

# Design of Medical Rehabilitation Experience System Based on Extended Reality

Zhengjie Xu<sup>1</sup>, Qi Zhang<sup>1†</sup>, Kaidi Xue<sup>1</sup>, Hongjia Yang<sup>1</sup>, Luyao Wang<sup>1</sup>, Haolong Yang<sup>2</sup>

1. Artificial Intelligence College, Zhejiang Dongfang Polytechnic, Wenzhou, China

2. Metropolitan College, Boston University, Boston, USA

## Abstract

This project integrates Extended Reality technology with medical rehabilitation, integrating cloud rendering, interactive experience systems, adaptation platforms, and digital scene resources. It is an innovative application research in the era of metaverse+medical rehabilitation. The project uses the Maya engine for the creation of digital assets, with Unity as the main functional development platform and PICO4 as the core device, to achieve interactive and fun experience effects for various rehabilitation training devices. It solves the problems of patients being dull, low participation, lack of confidence in traditional rehabilitation training, as well as the inability of medical staff to monitor patient progress in real time and adjust rehabilitation plans better.

**Keywords:** Rehabilitation; Extended Reality; Interaction; Unity

## 1 INTRODUCTION

With the increasing emphasis on rehabilitation therapy in society, the team of rehabilitation therapists is also continuously expanding. According to statistics, there are currently more than 10000 rehabilitation therapists active in the medical field in China, most of whom have a college degree or above. In order to improve the overall quality of rehabilitation therapists, various training institutions and academic organizations have emerged, promoting the professional development of rehabilitation therapists. However, the development of rehabilitation therapy in China also faces some challenges:

### (1) Neurorehabilitation

Neurorehabilitation patients are different from other rehabilitation patients as they require higher levels of intellectual and physical training. Therefore, traditional rehabilitation training is difficult to meet their requirements.

### (2) Musculoskeletal Rehabilitation

Patients with musculoskeletal rehabilitation need to engage in related bone and muscle movements to restore bodily function. Rehabilitation patients are often constrained by the environment and equipment to perform real operations and training. At the same time, it is impossible to control the risk issues involved in the rehabilitation process.

## 2 PROJECT SPECIFIC IMPLEMENTATION

In the context of metaverse+medical rehabilitation, Extended Reality (ER) technology is particularly important. It is a further development of virtual reality, combining the advantages of virtual reality<sup>[1]</sup>, augmented reality, and mixed reality. Real time physical information of the real world is obtained through cameras, sensors, and locators, and position tracking software and spatial map technology are used to overlay the physical environment of the real world with computer-generated virtual scene information, presenting users with a picture of virtual and real fusion; This plan introduces augmented reality technology in the design of the experience system, which is a rich and innovative approach to mainstream rehabilitation training forms. The plan uses various rehabilitation training equipment as specific adapter devices, and applies the latest ER technology and combines Maya modeling technology<sup>[2]</sup>, 3D

animation, Unity engine and other technologies according to the different needs of various patients. Based on interaction functions and data transmission requirements, a C # code framework is developed to design and implement an extended reality experience system for rehabilitation patients. This development uses the ER device PICO4 as the terminal device. Once developed, this system platform can be matched with various medical rehabilitation training equipment at any time, making it a comprehensive experience system platform.

### 3 SYSTEM DETAILED DESIGN

#### ***3.1 Build a Three-Dimensional Teaching Space that Integrates Virtual and Real Elements***

The teaching space of virtual and real integration refers to the use of extended reality technology visualization, which recognizes and obtains spatial information from the real environment through sensor devices, and constructs the fusion between three-dimensional virtual objects and the real environment in real time<sup>[3]</sup>. It imitates the real-time interaction of the experimental space in real activities, while providing rich digital resources.

#### ***3.2 Reconstruct Complex Training Processes***

Simplify the tedious training steps and enhance fun. At the same time, design interactive clue information<sup>[4]</sup> and set up virtual guidance in each interaction link, such as guidance dialog boxes, voice prompts, and other prompt methods, to guide patients to deeply integrate with the experience system during<sup>[5]</sup> the training process, so that patients can immerse themselves in the entire training environment and not easily fatigue.

### 4 CONCLUSIONS

This project proposes a metaverse rehabilitation experience system based on ER technology. Using platforms such as Maya for the creation of digital assets, Unity as the main functional development platform, and PICO4 as the core device, a multifunctional interactive experience system is constructed in the context of the metaverse+medical rehabilitation era. With the help of this system, patients can practice in the virtual reality world, simulate the actual working state of the brain, and train their nervous system and brain function through a large number of operations and visual sensations. Especially for behavioral rehabilitation, ER technology has a significant improvement effect on training and recovery. Therefore, this system completely solves the problems that patients face during traditional rehabilitation training, such as boredom, low participation, lack of confidence, and the inability of medical staff to monitor patient progress in real time and adjust rehabilitation plans better.

### REFERENCES

- [1] S. Xia, "Application of Maya in film 3D animation design," in 2011 3rd International Conference on Computer Research and Development, Shanghai, China, pp. 357-360, 2011.
- [2] G. Can, J. Odobez and D. Gatica-Perez, "Maya codical glyph segmentation: a crowdsourcing approach," IEEE Transactions on Multimedia, vol. 20, no. 3, pp. 711-725, 2018.
- [3] J. Kinsman and D. Asher, "Orbital dynamics of highly probable but rare Orionid out-bursts possibly observed by the ancient Maya," Monthly Notices of the Royal Astronomical Society, vol. 493, no. 1, pp. 551-558, 2020.
- [4] S. Pei and K. Chang, "Odd ramanujan sums of complex roots of unity," IEEE Signal Processing Letters, vol. 14, no. 1, pp. 20-23, 2007.
- [5] D. Jakelić and A. A. de Moura, "Tensor products, characters, and blocks of finite-dimensional representations of quantum affine algebras at roots of unity," International Mathematics Research Notices, vol. 2011, no. 18, pp. 4147-4199, 2011.