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Development of software for creating organizational models of the educational process of a virtual 3D university

Abstract. This paper reviews how virtual reality and augmented reality has been used in education, discusses the advantages and disadvantages of using these technologies in the classroom, and describes how virtual reality and augmented reality technologies can be used to enhance teaching at the Samarkand branch of the Tashkent university of information technologies named after Muhammad al-Khwarizmi. One of the main problems with virtual reality as a learning tool is that there are hardly any theories or models upon which to found and justify the application development. This paper presents a model that defends the metaphorical design of educational virtual reality systems. The results reached with the use of the developed software show the attributes that make the ideal Virtual Reality for situations of research and learning taking the discipline as a reference of the classroom to the computer labs and making more interesting to the student, making the learning easy.

Keywords: virtual reality for education, visualization of knowledge, design of virtual reality systems, smart classes, e-learning, sensors and interactive communication technology, 3D, blender, VRML, virtual laboratory.

Introduction. Virtual reality (VR) (lat. virtus - potential, possible; lat. realis - real, existing) - the world created by technical means on any substrate and transmitted to the subject through his usual sensations of the material world: sight, hearing, smell, and others. Also abnormal reality, imperfect, not meeting certain criteria of truth. The concept of artificial reality was first introduced by Myron Krueger in the late 1960s. In 1989, Yaron Lanier introduced the more popular now virtual reality. In the fantastic subgenre literature, cyberpunk, virtual reality is a way for a person to communicate with "cyberspace" —a kind of medium of interaction between people and machines created in computer networks.

The first virtual reality system was the Aspen Movie Map, created at the Massachusetts Institute of Technology in 1977. This computer program simulated a walk through the city of Aspen, Colorado, giving the opportunity to choose between different ways to display the terrain. Summer and winter options were based on real photos. Currently, virtual reality technologies are widely used in various areas of human activity: design and design, mining, military technology, construction, simulators and simulators, marketing and advertising, the entertainment industry, etc. The market volume of virtual reality technologies is estimated at 15 billion dollars a year.[1]

Virtual solutions. Unlike computer simulation systems, virtual reality systems are multifunctional and allow you to work in real time. And on the same hardware and software, you can build virtual worlds designed for completely different purposes. Inside the virtual world, it is possible to model not only real objects and interrelations between them, but also to unite objects that do not exist in the material world with a real connection. Or build imaginary connections for non-existent objects. This property of virtual reality is actively used by businessmen in management and marketing activities.

The structure of the human brain is such that almost every concept is associated with a certain visual image. When searching for a conceptual solution to any task, the thinking process is carried out precisely at the level of images, and not at the level of exact calculations. If you unload the memory, giving the person the opportunity to manipulate the "real" images of images, the search for solutions will go much faster, and these solutions themselves will surely be less standard. For example, a virtual reality system was introduced at one of the US stock exchanges, where the securities market was represented as an ocean. The height of the wave indicated a change in quotations, the weather-external conditions (political and economic). Purity of water symbolized the

purity of transactions. Additional convenience of the system consisted in the fact that it was possible at a glance to assess the situation on the stock markets virtually throughout the world.

Entertainment. Anyone who begins to engage in virtual and augmented reality, first of all go into entertainment, games, video, 360 degrees. But in my opinion, it is more interesting to look at other possibilities of applying these technologies.

Design. Designers and designers using augmented and or virtual reality helmets increase the efficiency of their work. There are solutions that allow designers from different countries to simultaneously work with one object in real time, which increases the efficiency of the production process or model and solves problems with communication. VR technologies can be used in prototyping and modeling, in production during assembly of products.

Sport. An interesting case of using virtual reality was in sports in the USA: when an American football player was preparing for a match, he put on a virtual reality helmet and pretended to start the game and his position on the field. So he was working out experience and working with a trainer on one or another strategy.

MIC. One of the pioneers of using virtual and augmented reality is the military. In the virtual world or with the help of augmented reality, they simulate fighting, demining or other operations to reduce the likelihood of error in a real environment.

The medicine. In this area, VR technologies are also beginning to be used more and more often - starting from conducting virtual training of doctors on how to operate correctly, to using virtual reality to rehabilitate patients and treat phobias (fear of heights, spiders and others). Immersion in virtual reality creates the effect of presence, which increases the effectiveness of rehabilitation or treatment. For example, the Russian company Intellect and Innovations creates a rehabilitation complex consisting of virtual reality display devices for partial and complete immersion, a motion capture system and feedback mechanisms. The complex is used to rehabilitate stroke patients who need to restore motor skills.

There are actually many more spheres, their analysis deserves a separate material, but we will focus on market volumes and technology investment amounts.

Architectural learning is intensely multifaceted and faces many challenges. Educational theories such as Problem Based Learning, Flipped Learning, Learning Styles theory, and Experiential Learning theory are researchers' responses to those challenges. In fact, many of these theories need proper

means in order to be effectively applied in architectural education. Moreover, the possibilities provided by Virtual Reality (VR) Technology, combined with the complex intrinsic properties of architectural pedagogy, place this technology under architecture researchers' constant watch. With its experiential nature, VR technology can improve architectural students' learning. Although the study of VR applications for educational purposes is not new, this is rarely studied in the light of emerging learning theories in architectural education. In response, an educational application called LADUVR ("Learning Architectural Details Using Virtual Reality Technology") has been designed by the authors to show how VR would address the current shortcomings of architecture learning systems.

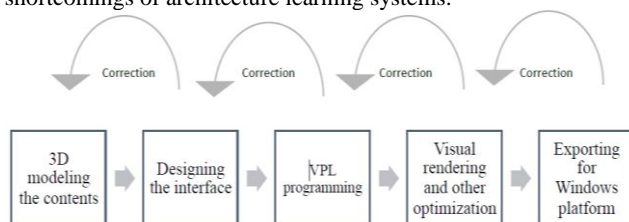


Fig. 1. The process of making LADUVR.[2]

Main part. Regardless of the hardware system, programming a VR application requires certain common tasks depending on the desired level of both realism and interactivity: (i) creating 3D environments and (ii) programming of interaction. In the early stages of VR research and development (1980s), applications were programmed directly by using high-level languages that required extensive knowledge and a lot of effort. At the time, there was no specialization of tasks, i.e., the same software was used for programming both the 3D environment and the interactivity of such an environment. Besides, since the graphic capacities of languages and equipment were very limited at that time, poor results were obtained regarding the visual aspect of the VR environment (the more important feature for achieving an adequate user immersion). In the following years, VR devices with better graphical results were developed. Besides, the work process was simplified, although a great specialization in programming was still required. In 1994, a new language emerged to represent 3D virtual reality: VRML (virtual reality modeling language), which is still used in some cases. In recent years, advances in multimedia have encouraged the development of a new VR software that is much more powerful, providing better photorealistic graphic results and improving the ease of use, i.e., it is intended for a less expert user. Furthermore, 3D modelling tasks have been separated from interactivity programming. Thus, the diverse software currently used in VR development can be classified into two main categories: (i) 3D modelling and animation software and (ii) development engines. Within the first category (3D modelling and animation software), the three-dimensional objects are generated by using the techniques of CAD software, as well as the visual aspect of surfaces, the illumination of the surroundings, effects of nature (fire, fog, liquids, etc.), dynamic effects (forces, gravity, etc.), and all kinds of animation. This type of software is also used in the production of films, videogames, and projects. The most widely used 3D modelling software are:

– Blender© (Blender Foundation, Amsterdam, Netherlands): The most popular free and open-source 3D animation and modelling software that currently exists. This software is difficult to learn.

– Autodesk 3DStudio Max© (Autodesk, San Rafael, CA, United States): The most used in technical applications of

engineering and architecture and in the creation of videogames. This software is more affordable to learn.

– Autodesk Maya© (Autodesk, San Rafael, CA, United States): The most advisable in the production of films. The main shortcoming is the high complexity in learning.

Regarding the second category, several names are used to describe it, including development engines, videogame engines (they were originally created for programming videogames), and graphic engines (they generate the interactive images used in videogames or VR applications). In the software industry, the word 'engine' refers to a program, or a part of it, that executes a certain type of task:

a database engine, a transcription engine, or a graphic engine. Development engines offer the programmer a set of basic programmed functions that are common in all VR applications: (i) a rendering engine to generate 2D and 3D graphics; (ii) a collision-detecting engine; (iii) possible interactions with the environment; (iv) sounds and music; (v) animation; (vi) artificial intelligence;

(vii) communication with the network; (viii) memory management, etc. Besides, development engines are easy to use and support the development for different platforms. The most used graphic engines are:

– Unity3D© (Unity Technologies, San Francisco, CA, United States): The most popular 3D videogame development engine currently available in the market. It is a flexible graphic engine offering a wide range of resources. The main advantage is its versatility. By being cross-platform, any project can be exported to both mobile (Android, IOS) and desktop operating systems (Windows, Linux and Mac OS), as well as to videogame consoles. In addition, it is also compatible with VR platforms, and it is really useful for designing projects either in 2D and 3D. Furthermore, Unity3D is easy to learn and to use, and offers a free version with some limitations.

– Unreal Engine© (Epic Games, Cary, NC, United States): A total cross-platform engine which has been free since 2015. Unreal Engine© is optimized for currently available consoles (including Nintendo Switch© (Nintendo Co., Kyoto, Japan)). In addition, it supports mobile and all types of VR devices. Nowadays, Unreal© is the reference development engine for multiple videogame and serious game applications as it is more graphically advanced than Unity3D©.[4]

The calculation of generalized evaluations. To the design of the automatons, the software uses tools in 3D, as the Blender and the VRML (Virtual Reality Modeling Language) and to the publishing of a page on the internet it is integrated the Program Language PHP (Hypertext Pre Processor). The results reached with the use of the developed software show the attributes that make the ideal Virtual Reality for situations of research and learning taking the discipline as a reference of the classroom to the computer labs and making more interesting to the student, making the learning easy.

Virtual reality, augmented reality and their variations represent computer interface techniques that take into account the tridimensional space. In this space, the user acts in a multi sensorial way, exploring aspects of this space through the viewing, hearing and tact. According to the available technology it's also possible to explore the smell and the taste. Body perceptions, like cold, heat and pressure, are included in the tact, through the skin (Kimer, 2011).

Virtual reality is characterized by three basic ideas: (Pinho, 2004)

- Immersion: the user has the real sensation of being inside the virtual world of the computer. Devices that make this sensation: digital helmets and digital cave.

- Interaction: the user manipulates virtual objects. Devices that make this sensation: digital gloves.

- Involvement: exploring of a virtual environment, it's as if the user took part of the virtual world and he can interfere directly in result of the application, the user can navigate on the virtual environment in a passive or active way.

Virtual Reality in the Education. The technological revolution has been permitting the use of new approaches in the teaching-learning process.

One of the conductive technologies to the building of innovative tools for the education is the Virtual reality, which offers tridimensional computer environments with advanced forms of interaction that can provide more motivation to the learning process. A very short time ago, we could consider that the great potential of VR use was in small groups placed in large urban centers and in teaching and researching institutions. However, the integration VR-VRML democratized its access, expanding more and more its potential and using fields (BARILLI et al, 2012).

With the help of resources of some modeling and animation programs as the Blender 3D, for example, the VR use can help students in the comprehension and assimilation of concepts, coming up as a valid alternative to get good results. Other benefits are observed with the use of Virtual Reality in the education.

According to Clark (2006) the Virtual Reality can be used to make the learning more interesting and fun with the purpose of improving the motivation and attention, decreasing costs when using the objective and the real environment no matter how expensive the simulation is. It also makes possible that situations that were impossible to explored in the real world can be done, for example: exploring a planet like Mars, traveling inside the human body, doing submarines explorations or inside caves, visiting very small places to be seen (molecules) or very expensive or very far away, or yet because this place is in the past (historical places) world. [3]

Necessity of Virtual Reality in education.

The following reasons support virtual reality in education:

- It provides new forms and methods of visualization, drawing on the strengths of visual representations and it provides an alternate method for presentation of material. VR can also more accurately illustrate some features, processes than by other means, allowing extreme close-up examination of an object, observation from a great distance, and observation and examination of areas and events which are unavailable by other means.

- Motivate and encourage active participation and interaction from students rather than passivity. Some types of virtual reality, for example, collaborative virtual reality using text input with virtual worlds, encourage or require collaboration and provide a social atmosphere.

- Virtual reality allows the learner to proceed through an experience during a broad time period.

It allows the disabled to participate in an experiment or learning environment & transcends all language barriers. With text access it provides equal opportunity for communication with students in other cultures allowing student to take on the role of a person in different cultures. The potential benefits of the use of VR in education and training: visualization and reification, an alternate method for presentation of material; learning in contexts impossible or difficult to experience in real life; motivation enhancement; collaboration fostering; adaptability, offering the possibility for learning to be tailored to learner's characteristics and needs; and evaluation and assessment, offering great potential as a tool

for evaluation because of easy monitoring and recording of sessions in a virtual environment. [5]

We will review in this example model of University and there are students choose their subjects where they learning his timetable.

The calculation of generalized evaluations. The main disadvantage of the virtual caves is the high cost, which makes the use of this type of immersive VR limited. On the other hand, the use of an HMD can often cause some level of cybersickness.

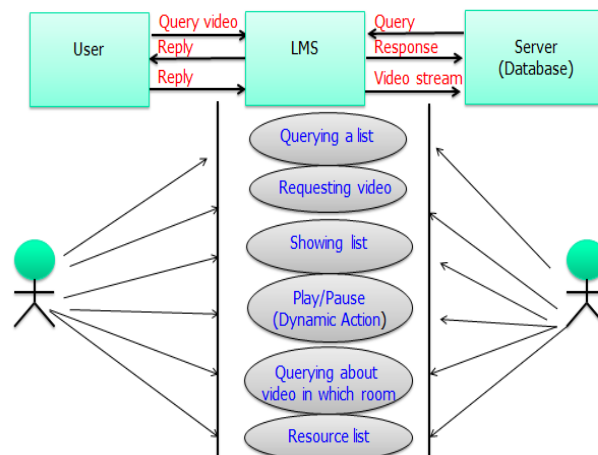


Fig. 2. Viewing of Rough Use Case diagram of the virtual reality in the educational systems.

View the walk through the main hall when you run this application script.

```
using UnityEngine;
using System.Collections;
public class walk : MonoBehaviour {
    public static int pointlar = 20;
    public GameObject[] points = new GameObject[15];
    Transform[] all_Point=new Transform[100];
    private Vector3 target_Pos;
    private int i = 0;
    public float speed_move = 5f;
    // Use this for initialization
    string intToStr(int a)
    {
        string s="";
        if(a==0)
            return "0";
        while(a!=0)
        {
            s = (char)((a%10)+'0') + s;
            a = a / 10;
        }
        return s;
    }
    void Start () {
        // tag point assignment
        string k;
        for (int j = 0; j < points.Length; j++) {
            k = intToStr(j);
            //k = (string)(j);
            Debug.Log(k);
            k = "point" + k;
            points[j] = GameObject.FindWithTag
            all_Point[j] = points[j].transform;
        }
    }
    if (distans < 0.5f){
        if (i < points.Length - 1){
```

```
i++;}
else {
    i = 0;    } } } }
```

Based on the experience of implemented development VR content in education can be noted that technology brings positive results when it is using by short sessions or as

simulators and trainers. It is inappropriate to use VR for lectures and seminars. In the development of software solutions should focus on the newest models of VR equipment, the most eco-friendly and ergonomic for a user. Hardware and software interface must be as simple as possible for users, especially for teachers.



(a)



(b)



(c)

DARS JADVALI									
Dars nomi	Xona	O'qituvchi	Kurs	Dars nomi	Xona	O'qituvchi	Kurs		
C++ dasturlash III	112	Soqiyev T	1	Darsni boshlash	Axborot kerakligi	301	Xasanov K	4	Darsni boshlash
Algoritmik asoslar	221	Ibrokova Sh	1	Darsni boshlash	Matematika nazariyasi	218	Masudov T	4	Darsni boshlash
Oliy matematika	304	Yashoboyev M	1	Darsni boshlash	Kompyuter tashkiloti	321	Axmedov F	4	Darsni boshlash
C++ dasturlash III	112	Soqiyev T	2	Darsni boshlash	Soni usul	111	Qarshiyev A	3	Darsni boshlash
Algoritmik asoslar	221	Ibrokova Sh	2	Darsni boshlash	Web dasturlash	310	Mamanazarov	3	Darsni boshlash
Oliy matematika	304	Yashoboyev M	2	Darsni boshlash	Operatsion tizimlar	311	Torov R	3	Darsni boshlash

(d)

Fig. 3. Testing models created with virtual reality applications. (a), the main view of the educational building, (b) laboratory room's project, (c) main entrance, (d) schedule table.

Conclusion. The educational software helped to take the Formal Language subject from classrooms to the computer labs, making the teaching or learning process more interesting and pleasant to the students, facilitating the teacher's work during the evaluation performance too. The advent of affordable and widespread virtual reality technology and the proliferation of smartphones capable of supporting augmented reality has opened incredible opportunities for improving the way that we learn. Students can now experience the topics they are learning about. Use of virtual reality technology has been shown to increase student engagement and focus, while the immersive and interactive environment encourages the students to become active learners.

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Разработка программного обеспечения для создания организационных моделей образовательного процесса виртуального 3D университета

Аннотация. Одна из основных проблем виртуальной реальности как инструмента обучения. В этой статье представлена модель, защищающая метафорический дизайн систем виртуальной реальности. Результаты этого исследования заключаются в следующем: виртуальная реальность виртуальной реальности, в настоящем документе рассматривается, как виртуальная реальность и расширенная реальность используются в образовании, и описывает, как можно использовать технологии виртуальной реальности и дополненной реальности для улучшения образования Самаркандского филиала Ташкентского Университета информационных технологий имени Мухаммада аль-Хорезми.

Ключевые слова: Виртуальная реальность для образования, визуализация знаний, умные уроки, электронное обучение, 3D, Blender, VRML. виртуальная лаборатория.

УДК 004.93

Мирзаев Н., Солижонов Ж.Д.

Юз тасвирини аниқлашда кадрлараро корреляцион таҳлил

Аннотация. Ушбу мақолада динамик объектни, хусусан, унинг юз тасвирини аниқлаш учун яратилган мавжуд усуллар таҳлил қилиниб, динамик объектлар ва улардаги юз тасвирни аниқлашга корреляцион функцияни қўллаш тадқиқ қилинган. Фотосуратлардан юз тасвирини аниқлаш мақсадида, юз тасвирларни, яъни матрицаларни (қатор, устун ва матрица бўйича) ўхшашлик коэффициентлари аниқланган ва уларни формулалар асосида ҳисоблаш келтирилган.

Калим сўзлар: динамик объект, юз тасвир, корреляцион функция, пикселлар фарқи, ўхшашлик коэффициенти.

Кириш. Тасвир кўринишидаги ахборотларни қайта ишлаш ва образларни таниб олиш йўналишидаги масалалар дунё миқёсидаги долзарб муаммолардан ҳисобланиб, уларни ҳал қилиш учун қўлаб ишлар амалга оширилмоқда. Биз қабул қилаётган ахборотларнинг 80% дан ортигини тасвирлар ташкил қилишини ҳисобга оладиган бўлсак, тасвирлар билан боғлиқ бўлган масалаларни ҳал қилиш қанчалик долзарб вазифа эканлигини англаб етамиз.

Сўнги йилларда бу йўналиш анча ривожланди ва замонавий информацион технологияларга асосланган интеллектуал тизимларнинг пайдо бўлишига сабаб бўлди.

Интеллектуал тизимларга қуйидагиларни мисол қилиб кўрсатиш мумкин:

- одамларнинг интернетда алоқа ўрнатиши (видеоконференция, консултация, почта);
- интернетда маълумотларни излаш ва уларга кириш учун рухсат олиш;
- интернет-маркетинг ва интернет-магазинларни ташкил қилиш;
- “Клиент-банк” тизими;
- киришни (маълумотлар базасига, дастур тизимига, биноларга ва х.к.) назорат қилиш;
- видеоназорат тизимларида шахсни юз тасвири бўйича таниб олиш;
- берилган юз тасвири бўйича маълумотлар базасидан шахсни излаб топиш.

Шу муносабат билан тасвирларни қайта ишлаш, хусусан, динамик объектлар ва улардаги юз тасвирни