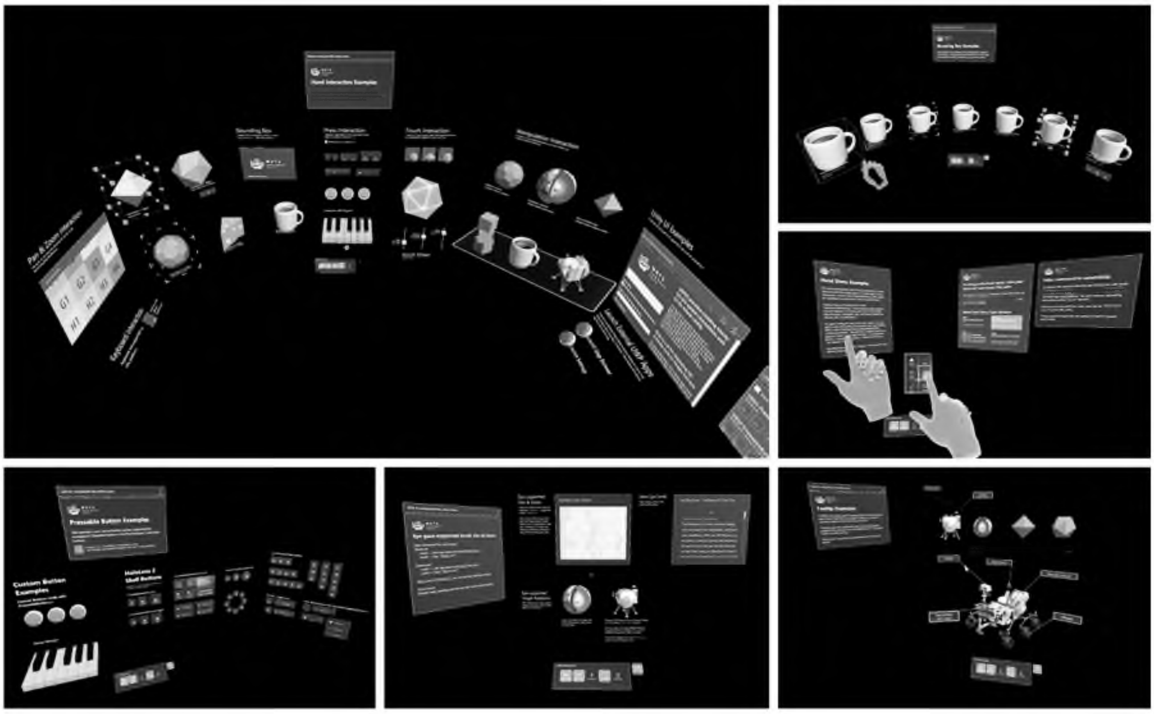

Figure 1 – Mixed Reality

However, there are multiple challenges in the process of technical implementation. First of all, the optimization of user experience is a key issue. Long-term use of head-mounted display devices can easily cause dizziness, mainly due to rendering delays and visual-motion mismatches. To solve this problem, the project uses foveation rendering technology to dynamically reduce the rendering resolution of non-fixated areas, steadily increase the frame rate to above 90Hz, and combine the Kalman filter to predict the user's head movement trajectory to reduce action and picture delays. Secondly, hardware performance limitations pose a challenge to the carrying capacity of complex scenes. The study introduces LOD (level of detail) technology to dynamically adjust the model accuracy according to the distance between the object and the user, and combines the behavior prediction algorithm to preload high-frequency usage scene resources, significantly reducing the GPU load.

The core advantages of this project are reflected in three aspects. First, the deep adaptation of hardware performance and educational scenarios. The perspective mode of Quest 3 allows users to observe the real environment at any time during virtual tasks, avoiding the safety hazards caused by complete immersion; second, the structured design of gamified educational content. The system breaks down learning goals into interactive games. For example, the "time management" module visualizes the time consumption of tasks through a virtual hourglass, and the "resource coordination" training simulates the use conflicts of shared equipment. Students naturally master the priority decision-making method in the process of resolving conflicts. Third, the scalable architecture design. The system adopts a modular resource loading solution. Users can replace learning content and task logic according to their needs, such as replacing chess with language learning, without reconstructing the underlying code. This flexibility enables the system to quickly adapt to the learning management needs of different courses.

In summary, this study built a simulation game system that supports student self-management by integrating the hardware features of Quest 3 and mixed reality technology. The advancement of this project is also to further verify the universality of mixed reality in complex educational scenarios – when technology is no longer limited to the demonstration of specific knowledge points, but builds a complete behavioral training ecosystem, it will have a more profound impact on the shaping of students' cognitive patterns and comprehensive abilities.

In the future, as technologies such as light field display and neural tactile feedback mature, mixed reality is expected to break through the limitations of existing interactive dimensions. For example, by simulating the difference in touch of objects of different materials, students can feel the temperature changes of chemical reactions in virtual experiments; or capture the state of attention through brain-computer interfaces and dynamically adjust the presentation rhythm of teaching content. These technological evolutions will continue to expand the boundaries of possibilities for MR education. The current system development based on Quest 3 is precisely the technical reserve for more complex forms of education.

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UDC 004

ANALYSIS OF AUTOMATED WORKFLOW ORCHESTRATION TECHNOLOGIES

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Abstract. *The article provides an overview of one of the workflow orchestration management systems. The article describes the basic structure and functionality of the orchestration system. A conclusion is made about the ease of use of the described system.*

Keywords: orchestration, workflow automatization, enhancement with AI.

Automated workflow orchestration is a technology that logically connects dispersed tasks, systems, and services through software tools, aiming to automate end-to-end business processes and enable dynamic optimization. Its core purpose is to reduce manual intervention, improve efficiency, and adapt to flexible adjustments in complex business scenarios.

Compared to traditional Robotic Process Automation (RPA) – which primarily simulates user interface operations (e. g., button clicks or form filling) – workflow orchestration emphasizes deeper integration between systems. For example, it can directly invoke APIs of internal ERP systems, cloud service interfaces, or databases to enable cross-platform data flow and logic control. Concurrently, workflow orchestration complements Business Process Management (BPM): BPM focuses on process modeling and analysis, while orchestration acts as BPM's "execution engine," translating abstract workflows