PriMera Scientific Engineering
Volume 3 Issue 6 December 2023
ISSN: 2834-2550

PriMera Scientific Publications

Augmented Reality In The Modern World

Type: Research Article
Received: October 26, 2023
Published: November 23, 2023

Citation:
Nina Zdolbitska., et al. "Augmented Reality In The Modern World". PriMera Scientific Engineering 3.6 (2023): 26-32.

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Abstract

AR applications have become an integral part of our daily life as a form of communication, for entertainment, shopping, travel, education, medicine, robotics, manufacturing, etc. [1, 2]. The development of simulation applications has recently become quite common. The development and management of applications with an interactive environment and the interaction of better functions, updates such as the use of augmented reality technologies such as AR and VR [1], recognition methods [3, 4] to improve user interaction play an important role in the current development trends.

The introduction of AR and VR in educational institutions and digital transformation in industrial and non-industrial areas has grown exponentially in recent years [5]. The article [5] presents the application of augmented reality technology in the field of engineering.

For example, in medicine, VR is used as a field for training future doctors, especially surgeons, which allows you to get not only theoretical knowledge, but also real practical experience from training, while eliminating the risk of harming a real patient [6]. In addition, it provides an opportunity to analyze rare diseases and acquire skills to deal with them in emergency situations. In addition, R can help in the rehabilitation of patients after severe injuries. In science, virtual reality technology can be used to simulate complex systems and processes, allowing researchers to study them in detail and make new discoveries.

In education, VR has long been used to conduct interactive lessons and create unique simulators that help accelerate the progress of learning the material and contribute to the acquisition of practical skills [7, 8].

This paper provides experiences and suggestions for the practice-oriented development and deployment of augmented reality technology in various fields that can be used for future augmented reality research.

Keywords: Augmented reality (AR); Virtual reality (VR); Web AR; image; configuration

Introduction

The use of virtual reality (VR) technology opens up many opportunities for various fields, including: science, medicine, education, entertainment, business, etc. Basically, VR is a computer-simulated environment that can simulate physical presence in real places or imaginary worlds [1]. It is worth noting that recently there has been a significant increase in the popularity of virtual reality technology in various fields of activity. Many factors affect this, including:

1. The rapid increase in the processing speed of large volumes of data allows the creation of more technological VR applications that provide a more realistic immersion of the user in the virtual world.
2. The appearance and development of an additional headset, which allows users to get new emotions and feel their own presence in another, virtual world.
3. The above two factors lead to: significant development of the game industry that uses virtual reality immersion technology.
4. Increasing the number of areas that actively use virtual reality technologies, in particular for tourism, marketing, various types of training, etc.
5. Finally, such a significant increase in the popularity of VR can be explained by people's desire to experience something new and unique that cannot be obtained in the real world, or to have completely new experiences in various areas of life.

One of the main advantages of virtual reality is the ability to create an immersive environment that gives the user the feeling of being in a certain world. It allows you to simulate any situation, even difficult or dangerous for a person, which is actively used in science.

In the field of entertainment, virtual reality technologies allow users to immerse themselves in completely different worlds, experiencing incredible emotions and unforgettable impressions. VR has also long been used for advertising and marketing purposes, allowing users to better familiarize themselves with the offered goods and even some services.

The use of virtual reality tools in the field of interior design allows designers and architects to create more accurate and detailed visualizations of their projects, and also allows virtual tours of rooms that are only at the design or construction stage.

This allows customers to get a more realistic idea of how the interior of their home or other space will look and helps speed up the construction or renovation project, avoiding mistakes and misunderstandings. In addition, virtual reality technologies provide an opportunity to consider various design options, compare and evaluate them depending on needs, which allows you to quickly make the right and balanced decision.

The use of virtual reality technologies in today's world is indispensable and extremely important, because they allow us to open radically different approaches to the usual processes of learning, communication and entertainment. Such technologies create new opportunities for increasing the efficiency and accuracy of research, increase the level of security and provide access to new knowledge and experience. Therefore, the use of VR technologies is an indispensable tool in today's world.

Related Technology

In fact, AR technology is not the only one in the family of technologies that connects the virtual world with the real world, this list also includes MR, VR and AR. Each of them has its own personality and methods of interaction with the user.

Virtual reality (VR) is an innovative technology that creates an immersive environment that exists entirely in a virtual world. The user in VR is surrounded by a simulated environment and can feel that he is in another place, another time or even in a fantasy world. The excitement of VR allows you to immerse yourself in a virtual experience and interact with it.

The main characteristics of VR technology include:

- Virtual world: VR creates a complete virtual world that can be created for a variety of purposes, including games, learning, simulations, and other applications.

- Immersion: Virtual reality gives the user the impression of being in another place. This is achieved through virtual realistic images, sound and sometimes even the sense of touch.
- Variety of devices: There are many different devices for VR, including headsets, controllers, lenses and other accessories. Devices can be connected to computers, game consoles or mobile devices.
- Applications: VR is used in a variety of industries, including gaming, education, medicine, architecture, training, and more. It can help with a variety of tasks, from learning and entertainment to virtual travel and therapy.
- Challenges: VR technology has its own challenges, such as high equipment costs, possible user discomfort and mobility issues. However, with the development and improvement of technology, these issues are gradually being resolved.

VR is a very promising technology that is widely used in various industries and has the potential to change the way we interact with information, learn, entertain and communicate. It continues to develop, offering more opportunities and creating new types of interaction.

Augmented Reality (AR) is a technology that combines the real world with virtual objects, supplementing reality with computer images, sound or other virtual elements. The main idea of AR is to expand the perception of the real world by adding virtual objects to the real context.

Key features of AR technology include:

- Real-time display: AR works in real-time, allowing the user to see virtual objects in the context of a real-world environment.
- Use on mobile devices: AR applications using the camera of mobile devices or tablets have become very common. Users can use their smartphones to add AR elements to the real world.
- Headgear: Some AR headsets, like Microsoft's HoloLens or Google Glass, are designed to work in commercial and professional scenarios. They enable users to see and interact with virtual objects in the real world.
- Applications: AR is used in various fields including marketing, education, medicine, design, gaming and some others. It can be used to improve user experience, training, data visualization and other tasks.
- Development prospects: AR is one technology that has great potential. It continues to develop, in particular thanks to the development of sensors, artificial intelligence and computing power. This makes it possible to create more complex and immersive AR experiences.

AR already has wide use and prospects for further development. It helps us see the world from a new perspective and opens up many possibilities in many fields, from education to entertainment and business.

Mixed Reality (MR) is a technology that combines elements of virtual reality (VR) and augmented reality (AR), creating an interactive and immersive experience for the user. This technology allows you to combine virtual objects with the real world in real time, creating the impression that they exist in the same space.

The main characteristics of MR technology include:

- Gradation of reality: MR can represent a spectrum from full virtual reality to pure augmented reality. This means that the user can choose how immersive the experience is.
- Sensory communication: MR works to enable users to interact with virtual objects in the real world using gestures, voice control, and other input methods.
- Wearability: Wearable devices such as Microsoft's HoloLens or Magic Leap One allow users to move around in the real world without restricting their movement.
- Uses in various fields: MR technology is used in various fields including medicine, education, design, entertainment, military and many others. It can be useful for training, simulations, data visualization and many other tasks.
- Development prospects: MR is a technology that continues to develop. New developments in hardware and software promise

even more functionality and convenience for users.

However, MR technology also faces challenges, such as the limited availability of high-quality devices and potential data privacy and security issues. However, with the development and improvement of these aspects, MR can become an important tool for various industries and bring innovations in human interaction with computers and other technologies.

Social poll

The methodology is based on information obtained as a result of the study and use of virtual reality technology for design and information about the technology and technological process, the volume of demand for the availability of specialized software, the degree of satisfaction with the already available tools, their quality. and defining the main criteria that are taken into account when using the system with technology and reality.

Google Forms were used to create the survey, which will be distributed among members of various social networks, including charitable communities.

The survey was conducted from July 15 to July 28, 2023. More than 70 unrelated users participated in the survey, including a population whose activities are related to various fields, including interior designers.

59.2% of respondents were professional designers and interior designers, and 40.8% were people from other professions. In addition, to generalize the selection, the following age data were obtained (underage users participated in the study):

- 10% of respondents are 18-21 years old;
- 30.8% - 23-26 years old;
- 36.4% - 27-31 years old;
- 16.3% - 32-38 years old;
- 6.5% - 39 years and older.

Below we present the results obtained after users' answers to the proposed questions (in % of the total number of surveyed users):

Have you used virtual reality technology in interior planning?

- yes - 60.6%;
- no - 39.4%.

Do you work in the field of interior design?

- yes - 55.1%;
- no - 44.9%.

Have you ever used the services of interior designers? (for non-interior design people)

- yes - 50.9%;
- no - 49.1%.

Have you maintained constant design contact with an interior designer? (for designers, interiors)

- yes - 65.0%;
- no - 35.0%.

Did the interior design match what they presented? (for designers, interiors)

- yes - 25.4%;

- no - 13.8%;
- individually - 60.8%.

Did a virtual “walk” around the room help you determine the layout of the space?

- yes - 87.5%;
- no - 12.5%.

The respondents did not have any comments or suggestions regarding the questions raised.

The described research results indicate that it is worth taking care of your independence and knowledge of technologies and virtual reality in the field of interiors.

Overview of similar solutions

In today’s era, which is characterized by the rapid development of technology and the emergence of many opportunities on the Internet, people are introducing more and more innovations into their daily lives in order to save time and money. With the help of personal devices, people can perform a wide range of tasks, including the growing trend of using virtual reality technologies in various areas of life, in particular: arranging living space.

Homestyler-Room Realize design is the most popular app on Google Play. The software product was created for interior design. It allows you to arrange the space, arrange the interior of the house, decorate, arrange the furniture and renovate the room. It also allows you to effortlessly select the right piece of furniture, move, rotate and precisely position it to visualize the desired design. However, the program does not allow you to use images of your own space, but only offers a gallery of already created rooms, although they can be resized. In addition, the application is partially paid, that is, in order to expand the functionality, you need to make a contribution.

And another popular program that is already in the AppStore - Planner 5D - interior design. The application offers a wide range of functions, but only in the paid version. The trial period is for three days, but most users complain that they are still billed during this period. A very limited number of projects and catalog items are available in the free version. The paid version has a snapshot feature that should allow you to use your own space for a 3D background image, but this feature doesn’t work quite right as it doesn’t always measure the room correctly.

Redecor - Home Design Game is a game app to improve your design skills. The application is very useful for novice designers, as it allows you to create photorealistic images of the interior. A chat is also available in which you can discuss your own projects. However, as in the previous software, most of the elements are paid, and the application also lacks the ability to use the Ukrainian language.

Thus, during the analysis of the selected software products, several main problems were identified, including:

- lack of ability to upload your own space image in most programs;
- lack of possibility to modify the configuration of catalog objects;
- high cost of subscription to open all functions;
- restrictions on the use of different types of gadgets for different programs.

Solutions overview

The plane search algorithm is the most important step in the creation of this product, because without proper interaction of the device with the environment, it is impossible to achieve the desired results.

Since the Three.js library provides all the necessary elements for the operation of an augmented reality application, the programmer’s task is reduced to developing the functionality of the application.

The first and most important element of the program is the ability to place 3D objects in a selected location in the real world.

In the first versions of the application, objects were placed at a location specified by the user on the phone screen and transformed into a selected point in the Ray element (an internal function of the Three.js library), which in turn draws a perpendicular to the 3D space from the camera to the plane. If Ray encountered an aircraft in the real world, it placed the user-selected object model there.

In the final program, Ray does not start from the place indicated on the screen, but from the center. This is due to the fact that the program can also be used on tablets. When using the tablet, it is not always possible to touch any area of the screen, and it is inconvenient to hold the tablet with one hand. Therefore, it was decided to optimize this element. In the current version, when the user clicks anywhere on the screen, the object is placed on the floor plane.

Another element necessary for the convenient operation of the program is a preview of the object in space. Since the size and location of an object cannot always be determined by the user, it is a good idea to use tags to inform the user of where and how the object will be positioned.

Another element that was added to the program was the module responsible for the rotation of the object in space. This feature is the result of UX (User Experience) optimization, so the user does not need to walk around the object to conveniently position the object, but only slide his finger on the screen to rotate.

The second most important element was the configuration of the objects, for this a special interface was developed in which the user can preview the model, select all the necessary components and, after full configuration, display the result in AR.

Figure 1: Preview of the object in space.

Conclusion

In today's world, the boundaries of using various technologies, including virtual and augmented reality technologies, are expanding significantly. Various fields are becoming increasingly saturated with them, including the developing field of interior design and architecture, as an integral part of human life in the 21st century.

This article considered the areas of use of virtual and augmented reality technologies in various spheres of life. In addition, to better understand the needs of the interior design industry, our own research was conducted and the results analyzed. The obtained data show that 91.5% of respondents believe that the use of virtual and augmented reality technologies will significantly facilitate the process of designing one's own home.

In addition, an analysis and comparison of systems already existing on the market, which use augmented and virtual reality technologies in the interior design process, was carried out. Based on the collected data, an own classification of software products was created based on various indicators.

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