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Virtual reality and augmented reality technologies: A closer look

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ABSTRACT

Virtual Reality (VR) and Augmented Reality (AR) technologies are based on the creation of a completely new scene that cannot be touched by the bare hand but is sensually perceived through a combination of artificial visual and sound effects. Although the overall goal of these two technologies is similar, the artificial reality that can be created via VR or AR is not the same. VR is a computer-generated simulation of an alternate world or reality, primarily used in 3D movies and video games. Virtual reality creates a simulation that aims to close off the outside world or immerse the viewers, using computers and sensory equipment such as headphones and gloves. The HTC Vive, Samsung Gear VR glasses, and Google cardboard are some of the most popular devices used in VR. Virtual reality applications are not limited to entertainment and games only, but are also used in the field of education and medicine, for example, surgeons plan and train their operations, and it has also been used in the military field to simulate some military exercises under harsh conditions.

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INTRODUCTION

In the 21st century, "technology" has a significant role in various fields that include education considering that it becomes an information super-highway worldwide (Dela Fuente & Biñas, 2020). With the great technological development that has occurred in recent years, new terms have begun to appear on news and technical platforms more than before, and while we have become somewhat familiar with a concept such as artificial intelligence, other concepts still cause confusion, and talk about the concepts of Virtual Reality (VR) and Augmented Reality (AR).

There are many contents ready for you to start building realistic, immersive apps with augmented reality. The tutorial-style chapters will give you hands-on experiences using Apple AR frameworks and technologies like Reality Composer, RealityKit, and ARKit. The author and his colleagues' previous AR book, ARKit by Tutorials, was a collection of ARKit-specific projects for creating various real-world AR experiences. The book also focused on SceneKit as the primary rendering technology, replaces ARKit with tutorials to teach all available rendering technologies Apple has to offer. This does not only includes the new RealityKit but also SceneKit and SpriteKit too. The book includes a collection of fresh new projects for creating various real-world AR experiences (Videnov, et al., 2018).

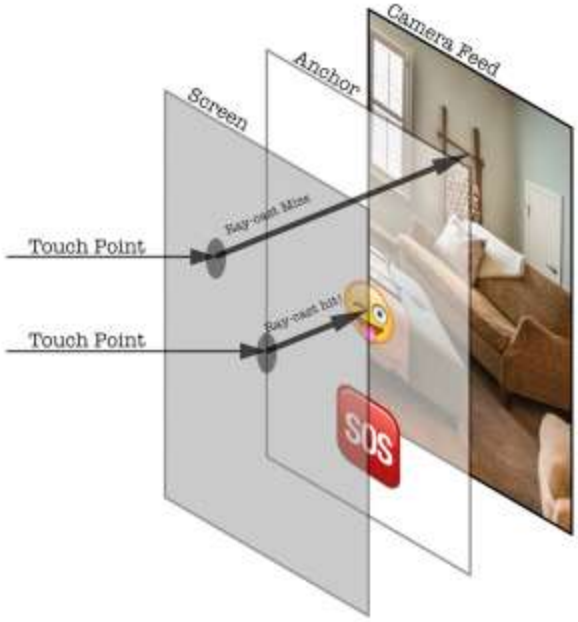

Figure 1. *ARkit*

The chapters underway to cover topics such as:

- ARKit & SceneKit: Find out how to use the power of SceneKit and ARKit together to create powerful 3D augmented reality scenes.
- ECS & Collaborative Experiences: Build a collaborative AR experience and learn how to create and manage a multipeer connection.
- Plane Anchors & Focus Nodes: Discover how to detect, manage and use plane anchors and focus nodes. Learn how to enable environmental mapping and add lights and shadows.
- AR Coaching Overlay & Billboards: Learn what it takes to add and use coaching overlays and billboards to your app for the purpose of helping on-board new users.

After reading this book, you will have a deep understanding of the technologies and frameworks used to create powerful, immersive AR experiences for the Apple platform. While the applications and technologies of

artificial intelligence are focused on providing higher capabilities for machines and computers around us to become more intelligent, virtual reality and augmented reality technologies focus on creating a completely new scene that cannot be touched by the bare hand, but is perceptually perceptible through a variety of artificial visual and sound effects. Despite that, that is, despite the similarity in the general goal that virtual and augmented reality technologies aim at, the new artificial reality that can be created through one of these two technologies is not the same, and our understanding and awareness of this artificial reality will not be the same through virtual and augmented reality (Farias, et al., 2011).

Virtual Reality

Let's understand it from a linguistic point of view: The word "virtual" originated in the fourteenth century AD, where this word was used to refer to the ability of something that does not have a real physical presence to represent something realistic and tangible, and this term continued to exist on the linguistic level until its widespread use In the field of software engineering from the middle of the last century until today to refer to technologies that are not present within the hardware but are present within the programs, and perhaps virtual memories are one of the famous examples of this(Kumar, et al., 2021).In this way, the use of this term has become synonymous with anything that can be perceived but does not have a real existence, and thus it has been applied to techniques that create a simulation of a non-existent world that may be partially or completely similar to the real world or not at all similar to it, so virtual reality is the field The technician concerned with creating a new reality and completely immersing the individual within this reality. This is done through the use of devices such as virtual reality glasses and their sensors, which display a new visual scene for the human being to move around and touch its components and interact with them fully.

HTC Vive glasses are one of the most famous and widely used virtual reality technologies in the gaming field, which relies on a powerful computer, two sensors, and a network of sensors that recognize the user’s movement and presence in the room to simulate his movement in virtual reality. Other types of less complex VR glasses can be used with smartphones directly, such as the Samsung Gear VR or Google's Daydream VR glasses, which rely on the smartphone's screen and processor to generate a virtual reality scene. Although this type of glasses is easier to use, it is of lower quality, the processing power provided by a desktop computer with discrete graphics cards and a large amount of high-speed random memory will be much better than the processing power that any smartphone can provide (Kumar, et al., 2021). The uses of VR goggles are not limited to gaming; It extends to include educational applications such as conducting anatomy and physiology lessons on a virtual body instead of human cadavers that are usually relied upon in medical schools, or even for surgeons to plan and practice their operations or make a virtual travel trip to see what the real trip will be like, and finally in the field the military; It can be used to simulate some military exercises under extreme conditions(Mollet & Chellali, 2008).

Figure 2. *Virtual Reality*

Augmented Reality

Instead of creating a new reality that is intangible and doesn't have any real physical components, we can do a few things that make the scene we see in front of us better: say we want to imagine a piece of furniture in our house. What if we could create a fake image of it that we could interact with and move it around in the room to see how it would appear? Or to remember something more exciting: the famous Pokemon Go game that swept the smartphone game market, which allowed users to chase Pokemon everywhere, even though they - that is, the Pokemon - did not exist in real life, but only on the screen of the smartphone depicting a real scene. Let's forget all that and go back to a simple example that we used at least once: the filters we use in Instagram and Snapchat apps are a form of augmented reality (Cwierz, et al., 2020).

Figure 3. *Human Interior Body AR*

These examples express the concept of augmented reality, which means introducing virtual elements to the real scene that we see in front of us, and thus we will obtain a new reality consisting of physical components that we can touch with our hand, and virtual components that we can perceive their presence and interact with, but we are unable to touch them. This is what the international furniture company IKEA has invested in, which provides users with an innovative way to help them choose the furniture and furnishings that best suit them, through an augmented reality application called IKEA Place, which allows choosing a specific product and watching its placement within the room, With the ability to move and rotate it (Cwierz, et al., 2020).

The augmented reality scene will be here on the smartphone screen, not through wearable glasses as it is in virtual reality. One of the most famous examples of augmented reality technologies that got a lot of buzzes is the Google Glass project, which represented the best visualization of what augmented reality technologies can provide and how to integrate them into our daily lives, despite not being able to achieve its goals and develop it as a salable product on a large scale. The spread of augmented reality applications has increased dramatically in recent years thanks to the support it has received from smartphone manufacturers, both in hardware and software terms, as Google launched the ARCore package to help developers launch augmented reality applications on smartphones Operating on the Android operating system, as well as for Apple, which has previously launched the ARKit package for the same purpose but is intended for smartphones of the iOS operating system(Li, et al., 2007).

Differences of Augmented Reality and Virtual Reality

Now, after the previous brief presentation, we can understand the most prominent differences between virtual reality technologies and augmented reality. Virtual reality means creating a new scene that does not have a physical presence, but rather appears through software processing, while augmented reality means creating a new scene that includes reality with its physical and sensory components in addition to software components that help improve it, enhance it and make it more efficient to accomplish a task. Virtual reality is described as a technology with full immersion, meaning that the user will be completely immersed in the artificial scene and its various effects to appear as if it were real. On the other hand, augmented reality is described as a technology with partial immersion, meaning that the user will be surrounded by artificial scenes in addition to the real reality in which we live. As for interacting with the real world, through virtual reality technology, the user will be completely isolated from the real world, meaning that everything he sees, touches, and moves will be objects, objects, and objects present in the artificial reality that he watches through virtual reality glasses. In the case of augmented reality, the user will not be isolated from the real world but will remain in contact with it. In this way, virtual reality can be understood as a technology that replaces our physical reality with an artificial digital one, while augmented reality

technology creates a new reality based on the integration of scenes from an artificial digital reality with the real world.

In terms of technical requirements, the process of creating a virtual reality experience requires the possession of additional tools, and the simplest forms of these tools are virtual reality glasses that can be used with a smartphone without the need to connect them with any other external hardware, and the complexity of the tools increases with the increase in the complexity and details of the scene that will be seen The individual in virtual reality and the abilities to interact with it and with its components. In the case of augmented reality, it is less complex and demanding than virtual reality; it is enough to own a smartphone, for example, to get different augmented reality experiences, from filters from social media applications to productivity tools provided by companies such as Ikea (Kim, 2010).

Figure 4. *AR versus VR*

Virtual reality tools and devices

a) Head-wearing devices (HMD)

It is similar to a mask or a helmet and is equipped from the inside with one or two small screens to display monochrome views or hear effective sounds (stereo). The individual can see what the program displays through the mask or helmet, and he can also view objects in their three dimensions, or it may be a complete cover for the head as He can see and hear at the same time (Ghosh & Bhuiyan, 2019).

Figure 5. *HMD*

b) Tactile gloves

They are sensors that cover the whole hand and generate an active interaction between the user and the virtual environment of the application to sense touch and feel the temperature for example, and they also have the ability to create a sense of the real environmental conditions.

Figure 6. *Gloves*

c) Motion sensing

This technique depends mainly on a special suit worn by the actor, on which white dots are placed in the articular sites (such as the wrist, elbows, ankle, knees), and these points are also placed on his head and face, and a pair of video units follow the movements of these points (where each point is defined through a special computer program) and linking it to similar points on a virtual character that is configured in the computer, and through powerful computer processors and complex programs, the virtual character is moved with very realistic movements using different clips recorded from the movement of the real actor, and this process is known as Performance Animation. In some applications, the movement of the actor's head, face, eyes, and mouth are simulated by a virtual speaking character. The performance animation aims to achieve rapid and accurate character building in the virtual world, and this method has been used recently in the production of many films such as Trial or. NS. Simpson contained a "performative animation" of what supposedly happened at the scene of the crime.

Figure 7. *Motion Sensing*

d) Omnidirectional BOOM

The omnidirectional endoscope BOOM developed by Fakespace is a screens and optical system combined with a box connected to a multi-connection arm, and when the user looks through the holes in the box, he sees the virtual world, and he can direct the box in any direction allowed by the processing capacity of the tool, and the head tracking process is done through Sensors in the connections of the arm that holds the box.

Figure 8. *Boom in VR and AR*

e) Assistive devices

A variety of assistive devices in virtual reality, for example, the joystick, mouse, and keyboard. In general, the input devices for virtual reality programs are in constant development, as some auxiliary devices have recently appeared in the market, such as the comment ball, the three-dimensional joystick, the navigation stick, the head of the heel, and so on, all of which are auxiliary devices for virtual reality applications.

f) Computer system

There is no doubt that virtual reality mainly depends on the computer, but to reach a complete sense of the reality of virtual reality, a computer system with high specifications is required. Geometric shapes are generated in a distinctive way that shows data and information artistically and wonderfully similar to virtual reality.

g) The nano-manipulator

The nano-manipulator includes a pointing machine that looks like a steering stick, and this machine is connected to a personal computer equipped with a highly advanced graphic card, which converts the microscope data to display it in the form of a three-dimensional image of multiple colors, and this precise sensor enables

scientists to touch and feel the features of the small things they are studying Scientists have felt the small edges and gaps in the protein molecules and the viscosity of some types of pathogenic bacteria.

Figure 9. *Nano Manipulating*

h) Virtual worlds

The Internet is also a virtual reality tool, and in many ways, one of these ways is the virtual world, and the second life is an example of the virtual world. Classification of the virtual experiments and applications that were used for education according to the following categories: Educational virtual games; Virtual theatre; The virtual lab; Virtual Museum; Virtual educational environments (Virtual classrooms, training halls, science circles, study libraries, virtual universities and scientific conferences); The virtual garden; Virtual space and aviation; Virtual factories and virtual vocational training institutes; Virtual Courts and Virtual Felonies and Virtual medical operations (Ghosh, et al., 2019).

CONCLUSION

The greatest benefit from such experiences is that it eventually led to the development of “mixed reality” glasses, which are glasses that combine virtual reality and augmented reality, meaning that they photograph actual reality through a camera, and then add models and models through the glasses within an environment. A buffer is similar to that provided by virtual reality technology. As for augmented reality applications, both the main stores for the Android and iOS operating systems are full of a large number of applications compatible with the technology, and once you type the letters AR in the search box in any of the two stores, you will find a great variety between these applications, and the Internet is full of many lists that determine the best Augmented reality apps and games, all you have to do is bring your phone that supports the app, download any of these apps and games and try them out. Now you can decide whether virtual reality solutions and applications are suitable to achieve any of the marketing and development goals of your business to reach the desired growth rate in light of the increasing competition daily and the availability of many alternatives or not and determine the aspects and tasks that you can exploit the advantages of virtual reality technology To improve and careful research to choose the most suitable professional company specialized in providing virtual reality (VR) solutions and applications.

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