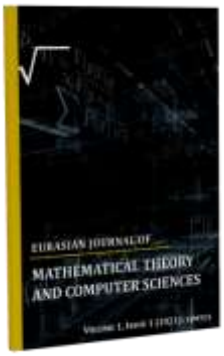
EURASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES
Innovative Academy Research Support Center
UIF = 8.3 | SJIF = 5.916 www.in-academy.uz




# MODERN TECHNOLOGIES OF VIRTUAL REALITY– A NEW MULTIMEDIA OPPORTUNITIES

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https://doi.org/10.5281/zenodo.7251370

**ARTICLE INFO**
Received: 05th October 2022
Accepted: 15th October 2022
Online: 26th October 2022
**KEY WORDS**
*Virtual reality, virtual reality glasses, digital education, augmented reality, mixed reality, medicine, military, training.*

**ABSTRACT**
*The article considers virtual reality, the constituent elements of virtual reality, types and applications of virtual reality (VR) technologies.*

## INTRODUCTION

Virtual reality technology is one of the most promising in the near future. It is constantly developing rapidly, now, in addition to games, there are many solutions that can simplify work both in the office and in industrial enterprises.

The modern world cannot be imagined without the widespread use of VR technologies. This term refers to a variety of processes - from the simple use of the Internet to the creation of interactive information environments using special technical devices - VR devices. VR technologies first appeared half a century ago. The development of VR technologies and their implementation in everyday life is ongoing and is considered one of the parts of the global digital transformation. Therefore, the assessment of the impact of each type of technology on various parameters of human activity is of particular importance. Modern consumer VR devices are lightweight, have high image quality, are easy to use and therefore are becoming more widespread, including ensuring human safety. VR-technologies as a technology of human-computer interaction provides user immersion in a three-dimensional interactive information environment. Virtual objects of this environment have properties similar to those of real objects in the real physical world. VR technology provides a simulation of the surrounding reality with a high degree of certainty[1].

Augmented and virtual reality technologies are used in education and medicine, training programs and simulators are developed on their basis, medical devices simulate and perform

operations. In connection with the above, the question of the impact that augmented and virtual reality technologies can have on business is relevant. This article discusses multimedia tools of virtual reality. With the help of these technical means, virtual reality constructs a completely digital world, completely restricting the user's access to the real world, modifying the space around the user.

In the modern educational process, computer technologies, 3D technologies and VR technologies are actively used in the educational process. Using VR as a means and method of teaching, the following main positive properties were identified - interest in learning, ensuring greater inclusion and involvement of the student in the learning situation, a positive effect on cognitive abilities, the possibility of learning and modeling situations that require the development of specific skills, and at the same time it is too large risk in case of failure in the real world (professional training of doctors, pilots, operators of nuclear power plants, etc.), successful training of students with disabilities[2].

In chemistry, VR helps model the forces of molecular attraction and repulsion. Plunging into the developed VR system, chemists, in the truest sense of the word, can feel these forces with their hands, building three-dimensional models of molecules in virtual space.

In architecture and design, VR allows you to optimize the cost of building materials, test the model of the planned building for strength, say, during earthquakes or other natural phenomena. In VR systems, auralization is used - the presentation of non-sound information in sound form. This feature is used to model and optimize the acoustics of concert halls. These methods make it possible to simulate the acoustics of even non-existent ancient temples and amphitheaters according to their descriptions or the remaining ruins. With the help of auralization programs, methods for calculating room acoustics are created and improved. VR is used in city planning for optimal development, taking into account the load of city roads, wind speed and many other factors. Reconstruction of historical events is also of scientific interest. In general, virtual reality systems are required when working with spatial data that is difficult to represent in the aggregate.

To date, there are already virtual anatomical atlases that represent various organs and systems of average men and women. A computer can recreate not only external, but also mechanical parameters of organs. The fundamental difference of virtual anatomy is that the observer can be placed at any point both outside and inside the body, as well as travel along certain channels and systems. Using electromagnetic, pneumatic and hydraulic systems, it is possible to simulate a virtual scalpel or other instrument in a virtual glove[11].

**RESULTS and DISCUSSIONS**

Virtual reality systems try to imitate all basic human sensations, including stereo vision, stereo sound, touch, smell, etc. In the case of a conventional video image, a person is, as it were, an outside observer who perceives video information through the display window. The stereo image transfers a person to the space of the video scene, where he is the first person to perceive it. In turn, for a person, virtual information becomes real in the surrounding world. To perform any action in the virtual world, special devices are created by real organs (for example, hands). An example of such devices are virtual gloves that are put on the hand and transmit the movement of the hand and fingers to the computer. The use of such technologies can significantly improve the level and quality of these simulators, so research in this

direction is carried out quite intensively. The user must be able to touch virtual objects, take them with his hand, move them to a new place, etc., that is, visually and physically feel contact with the virtual world. The tasks that arise when creating virtual reality systems have great opportunities for parallelization, which, in turn, allows using distributed computing environments to solve them. These can be cluster systems of personal computers or environments built using the methods of the theory of dynamic stochastic networks[2].

There are different approaches to imitate reality. They are very different in concept. Since the degree of immersion is very different. VR, CR, AR, MR, XR are different things. Each of them uses different helmets and virtual goggles. There are several types of helmets and virtual goggles:

Virtual reality (VR) helmet. The principle of operation is based on the creation of a digital environment that has no relationship with the outside world. Sounds, three-dimensional objects, lighting form a virtual world with which the user interacts through voice, movements and gestures. Virtual reality can be used not only for playing games and watching 360° videos, but also for demonstrating projects that are being created, for example, buildings or landscape objects. An example for this category is HTC VIVE Cosmos.

Standalone virtual reality (VR) glasses. The development of technology makes it easier and more convenient to use virtual reality equipment. If earlier the user had to attach a lot of manipulators and sensors to his body, today there are models of completely autonomous VR glasses. Standalone virtual glasses are a full-fledged and self-sufficient device that does not require a smartphone or a powerful computer to function. At the same time, the user does not need to worry about the correct position of the phone or display, difficulties with sound adjustment. Standalone VR glasses have their own processor, RAM, video accelerator, HDD, and everything else for high-quality immersion in the virtual world. You can control the equipment using special control buttons located on the device body - the user does not need a remote control to switch videos or perform actions in the game. Examples of standalone glasses are Oculus Quest 2, Oculus Quest 64/128 Gb, HTC Vive Focus, Lenovo Mirage Solo[1].

Mixed reality (MR) helmet. The difference between MR and VR is that graphic and text elements are attached to the surface in the surrounding reality, and are not formed in an artificial three-dimensional environment. With the help of MR glasses you can build virtual objects, view and change them in several planes. Holographic computers are usually controlled by gestures, voice, or a wireless controller. The functionality of the MR glasses software platform depends on the installed applications. An example for this category is Microsoft HoloLens.

Mixed reality (MR) glasses. Modern technologies make possible an exciting immersion in the world of virtual reality. Thanks to innovations, the user can find himself in mixed reality - a kind of mixture of the ordinary and virtual worlds. Mixed reality glasses allow the user to see both the real world and quite believable virtual objects. A feature of the technology is the attachment of virtual objects to points of ordinary space: the user can consider them as quite real. Mixed reality glasses are a combination of virtual and augmented reality. Mixed reality equipment is complex equipment that is created by large technology corporations.

Augmented reality (AR) helmet. AR and MR are similar in that they do not use a simulated 3D environment. Augmented reality is designed to provide digital information about places and

objects that have fallen into the lens of the helmet or requested by the user. User interface objects are superimposed on space through lenses, so you can follow the readings of connected sensors while you work. An example for this category is the RealWear HMT-1.

Augmented reality (AR) glasses. This is a device that creates an image, focusing on the things in front of it. In another way, this device is a real mini-computer that displays maximum information. It combines the functions of a navigator, Internet browser, organizer. Unlike VR devices, the device is really a glasses, light and comfortable to wear. Examples of augmented reality glasses are Microsoft Hololens, Google Glass 3.0, Epson Moverio BT-300, Recon Jet. Unlike virtual, augmented reality glasses display information about those objects that the user's gaze is aimed at. The equipment uses cameras and sensors that monitor the movement of human pupils. In accordance with this, you can change the system settings, use images, use the Internet and other functions. The average weight of these glasses is 40-60 gr, they are compatible with a computer, mobile phone and other devices. able to function autonomously outside a computer, smartphone or console, you can receive information from the worldwide web, use various useful applications, and communicate with other devices[4].

VR helmets for PC and consoles. Such virtual reality helmets work in conjunction with a computer or game console. Unlike stand-alone VR headsets, PC and console headsets do not contain hardware components responsible for processing processes, but only displays and a headset for displaying information. Performance in each game is not fixed and depends on the configuration of your computer. Such helmets are profitable and convenient for home use. Examples for this category include HTC Vive Pro, Oculus Rift S, Samsung HMD Odyssey+, Pimax 8K X, Valve Index helmets.

Virtual reality glasses for smartphones - make it possible to enjoy games in three-dimensional space and watch exciting 360 ° video and you need special rooms with 3D technologies. 3d glasses for smartphone is a virtual helmet that allows you to watch games with movies in three-dimensional space and feel the effect of presence. Examples of 3d glasses for smartphone Google Daydream, Homido, Samsung Gear VR, Fibrum.

**CONCLUSIONS**

Virtual reality systems represent a new stage in the technological development of mankind. Not all technical problems in this area have been solved, but a start has already been made and the rest is a matter of time. The virtual reality immersion system will provide extremely versatile tools for the realization of human fantasy. In the future, they will become more accessible to the mass consumer, and the software will make the user's interaction with the virtual environment intuitive[14].

In the future, there will be dynamic changes in people's lives, as virtual reality will change a lot. With the development of VR application development, people will be able to receive education in remote areas, as well as share updated information and knowledge in different parts of the world, it helps students to focus better, doctors have the opportunity to practice on things that are not real people, and find ways to improve medical science and technology. Virtual reality will give people the ability to travel without having to leave their homes. The future promises people the ability to shop, travel, and even socialize without even leaving their homes. In addition, virtual reality will allow people to feel comfortable while working from home. With the development of the VR application, people can work from anywhere by

connecting to digital printers and they will even perform non-stop tasks. VR is one of the main directions of development in the IT field. VR, AR, XR and other technologies are already part of our bright future, as they are already being used not only in the entertainment industry, but also in the field of education and for solving applied problems.

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