

Mixed Reality in Smart Computing Education System

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Abstract— One of the technologies that has been showing possibilities of application in educational environments is the Mixed Reality (MR) comprising of both Augmented Reality(AR) and virtual Reality(VR), in addition to its application to other fields such as tourism, advertising, video games, among others. The primary reason for this research work is to depict and condense trials with production training and education applications utilizing mixed reality gadgets. The entry of new and further developed mobile devices opens up more opportunities for the applications to develop and be circulated. This paper tries to build upon the current state of mixed reality and its application in education. The first segment describes basic structure of mixed reality and its different parts. Following segments give a definitive structure of some experimental applications that were developed for the mixed reality, with the inference taken from the data of experiment done by the National university of Columbia on secondary school students and lastly, the paper shows the benefits of those applications over the traditional teaching methods and the basic user reactions to them.

Index Terms—Mixed Reality, Augmented Reality, Virtual Reality, Mobile Devices, High-End, Teaching-Learning Processes, Virtualization.

I. INTRODUCTION

Mixed Reality (MR) which includes Augmented and Virtual Reality (AR and VR) is an emerging technology and that is being driven and included in modern Education. The most noteworthy purpose behind the applications is that individuals discovered MR plays a basic and fundamental part in making the experience of any object virtually. In any case, MR gadget was excessively costly as of not long ago, the MR equipment is sufficiently cheap enough these days to be connected all the more widely [6]. Mixed reality is the result of blending the physical world. Mixed reality is the next evolution in human computer interaction (HCI) and hence unlocks possibilities by advancements in mobile technologies and new mixed reality devices. The term *mixed reality* was originally introduced in a 1994 paper by Paul Milgram and Fumio Kishino, "A Taxonomy of Mixed Reality Visual Displays." Their paper introduced the concept of the *virtuality continuum* and focused on how the categorization of taxonomy applied to displays. Since then, the application of mixed reality goes beyond displays but also includes environmental input, spatial sound, and location [4]. In real time applications, users concentrate on the both real and virtual conditions. Compared to the existing approaches, virtual reality compelled in the virtual environments. These interactions mimic our natural behavior

of interaction, such as objects getting bigger as you get closer and the changing of perspectives as you move around an object [3].

II. REALITY-VIRTUALITY CONTINUUM

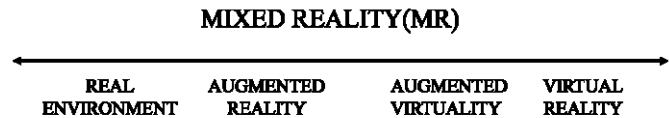


Fig. 1. Mixed Reality (MR)

Augmented reality (AR) is an emerging technology that is being driven and included into different environments education. In the Horizon 2017 report, which reported that performs to identify and describe emerging technologies that will have an impact on learning, teaching and creative research in education, the reality is highlighted increased as a key trend since 2016 for improve digital literacy. Augmented reality innovation has been utilized as a part of a few fields, for example, pharmaceutical, mechanical autonomy, fabricating, machine repair, flying machine reenactments, diversion, gaming and training. Enlarged the truth is an innovation that interfaces the PC world to the human world. Other than that, increased the truth is additionally characterized as an innovation that enables clients to see this present reality with PC created objects superimposed. As indicated by, at first, the enlarged the truth was utilized for military reason to build up a propelled pilot training program. These days, enlarged the truth is additionally executed in the instruction field [2].

A few investigations demonstrate that expanded the truth can improve the instructing and learning background. Coordinated increased reality in the instruction field draws in the student to investigate this present reality by utilizing media components, for example, writings, recordings and pictures as supplementary components to lead examinations of the surroundings. Increased the truth is likewise ready to expand the coordination of this present reality with advanced learning assets in three measurement (3D) frame. For instance, the utilization of expanded reality empowers student to learn troublesome logical wonders in Chemistry, for example, synthetic bond. Science is a reasonable subject that requires dynamic ideas for inside and out comprehension.

Thusly, expanded reality decreases the issue to comprehend the conceptual ideas by picturing the basic ideas of covalent helps to identify the objectives from chemical bond. The higher reality environment helps the students to obtain the planetary groups. Kerawalla et.al explains the function of virtual materials and helps to identify the objects in 3D shape.

Kaufmann et al. additionally found that virtual materials in 3D not just give students a true setting to team up, yet in addition uncover virtual 3D protest improve the comprehension of the points.

A. Virtual Learning

These days, video and PC amusements are generally utilized by the more youthful age and all cutting- edge video and PC recreations are incorporated with 3D advancements, for example, multiplayer internet diversions (MMOGs). The utilization of virtual learning Environment in instruction is making its stamp in light of the fact that virtual learning Environment builds cooperation and correspondence openings amongst instructors and understudies.

Virtual learning Environment enable instructors to direct educating and learning process for all intents and purposes and lead learning exercises which are hard to be executed in classroom. Virtual learning Environment additionally advances communitarian learning, and the key component for coordinated effort is social cooperation. The understudies can cooperate or speak with their companions in the virtual world and can share in gather exercises for all intents and purposes. Besides, virtual Environment likewise moves inventive learning techniques, which are appropriate for every person. Along these lines, understudies are alright with this learning design in light of the fact that as they can control their learning procedure in view of their pace.

III. MIXED REALITY DEVICES

The PC innovation has progressed impressively and one fascinating innovation is the use of virtual reality. With the assistance of virtual reality, we can mimic a fantasy of genuine or anecdotal universes, most usually utilizing uncommon virtual reality headset that is worn on the head. In the headset, the client can see a reproduced situation, as a rule showed on a stereoscopic show. Headset development is followed and the subsequent picture is adjusted relying upon the situation of the client in respect to GPS beacons.

MODEL	RESOLUTION	REFRESH RATE
MOBILE DEVICES	1920 X 1080	60Hz
OCULUS RIFT DK2	1920 X 1080	75Hz
OCULUS RIFT CV1	2160 X 1200	90Hz
HTC VIVE	2160 X 1200	90Hz

Table 1: Basic Device Comparison

Table 1 shows that comparison features of different models with the resolution models. The most widely recognized applications for virtual the truth are computer games. Be that as it may, there are likewise accessible business applications concentrated on specific fields, for instance, prescription. These are however costly or hard to get to. Our objective was to look at the alternatives of present day headsets for virtual reality and build up certain testing applications, concentrated on instruction [12].

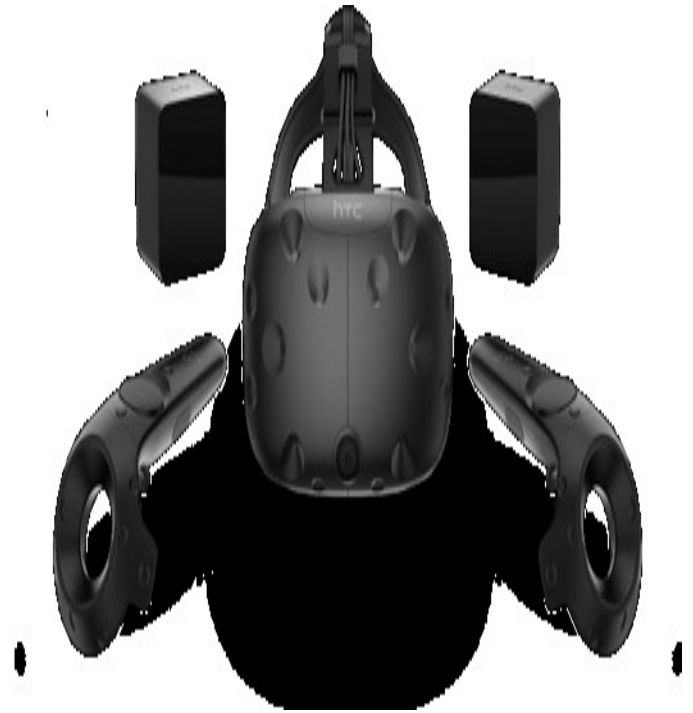


Fig. 3. Htc Vive VR Headset

A. Mobile Devices

Mobile learning is another pattern in the instruction field. In the previous decade, the innovation of cell phone has been upgraded from a straightforward mobile phone to a high innovation gadget with touch screen and different highlights, with in excess of 1.7 billion clients. Versatile learning gives community association and learning open doors for individual or gatherings. Other than that, portable adapting additionally gives data or information through versatile innovation, for example, the portable web at student's pace. This innovation is incorporated in the educating and learning process since portable learning is a compelling instrument for coordinate learning techniques available through cell phone, which gives availability of the substance and spares time, and need limitation to the learning condition. In this way, portable learning is more adaptable and accessible to various instructing and learning materials [7].



Fig. 4. Samsung Gear VR headset

IV. APPLICATION DEVELOPMENT

Application for virtual reality can be produced utilizing different devices. In the event that the objective is to accomplish a practical look, one suitable choice is to utilize an advanced diversion engine. An game engine is an instrument used to create present day diversions 3D and 2D applications. Most normal present-day Engines are:

- Unity 3D
- Unreal Engine 4

Both engines have their upsides and downsides, despite the fact that for our motivations we picked Unity. Fundamentally as a result of its help for the C# programming dialect and the simplicity of accomplishing a practically looking outcome. A case of the improvement condition in Unity 3D [9].



Fig. 5. Unity 3D Editor

These tools were selected for the benefits that offer to use without license payment for academic purposes and without profit [8].

V. TEST APPLICATIONS

A. Visualization of a maze in VR

The very first application was the visualization of the maze. Our goal was to enable the movement and interaction with a simple environment and the user reaction to the automatic movement was considered. For these purposes, a low resolution model of the maze was created.

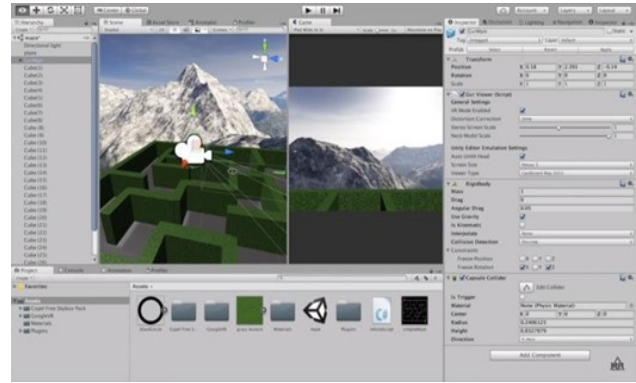


Fig. 6. Maze modelling in Unity 3D

For the visualization in the mobile devices Google VR Plugin for unity is used. Mazes are developed as 3D models and are made as rigid bodies which have to be stationary even when the object collides with it. Then the controller script of the person determines the movement pattern and movement mechanism. For the purposes of testing a simple movement mechanism was devised which initiates movement when the head tilt is more than 30 degrees and comes to a halt vice- versa. This demonstrates the specifications of interaction between the user and the surroundings.

B. Roman colosseum in VR



Fig. 7. Colosseum Model in Unity 3D

The main idea behind this experiment is to show the students how different animals move around in their respective environments.



Fig. 8. Interactive Dragon (Left Joystick) in AR

This experiment is carried out but using Vuforia Plugin for Unity 3D. It is a bookstore developed for support in the Implementation of applications with augmented reality, is compatible with a variety of 2D and 3D objects and provides a programming interface in C ++, Java, Objective-C and .NET. The RA applications developed with Vuforia are compatible with a wide range of mobile devices, such as iPad, iPhone and phones and tablets with Android 2.2 or higher.

First a database of images is created using the Vuforia web interface and the database is then uploaded in to the Unity editor. Then each 3D design of the animal is to be mapped with the respective image. The camera of the mobile device when focused on the particular image shows an augmented model of the given animal, in our case a red dragon [11]. This experiment can be further extended to multiple animals and the students can learn about the individual animal behavior patterns, food habits etc. This is not only limited to the animals but any creature which can be modelled and animated using Unity 3D and C# scripting [1].

VI. EXPERIMENTAL DATA INFERENCE

An aggregate of 103 assessments of the 35 visualizations were obtained. For this assessment we obtained the data provided by the national university of Columbia which utilized a configuration that considers four measurements educational, aesthetic, functional and content. Table 1 demonstrates the viewpoints to be assessed in each measurement, the scale for the assessment was from 1 to 5, being 5 "unequivocally concur" and 1 "firmly oppose this idea". The survey finished with three open inquiries in which could reflect positive and negative viewpoints found in experiment and extra perceptions to the procedure [14].

The methodology of test included a moment where the students did their interaction with the Visual Representations of the objects by using markers and mobile devices. Second, the students evaluated each visual object by means of a questionnaire. The data when calculated provides the following results.

Table 2: Deviations in Different Dimensions

Dimension	Average	Standard Deviation
Educational	4.43	0.47
Aesthetic	4.39	0.59
Functional	4.25	0.52
Content	4.12	0.61

As you can see the average for all dimensions is greater than 4.1. The best qualified dimension was the education with a value of 4.43 and the lowest score was the content with a value of 4.2. However, from the above can conclude that the Visualization of objects in Augmented Reality made that they made a pleasant interest to the target population.

VII. CONCLUSION

This research work discoursed the trend of technologies used in the education field. Other than that, this paper additionally talked about a portion of the qualities of every

innovation to be utilized as a part of the instructing and learning process. Learning condition and versatile learning in training field.

Other than that, we also obtained the data provided by the National university of Columbia and produced some detailed insights on the interaction between the Mixed Reality mobile application used by the students. The results have been extremely in favor of bringing the Mixed Reality based mobile applications in to the modern-day education system.

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