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Metaverse Realistic Media Digital Content Development Education Environment Improvement Research

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[Abstract]

Under the influence of COVID-19, as a measure of social distancing for about two years and one month, non-face-to-face services using ICT element technology are expanding not only to the education sector but to all fields. In particular, as educational programs using the Metaverse platform spread to various fields, educators, and learners have more learning experiences using Edutech, but problems through non-face-to-face learning such as reduced immersion or concentration in education are raising In this paper, to overcome the problems raised through non-face-to-face learning and develop metaverse immersive media digital contents to improve the educational environment, we utilize VR (Virtual Reality) based on an immersive metaverse to provide education / Training contents and the educational environment was established. In this paper, we presented a system to increase immersion and concentration in educational contents in a virtual environment using HMD (Head Mounted Display) for learners who are put into military education/training. Immersion was further improved.

▸ **Key words**: Metaverse, Virtual Reality, Edutech, Concentration, tangible contents

[요 약]

COVID-19의 영향으로 약 2년 1개월에 걸친 사회적 거리두기의 조치로 ICT 요소기술을 활용한 비대면 서비스들이 교육 분야뿐만 아니라 전분야로 확대되고 있다. 특히 메타버스(Metaverse) 플랫폼을 활용한 교육 프로그램들이 여러 분야로 확산되면서 교육자와 학습자가 에듀테크(Edutech)를 활용한 학습 경험이 많아지고 있지만 교육에 대한 몰입도나 집중력 저하 등 비대면 학습을 통한 문제점을 제기하고 있다. 본 논문에서는 비대면 학습을 통해 제기되고 있는 문제점을 극복하고 메타버스 기반 실감미디어 디지털 콘텐츠를 개발하여 교육 환경을 개선하고자 몰입형 메타버스 기반으로 VR(Virtual Reality)을 활용하여 군에서 필요로 하는 교육/훈련 콘텐츠와 교육환경을 구축하였다. 본 논문에서는 실제로 군 교육/ 훈련에 투입되는 학습자에게 HMD(Head Mounted Display)를 활용하여 가상환경에서 몰입도와 집중도를 높일 수 있도록 교육콘텐츠에 대한 시스템을 제시했으며, 교육훈련에 필요한 장비들을 실사화하여 몰입도를 더욱 향상시켰다.

▸ **주제어**: 메타버스, 가상현실, 에듀테크, 집중도, 체감형 컨텐츠

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I. Introduction

As social distancing develops around the world according to the influence of COVID-19, a variety of untact services implementing ICT element technology are being provided. In particular, social activities based on Metaverse are attracting keen attention. Untact education and meetings, which were implemented on online platforms, have recently been expanding on the Metabus platform, and commercialization is actively taking place as it has begun to be serviced in a variety of fields including marketing promotion, real estate construction, politics, administration, and operation of corporation.

AR/VR technology, one of the Metaverse technologies, is being used in various fields, and the examples of using it are as follows. First, the Institute of Forensic Medicine at the University of Zurich in Switzerland proposed a low-cost system that allows interactive visualization of crime scenes using virtual reality, and Staffordshire University in the UK is also considering a project to develop an alternative way to express crime scenes through virtual reality. Second, Thales Alenia Space, a Spanish aerospace manufacturer, used virtual reality to check the exact location of each spatial component that makes up a satellite, and used the augmented reality AR app to better understand the final product before assembly to facilitate spacecraft production. Third, with pain relief, various VR experiences were designed for medical treatment, which could help alleviate certain pain caused by routine medical procedures, and also relieve chronic pain symptoms. Finally, in the field of education, diverse educational services have been commercialized since the spread of the Internet and personal computers, and research on education based on ICT has continued by spreading to the field of Edu-tech. EduTech is a compound word of 'Education' and 'Technology', which combines ICT technologies and educational services including virtual reality (VR), augmented reality (AR), artificial intelligence (AI), and big data to provide a new learning experience[1],[2]. Particularly, since the past times, military education/training institutions have implemented education/training using VR, and the experience of educators and learners in untact education is increasing significantly as untact education is provided based on the outbreak of COVID-19[3].

This paper presented a system that deserves to increase the concentration of learners and immersion in educational contents by building an educational space for learners on an immersive Metaverse basis using VR. Through this, in order to improve the content development education environment in the future, the direction of interactive education through VR was presented.

II. Preliminaries or Research Background

1. Virtual environment-based education

1.1 Paradigm of untact education

A variety of attempts and studies to educate in virtual environments are underway with the spread of mobile devices and personal computers and the spread of Internet services. This is developing into the form of e-learning, U-learning, and edu-tech with the development of ICT devices and networks and paradigm changes[4]. EduTech is which provides a new learning experience by combining ICT technologies and educational services including virtual reality (VR), augmented reality (AR), artificial intelligence (AI), and big data[5],[7].

In order to improve the effectiveness of education, the characteristics of educational tools including AR/VR and smart contents for education should be identified and provided accurately. Hence, it is necessary to increase immersion and interaction via realistic modeling[6]. Moreover, it should provide contents associated with a variety of education/training.

1.2 Learning concentration of untact education

As presented previously, discussions are underway on the effectiveness of untact education as untact education is strengthened based on the spread of COVID-19. According to studies even if the same subject and the same professor is implemented, education can be accepted differently by students if the environment of the classroom is different, so no matter how good the educational contents or teaching method is, the effect of education may not be great if it is an educational environment that learners having hard time focusing on[1].

2. Immersive Metaverse Education Platform

2.1 Background of the Metaverse

Metaverse is a term that represented in a science fiction novel in 1992 about the interaction of virtual objects and people embodied as avatars in a virtual world[2]. Based on the Fourth Industrial Revolution, such technologies are developing into a more three-dimensional and realistic Metaverse platform with active research, technology development, and commercialization of services relevant to smart contents including experiential virtual reality, augmented reality, mixed reality, and extended reality recently.

2.2 Elements of the Metaverse

Characteristics of Metaverse were classified into three elements: immersion, digital identity and platform.

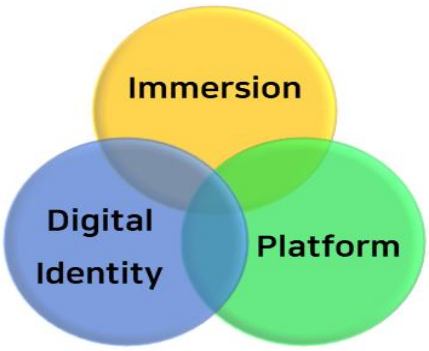


Fig. 1. Elements of the Metaverse

'Immersion' refers to that users can be interested in and focus on their mental capabilities, and the influencing factors should be identified and the level should be adjusted and reflected in the system to increase the user's immersion. As the time and frequency of online activity increases, it has a new identity beyond the identity of objects in the real world, which is called digital identity. Digital identity can be represented by decorating and acting virtual characters including avatars and creating interconnections with other characters on the Metaverse. The last platform refers to an environment in which users of various purposes can participate and obtain the value they want via mutual transactions.

2.3 Immersive Metaverse using VR

Immersive Metaverses should provide a fully immersive environment that cannot be identified from reality by wearing virtual reality devices including HMD(Head Mounted Display) or augmented reality smart glasses[6]. VR is an expression of a specific environment or situation itself that is not real. In other words, it is available to cross the boundary between reality and virtual reality by stimulating the user's five senses via a virtual environment or situation created and allowing a space-time experience similar to reality.

This paper presents a system that helps to measure the concentration of learning via the immersive elements of Metaverse. In order to accomplish this, it has developed a system that can increase actual educational effectiveness by creating and providing fully immersive educational contents based on VR used in actual military education/training. This will enable you to provide a real-life experience by training the contents used in real education/training.

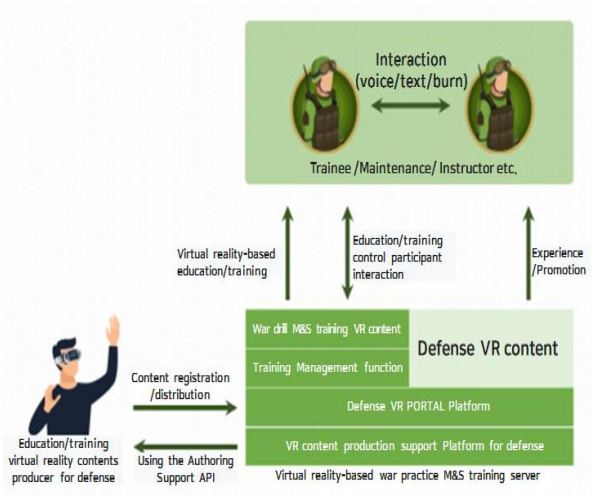


Fig. 2. Military Education/Training Content Structure

III. The Proposed System of Immersive Metaverse Education Platform

1. Building an Education Platform

In this particular study, it was produced based on the contents of education/training in special cases, and via this, it was based on the contents to be achieved in real life. This system was basically developed using the Unity engine, and requires the minimum specifications of CPU i5-10500 3.10Ghz, RAM 8.0G, and GPU UHD to use the PC Application system. The system configuration diagram is shown in Fig. 3.

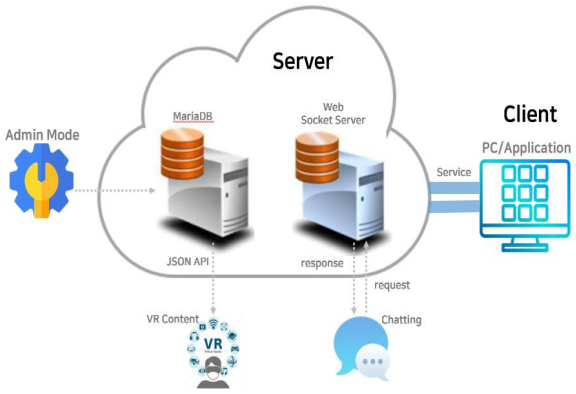
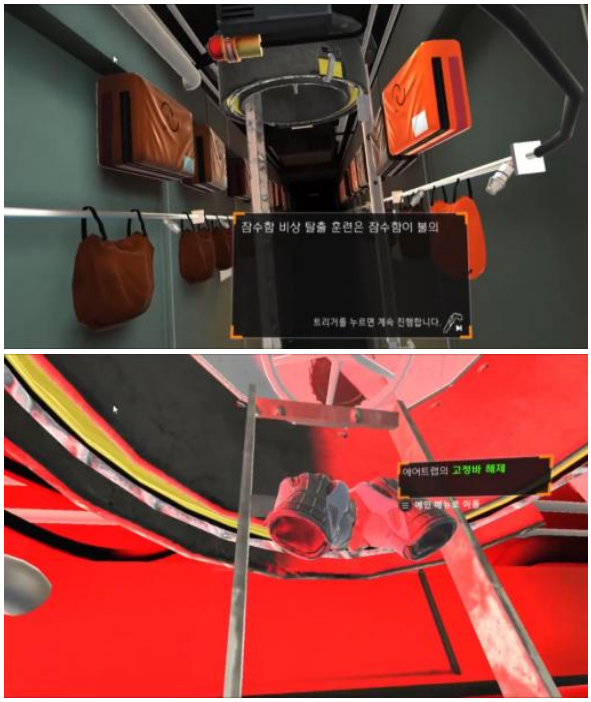


Fig. 3. Education/training system structure

Through two large categories, first, the content corresponding to the occurrence of an emergency inside the submarine was produced as shown in Fig. 4.

Fig. 4. Military education/training content menu

Through the two large categories in Fig. 2, first, the contents corresponding to the occurrence of an emergency inside the submarine were produced as contents as shown in Fig. 5.



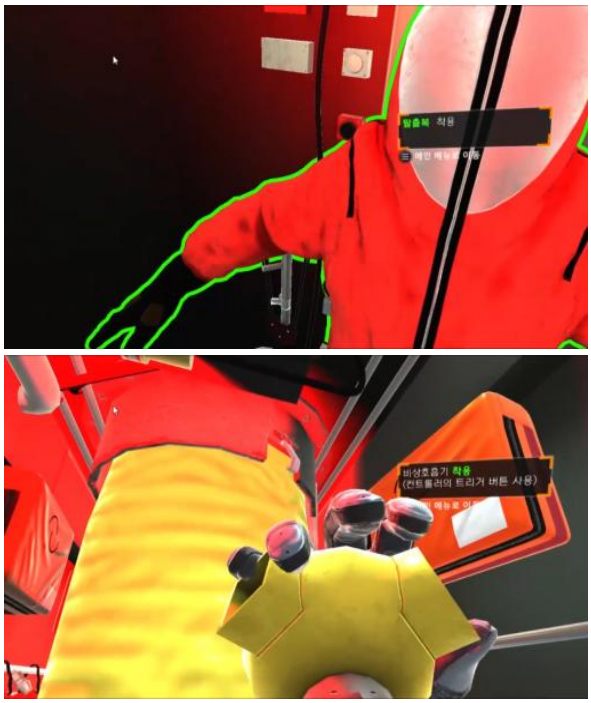


Fig. 5. Submarine emergency escape education/training contents

In addition, as a countermeasure against emergencies inside submarines, the order of how to use expansion life rafts in Fig. 2 category was produced as shown in Fig. 6 as content.

Fig. 6. Inflatable life raft education/training contents

2. VR use cases through immersive environments

As shown in Fig. 7, an immersive environment was provided to students and education was conducted using HMD. In Fig. 8, training was conducted by building a VR simulator environment where you can experience the ultimate sense of immersion through active VR.

Fig. 7. HMD Utilization Training Scene

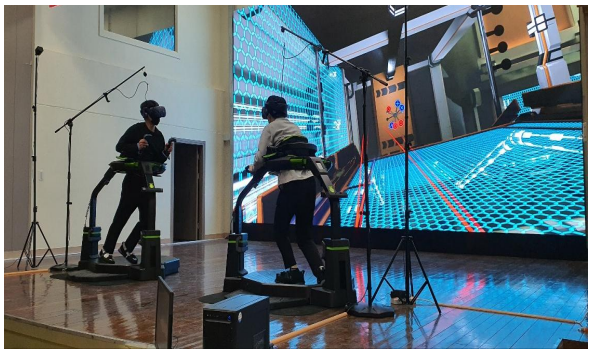


Fig. 8. Training scene using VR simulator

In the case of the HMD method, education and training with a high sense of immersion are possible with a simpler two-handed controller instead of a keyboard and mouse, but physical movement such as walking and running is impossible[8].

In the case of a VR simulator, exclusive VR device shoes and PODs are provided so that the user can recognize the direction and speed of movement and even the movement of running while avoiding obstacles, and additional waist protectors and cradle are provided to catch back steps and jump, thereby matching the characters in the content. You can experience the same movement.

Since it is not wearing an HMD while training, it is possible to escape from the dizziness or inconvenience of wearing it, which has transformed VR from a simple passive experience level to an active autonomous activity level, which has led to the innovative expansion of the VR industry.

In line with this, various contents that can break down the boundaries between physical and virtual spaces and products that can increase activity and immersion are needed. Accordingly, the 'AR Content Lens' developed at UNIST in February 2023 took the Metaverse technology one step further.[9]

IV. Conclusions

Moreover, in this study, for rapid system development, a content generation system for easy development was created to graphicalize the behaviors implemented by each training step to make it easier to generate the next step and to make it easier to modify and delete.

Due to the demand for untact education, untact services implementing diverse element technologies are widely used and emerging in the field of education. In addition, as untact education spreads, experience in various untact education is increasing. It is expected for the system developed in this paper to solve the problems of the concentration and immersion of learners raised in untact education and increase the effectiveness of education in a virtual environment. Moreover, it is available to serve as a platform for implementing various experimental studies. In particular, it was developed based on the contents of education/training utilized in the actual military, making it more dependable. However, with this paper, further development is demanded on the need for haptic-based realistic tools as a technical element to reduce the gap with reality. This should increase contents that can be utilized to actual education/training centers as they have the functions demanded in the field while lowering individual production costs. As the content increases, the quality of education can be further improved through the diversification of content, and as the content becomes richer, the level of education can be further increased by applying it to various fields. This should lead to research on not only content development but also ways to improve the educational environment in the metaverse environment that lacks resources.

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