

New Challenges in Metaverse with Respect to Augmented Reality and Virtual Reality

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ABSTRACT

The Metaverse is a concept of an online, 3D, virtual space connecting users in all aspects of their lives. It would connect multiple platforms, similar to the internet containing different websites accessible through a single browser. The concept was developed in the science-fiction novel Snow Crash by Neal Stephenson. However, while the idea of a Metaverse was once fiction, it now looks like it could be a reality in the future. Crypto cloud economies are the next emerging market investment frontier and the Metaverse is at the forefront of this Web 3.0 internet evolution. The Metaverse is a set of interconnected, experiential, 3D virtual worlds where people located anywhere can socialize in real-time to form a persistent, user-owned, internet economy spanning the digital and physical worlds. The internet has always been about connecting people. Over the past three decades, internet technology has evolved, and the way we all interact with the web has evolved with it. Much has changed, but three key eras of online-based communities could be thought of as: • Web 1.0 - Netscape connected us online • Web 2.0 - Facebook connected us into online communities • Web 3.0 - Decentraland connected us into a community-owned virtual world.

Keywords— Metaverse, Web 3.0, Web 2.0, Netscape

I. INTRODUCTION

The Metaverse is a concept of an online, 3D, virtual space connecting users in all aspects of their lives. It would connect multiple platforms, similar to the internet containing different websites accessible through a single browser. The concept was developed in the science-fiction novel Snow Crash by Neal Stephenson. However, while the idea of a Metaverse was once fiction, it now looks like it could be a reality in the future. The Metaverse will be driven by augmented reality, with each user controlling a character or avatar. For example, you might take a mixed reality meeting with an Oculus.

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Web 1.0 - Netscape connected us online

Web 2.0 - Facebook connected us into online communities

Web 3.0 - decentral and connected us into a community-owned virtual world.

A. Metaverse in Gaming

Because of the emphasis on 3D virtual reality, video games offer the closest Metaverse experience

currently. This point isn't just because they are 3D, though. Video games now offer services and features that cross over into other aspects of our lives. The video game Roblox even hosts virtual events like concerts and meetups. Players don't just play the game anymore; they also use it for other activities and parts of their lives in "cyberspace". For example, in the multiplayer game Fortnite, 12.3 million players took part in Travis Scott's virtual in-game music tour.

	Web 1.0	Web 2.0	Web 3.0
Interact	Read	Read-Write	Read-Write-Own
Medium	Static Text	Interactive Content	Virtual Economies
Organization	Companies	Platforms	Networks
Infrastructure	Personal Computers	Cloud & Mobile	Blockchain Cloud
Control	Decentralized	Centralized	Decentralized

Figure-1: Key Features of Web-1.0, Web 2.0 and Web 3.0

B. Crypto File and Metaverse

Gaming provides the 3D aspect of the Metaverse but doesn't cover everything needed in a virtual world that can cover all aspects of life. Crypto can offer the other key parts required, such as digital proof of ownership, transfer of value, governance, and accessibility.

- Digital Proof of Ownership:** By owning a wallet with access to your private keys, you can instantly prove ownership of activity or an asset on the blockchain. For example, you could show an exact transcript of your transactions on the blockchain while at work to show accountability. A wallet is one of the most secure and robust methods for establishing a digital identity and proof of ownership.
- Digital Collectability:** Just as we can establish who owns something, we can also show that an item is original and unique. For a Metaverse

- Transfer of Value:** A Metaverse will need a way to transfer value securely that users trust. In-game currencies in multiplayer games are less secure than crypto on a block chain. If users spend large amounts of time in the Metaverse and even earn money there, they will need a reliable currency.
- Governance:** The ability to control the rules of your interaction with the Metaverse should also be important for users. In real life, we can have voting rights in companies and elect leaders and governments. The Metaverse will also need ways to implement fair governance, and blockchain is already a proven way of doing this.
- Accessibility:** Creating a wallet is open to anyone around the world on public block chains. Unlike a bank account, you don't need to pay any money or provide any details. This makes it one of the most accessible ways to manage finances and an online, digital identity.
- Interoperability:** Block chain technology is continuously improving compatibility between different platforms. Projects like Polkadot (DOT) and Avalanche (AVAX) allow for creating custom block chains that can interact with each other. A single Metaverse will need to connect multiple projects, and block chain technology already has solutions for this.

C. Future of Metaverse

Facebook is one of the loudest voices for the creation of a unified Metaverse. This is particularly interesting for a crypto-powered Metaverse due to Facebook's Diem stable coin project. Mark Zuckerberg has explicitly mentioned his plans to use a Metaverse project to support remote work and improve financial opportunities for people in developing countries.

Facebook’s ownership of social media, communication, and crypto platforms give it a good start combining all these worlds into one. Other large tech companies are also targeting the creation of a Metaverse, including Microsoft, Apple, and Google

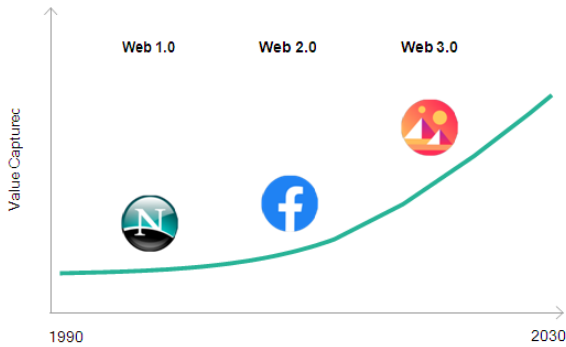


Figure-2: Exponential Evolution of Web Communities

D. The Meta Market Opportunity

A greater and greater portion of our attention is going towards digital activities, especially for younger generations. Today, ~1/3rd of our lives (~8 hours/day) is already spent watching TV, playing games, or on social media.

As we spend more of our time in these digital world experiences, we also spend more of our money within these digital realms to build our social status within these online communities.

E. The Meta Web 3.0 Economy

Web 3.0 crypto Metaverses are emerging market virtual world economies with a continually developing complex mix of digital goods, services, and assets that generates real-world value for users.

Early Web 3.0 Metaverse worlds have been typically built on top of blockchain computing platforms (layer one) with a host of parties contributing to the development of the games and in-games items that can be freely traded on the blockchain.

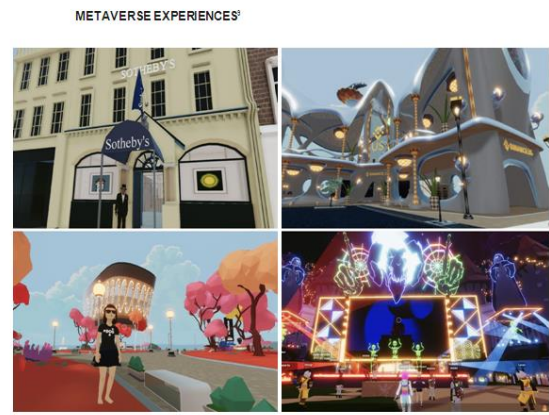


Figure-3: Web 3.0 Metaverse worlds are part of a larger interconnected crypto cloud economy

F. Challenges

Here are some of its potential limitations:

- **Identity verification:** In the Metaverse, you could face challenges related to identity authentication or verification. In the Metaverse, people will use their avatars. Thus, it could be challenging to identify people in the virtual world. Users will be verified through their avatar features, voice, and facial expressions.
- **Damaging Reputation :**Scammers can try to damage someone’s reputation by mimicking e someone else’s avatar.
- **Data Privacy :**This technology will depend highly on VR and AR devices with camera capabilities and unique identifiers. This can result in the leaking of the personal data of users.
- **Laws & Regulations :** Another challenge we could face in the Metaverse is related to laws, regulations, legislation, and jurisdiction. This technology will bring a huge number of people together. The absence of laws that regulate the boundaries in such virtual worlds could be a challenge.

G. PROTOCOLS USED

These decentralized protocols interoperate with and provide the technical infrastructure to support Metaverse virtual economies.

- **Payment Networks:** Web 3.0 Metaverse economies can use their own digital currency, like MANA, or the currency of the layer one base crypto cloud economy platform they're built on, such as Ethereum (ETH) or Solana (SOL).
- **Decentralized Finance:** Decentralized exchanges allow users to trade in- game items while lending platforms allow users to take out loans on their virtual land.
- **NFT Sovereign Goods:** Players can purchase NFTs from other creators and bring them into other virtual worlds to be put on display or sold.
- **Decentralized Governance:** Legal frameworks take back control of the digital economies from centralized corporations and allow a global network of Web 3.0 Metaverse users to decide the rules of their collectively owned virtual space.
- **Decentralized Cloud:** File storage solutions such as Filecoin give Web 3.0 Metaverse worlds a decentralized infrastructure solution to store data while services like Livepeer give virtual worlds decentralized video transcoding infrastructure.
- **Self-Sovereign Identity:** Internet-native social reputation coin ("creator coins") data from other platforms may be transferred **into the Metaverse** and used for identity or credit scoring.

H. Metanomics

When you think about the economics of the Metaverse—or metanomics—there are opportunities in almost every market area. Imagine you have an online avatar and you want to change what it/you are wearing, you will be able to buy limited-edition, digitally branded clothing that you pick after browsing a virtual showroom. Or you may start your own small business, such as an art gallery where you display your latest and greatest collections, or a virtual private club.

II. AUGMENTED REALITY

The word "Augmented" means to add. It is created by using the technology by adding digital information to an image or something. Augmented reality is an important concept and impacts our lives deeply. It provides an improved version of reality as it uses different tools to make the environment existing and real. Augmented reality gives you an interactive experience of the real-world environment. It keeps you in your place and superimposes the technology in the form of text, sounds, and images.

Augmented Reality (AR) is a way by which technology can change how we perceive the world around us. It's also very useful in various fields, but first, we need to know what is augmented reality and how it is different from virtual reality.

A. Advantages of Augmented Reality

The advantages of Augmented Reality are listed as follows -

- It increases accuracy.
- It offers innovation, continuous improvement, and individualized learning.
- It helps developers to build games that offer real experiences.
- It enhances the knowledge and information of the user.

B. Disadvantages of Augmented Reality

The limitations of Augmented Reality are listed as follows –

- Projects based on AR technology are expensive to implement and develop.
- Excessive use of augmented reality technology can lead to eye problems, obesity, etc.
- It can cause mental health issues

III. VIRTUAL REALITY

It is a very important and interesting term. The terms 'Virtual' refers to something conceptual that does not have its physical existence, and the word 'reality

refers to the state of being real. So, virtual reality means something that is almost real. It is defined as the creation of a simulated environment by using computer technology. Viewing virtual reality means viewing a completely different reality than the one in front of you. It can be artificial, like an animated scene or a place which is photographed and integrated in a virtual reality app. It enables us to move around and look in every direction - up, down, sideways, and behind, as we are present there actually.

A. Advantages of Virtual Reality

The benefits of virtual reality are listed as follows -

- It creates an interactive environment.
- It helps us to explore the world by creating a realistic world using computer technology.
- It makes education comfortable and easy.
- It allows users to do an experiment in an artificial environment.
- It increases the work capabilities.
- Virtual reality is helpful for medical students to do practice well. It will be helpful for patients, too, as it offers a safe environment to them by which a patient can come into contact with the things they fear.
- Virtual reality helps to measure the performance of sportsperson and analyze their techniques.

B. Disadvantages of Virtual Reality

The limitations of virtual reality are listed as follows -

- Using VR, people start ignoring the real world. They started living in the virtual world instead of dealing with the issues of the real world.
- Training in the virtual environment does not have the same result as training in the actual world.
- It is not guaranteed that a person has done a task well in the real world if he/she has performed that task well in the virtual world.

C. The Reality-Virtuality Continuum

The **reality-virtuality continuum** is a scale that was given by Paul Milgram. It is a scale which has two extremes one part depicts the ‘virtuality’ or an environment which is completely virtual and, the other part describes a real environment or ‘reality’ and the middle part is termed as “mixed reality”, thus this scale contains all possibilities for one object or plane being completely digital or completely real.

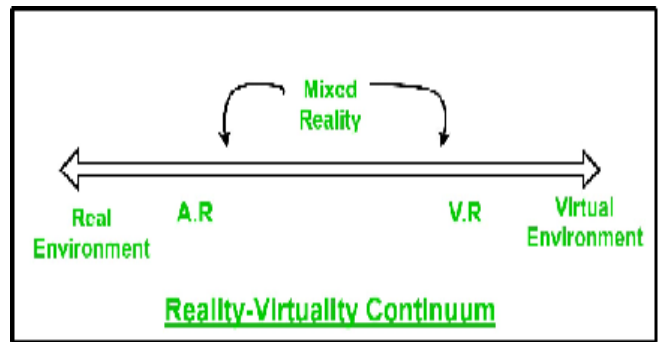


Figure-3: Reality-Virtual Continuum

Examples: One of the best examples of augmented reality is the app “**Pokemon GO**“.so what that game does is that it imposes the images of pokemon which are digitally created and puts them into our real-world view which we can see through our phone’s camera. the newest development in augmented reality technology is done by Google through their **ARcore** app.

ARcore is a platform for developers to design and run AR apps on their devices. Google also created an app called “**just a line**” which lets users draw virtually in the real world. There are tons of apps on google play store that uses AR technologies like “**houzz**” or apple store like “**amikasa**” which helps you style your room and helps you design a room layout by implementing the furniture in your room using your phone’s camera.

A few Examples of MR apps are:

- An app that allows users to place notes around their environment.

- A television app placed in comfortable spots for viewing.
- A cooking app placed on the kitchen wall.
- Microsoft’s Hololens is also a famous example of MR.

One common thing between all the above forms of technology is that they change the way we perceive real-world objects.

IV. AUGMENTED REALITY V/S VIRTUAL REALITY

Revenue	The projected revenue share for augmented reality in 2020 is \$120 million.	The projected revenue share for virtual reality in 2020 is \$30 million.
Visual senses	In Augmented reality, a user always has a sense of presence in the real world.	Whereas, in virtual reality, the visual senses are under control of the system.

Table-1: Comparison Between Augmented Reality and Virtual Reality

Features	Augmented Reality	Virtual Reality
Involvement	In AR user is partially immersed with the real world, i.e. user is immersed with mix of real-world and virtual world.	In VR, the user is completely immersed in a virtual world.
Distinction	In augmented reality, it is easy to distinguish between both real-world and virtual world.	In Virtual reality, it is hard to distinguish between the virtual world and real world.
Devices used	In AR, there is a use of tablet, smartphones, or another mobile device.	In VR, there is a use of head-mounted display or glasses.
Reality and virtuality	Augmented reality is 75% real and 25% virtual.	Virtual reality is 75% virtual and 25% real.
Network data	Augmented reality requires upwards of 100Mbps bandwidth.	A virtual reality video with 720p requires a connection of atleast 50Mbps.

V. IMPORTANCE OF AUGMENTED REALITY

The development of AR technology is set to revolutionize industries from retail to military to education to tourism and transform the way we interact with the digital world every day. Augmented reality has many uses in different fields like archaeology, architecture, visual arts, commerce, education, video games, and military training, etc. some applications of AR are

- AR is being used to aid research in archaeology. AR can be used to recreate different structures and overlay them in the real environment so that researchers can study them correctly.
- AR applications in smartphones include Global Positioning System (GPS) to locate the person’s location and its phone’s inbuilt compass to find device orientation.
- Augmented reality can be used in the field of tourism to enrich visitor’s experience during visits like the Eiffel tower has an AR app that can show you it looked throughout history when it was being built.

Metaverse transformers

These dynamic technologies are expected to play distinct and vital roles in the development of the metaverse as a viable business force during the next several years.

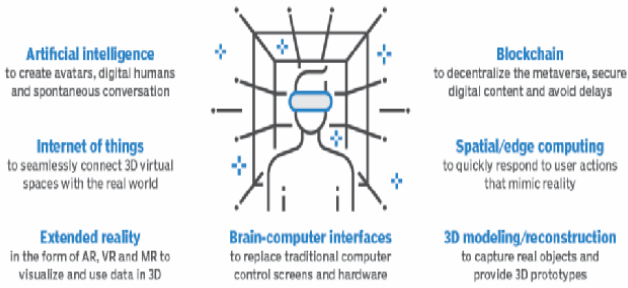


Figure-4: Metaverse Transformers

The consensus among Shein's expert sources was that these seven technologies will have the biggest impact on Metaverse development over the next decade:

- artificial intelligence
- internet of things
- extended reality
- brain-computer interfaces
- 3D modeling and reconstruction
- spatial and edge computing
- blockchain

A. Metaverse Usage in Modern Aspects

The online gaming industry has decades-long experience in creating immersive virtual worlds. And to the extent a proto-Metaverse has a mainstream use, the massive audiences that flock -- albeit not synchronously -- to the likes of Roblox, Epic Games and Decentraland suggest that playing games, building virtual worlds and investing in real estate might be it.

Enterprises are experimenting with Metaverse applications in the workplace that build on the virtual applications companies deployed during the pandemic to support remote work. An early application of Metaverse technologies involves workplace training. Some hospitals are already using VR and AR to train for common medical procedures, reported TechTarget news writer Esther Ajao. One technology recently approved by the FDA is Medivis, an AR surgical system that lets surgeons quickly sync with a

hospital's digital imaging system. Other Metaverse-type applications she wrote about in her article, "Enterprise applications of the Metaverse slow but coming," include the following:

- **Digital twin avatars**

These twins will not only exist on computer screens but will be rendered as AI-powered holograms or holographic images that are assigned tasks, Ajao reported. A CEO, for example, could activate an AI-powered hologram of himself to engage with multiple stakeholder groups at once.

- **Metaverse for work collaboration.**

Enterprises are starting to use the Metaverse to add "an element of realism" to remote work experiences, said Forrester analyst J.P. Gownder. This includes setting up 3D rooms where employees can collaborate spaces. Accenture hires more than 100,000 people every year and uses Microsoft Mesh to help onboard new employees. New hires meet on Teams to receive instructions on how to create a digital avatar and access One Accenture Park, a shared virtual space that's part of the onboarding process. The futuristic amusement park-like space includes a central conference room, a virtual boardroom and digital monorails that new hires use to travel to different exhibits.

B. Metaverse Ecosystem

The Metaverse ecosystem is basically a self imaginary experience for the users which allows them to interact with two people using the Metaverse technology. The Metaverse ecosystem basically deals with the creation of online virtual reality rooms where the users will share their thoughts and ideas and communicate with each other on the Metaverse in virtual reality. For example – Roblox allows its users to create online rooms while playing games for interaction with the users within the Roblox ecosystem of the game. This creates an immersive ecosystem for the users to pursue and create the

characters and stories for the interaction between the users and their avatars.

VI. TECHNOLOGIES USED IN METAVERSE

Basically, the types of technologies used in Metaverse are as follows:

Hardware: The type of hardware used in the Metaverse will be a pair of glasses that will be used to create a 3D virtual reality image in front of the eye of the users. These pair of glasses form a three-dimensional image on the screen on the hardware of the Metaverse. It may be a pair of AR spectacles or a virtual reality headset like the Oculus Quest 2. These hardware devices play an important role by giving an immersive experience to the users about them so that the users feel that he is really in person next to what is happening on these pair of virtual reality glasses.

Software: Popular game development engines like Unity, Amazon Sumerian, and Unreal Engine 4 (UE4) are some of the most powerful sets of VR development tools. They allow the real-time rendering of visuals in the graphics used to display virtual reality to the users. These software tools have the capability to initiate high-fidelity real-time graphics, and artistic tools and graphics. They have the compatibility with all popular VR platforms like Oculus, Sony, etc.

VII. APPLICATIONS OF METAVERSE

Virtual Reality: Virtual Reality is the main backbone of the Metaverse. Metaverse enables the users to interact, socialize and collaborate with each other using 3D virtual reality. The users can interact and play with each in the digital world by attending music concerts and conferences, playing football virtually, and even more. Anything that we can do in real life is possible in the Metaverse using virtual reality.

Video Games: Multiplayer battle royale games like Call of Duty, Roblox, Minecraft, and Fortnite have brought new features into the gameplay that make it more immersive than ever before. Users can customize their avatars by making virtual items and then fight with other people in the game in the 3D surroundings using the Metaverse.

Events: Due to Covid, people have now chosen to attend music and launch events virtually instead of risking their health. Music events, cultural events, and other technical events can be conducted on the Metaverse just like what happens in the real life. People can socialize and interact within the 3D space of the event.

Buy and Sell: Metaverse enables users to buy and sell interactive virtual things online. People can now buy and sell virtual fungible tokens like NFTs and also try new items. We can try new clothes on our avatars using Metaverse just like what happens in the real life.

Enhanced Social Media Experience: Now social media platforms like Instagram, Facebook, and Twitter will become more and more immersive as the Metaverse arrives because the users will have the ability to enjoy the content now in virtual reality using 3D images.

Online Education: Now the students can create their own customized avatars in online classes and now they can understand the topics taught in the online classes using the immersive learning experience with the help of the use of virtual reality in teaching the students.

VIII. REAL-WORLD EXAMPLES

Fortnite Concerts: Users can now enjoy concerts with their friends online through the use of Metaverse technology. Fortnite allows its users to hold and attend the various music and culture concerts and events in its game so that the paid users can now

attend them with their community of people online to ensure the virtual reality connection through the use of the Metaverse technology.

Virtual Real Estate: We can now use the Metaverse technology in order to enable the purchase and sale of virtual real estate through the use of cryptocurrencies. Virtual real estate is an important source of investments for an upcoming investor because more and more people are getting interested in the Metaverse and NFTs.

Ready Player One: This film uses Metaverse technology to showcase to the users the true capacity of the Metaverse technology. The touch-sensitive gloves and virtual reality headset used in the film give us a slight glimpse into what the future of the Metaverse looks like.

Second Life: Second Life is one of the examples of a gaming Metaverse, where the users have the ability to create their own digital avatars and characters to host their online open gaming world with the help of Metaverse technology.

The Sandbox: The Sandbox is basically a virtual reality Metaverse that allows users to experience, explore and play in a three-dimensional world. It also allows players to create their own digital avatars and characters to host their online open gaming world with the help of Metaverse technology. Users can also buy some NFTs for the in-game purchases for customizing their characters.

Decentraland: A piece of virtual real estate property on Decentraland was auctioned off for a price of \$2.4 million. Decentraland is one of the best Metaverse examples to acknowledge the true potential of Metaverse technology.

Illuvium: It is an open-world role-based game that uses the Ethereum cryptocurrency-based Blockchain

network and it is expected to be released in 2022. Here, the users search for the collecting NFTs, which represent each Illuvial.

IX. CONCLUSION

While a single, united Metaverse is likely a long way off, we already can see developments that may lead to its creation. It looks to be yet another sci-fi use case for blockchain technology and cryptocurrencies. If we will ever really reach the point of a Metaverse is unsure. But in the meantime, we can already experience Metaverse-like projects and continue to integrate blockchain more into our daily live .some significant distinctions between Augmented Reality and Virtual Reality, despite the fact that both have their own individual advantages. Augmented Reality provides its users the ability to interact with digital content that is superimposed over the real world, whereas Virtual Reality produces an experience that is wholly immersive. Augmented Reality has a wide range of potential uses in a variety of disciplines, including education, healthcare, and even business. Virtual Reality, on the other hand, is mostly utilized for gaming and entertainment purposes.

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