Research on the Development and Implementation of Augmented Reality Technologies

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Abstract. The article deals with the development of augmented reality applications on the Vuforia platform, as well as the use of augmented reality technology in the educational process for visual modeling of educational material to supplement the material with visual information. The results of the analysis of existing approaches to the development of augmented reality applications, platforms, tool development environments such as Vuforia, with the ability to connect Unity, and the implementation of augmented reality technology are shown. The importance of using high-level augmented reality technologies, the prospects for using augmented reality technology, and the opportunities and advantages of using it in the educational process are highlighted. It is noted that the situation in the field of education determines the relevance of the use of new information technologies in the field of education and one of the promising areas of development of innovative educational technologies is the use of augmented reality in the learning process. An augmented reality application to great Kazakh poet Abay Kunanbayev's poems created based on marker technology is proposed.

Keywords: augmented reality, Vuforia, recognition, interactive technology.

1 Introduction

Augmented Reality (AR) technology in the educational space has been used relatively recently. Today, education is considered one of the most promising areas for the development and implementation of augmented reality technologies. The idea of using augmented reality for learning purposes is quite new, and AR technologies have recently been used in history, geography, and literature classes [1].

Augmented reality is a term that refers to various options for embedding imaginary, virtual objects in a human-visible, real-world space. Additional information can be in the form of text, images, video, sound, and three-dimensional objects. Playback of some processes using augmented reality allows you to visualize the process in real dimensions and capabilities. The principle of technology in a broad sense lies in changing a person's view of the real world using computer technology. In this case, it is possible to use all his senses. In

a narrower sense, it is adding new objects to the video image in real time. The author considers augmented reality as "the answer of modern technologies to the problematic issues that arise every day. It is more understandable to most people, it is easier to implement than virtual worlds. Augmented reality allows us to make everyday reality richer. Combined with the inexhaustibility of Internet resources, its possibilities are limitless." [3]

Many experts call augmented reality "improved", "extended", and even "additional". The name "augmented reality" will still be more accurate, since this technology can both complement the surrounding world with objects of the virtual world, and eliminate objects from it. To further clarify, we can define augmented reality as "an environment with direct or indirect addition of digital data to the physical world in real time using computer devices – tablets, smartphones and innovative gadgets, as well as software for them".

2 Methods and Technologies

The authors developed an augmented reality for the works of the great Kazakh poet Abay Kunanbayev (Fig. 1). A book of poems using augmented reality is a fascinating story with an instructive meaning. When you hover your phone's camera, the book's landscapes come to life, reproducing the book's "live" story.

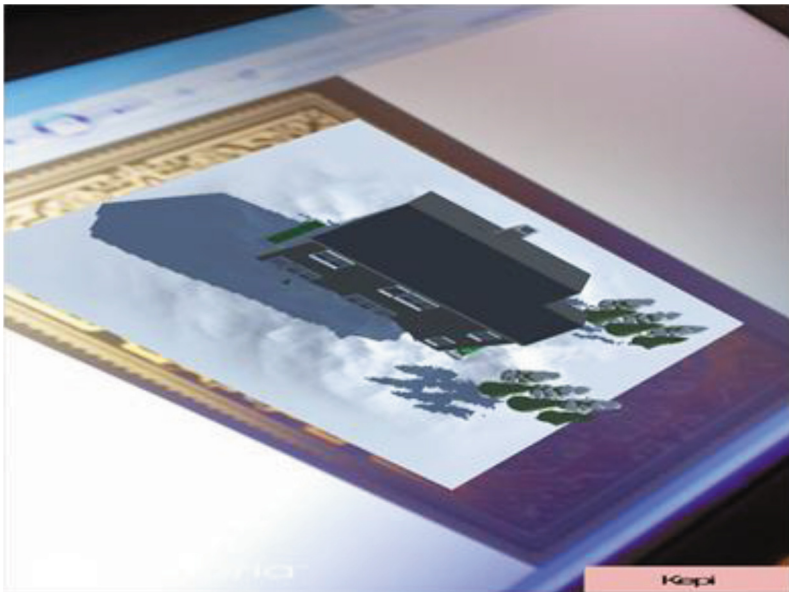

Fig. 1. Augmented reality to poems about winter.

Augmented reality for poems is developed on the Vuforia platform. Vuforia is an augmented reality platform and Toolkit for developing augmented reality

software for mobile devices developed by Qualcomm. Vuforia uses computer vision technologies, as well as tracking flat images and simple three-dimensional real objects in real time.

Fig. 2. Augmented reality for Abay Kunanbayev's translation "Mountain peaks sleep in the darkness of the night…".

Vuforia can recognize text, also has the ability to recognize cylindrical markers. The ability to register images allows developers to position and Orient virtual objects, such as 3D models and media content, in conjunction with real images when viewed through mobile device cameras.

The specificity of augmented reality is that it visually combines two initially independent spaces: the world of real objects and the virtual world created on a computer.

The virtual object is oriented on the real image so that the observer's point of view applies to them in the same way to achieve the main effect – the feeling that the virtual object is part of the real world. The app supports various 2D and 3D target types, including unmarked Image Targets, three-dimensional Multi-Target targets, and reference markers that highlight objects in the scene for recognition. Vuforia provides application-programming interfaces in C++, Java, Objective-C, and .Net through integration with the Unity game engine. Thus, it supports the development of AR applications for iOS and Android, while assuming development in Unity and is compatible with a wide range of devices, including iPhones, iPads, smartphones and Android tablets.

3 Results and Discussion

The question about the possibility of using augmented reality technology in education can be answered in the affirmative, because this technology allows

you to make lessons exciting, interesting, and understandable. Using augmented reality, you can "animate" static pages of books and textbooks, take a walk through the jungle, feel like a participant in a historical event, or "draw" associations that arise when reading literary works or listening to music [2].

In addition, in some educational organizations, the implementation of practical training may be difficult or impossible: for example, there are no necessary chemical reagents or mineral / rock rocks to demonstrate them to students. Thus, the situation in the field of education, concerning practical training, determines the relevance of the use of new information technologies in the field of education. One of the promising areas of development of innovative educational technologies is the use of augmented reality in the learning process.

However, electronic information or interactive tools are most often used in almost all areas of training. Almost all schools equip classrooms with computer equipment, projection equipment, electronic learning resources, and other modern learning tools. Most often, the capabilities of this technique are not fully used. Augmented reality can be used in the study of any subject, whether it is physics or history, biology or literature. Already now, you can find many programs for young mathematicians (Pocket Tutor), novice biologists (AR Flashcards) and others. [3]

Like any new technology, AR has its advantages and disadvantages. On the one hand, it allows you significantly to expand the possibilities of the educational process. The school must keep up with the times and demonstrate to children what they will have to work with in the near future. The disadvantages of this technology go beyond the educational process and are primarily related to social consequences (the use of contact lenses with augmented reality, problems related to the confidentiality of information [4]).

At the present stage of development of computer technologies, it is necessary that augmented reality technologies influence learning technologies, enriching their tools and methods, expanding didactic and cognitive capabilities. Placing virtual objects in a specific environment where they are not initially available would allow you to model unusual educational practices.

How can augmented reality technology be used in the educational process? First of all, as an auxiliary tool for maximizing the visibility and interactivity of the studied subject, deeper immersion in it, and conducting virtual laboratory work.

The use of such technology as augmented reality provides students with the opportunity to practice their theoretical knowledge safely, for example, to conduct chemical experiments and experiments, to visualize algorithms for sorting arrays or encoding information, to see how individual parts of the computer work, etc., to visualize objects presented in educational materials. [5, 6] thus, the visibility of the content of education is significantly increased; moreover, since

the technology is quite new, and its use requires the usual gadgets for modern students-smartphones, it increases the interest of students in the discipline being studied.

Using augmented reality and 3D modeling together motivates students to learn programming and 3D modeling [7, 8]. This technology can be used when performing project tasks, to visualize the results of students ' work on the project, making it as interactive as possible.

Various platforms are used to develop augmented reality applications. Such a platform is Vuforia – a leading computer vision platform with more than 300,000 developers. ViewAR SDK first customers were furniture companies. Now the company offers powerful 3D visualization tools: TryLive Retail is a new reality for brands and stores; SmartCam3D View is an augmented reality application for drones, but you can use its capabilities in development by applying geographical labels to the image. Infinity AR is a platform for building a three-dimensional scene of the surrounding space and add the necessary elements.

4 Conclusions

The technology of augmented reality allows the teacher to involve students in research, developing educational situations for this purpose, using modern technologies, sophisticated tools and methods (as in [10, 11]) of activity to achieve a high-quality result of knowledge. Placing virtual objects in a specific environment in which they are not initially available allows you to model unusual educational practices that affect learning technologies, enriching their tools and methods, expanding didactic and cognitive capabilities, and providing sample opportunities to improve the quality of education.

Elements of augmented reality developed in the course of research can be used in teaching directly in literature lessons, and similar elements can be developed for other disciplines on their basis. The use of augmented reality elements in training helps to increase motivation to use gadgets for solving educational tasks, interest in the educational process due to the visibility and novelty of the technology, and therefore a better understanding of the educational material.

The new technologies like augmented reality and robotics have their own ethics pros and cons. Some discussion on the topic is given in [9].

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