

# ТЕХНОЛОГІЯ ДОПОВНЕНОЇ РЕАЛЬНОСТІ. ЗАСТОСУВАННЯ ТЕХНОЛОГІЇ ДОПОВНЕНОЇ РЕАЛЬНОСТІ ТА ВПЛИВ НА ЖИТТЯ ЛЮДЕЙ

Вінницький національний технічний університет

*Анотація: У цій статті йдеться про технологію доповненої реальності, про її розвиток, приклади застосування доповненої реальності у сучасному світі та її вплив на життя людей.*

**Ключові слова:** Доповнена реальність, технології, інновації, віртуальний, взаємодія

*Abstract: This article is about the technology of augmented reality, its development, examples of the application of augmented reality in the modern world and its impact on people's lives.*

**Keywords:** Augmented reality, technology, innovations, virtual, interaction

## Introduction

In recent years, technological advancements have reshaped our lives in ways that were once considered unimaginable. Today, such technologies as augmented reality (AR), that were conceived as nothing more than science fiction concepts 10 or 15 years ago, are slowly gaining more popularity and recognition by the world. Moreover, in the past few years, developments of augmented reality (AR) have made significant strides, establishing this technology as one with big potential to change the world. One of the most significant and most popular developments of the AR technology has been the slow but steady introduction of AR headsets and glasses. These devices allow users to overlay digital content onto the real world, creating a truly immersive AR experience [1].

The augmented reality (AR) technology is a technology that combines virtual information with the real world. Its principle is to apply computer-generated and computer-assisted virtual information, such as text, images, 3D models, music, video, etc. to the user's view of the real world after simulation. In this way, the two kinds of information complement each other, thus achieving the enhancement of the real world [2].

For the last 5 years, there has been a growing interest and investment from more and more prestigious scientific institutions, universities, and businesses in the field of augmented reality (AR). Numerous papers and scientific research findings have been published, highlighting the viability and innovative potential of AR as a human-computer interaction technology. As the computing power of both software and hardware continues to advance, AR has transitioned from being primarily a subject of theoretical research in laboratories to a stage of widespread industry application. Serving as a connection between the digital and physical realms, AR presents a fresh perspective for people to engage with their surroundings and work. Today, AR is recognized to be one of the few most promising technologies of the future on par with Artificial Intelligence and Robotics.

## Technical aspects

The concept of augmented reality consists of 3 key technologies, such as:

- Intelligent Display Technology
- 3D Registration Technology
- Intelligent Interaction Technology

According to relevant data, over 65% of human information acquisition is dependent on visual perception, making it the most instinctive mode of interaction with the surrounding environment. Firstly, the advancement of Intelligent Display Technology has paved the way for augmented reality, taking it to new levels of

possibility. This progress is further fueled by the emergence of various display devices that leverage intelligent display technology. These devices play a pivotal role in elevating the capabilities and experiences offered by augmented reality applications [2].

Secondly, the 3D Registration Technology plays a crucial role in the functioning of augmented reality systems by accurately overlaying virtual images onto the real environment. The primary process of 3D registration involves two key steps. Firstly, establishing the relationship between the virtual image, model, and the camera or display device's position and orientation information. Secondly, precisely projecting the virtual rendered image and model into the real environment to seamlessly merge them with the physical surroundings. Various approaches exist for 3D registration, including hardware tracker-based registration, computer vision-based registration, wireless network-based registration, and mixed registration techniques. Among these, the hardware tracker and computer vision-based methods are particularly popular. In computer vision-based 3D registration, reference points are utilized to determine the real scene's direction and position using the camera or display [2].

Thirdly, the Intelligent Interactive Technology is closely intertwined with the Intelligent Display Technology, 3D Registration Technology, ergonomics, cognitive psychology, and other related disciplines. Within augmented reality (AR) systems, a diverse range of intelligent interactions takes place. These interactions encompass hardware device interactions, location interactions, tag-based interactions, and other information-based interactions. As intelligent interaction technology advances, AR goes beyond the mere superimposition of virtual information onto real scenes. It enables real-time interaction between users and virtual objects within the physical environment. This interaction relies on users providing specific instructions to the virtual objects present in the scene, and in turn, the virtual objects respond with appropriate feedback. Consequently, users of augmented reality applications can enjoy a more immersive and engaging experience.

Augmented Reality is no longer a fantasy or an element of fan-fiction stories. Today it is a rapidly developing technology that has the power to revolutionize multiple if not all aspects of life, having virtually countless applications. This technology has a colossal potential to change the world completely, and it already is. As technological advancements progress at an unprecedented pace, we can anticipate more and more innovative applications of AR in the years to come. Below are some of the most popular ways this technology will be making a significant impact.

### **Retail**

The retail industry is one of the industries that has been investing the most in digital transformation in recent years. In fact, it is one of the sectors that has already implemented the most technological advances in many areas such as logistics, storage, marketing and customer service. Within this digital transformation and technological investment, it is worth highlighting the implementation of immersive technologies such as augmented reality. With augmented reality in retail, shopping will take a new turn. This powerful technological tool offers a multitude of implementations and uses, from recreating the process and experience of shopping in a physical shop, without the need to go there, to the assembly of products or trying them out and testing them as if the user had them in their own home [3].

### **Military**

The military sector has always been and always will be a forefront of using emerging technological advancements for the purposes of training and combat enhancements. And augmented reality is no exception. Because warfare is constantly evolving, armies have to keep up with the newest military trends and look for opportunities to get ahead in the technological war. And, with the expanding possibilities of data and graphics processing, the number of uses of augmented reality in military grows exponentially. AR can be extensively used for realistic training scenarios. It enables soldiers to experience virtual combat situations, providing them with immersive training experiences and allowing them to practice critical skills in a safe environment. AR can simulate battlefield conditions, tactical exercises, and even complex mission scenarios, enhancing training effectiveness. AR systems can provide real-time, contextually relevant information to soldiers on the battlefield. By overlaying digital information onto their field of view, soldiers can access critical data such as maps, enemy positions, friendly forces, and operational intelligence. This enhances situational awareness, reduces cognitive load, and facilitates better decision-making in high-pressure situations. AR can assist soldiers in target acquisition and engagement. By utilizing AR-enabled scopes or goggles, soldiers can overlay target information, such as range, wind speed, and bullet trajectory, onto their view. This can improve accuracy, reduce engagement time, and enhance overall operational effectiveness. AR enhances command and control capabilities by providing commanders with an augmented view of the battlefield. They can visualize

troop movements, coordinate forces, monitor assets, and receive critical updates in real-time, enabling more effective decision-making and mission planning [4].

### **Design and architecture**

From architecture to construction to modeling to design in general, AR has been a huge help to professionals. Today, professionals such as engineers and architects can use headsets and other AR technology to virtually step into the spaces such as buildings and get an idea of what their finished work would look like. By using specialized apps, they can transform the simplest drawn plans from paper into a 3D model. The main use of augmented reality in architecture is for project presentations, where you can showcase a realistic 3D model of your building concept in an interactive way. It works great for presentations you do for your clients, as AR allows them to examine the design from any angle, and zoom in and out on it. At the same time, augmented reality can be a valuable collaboration tool for when you work on a project with your team. Namely, it can be quicker and easier to view the entire concept in AR and identify any issues that might need improvement [5,6].

### **Gaming**

The gaming industry has witnessed rapid advancements in augmented reality (AR), providing immersive experiences by merging virtual elements with the real world. AR games bridge the gap between reality and the virtual realm, enhancing realism and user engagement. Multiplayer AR games foster social interaction by connecting the virtual and physical worlds, encouraging players to interact and explore their surroundings. Although AR games have certain hardware and connectivity requirements, their transformative potential in the gaming industry is substantial. They offer unique experiences and opportunities for game publishers and developers to engage with players and explore novel revenue streams. The possibilities of AR in gaming are extensive, revolutionizing the gaming experience, promoting social interaction, and unlocking new avenues for game development. As technology continues to advance, we can expect even more innovative and captivating AR games to emerge.

### **Conclusion**

Augmented reality (AR) technology has made significant progress in recent years, driven by advancements in computer vision and artificial intelligence. However, there are still challenges to overcome. Tracking registration methods need to improve to better understand the environment, display technology should offer more affordable and immersive options, and natural and multi-user interaction modes require further research. The integration of AR with wearable devices holds promise for creating a more realistic and interactive world. Overall, the future of augmented reality technology will have a transformative impact on human life and is an inevitable, significant trend in technological development.

### **СПИСОК ВИКОРИСТАНОЇ ЛІТЕРАТУРИ**

1. Why Augmented Reality Is One Of The Most Promising Experimental Technologies Of This Decade. URL: <https://www.forbes.com/sites/forbestechcouncil/2023/02/06/why-augmented-reality-is-one-of-the-most-promising-experimental-technologies-of-this-decade/?sh=78d474493c85>
2. An overview of augmented reality technology (PDF). URL: <https://iopscience.iop.org/article/10.1088/1742-6596/1237/2/022082>
3. Augmented reality: the success story of the retail industry. URL: <https://www.onirix.com/augmented-reality-in-retail/>
4. Augmented Reality in Military: AR Can Enhance Warfare and Training. URL: <https://jasoren.com/augmented-reality-military/>
5. Augmented Reality for Architecture: How Does it Work? URL: <https://archicgi.com/architecture/augmented-reality-for-architecture/>
6. What are the top 10 uses of Augmented Reality (AR)? URL: <https://aetosimaging.com/blog/top-10-uses-of-augmented-reality>

**Костюхін Ростислав Сергійович** — студент групи ІКІ-22Б, факультет інформаційних технологій та комп'ютерної інженерії, Вінницький національний технічний університет, Вінниця, e-mail: [kostyuhinrost@gmail.com](mailto:kostyuhinrost@gmail.com)

Науковий керівник: **Кухарчук Галина Вікторівна**

**Kostyuhin Rostyslav Serhiyovych** — Faculty of information technologies and computer engineering, Vinnytsia National Technical University, Vinnytsia, e-mail: [kostyuhinrost@gmail.com](mailto:kostyuhinrost@gmail.com)

Academic supervisor: **Kuharchuk Halyna Viktorivna**