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Analysis of the Feasibility of VR Metaverses and Examining its Societal and Health Ramifications - A Survey

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ABSTRACT
Throughout this journal, we aim to highlight the existing problems that plague modern Metaverses, discuss at length the paradigm shift society at large might face upon the widespread utilization of VR spaces by the general public, and discuss solutions on how to make Metaverses financially viable. Additionally, we will be touching upon the features that, if implemented, will help unveil the infinite potential of Virtual Reality.
Keywords : VR-headsets, Economics in the metaverse, Photo-realistic graphics, neuralinks for maximum immersion.

I. INTRODUCTION

Imagine a virtual world where billions of people live, work, shop, learn and interact with each other -- all from the comfort of their couches in the physical world. In this world, the computer screens we use today to connect to a worldwide web of information have become portals to a 3D virtual realm that's palpable -- like real life, only bigger and better. Digital facsimiles of ourselves, or avatars, move freely from one experience to another, taking our identities and our money with us. This is known as the metaverse and, hype notwithstanding, it does not exist today . What are enterprise leaders to make of a fast-evolving, hyped-up concept that could fundamentally change how humans live? This in-depth guide to the metaverse breaks down where this nascent technology revolution stands today and where it is headed. Topics include the technologies and platforms that support the metaverse, its benefits and challenges, how to invest in it, its history, why the metaverse is important and its impact on the future of work.

1. Neuralink: Neural links are implants that could give users the ability to bypass their senses to virtually simulate vision, touch, taste, and effectively their entire perception. Its application in Metaverses can add to a user's immersion and better his/her experience to an unprecedented degree.

2. Economics in the metaverse: Expected to be a customer- first economy with numerous franchises preparing for the possibility that these VR verses will become a space where one will be able to go shopping, play games, meet friends, attend concerts, work and generally build a virtual life.

3. VR: A virtual reality headset is a heads-up display (HUD) that allows users to interact with a simulated environment and experience first-person view (FPV). A VR headset replaces the user's natural environment with virtual reality content such as movies, games, and prerecorded360-degree VR environments.

4. Photo-realistic graphics: Photorealism takes computer graphics to a higher level by making them look hyper-realistic. Technically, this includes high-resolution rendering, AI upscaling, and ray tracing to deliver sophisticated, realistic graphics while maintaining a steady FPS (frames per second) count.

II. RESEARCH ELABORATIONS

How can it be more immersive?

VR Immersion aims to enhance one's experiences and satisfaction in the virtual space. Immersion is achieved within the confines of existing technology via the use of,

1. Augmented reality: AR refers to technologies that add a simulated layer of information on top of the real world. This technology can enhance existing VR verses by providing an interface with the real world.
2. Digital twins: Digital twins are near-exact virtual models of real-life objects, processes, or systems. They strengthen infrastructure performance and automation.
3. 360 contents: This allows for a 360-degree viewing angle of the VR world around a user. It's a must for an all-around immersive experience.
4. Photo-realism: If the VR world bears a striking resemblance to our real world, then users will be more inclined to revisit this VR verse as it emulates the look, texture, and physics of our world. What are the health issues associated with the prolonged use of VR?

Virtual reality exposure can cause sensory system disruption and by these LED panels can cause epileptic seizures in vulnerable persons. Many users of virtual reality report eye strain, headaches, and, in rare cases, nausea. Experts believe this is because of how VR impacts the eye-brain relationship. In real life, our eyes automatically converge and focus on a point in space, and our brain has become so accustomed to this that it has linked the International Journal of Scientific and Research in Science, Engineering and Technology 3 two reactions. Virtual reality isolates them, which confuses the brain. In a virtual environment, the way we see and interact changes because we may be projecting something far away onto our eyes but is only a few inches distant. Science refers to this as the "vergence-accommodation conflict," and it is unclear how significant it is. Prolonged use can lead to chronic health issues like Gorilla Arm Syndrome and rotator cuff injuries. Heavy users of virtual reality headsets can experience strain on the cervical spine thus risking increased neck strain.

How to prevent escapist tendencies and detachment from reality from taking hold?

Prolonged use of VR has increased the dissociative experience of many (depersonalization and derealization). The appeal of VR to many lay in how it provides an escape from the harshness of reality. If not moderately, one might risk living vicariously through their VR persona.

III.FINDINGS

We have discerned that modern metaverses haven't gained traction due to myriad reasons like poor graphics of the VR worlds, high costs of VR headsets, the limited scope of most VR verses, and unrealistic expectations of users, to name a few. Moreover, companies are struggling to monetize their respective metaverses as people are reluctant to enter VR due to the high cost of VR headsets. Advertisers are also hesitant to venture into VR as it's still in its infancy. Thus, innovations in photo-realism graphics and improvements in user immersion are desperately needed to make metaverses attractive to the general public. Additionally, tremendous investments (capital and manpower) in this domain are needed to fully realize the infinite scope of the VR space.

IV.EXAMPLES

• The launch of Horizon Worlds in 2021 by Meta Platforms and the vision of how the metaverse could potentially shape many aspects of how we work and socialize, has engendered an increasing level of questioning and debate from academics and

practitioners on the numerous societal implications for many people worldwide (Fernandez & Hui, 2022).

• The technology to enable the creation of the metaverse is fast evolving with the use of VR headsets, haptic gloves, AR, and Extended Reality (XR), that enables users to fully experience the high levels of interaction and immersive experience. Organizations are starting to assess the potential of the metaverse and how it can be integrated within their existing business models. The recent announcement that Italy's top soccer division will be screening AC Milan vs Fiorentina within the Nemesis metaverse, allowing fans to interact within the Serie A symptoms including nausea, vertigo, sweating, pallor, loss of balance, etc., collectively referred to as "virtual reality sickness." These effects may show up within the first few minutes of consumption in sensitive people. After a session, virtual reality can also temporarily alter a person's sensory, motor, and perceptual capacities. This might compromise their hand dexterity or the ability to maintain body orientation. Exposure to the temporal modulation of the light generated virtual room (Reuters, 2022), highlights the emerging adoption and transformative potential of metaverse technologies

V. CHALLENGES

• Security and privacy. Despite the considerable research relating to metaverse technologies, little attention has focused on security and privacy in the metaverse. As with social media platforms, security and privacy are critical issues in the metaverse. Malicious users can monitor and collect metaverse users' behavior (e.g., interaction with other users, purchase actions) and biometrics (e.g., facial expressions, vocal inflections) in real-time, which could be used to recognize the user. Therefore, to provide users with suitable services securely and efficiently, we must consider cybersecurity and privacy concerns because the metaverse is built in the cyber (or digital) environment. Cybersecurity and privacy should provide various measures, methods, and solutions to ensure that users and systems are protected from diverse threats and vulnerabilities (Zhang et al., 2022)

• Data security. In the metaverse, the user's alter ego, the avatar, creates various data such as intimate information (e.g., messages, voice, and video), corporate secrets used for work, and the personal information needed for services to continue. As a result, security threats to such data will continue. Personal information and content stored in a virtual environment, metaverse platform, or service system can be forged and leaked. For example, an avatar's information, such as voice and video recording, could be hacked while the user using the platform, or an attacker could forge the avatar and abuse it. However, it is very difficult to determine when to accurately check the security measures needed to exercise control over personal information because complex services in the metaverse share diverse types of personal information in real-time rather than at a specific point. Moreover, protection measures and management policies for the existing system are insufficient to protect the virtual environment of the metaverse from cybercrime and cyber-attacks, so it should be improved to suit the characteristics of the metaverse. For example, a more fine-grained authentication and dynamic access control policy for data, or pseudonymization of personal information is required. Furthermore, to limit the impact of unauthorized access, sensitive data should be stored securely through encryption.

• Privacy. Metaverse systems can collect far more sensitive information than traditional systems, and this can significantly violate user privacy. For example, metaverse headsets with live microphones can record all conversations, and HMDs with always-on cameras can record video in private spaces. Furthermore, eye-tracking technology can record what the user looks at (Fineman & Lewis, 2018). Falchuk et al., (2018) proposed privacy issues and countermeasures in the

metaverse, especially for Avatars and the characteristics of the metaverse that continue to proceed without stopping. They emphasized the importance of protecting the privacy of users, suggesting solutions such as physically invisible avatars, teleportable avatars, and multiple cloned avatars that could identify user behavior patterns and perform similar behaviors. To avoid privacy issues, sensitive data needs to be more strongly protected by fine-grained authentication, dynamic access control, pseudonymization, and encryption, as is the case in countermeasures for data security. Moreover, privacy strategies for personal information collected by metaverse platform suppliers, should also be established and privacy responsibilities should require clarification.

• Software security. Most of all, reinforcing the security of the metaverse platform itself is an important issue. As in existing software systems, there are many kinds of security threats (e.g., insecure system architecture, unpatched software, malware, ransomware) in the metaverse. Moreover, there is a risk that minors could be exposed to violence and pornography. For example, Roblox, a representative metaverse, was attacked by hackers. Hackers infected the Roblox system with ransomware and demanded Robux, which is a virtual currency in the game. In addition, hackers exposed sensational images and racist messages and caused game characters to engage in obscene acts. Moreover, malicious software could temporarily "blind" a user, and AR use in real-world environments, such as in medicine and industry, create opportunities for malicious attackers to impact life and safety. It will also be important to consider whether to conduct sensitive business—such as high- security research—using metaverse systems (Fineman & Lewis, 2018). To protect the user from software threats, “security by design” architecture is necessary in the early phase of software development

• Hardware (device) security. Some devices (e.g., HMDs, VR headsets, IoT devices) can be used for authentication and to control access to content (Rogers et al., 2015; Schneegass et al., 2016). They could allow users to bypass the required authentication and authorization process without using a username and password. In addition, devices could be linked to biometric data, including the tracking of physical movements. Therefore, if malicious attackers hijack the user or administrator rights of the devices using the security vulnerabilities of metaverse devices, they can control the connected devices remotely, steal specific device information (e.g., gaze information, activities in the metaverse, etc.), or infiltrate the central management server in metaverse systems. Therefore, every device used in the metaverse platform should be secured. At a minimum, the devices must be kept up to date with patches and must follow effective security countermeasures. In addition, when security functions are implemented on a device, using a separate secure chip instead of the software module in the device is recommended, because the CPU load is large and device performance may deteriorate.

• Network security. Metaverse platforms normally have no implemented encryption for network connections (i.e., from the user’s device to the platform) or for connections between Avatars. Therefore, attackers can capture messages or sensitive information through sniffing or spoofing attacks on the metaverse platform. Therefore, depending on the data and the situation in the metaverse,

network connections need to be encrypted with a secure and efficient cryptography algorithm. Availability is another key concern, as a network disconnection or security attacks (e.g., distributed denial of Service (DDoS)) would impact metaverse services more seriously than it would impact online asynchronous services. For instance, a DDoS attack can create unexpected results on a metaverse system, so it is advisable to be prepared with a business continuity

and disaster recovery plan if a system is critical for a business process.

• Challenges and opportunities. Security and privacy should not be optional in the metaverse. They are fundamental and indispensable components that should be continuously managed in all phases of the service process in a metaverse environment. That is, security and privacy should be considered and controlled through maintenance from initial deployment to decommissioning. To provide security and privacy appropriately, we can follow the "security by design" architecture. "Security by design" is an approach to cybersecurity that enables an organization to automate its data security controls and formalize the design of its infrastructure so it can build security into its IT management processes (Amazon Web Services, 2015). All products (e.g., software, hardware, network, content) and services should be designed and implemented to ensure that the key security properties (i.e., confidentiality, availability, integrity, authentication, and accountability) and privacy issues are maintained properly in all phases of development and maintenance.

Particularly, advanced protection technologies, such as automated, flexible, encrypted control of data access using artificial intelligence, are required. As mentioned earlier, the metaverse has the same security and privacy issues as an IT service platform, but it is necessary to establish a customized security and privacy strategy considering the characteristics of the metaverse, rather than to apply existing security countermeasures. In addition, a strategy for protecting the copyright of creations generated in the metaverse is required.

• Sustainable environment. To maintain sustainability, the environment of the metaverse must operate with many users, and seamless services are available even in relatively low-end mobile devices. For long-term service, environmental design must consider the scalability of the current constrained environment. To expand the environment and utilize it, it is necessary to continuously develop open-source platforms that can support collaboration between various developers and a leading expert group.

• Sustainable interface. An easy-to-use interface is a key feature for making the metaverse sustainable. Beyond AR and VR, holograms and lenses that are attached to the eye are also helpful. To provide a real-time, detailed image to the user, a more advanced approach (e.g., increasing the rendering density for the focused part) is needed. HMDs also analyze and utilize user information based on eye movement, focus, blinking, winking, and direction. Furthermore, some interfaces protect young users by smoothing and expressing undesirable sounds in the real world. Interfaces in the metaverse are mostly composed of visual and auxiliary auditory forms. Some of the senses (e. g., touch, smell, and taste) are considered, but studies on sensors are still at an experimental level. When these various sensors are commercialized, it is possible to create a more immersive and continuous world. As interest in multimodal learning (Park & Kim, 2022b) is growing, it is also necessary to study end-to-end multimodal pre-trained models to process various types of information.

• Sustainable interaction. Interaction is important to maintaining the metaverse. Interaction can be classified as conversations between users and conversations with NPCs. Conversations between users are generally communicated through social networking using their native language and English. However, for speakers of different languages to use a metaverse, a service that interprets and provides natural expressions through translation is required. An important point about conversations with NPCs is that persona (e. g., preference, hobby) is a factor that enriches the metaverse. A lifelong conversation system with various personas and

philosophies is needed. It is difficult to maintain the user's continued interest with a simple NPC model that does not have a multi-persona. We need NPCs that grow with users and respond reliably to unexpected situations. It should be possible to provide a reasonable response based on conversation history (e.g., a conversation one month ago) with the user's activity as lifelog. NPCs can be extended and utilized not only for humans but also for various living things (e.g., horses, dogs, cats) and inanimate things (e.g., desks, clocks).

VI.CONCLUSION

To summarize, Metaverse is currently in its early phases. It is unknown how long it will take to completely evolve or how well it will mirror real life. However, one thing is certain: it has the potential to be the next virtual reality revolution. It has the potential to alter our perceptions of the internet and social media interactions. However, concerns must be addressed, and this should not be used as an escape from reality, since this can be detrimental to one's mental health. Overall, the metaverse is certainly the internet's next generation.

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