FEATURES OF VIRTUAL REALITY DESIGN

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Received: 2021-06-14
Accepted: 2021-07-16
DOI: http://doi.org/10.46489/gpj.2021-1-2-7

Abstract. The article reveals the features of virtual reality design. The essence of virtual reality, scope and principles of implementation are described. An overview of innovative developments in the field of virtual reality, such as: Oculus VR and Samsung Gear VR. It is emphasized that virtual reality offers the potential of an extremely exciting experience that can open up real opportunities for learning and development. The main stages of virtual reality construction are identified, which are divided into five phases: the phase of assignment, analysis, creation, testing, implementation, and operation. Each of the phases is described in detail, separating the basics of its implementation, and indicating the actors responsible for its implementation. Features of solutions in the design of the virtual environment, which are based on certain rules of technical design such as: the relationship between earth and horizon, atmosphere, landscape, sounds, motion control, focus, interactivity. Each of the rules is described in detail, its essence is analyzed. Thus, the peculiarities of the connection between the earth and the horizons emphasize the realism of the presence of both of them in the field of visibility; Atmospheric (air) perspective can help users understand the scale of the virtual environment, thus making the space more natural. Regarding the peculiarities of landscaping, eight categories are emphasized: land - open environments allow you to move in any direction above the ground, while the filled area allows you to move only between objects; path - provides pedestrian traffic from one place to another between the elements of the terrain; obstacle - an object the size of an animal with which a collision is possible; barrier - a special type of obstacle that usually blocks the view and movement; edge, precipice - the limit of a possible approach, a dangerous zone; degree - a part placed adjacent to other objects, which provides both descent and ascent; slope - may or may not allow the movement of pedestrians depending on the angle and texture of the soil. It is emphasized that in the virtual environment of user movement control with the help of objects is one of the main design techniques. It is emphasized that the demonstration of the center of focus helps to navigate in space, it is also used to move and interact with objects.

Keywords: integration of sciences, interdisciplinarity, multidisciplinarity, transdisciplinarity, synergetics.

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INTRODUCTION

Virtual reality is an artificial set of images, sounds, smells, etc., which are created using computer technology to form a simulated environment, including auditory, visual, haptic, and other types of haptic feedback. This technology can be used to create an environment similar to the real world, with effects and events that cannot be experienced in ordinary physical reality or whose realization can be very risky. The benefit of virtual reality over other media is that the user does not even need to leave their own home to experience the virtual world. Although virtual reality has captured the public's attention since the 1980s, it is only in the last decade that virtual reality headsets have firmly entered the market, making a breakthrough in sales rankings. New equipment has entered the consumer market with affordable pricing models, but at the same time, entirely new technologies are being developed and developed. The beginning of modern virtual reality can be attributed to 2012, when a Kickstarter project called Oculus Rift was introduced to provide a high-quality display on the head (virtual reality helmet). The latest version of the Oculus Rift S has an LCD - display, 2560x1440 resolution per eye, refresh rate of 80 Hz, tracking and positioning capability. The device also has a field of view of 110 degrees and built-in headphones with 3D sound effects. As a specific sphere of representation, virtual reality still has a long way to go, and a huge design breakthrough to make the created world no different from the real world and be accessible and easy to use for the average everyday user.

Under the conditions, variations of virtual world realization techniques have been reflected in the works of many scientists.

Thus, A. Boltenkov (Boltenkov, 2021) presented a study devoted to determining the relevance and feasibility of virtual (VR) and augmented (AR) reality technologies in the field of design-designing.

Also, in this area, the work of K.T. Golubchak (Golubchak, 2021), the author, highlighted the trends in the use of virtual reality technologies in architectural education as the most revolutionary means presented by modern information technology. The author revealed the pros and cons of using virtual reality technology in architectural education, reviewed technological means and software and outlined the prospects for further research in this field. O. G. Danilian and O. P. Dzoban (Danilyan, 2020) revealed the principles of virtual reality and cyberspace as attributes of modern society. In (Mozhenko, 2018) analyzes virtual reality technology in their relationship with the development of screen audiovisual arts.

Scientists emphasize that virtual reality itself is becoming a new aesthetic and artistic tool, a new reality for audiovisual arts, which requires artists new approaches and professional mastering of this powerful tool to influence the audience. The virtual and augmented reality application directions in everyday life were described by M. Krasnoschek, O. I. Kozik and J. I. Shestak (Krasnoschek, 2017). Among the foreign authors it is worth noting such works as: Casteleiro, Joana (Casteleiro, J. 2021), Davey, Steffi & Hancock, Paul (Davey, 2019), Evans, Pete & Söderlund, Carina (Evans, 2021), Peña Pérez Negrón, Adriana & López, Graciela & Orozco Aguirre, Héctor Rafael (Negrón, 2020), Martirosov, Sergo & Kopeček, Pavel (Martirosov, 2017), Debarba, Henrique & Chagué, Sylvain & Charbonnier, Caecilia (Debarba, 2020), Mohammed, Wafaa (Mohammed, 2020), Engeli, & Kurmann (Engeli, 2021), Adwernat, Stefan & Wolf, Mario & Gerhard, Detlef (Adwernat, 2020) and others. However, given the described scientific achievements, on the subject, the question of considering the design features of virtual reality remains open and requires detailed elaboration.

RESULTS

Virtual reality has a vast sphere of implementation given the current level of informatization of society. The most important and widespread use of this technology is in the field of entertainment. But the most extensive user base of virtual reality is in the gaming industry.

Unlike movies and videos, where the user appears from the third-person perspective of the world of the characters they live, video games allow you to control your character and always try to put the user in their place. Virtual reality devices used in the gaming industry have interactive software and hardware. Virtual reality games can be felt or controlled by body movement. Thus, the user can use a virtual reality headset to move around the artificial world. In addition, the user can interact with 3D creatures that appear on the screen.

A new era of virtual reality began with the announcement of the Oculus VR and Samsung Gear VR prototypes. The virtual reality headset features handheld controllers and tracking technology to offer users an exceptional experience.

Virtual reality offers the potential for a highly immersive experience that can open up real opportunities for learning and development. Using virtual reality technology, medical trainers can supplement existing training, allowing workers to do things that are relatively rare when it comes to traditional training paths in the medical profession. Virtual reality essentially offers medical professionals the opportunity to rehearse and adopt new skills and knowledge in an extremely realistic environment without the associated risks.

Because of its ability to provide a flexible range of simulations, virtual reality remains the most effective and widely used option for military training. Traditional military factions use artificial weapons to train soldiers without providing a real-world experience. With virtual reality, the military is creating training kits that include caves, motion trackers, vests, and weapons to train soldiers better. In extreme environments such as the jungle, navigation and teamwork are critical.

Virtual reality helps soldiers train in such environments and receive training with submarines and land vehicles without having to get into a real vehicle. Virtual reality simulators also provide data and feedback on soldiers' reactions during various scenarios. Reaction data can be used to prepare a soldier for individual training.

Virtual reality is one of the technologies with the greatest projected growth potential. However, the experiences it now provides to the average user are mostly auditory and visual.

It still has a long way to go to provide simulations of touch, smell, and other senses. In addition, virtual reality is not yet as user-friendly as possible, or possible at all. Users must have a separate room with an open space to use virtual reality. It has to be set up with lots of wires and cables.

It is also impossible to wear heavy headsets for long periods of time. These limitations will definitely be overcome in the future, and a deeper experience and reality performance will be achieved.

The methodology for building virtual reality is divided into five main phases, Fig. 1.

The assignment phase involves the customer and the developer working together. This phase should be performed as carefully as possible and all things considered, as it is the basis for further work. Determining the purpose of virtual reality creation is the most important part and should be the first task to be performed. During this phase, a draft scenario is composed, and the customer of the project describes the plot, objectives, and settings of the virtual environment.

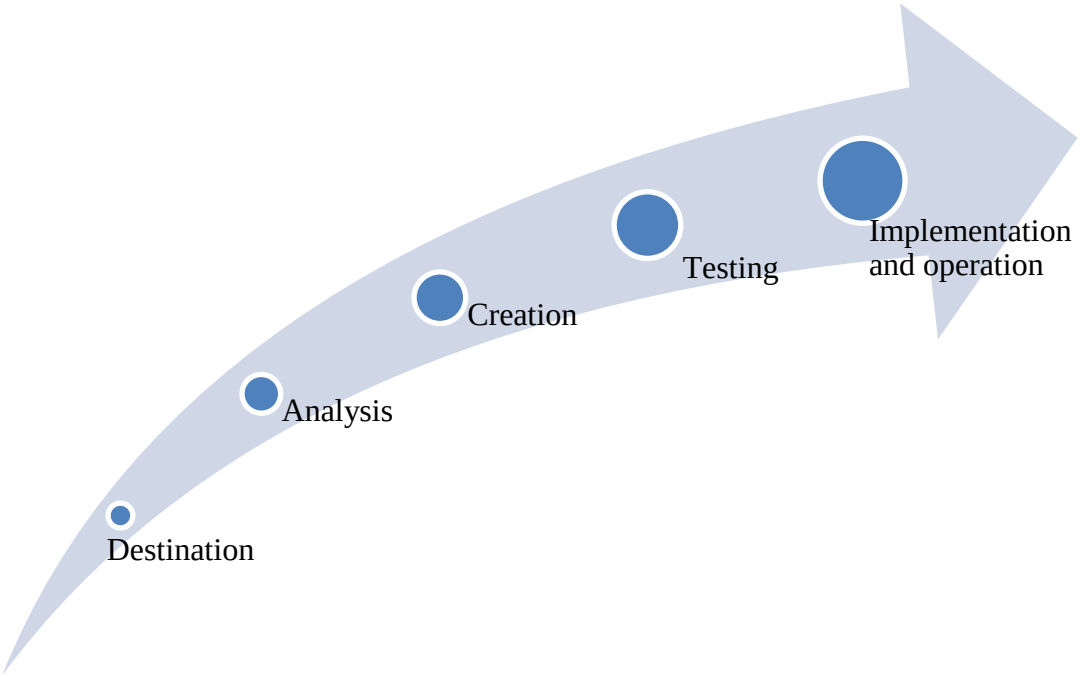

Fig. 1. Phases of the virtual reality methodology

The analysis phase is based on detailing the scenario, isolating objects, and establishing the classes and states of each object.

The creation phase consists of creating the resources of the virtual environment - the little bricks that build the entire virtual world. The requirements for some of the assets can be understood from previous phases of analysis or even from the draft scenario. During the creation phase, the client must be involved in the process and participate in regular reviews and consultations. This is an extraordinary programming-like approach. All assets should be reviewed as soon as possible and documented accordingly. There are many types of resources, scripts, texts, graphics, animations, sound, and equipment. The form of the assets is strongly influenced by the target group and the level of immersion specified in the assignment phase. Scripts drive the virtual world. Different scenarios support all actions. There are scenarios to maintain the state of the objects, scenarios that change states.

Scripts should be written as universally as possible, although some scripts for a small number of specific actions do not need to be universal. The basic platform for scenarios is the state diagram. Such scenarios will cause a logical mechanism to provide the virtual world. Forms dialogue trees, item descriptions and all other texts that will take part in the virtual environment. The basis of most texts is a detailed script. By graphics, we mean two-dimensional graphics, such as a graphical interface or three-dimensional models representing objects, architecture, and the like. In addition, there are lights, renderings, shaders, and the like. Graphic assets depend on the detailed scenario (if the virtual world is based on reality, you can use the script project). People models are based on the detailed scenario and other models from the list of assets.

Animations are based on the state diagram and are the basis for interaction in the virtual environment. Corresponding animations accompany almost all state changes. Some animations do not accompany state changes but accompany the state itself (e.g., fan rotation). Some animations are based on the nature of objects themselves, such as the animation of doors opening.

Some sounds are based on text (dubbing), while other sounds accompany the animation as well as environmental sounds. Sound quality is often underestimated, but sound creation is a

very complex task. Therefore, sound quality has a big impact on the level of immersion.

The hardware is designed to buy, install, and implement the virtual environment in virtual reality development methodology. The client may require the use of certain hardware that he already has at his disposal or order the resulting program on new hardware. The basis for the choice of hardware is primarily the level of immersion and complexity of the virtual environment.

The testing phase is carefully performed throughout the project. Every step is assessed as soon as possible. Not only the scenarios but all the assets together must be assessed. Tests should focus not only on bugs and raw exceptions in the code but also on the overall feel of the virtual environment.

The implementation phase involves implementing the software with the hardware and calibrating it for light and acoustic conditions. Calibrations are very important for stereoscopic projection and haptic interaction - the user must see the feel in the actual position. Final testing, of course, is done after deployment.

After implementation, the project is not closed. Instead, the developers should be able to monitor the implemented virtual environment and collect data for further repair or modification.

Features solutions in the design of the virtual environment are based on certain rules of technical design.

1) The connection between the ground and the horizon

"When the pilot is in the clouds, you can't see anything outside, and that can be very disorienting. When the pilot comes out of the clouds and sees that the ground and sky meet on the horizon, he can orient himself. Users can in such a situation in a poorly constructed virtual reality world, will inevitably cause seasickness. The connection between the land and the horizon is as important in virtual reality as it is in our physical reality" - James J. Gibson (Gibson J. 2015).

2) Atmosphere

Atmospheric (aerial) perspective can help users understand the scale of the virtual environment, thereby making space seem more natural. The concept of this phenomenon is simple: "The farther an object is, the more air and particles we have to look through, which makes objects that are farther away less sharp and blurrier than objects close by" - Bruce Goldstein (Goldstein, 2013).

3) Landscape

James J. Gibson (Gibson J. 2015) divides landscape objects into eight main categories: The ground is rarely an open environment. It is usually filled with objects. Open environments allow you to move in any direction above the ground, while filled terrain allows you to move only between objects. The path provides pedestrian movement from one place to another between elements of the terrain. An obstacle is an object the size of an animal with which it is possible to collide. A barrier is a special kind of obstacle, usually blocking visibility and movement. A water barrier prevents the movement of pedestrians. An edge, a cliff is the limit of a possible approach. It is a danger zone. Hikers avoid such places. Grade - placed adjacent to other detail, which provides both descent and ascent. Slope - may or may not allow pedestrian movement depending on the angle and texture of the ground.

Using the objects of these categories as building blocks for virtual reality will provide a natural, intuitive interaction with the environment.

4) Sounds

The user's integration into a particular environment through sounds is achieved by fading first the sound, then the image. This creates a mental image of the environment through sound, reducing the shock factor.

5) Traffic control

In virtual environments, controlling the user's movement with objects is one of the main design techniques. Subtle changes to the environment, such as growing flowers in the opening areas of the aisle to draw users' attention to the right path, can enhance the reality of the world. However, the use of certain objects must be contextual.

6) Focus

Demonstrating the centre of focus helps you to navigate in space. It is also used to move and interact with objects. These specific tasks require him to react differently: Resting-state - The intersection should be as small as possible at rest, giving only information about where the user is looking. Motion - The intersection should be turned on when the user looks at any available location. At the same time, it should turn into a big pointer, highlighting the selected area around the projected over it from the user's point of view. Interact with objects - when the user pays attention to an interactive object, the intersection should react accordingly. Intersection colouring - it should adjust its colour to the brightness level of the background, switching between light and dark modes to remain visible in any lighting conditions. Objects as an intersection - replacing the intersection with specific 3D objects can be a slight hint at the possibility of interaction (e.g., a key instead of an intersection when you can open the lock).

7) Interactivity

Objects that should or have change features should conventionally show this to the user, with a slight change shading the object or even a subtle sound describing its behaviour when the user looks at it.

CONCLUSIONS

The paper provides an overview of the design features of virtual reality. Virtual reality shows a lot of promise for the future as it gives the user an immersive experience. Thus, businesses can take advantage of this key feature and take it a step further in promoting their products and services. Despite all the obstacles, the virtual reality market is growing, especially in the gaming and enterprise segments. The trend is toward virtual reality becoming mainstream in the near future. So, it is inevitable that those businesses that begin to incorporate virtual reality solutions into their processes have a better chance of dominating the market. Prospects for further research are based on developing a new methodology for creating virtual environments in game development tools with a detailed elaboration of the proposed virtual reality design features to improve the quality and level of reality.

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