

A Review of Metaverse

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Abstract

The Metaverse is an evolution of the internet. It is a virtual reality simulation that can be used for various purposes, from entertainment and social networking to education and business. The present paper discusses how Metaverse can be accessed, its uses in various industries, and the technologies required for it. The paper also presents the challenges for Metaverse.

Keywords : Immersive experience, Metaverse, virtual world

I. INTRODUCTION

Facebook rebranded itself as Meta in 2021. Meta is a shared, immersive, 3D virtual space. The term Meta is used to refer to different enhanced online environments. These include video games like Fortnite, workplaces like Microsoft's Mesh or virtual operating rooms. Instead of a single shared virtual space, the current Metaverse consists of multiple Metaverses with limited interoperability. Technologies that provide access to this virtual world, such as virtual reality (VR) headsets, and Augmented Reality (AR) glasses are evolving quickly, but others like adequate bandwidth and interoperability standards will take time to be developed [1].

II. ACCESS TO METAVERSE

Augmented Reality and Virtual Reality are important for the growth and development of Metaverse.

Virtual Reality is a simulated 3D environment through which users can interact with a virtual 3D environment that looks and feels real. It requires a VR headset that takes over a user's field of vision. Haptics that include gloves and vests that enable lifelike interaction with the virtual environment [1].

Fig. 1 shows seven layers of Metaverse.

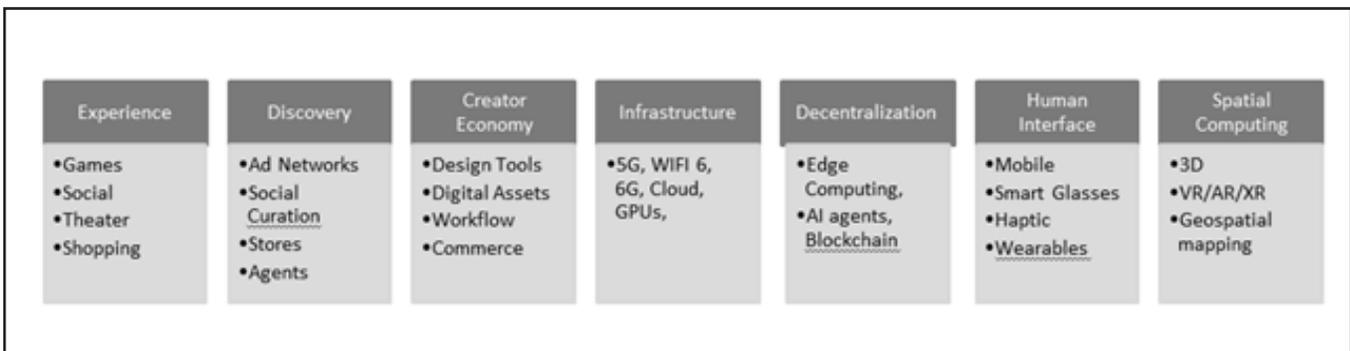


Fig. 1. Seven Layers of Metaverse

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III. METAVERSE TECHNOLOGIES

Some technologies that will have a big impact on Metaverse development are [1]:

↳ **Artificial Intelligence** : Artificial intelligence is the simulation of human intelligence by computer systems.

↳ **Internet of Things** : Internet of Things (IoT) is the network of physical objects that are embedded with sensors, software, and other technologies for connecting and exchanging data with other devices and systems over the internet.

↳ **3D Modeling and reconstruction** : 3D reconstruction is the process of capturing the shape and appearance of real objects.

↳ **Spatial Computing** : Spatial computing refers to processes and tools used to capture, process, and interact with 3D data. Components of spatial computing can include IoT, digital twins, ambient computing, augmented reality, virtual reality, AI, and physical controls

↳ **Edge Computing** : Edge computing is an emerging computing paradigm which refers to a range of networks and devices at or near the user. Edge is about processing data closer to where it is being generated, enabling processing at greater speeds and volumes, leading to greater action-led results in real time.

↳ **Blockchain** : A blockchain is a distributed ledger with growing lists of records (blocks) that are securely linked together via cryptographic hashes. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. The timestamp proves that the transaction data existed when the block was created. Since each block contains information about the previous block, they effectively form a chain, with each additional block linking to the ones before it. Consequently, blockchain transactions are irreversible. Once they are recorded, the data in any given block cannot be altered retroactively without altering all subsequent blocks [2].

↳ **Extended Reality** : Extended reality refers to augmented reality (AR), virtual reality (VR), and mixed reality (MR). Sometimes, the abbreviation “XR” is used to refer to all of them. The technology is intended to combine the physical world with a "digital twin world" that is able to interact with each other [3].

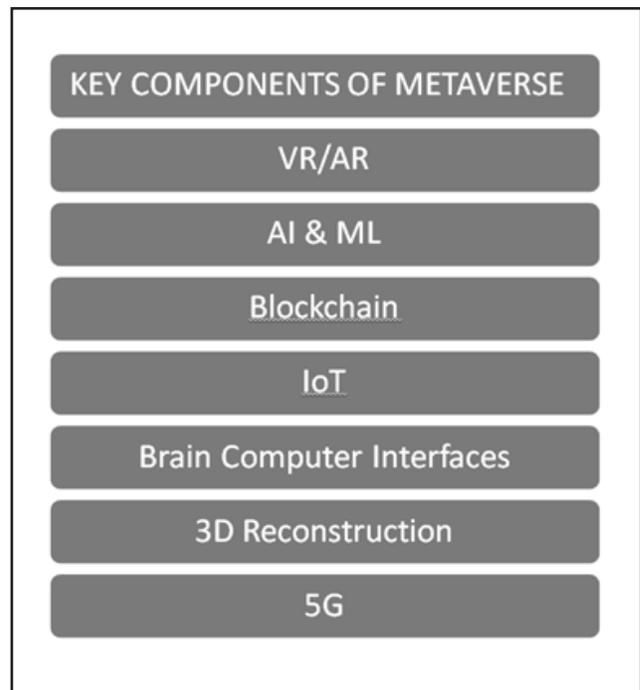


Fig. 2. Key Technology Components of Metaverse

↳ **Brain Computer Interfaces** : These are direct communication pathways between the brain's electrical activity and an external device, such as a computer or a robotic limb.

IV. ROLE OF METAVERSE IN VARIOUS INDUSTRIES

A. Healthcare

Telemedicine or telehealth solutions can be delivered using Metaverse. Healthcare providers can do diagnosis, provide treatment, and monitor health of patients using AR headsets and wearable devices. Immersive experience of Metaverse can alleviate fear and discomfort of patients [4, 5].

B. Manufacturing

Manufacturers can create a virtual prototype and test its design and working. Flaws can be identified and rectified in time. This improves safety and productivity of employees. Metaverse can also be used to train technicians virtually. It decreases turnaround time and enhances productivity. BMW built virtual cars using

simulations at a factory before deploying the final layout for the factory [4].

C. Retail

Customers can try items like clothes, footwear etc. on their online avatars before buying them. Retailers can use Metaverse to stay ahead of competition. Nike, launched virtual Nikeland world within the online game Roblox, where players can buy branded products for their avatars [4].

D. Entertainment and Media

Metaverse can be used for creating an immersive experience in gaming applications. It can also be used to create a virtual environment that gives the experience of a live concert or of a theme park in the comfort of their homes. Walt Disney will create a theme park for all its audiences in the Metaverse by leveraging VR and smart devices [4].

E. Real Estate

For real estate investors, virtual land in the metaverse offer lucrative opportunities. Metaverse properties can be developed, sold, or leased. Companies can also rent out their virtual space for concerts or give them on lease for other entertainment/gaming activities [4].

V. CHALLENGES

A. Legal

Metaverse brings people together in a virtual world where real world experiences and transactions are emulated. It can make people vulnerable if there is no legislation. A work created by AI cannot be copyrighted as it is not created by a human. It is difficult for content creators in Metaverse to protect their Intellectual Property as it is difficult to track copyright infringement in a virtual world [6].

B. Identity

Since Metaverse creates a virtual environment and virtual avatars, it is difficult to establish and track identity.

C. Data

There are concerns that the virtual world can create an environment in which data can be abused and companies can use data in unauthorized ways to control markets [6].

D. Ownership

While users can buy virtual items, how they can be given ownership rights and how ownership can be verified is a problem. Metaverse creates fragmentation which restricts immersive experience.

VI. CONCLUSION

While Metaverse holds immense potential for various industries, it remains to be seen how people would take to it, whether they would be comfortable with virtual environments and how much time they would be willing to spend with it given the challenges facing Metaverse.

AUTHOR'S CONTRIBUTION

Deepak Jain is the sole author of the present paper. He has researched entirety of the work described in this paper from secondary sources.

CONFLICT OF INTEREST

The author certifies that he has no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in the manuscript.

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About the Author

Deepak Jain is an experienced engineer and product leader with a demonstrated history of working in the computer software industry solving technically challenging problems at scale. Eager to build products, solving real-time problems, Deepak founded Subtlelabs as a product engineering company that is today serving customers across the globe. He had earlier worked with global companies and created solutions in Healthcare, Security, Fintech, Logistics, and CRM domains.