RESEARCH ARTICLE

Virtual Reality and Augmented Reality: Its Impact in the Field of Accounting

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Virtual-Reality and Augmented-Reality technologies are forming a new environment in accounting, where actual and virtual elements are combined at various levels. The possibilities of Virtual Reality and Augmented Reality (VR/AR) technologies in supporting the dynamics of global accounting systems and addressing the grand impact on accounting were examined in this study. This research looked into the uses, applications, and benefits of virtual reality and augmented reality in accounting, as well as the potential constraints. This article aims to provide a better understanding of how new technologies affect accounting. It explains the applications, benefits, and limitations of virtual reality and augmented reality in accounting, as well as how it has made accounting easier. The paper finishes with a discussion of theoretical and managerial consequences, as well as a research agenda for the future.

ABSTRACT

Keywords: *Virtual Reality; Augmented Reality; Field of Accounting*

1. Introduction

The computer-generated simulation of a situation that connects the user, who perceives it via one or more of the senses (mostly vision, hearing, and touch), and interacts with it in a way that appears to be genuine is known as virtual reality (VR) (LaValle, 2017; Sherman & Craig, 2002).

Head-mounted displays (HMDs), cubic immersive spaces (CAVE), huge screens (power walls), mobile devices (smartphones, tablets), or desktop and laptop computers can all give VR experiences, which are occasionally supplemented with various devices for either simulation or tracking.

Augmented reality (AR) is a type of virtual reality in which digital devices are used to overlay additional sensory information (sounds, objects, avatars, graphics, labels, and so on) over the real world. This gives contextual information that improves the aesthetic, usability, and pleasure of the site, as well as provides a more interactive experience. The difference between VR and AR is that VR generates a reality experience entirely based on virtual data, whereas AR enhances the perception of the real world with additional computer-generated data (Carmigniani, 2011)

Technological advancements in digital displays, motion sensors, computer vision, and computation have fueled the rapid expansion of VR applications in accounting. VR has become far more immersive and engaging for consumers as a result of these advancements. According to Gartner (2018), virtual reality is one of the top ten strategic technologies that will evolve through 2028. The global market for virtual reality applications is presently valued at roughly US$14 billion, with even conservative projections predicting that it will reach US$50–60 billion in 3–5 years.

Virtual Reality and Augmented Reality techniques and technologies create virtual settings that share many of the same qualities as our physical surroundings. Viewing and interacting with three-dimensional objects is more realistic than abstract mathematics and two-dimensional representations of reality.

In the coming years, virtual and augmented reality will drive increased automation in the accounting and financial fields. As a result, VR and AR will make inventory, invoicing, customer management, stock auditing, and other duties more efficient. The purpose of this chapter is to evaluate the possibilities of Virtual Reality and Augmented Reality (VR / AR) technologies in supporting the dynamics of global accounting systems and in dealing with the massive impact that unexpected events can have. Due to the introduction of virtual reality and augmented reality in accounting, there have been many changes in how businesses conduct their everyday company operations and how their strategies have altered as a result of increased business competitiveness. This has had an impact on many businesses and has resulted in fierce corporate competition on a local, national, and worldwide scale. Businesses that have used virtual and augmented reality well have experienced significant benefits in their operations.

In the realm of accounting, VR and AR have brought in a slew of new players, including auditors, financial management, operational employees, bankers, and investors, to name a few. Many businesses in the professional services industry have been revolutionized as a result of it. Virtual and augmented reality have progressed in several areas, including techniques, computer hardware, programming languages, and data sources. The most significant impact VR and AR have had on accounting is in the areas of inventory, invoicing, stock auditing, and much more.

Virtual Reality

The term "virtual reality" refers to a digital environment in which users are immersed in a simulated environment. Virtual reality (VR) is a computer-generated artificial environment of pictures and sounds that is influenced by the actions of the person experiencing it. Instead of being a spectator, virtual reality makes its users a part of the experience. Instead of looking at a screen, the user will be engaged in the experience and will be able to interact with the characters and flip through the various options accessible in 3D forms. To generate a virtual environment, VR mostly relies on aural and visual effects.

Virtual reality grew in popularity at this time, particularly in the 1990s, but it quickly faded due to a large gap between consumer expectations and technological limits. "Virtual realities," "immersive multimedia," "artificial reality," and "computer-simulated reality" are all terms used to describe virtual reality. The word "cyberspace" is a synonym for "virtual reality," according to a dictionary definition, however, the two terms are fundamentally distinct (something that is "virtual" does not necessarily need to rely on a network, for instance). "Augmented reality" and virtual reality share certain similarities (or AR). Virtual reality is the creation of a virtual environment that is presented to the senses in such a way that we feel as if we are physically present in it. It achieves this purpose

through a variety of technologies and is a technically challenging effort that must take into account, perception and cognition. It can be used for both fun and serious purposes. The technology is getting less expensive and more widely used. The gadgets used in virtual worlds play a significant part in the construction of good virtual experiences from a technological standpoint. A device such as Input devices, which can range from a simple joystick or keyboard to a glove that captures finger motions or a tracker that captures postures, allow the user to communicate with the virtual environment. More specifically, the keyboard, mouse, trackball, and joystick are simple desktop input devices that allow the user to issue continuous and discrete commands or movements to the environment. Tracking devices such as bend-sensing gloves that capture hand movements, postures, and gestures, pinch gloves that detect finger movements, and trackers that follow the user's movements in the physical world and translate them into the virtual environment are examples of other input devices. The output devices, on the other hand, allow the user to see, hear, smell, and touch everything that occurs in the virtual world.

As previously stated, visual devices provide a wide range of options, ranging from the most basic or least immersive (a computer monitor) to the most immersive (VR glasses, helmets, HMD, or CAVE systems). Additionally, audio, speaker, and haptic output devices can activate bodily sensations, resulting in a more realistic virtual experience. Haptic devices, for example, can trigger the user's touch sensations and force models. The head-mounted display is the most immediately recognizable component of Virtual Reality (HMD). Humans are visual creatures, and the display technology that separates immersive Virtual Reality systems from standard user interfaces is frequently the most significant distinction. CAVE automatic virtual environments, for example, actively project virtual content into room-sized screens. Consumer and industrial wearables are the wild west, while they're enjoyable for individuals in colleges and big labs. The future of wearables is unfolding, but it is yet uncertain, thanks to a plethora of developing hardware and software alternatives. HTC Vive Pro Eye, Oculus Quest, and PlayStation VR are leading the way, but Google, Apple, Samsung, Lenovo, and others may surprise the industry with new levels of realism and usability. Whoever wins, the ease of purchasing a helmet-sized gadget that can be used in a living room, office, or factory floor has propelled HMDs to the forefront of Virtual Reality technology.

Augmented Reality
The origin of augmented reality, as we know it, is traced back to Sutherland's work in the 1960s, which employed a see-through HMD to display 3D visuals. However, it has only been in the last decade that enough work has been done to classify AR as a scientific field. AR has been defined as a variation of VR (Azuma, 1997). Azuma released a survey in 1997 that defined the topic, described various challenges, and summarized the previous developments. AR's progress and growth have been remarkable since then. Several AR conferences, such as the International Workshop and Symposium on Augmented Reality, the International Symposium on Mixed Reality, and the Designing Augmented Reality Environments workshop, began in the late 1990s.

Augmented reality (AR) is a game-changing technology that seamlessly blends digital data with the physical world in real-time. In layman's words, it supplements the real world by adding virtual elements to it. Augmented reality (AR) is a technology that superimposes or overlays a computer-generated image over a user's perspective of the actual world, resulting in a composite view. AR started as a kid's game, but it quickly grew in popularity among people of all ages. AR became a trendsetter with the popular mobile gaming app Pokémon Go, putting it on the hi-tech map. The rest, as they say, is history, with fast-paced developments aimed at providing engaging and immersive experiences across a variety of verticals, platforms, and devices.

Augmented reality is now a reality, allowing companies to go above and beyond with innovative and customized applications. Whatever the industry, AR technology can help incorporate innovation into goods, processes, and services to deliver unrivalled customer experiences. AR can accurately help in design, development, marketing, customer service, and decision-making in a fast-paced setting, regardless of location or region. AR may be a long-sought-after solution, as it is a technology that can be used anywhere and at any time to create captivating experiences on the web and mobile devices.

The Application of VR and AR in the Field of Accounting
With the introduction of the next generation of augmented reality (AR) accounting software, the accounting profession is about to take a big step forward. Accountants and accounting software, on the other hand, will have access to more than just data. They'll have vital insights and the capacity to integrate data fast to grasp the organization's implications.

Inventory, invoicing, customer management, performing audits, financial statements preparation, and teamwork are likely to be used in VR and AR in the field of accounting, as explained mentioned below.

Inventory: Checking inventory for bulk orders or updating real-time inventory is still a time-consuming operation. In real-time, VR will inform accountants about the state and worth of inventories. In addition, virtual reality will lower the cost of physical inventory and shipping. With a flick of the finger, the buyer can see new goods and their specifications. This not only improves the consumer experience but also saves the company money on inventory costs.

Integration: Accounting will become more accessible to its consumers as Artificial Intelligence is included. Accounting, according to VR experts, will be more accessible through social media sites such as Facebook Messenger or Slack. Accounting can also be accessed through Siri, Alexa, and other virtual assistants. Customers and the business will be able to communicate freely with each other using this way. It will, nonetheless, aid in the discovery of new apps and the initiation of a speedy response to any form of financial query.

Cash is becoming a relic of the past: Virtual reality is making and upgrading the transactional parts of the accounting business a highly natural process. If a firm wants to keep its clients, payment convenience is critical. Customers are more likely to return to businesses that accept a variety of payment options, such as credit cards, debit cards, and other forms of payment. The VR will enter the transaction straight into the accounting systems once the payment has been transferred. This makes auditing more efficient and information available in real-time. As a result, account reconciliation and finalization will be a simple and rapid process.

Remote Work: Virtual reality will allow accountants to work from anywhere on the earth. It provides users with experiences to increase operational efficiency from its staff in any part of the world. Whether it's a team gathering, a training program, an award presentation, or performance recognition, VR will make it a gratifying experience for the remote employee.
Virtual reality is on its way to becoming a critical component of any company. It offers its consumers a unique and far-reaching experience. Finally, virtual reality has the potential to shrink the planet by allowing businesses to access an efficient workforce or secure clients from anywhere in the world.

Financial Statements Preparation
Financial statements and other reports can be time-consuming and stressful to deal with. There is a good chance one could make a mistake. Augmented reality accounting can improve overall productivity while also securing the entire process. Accountants consider journal and ledger entries while generating financial statements. The procedure entails managing a large amount of data, evaluating it, and entering it into a computer to generate statements. Although there are accounting solutions to manage such accounting procedures, which can boost productivity to a certain extent, there is still a risk of data inconsistency because data visualization is not immediately accessible or well-organized. However, using 2D and 3D formats, Augmented Reality can successfully solve data visualization. Instruct the machine by gestures or voice commands to project information on the screen. Easily manage data with just a finger swipe to extract needed information.

Performing Audits
Every industry is required to conduct audits. When it comes to auditing, technology plays a big part, and AR has a lot of applications to offer. Auditing is a complex and time-consuming process. Internal audits are simple to conduct, but external audits take a long time to complete. Data must be scrutinized for conformity with government rules and regulations by an accounting team using systemized methods and a checklist. However, augmented reality accounting has the potential to radically change the auditing scenario. All of the inspection work will be done by a specified set of commands, and checklists can be managed with voice commands.

Teamwork
Accounting software allows communication with employees consistently, whether they work remotely or on the same premises. AR integration ensures a smooth workflow and high levels of engagement. Accountants can communicate information via chats and video conferences, monitor performance, do computations, and interact with clients using software solutions. Employee decision-making capacities will be aided by AR. Employees may discuss work in real-time from multiple locations, organize, project 3D simulations, and evaluate data in 3D formats with the help of AR projections. AR is poised to alter the future while also influencing current technology.

The Benefits of VR and AR in the Field of Accounting
VR and AR technology has advanced significantly, and their applications are now extending to a wider range of accounting firms and industries. This technology may appear to be costly to use, but by exploiting the many competitive benefits, it may cut expenses, increase operations' performance, and produce a higher return on investment (ROI) for all the business projects in accounting.

This section will shed more light on the benefits of virtual reality and augmented reality in accounting, as well as how these technologies can digitally expand an organization.

Leading brands create VR accounting experiences for a variety of reasons, including engagement and inspiration. With these virtual reality business benefits, accounting firms will be at the cutting edge of technology and will attract customers' attention.

Because virtual and augmented reality have the customized qualities of social media platforms, yet users can experience the material in an immersive, engaging way from a first-person perspective, they are the trending channels for growing brand recognition. Accounting firms will gain from this because it will raise brand recognition through social media sharing. By utilizing the power of AR and VR, even new brands may significantly increase their online visibility. Users may easily and quickly share their experiences on social media networks when they use AR and VR applications. This can spread even more excitement if their friends and relatives become interested in checking out the brand as well.

Web and social media analytics are integrated into augmented and virtual reality solutions. This is quite useful in determining consumers' preferences and behaviour in different accounting units or firms. The possibilities are unlimited if a comprehensive insight is acquired through analytics. Knowing users' diverse tastes provides solutions to ignored user-end problems, which is beneficial in the refining target market, strategy, reach, etc.

The quality of VR/AR stands out in implementing learning amongst accounting students in the university where learning with VR/AR is more explicit compared to classroom learning. Students in colleges are taught how to visualize data since it is a vital tool for traders to use in accounting to assist them to make key judgments regarding wealth management, especially as accounting businesses get more sophisticated and there is more data to analyze. For an instance, Salesforce uses Oculus Rift to create an immersive 3D environment for analyzing data. With the said VR/AR technology, students get to gain more insight with this experience to explore data visualization in accounting. The use of these tools will make accounting among learners much more interactive and create deep impressions on the minds of the students. This will make accounting more effective because the students will find it easy to remember or retain new concepts.

The most interesting benefit of VR and AR in accounting is that they can perform functions ranging from taking stock of inventory to hosting virtual conferences. It allows users to immerse themselves in an environment with a vast amount of synthesized data that is presented simply and understandably. By using VR/AR technology, there will be less paperwork and more productivity. Keeping track of paperwork and maintaining physical books can be challenging and time-consuming but when it comes to the use of VR/AR in accounting services, the use of these technologies maintains and update every detail of records within one type of software and provide a dashboard for assessment.

The Limitation of VR and AR in Accounting
One of the most feared consequences of augmented reality is the loss of privacy. Because AR technologies can observe what a user is doing, the user's privacy is jeopardized. AR collects a lot of data about who the user is and what they're doing - much more than social media networks or other forms of technology, for example. The potential loss of privacy if hackers get access to a device is enormous. Hackers can use advertising to inject malicious content into AR applications. Unsuspecting users may click on advertising that directs them to hostage websites or malware-infected AR servers with shaky images, putting AR security at risk.

Hackers could acquire access to a user's augmented reality device and record their actions and interactions in the AR world. They may later threaten to publicize the recordings unless the user pays a ransom. Individuals who do not want their gaming and other AR interactions made public may find this unpleasant or distressing. Criminals may also be able to steal network credentials from Android-based wearable gadgets. Hacking could be a cyber concern for merchants who utilize augmented reality and virtual reality shopping apps. Many clients' card information and mobile payment options are already stored in their user profiles. Because mobile payment is such a flawless process, hackers may be able to acquire access to them and deplete accounts invisibly.

Denial of service is another possible AR security threat. Users who rely on AR for work, for example, can find themselves cut off from the information stream they're receiving. This would be especially troubling for professionals who rely on technology to do their jobs in dangerous settings when a lack of access to information might have significant implications.

The crucial limitation of Augmented reality is unreliable content. AR browsers facilitate the augmentation process, but the content is created and delivered by third-party vendors and applications. This raises the question of unreliability as AR is a relatively new domain, and authenticated content generation and transmission mechanisms are still evolving. Sophisticated hackers could substitute a user's AR for one of their own, misleading people or providing false information. Various cyber threats can make the content unreliable even if the source is authentic. These include spoofing, sniffing, and data manipulation.

There are still limitations with AR technology that needs to be overcome. AR system has to deal with a vast amount of information in reality. Therefore, the hardware used should be small, light, easily portable, and fast enough to display graphics. Also, the battery life used by these complicated AR devices is another limitation of AR uses. Also, AR tracking needs some system hardware such as GPS to provide accurate markers, ask them to be both accurate and reliable enough. These hardware obstacles need to be resolved for practical AR use. AR systems usually obtain a lot of information and need software to filter the information, retain useful information, discard useless data and display it conveniently.

Because VR is limited to closed spaces and does not entail interactions with the actual world, it poses a different set of security risks than AR. Regardless, virtual reality headsets block the user's whole field of vision, which can be harmful if the gadget is hacked. They could, for example, modify content to make the user dizzy or nauseated.

VR, like AR, is concerned about privacy. The very personal nature of the obtained data, such as iris or retina scans, fingerprints and handprints, face geometry, and voiceprints, is a major VR privacy concern. Finger tracking is an example; in the virtual world, a user might utilize hand motions, in the same manner, as they would in the actual world, such as typing a code on a virtual keypad with their fingers. However, doing so necessitates the system recording and transmitting finger tracking data demonstrating fingers inputting a PIN. An attacker who obtains this information can duplicate a user's PIN. Eye-tracking is another example; eye-tracking may be included in some VR and AR headsets. Malicious actors could be able to profit from this information. Knowing exactly what a user is looking at could give an attacker important knowledge that they can use to duplicate human activities.

Because everyone moves in their way, it's nearly impossible to anonymize VR and AR monitoring data. Researchers have identified users with a high degree of precision using behavioural and biological information collected in VR headgear, posing a serious threat if VR systems are compromised. VR and AR tracking data should be considered 'personally identifiable information (PII)' in the same way that zip codes, IP addresses, and voiceprints are. Other parties can use it to distinguish or track an individual's identity, either alone or in combination with other personal or identifiable information, hence it qualifies as PII. As a result, virtual reality privacy is a serious issue.

Attackers may also introduce features into virtual reality platforms to trick users into divulging personal information. This, like AR, opens the door to ransomware assaults, in which hostile actors damage platforms before demanding a ransom.

Machine-learning algorithms allow for the manipulation of sounds and films while maintaining a realistic appearance. If a hacker gains access to a VR headset's motion-tracking data, they can use it to generate a digital replica (also known as a deepfake) and so compromise VR security. They could then overlay this on another person's VR experience to carry out a social engineering attack. Apart from cybersecurity, one of the most serious limitations of virtual reality is that it entirely cuts off a user's visual and auditory connection to the outside world. It's always a good idea to start by assessing the physical safety and security of the user's surroundings. This is also true in augmented reality, where users must be aware of their surroundings, especially in more immersive contexts.

Conclusion

The primary motive for incorporating virtual reality and augmented reality into accounting is to improve user perception and cognition of the complexities of accounting market systems and manifestations. Because of its advanced visualization approach and metaphoric representation that imitate real-world events, virtual and augmented reality is being used in accounting systems. Like VR, Immersive multimodal engagement, which incorporates vision, spatialized audio, and haptic sensation gives the user the illusion of being in a real-world accounting system. Users are presented with layered scenarios and are required to produce solutions while considering multicriteria effects. They can experiment with several tactics in a virtual environment to aid decision-making and lessen the danger of making a mistake in real-world accounting trading situations. Accounting can define market strategies, take actions in financial statement preparations, perform audits, and inventory, among other things, using VR/AR technology. It can also perceive the consequences of decisions made with a high degree of visualization, increasing awareness of the complexity and unpredictable events that can occur in the real accounting system. There are several reasons to be optimistic about VR/prospects. AR's first, huge corporations continue to invest heavily in VR/AR for mass-market applications, while start-ups continue to innovate; VR is thus expected to become a fundamental part of the marketing landscape. Second, academic and research institutions are increasingly equipped with VR, and accounting and consumer research on VR, or employing VR, is steadily rising. We believe that this article will provide accountants and accounting researchers with insights into the impact of these technologies (VR/AR) on accounting systems, allowing them to identify and answer important research questions. Accounting needs to better use 3D/ VR/ AR technologies, as keeping track of debtors and creditors gets more difficult and as accounting grows larger.

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