

# The Metaverse Revolution: A New Era of Digital Society

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## ABSTRACT

*In recent years, the idea of the metaverse has drawn a lot of interest, and it is predicted that this trend will continue in the future. The metaverse has arisen as a new tool for social networks and three-dimensional (3D) virtual worlds since Facebook changed its name from Facebook to Meta in October 2021. It is a virtual space where users can interact with each other and the environment in a virtual world. This virtual world is expected to be fully immersive, and it will be built on a combination of technologies such as virtual reality, augmented reality, and artificial intelligence. One potential application of the metaverse is in the fields of entertainment and education. It also has the potential to disrupt the way we work. However, there are also challenges that need to be addressed as the metaverse becomes more prominent. These include issues related to privacy, security, and governance, as well as concerns around the potential for addiction and other negative impacts on mental health. Overall, the metaverse is likely to become a major future trend, with implications for a wide range of industries. In this paper, we will discuss the future trends of metaverse and its revolution in detail.*

**Keyword:** - Metaverse, Virtual reality (VR), Augmented reality (AR), Artificial intelligence (AI).

## 1. INTRODUCTION

The Metaverse is a term that refers to a shared virtual universe, where people can interact with each other and experience a range of activities, such as socializing, gaming, and creating art and entertainment. The idea of the metaverse has been around for several decades, but recent technological advancements, including virtual reality and blockchain, have made it more tangible. The concept of the Metaverse was first introduced in Neal Stephenson's 1992 novel, "Snow Crash". The book described a virtual reality world that was accessible through a headset, where people could interact with each other in a shared space. Since then, the term metaverse has been used to describe a range of virtual environments, from online games and social media platforms to fully immersive virtual reality experiences. Fact is, now a day's consumers are demanding haptic and immersive capabilities with their digital interfacing, and such traits are only possible with the newly emerging technologies of Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and Extended Reality (XR). The metaverse is the answer that amalgamate some of these pertinent technology with inside the worldwide context. Users can have interaction with this digital eco machine via their virtual avatars. The avatars are the virtual embodiments of the users, and has the same legal authority in the metaverse as one's legal rights in the real world. Despite the metaverse being evolved and supposed to make bigger the scope of competencies in social Media, its capacity for different industrial, commercial, societal, educational, medical, military, and governmental sectors are immense. One of the main advantages of the metaverse is the ability to create immersive and meaningful experiences.

The metaverse also has the potential to transform the way we work. As remote work becomes more common, the metaverse can provide a virtual workspace where employees can collaborate with each other, attend meetings, and even attend virtual conferences. This can provide more flexibility and accessibility for workers, as well as reduce the cost and environmental impact of travel. In addition, the metaverse can also provide new opportunities

for businesses. Companies can create virtual storefronts, where customers can browse and purchase products in a more immersive and engaging way. The metaverse can also provide new opportunities for advertising and marketing, as companies can create interactive and engaging experiences that are not possible in traditional advertising. However, there are also concerns about the impact of the metaverse on privacy, security, and social inequality. As people spend more time in virtual environments, there is a risk that personal data can be compromised. In addition, there is a risk of cyber-attacks and hacking, which can have serious consequences for both individuals and businesses. There are also concerns about the potential for social inequality in the metaverse, where access to the technology and virtual experiences may be limited to certain groups.

## 1.1 Literature Review

The metaverse related studies and surveys are widely available and has incremented over the past few years [1]. The authors in [2] presented a comprehensive survey, and can be considered as the first scientific publication that discussed about the metaverse on a broader technical context.

"The Future of the Metaverse: Trends and Opportunities in Virtual Worlds" by Digi-Capital. This report provides an overview of the Metaverse ecosystem, including its history, current state, and future trends.

"The Metaverse Roadmap: Pathways to the 3D Web" by the Metaverse Roadmap Project. This report provides a comprehensive analysis of the technical, social, and economic factors that will shape the development of the Metaverse over the next decade.

"The Metaverse and the Future of Digital Life" by Matthew Ball. This report provides a deep dive into the technical, social, and economic aspects of the Metaverse, and explores its potential to transform the way we live, work, and play in the digital world.

"The Rise of the Metaverse: A Deep Dive into Virtual Worlds" by Deloitte. This report provides an overview of the Metaverse ecosystem, including its history, current state, and future trends.

The main contributions of this survey are:

- Firstly, we present a brief overview of metaverse, followed by the motivation.
- Secondly, we discuss application of metaverse for addressing the challenges faced by several technical aspects of the metaverse.
- Thirdly, we discuss about the impact of metaverse on some of the key enabling technologies such as Internet of Things, digital twins, multi-sensory XR, AI, and the big data.
- Fourthly, we discuss about some of the interesting projects such as Decentraland, Sandbox, Axie Infinity, and Illuvium that leverage the metaverse.
- Finally, we conclude the paper with some potential future research directions.

## 2. THE METAVERSE: PRELIMINARIES

**2.1 What is the metaverse?** - The word "meta" origins from the Greek language, which is a prefix that means "more comprehensive" or "transcending". The word "Verse" is abbreviated version of universe, which represents a space container. When those phrases are combined, a latest word "Metaverse" comes into the picture, where the traditional social systems are transformed into a novel digital living space. State-of-the-artwork technology which include digital reality (VR), virtual twin, blockchain, etc. are used to build the metaverse that maps everything in our real world [3] to a parallel universe. In 1992, Neal Stephenson, in his famous science fiction novel called Snow Crash [4] firstly proposed the initial conception of the metaverse, wherein human beings make use of virtual avatars to manipulate and compete with every different to improve their status. There are not unusual place requirements and only a few actual implementations are available.

**2.2 What are enabling technologies of metaverse?** - The metaverse is a fusion of multiple emerging technologies such as artificial intelligence (AI), VR and digital twins. The center technology required in the metaverse are:

1. The maximum vital era for recognition of the metaverse is prolonged truth era, along with AR and VR. While AR can overlay and superimpose digital information onto the physical environment, VR allows users to experience the digital world in a vivid way [5].
2. The 2nd critical era is virtual dual, which establishes a digital dual of an actual international object by utilizing real world data to predict the expected behavior of the real world object [6].
3. The technology-blockchain performs irreplaceable roles with inside the metaverse. On one side, blockchain generation serves as a repository, so customers can use it to save information everywhere with

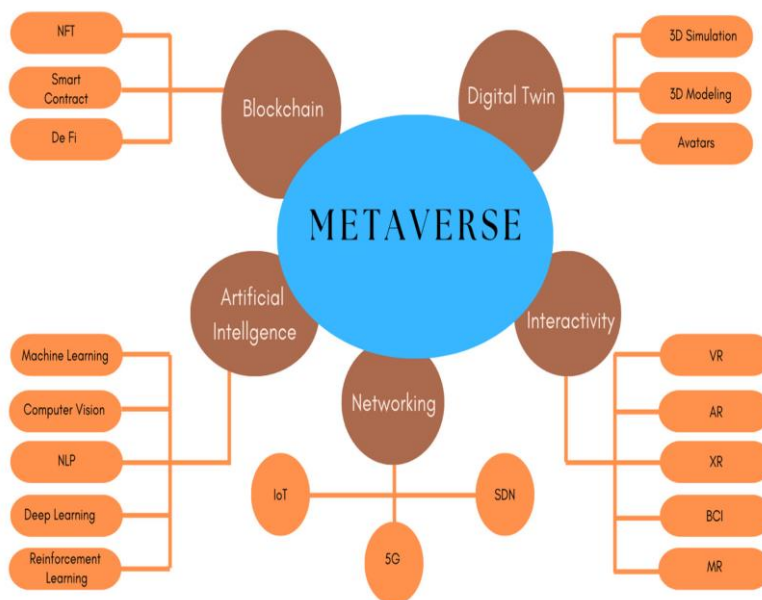
inside the metaverse. Users are allowed to exchange digital objects with inside the identical manner as with inside the actual world. Hence, blockchain bridges the real world and the metaverse [7].

**2.3 What are applications of the metaverse?** - Some of the popular applications of the metaverse are as follows.

- **Online video conference:** In the atmosphere of the Covid-19 pandemic, many small corporations are kept alive through the application of telecommuting. However, as we all know, face-to-face communication is significant, 70% expression of people comes from body language rather than verbal language. Telecommuting has a number of problems unlike traditional face-to-face collaboration, such as inefficient cooperation, delay interaction and misunderstood feedback [8].
- **Digital Real Estate:** In general, real estate refers to property consisting of land and buildings, which may be used for establishment, living, investment, rent, sale and buy. IN the metaverse, the above-cited sports also can be implemented. The virtual platform explicitly emphasizes the scarcity of virtual land to users, which is offered to users at auction and traded for NFTs [9].
- **Digital Arts:** Traditionally, people establish the 3D images through some modelling tools such as Maya and ZBrush. However, the metaverse has a sturdy cognizance at the show layer, which brings new ways of expression and art work creation, so we are able to draw figures through the usage of a broom directly. On the opposite hand, the rising blockchain era has additionally added conventional artistic endeavors from offline to online. In the virtual gallery placed in the metaverse, the users can enter the gallery to appreciate from all dimensions [10]

#### 4. Metaverse Framework and Building Block Technologies

Metaverse is interdisciplinary surroundings created with the aid of using embedding distinctive different technology at distinctive layers of its entire architecture. It is a three-D model of the modern-day internet. A person can have interaction with the digital worlds the use of a few gadgets as an example AR/VR glasses or head-installed displays (HMDs). These gadgets permit customers to have interaction and carry out extraordinary movements virtually. The information is amassed from the actual international via the IoT and sensor networks and are used to expand virtual twins. The digital provider providers (VSPs) and bodily provider providers (PSPs) assist keep the digital and real-global environments of the metaverse. Some of these imperative technology is mentioned underneath and proven in Figure 1.



**Fig -1:** Block diagram of Metaverse

### **3.1 Virtual Reality (VR)**

Virtual reality (VR) gives a simulated enjoy to customers the use of a head-hooked up display (HMD) or VR glasses [11]. It lets in customers to immerse themselves in a 3-d virtual global the use of software program and hardware components. Moreover, it affords superior technical abilities and an unbroken immersive enjoy permitting freedom of second to the customers with inside the digital world [12].

### **3.2. Extended Reality (XR)**

Extended fact is an umbrella time period that refers to VR, AR, and blended fact (MR). It consists of all digital and actual blended environments. The time period prolonged truth become utilized in 1960 for the primary time in history [14]. It gives myriad kinds of packages and a big wide variety of tiers in a digital environment. In the healthcare domain, 3 exclusive styles of VR technology have been Used namely: haptic tool simulators, head-established displays (HMDs), and computer-primarily based totally simulations [15].

### **3.3. Augmented Reality (AR)**

Augmented fact is likewise one of these technology which have converted the outlook of the world. The users' real-international perspectives are bolstered with the aid of using augmented reality (AR) with virtual overlays that mix synthetic objects. In different words, augmented fact way covering virtual photos onto the actual international to decorate them with virtual details. Doctors and surgeons use augmented truth for surgical treatment that augments a part of the frame in which it wishes the manner and assists them all through the manner [16].

### **3.4. Internet of Things (IoT) and Network**

The Internet of Things (IoT) gives a huge variety of technology together with sensors, Wi-Fi networks, and nanotechnology, to attach and speak among a huge variety of gadgets along with smartphones, clever watches, healthcare gadgets, etc. IoT in conjunction with different technology is reworking the lives of humans even as making matters simpler for us. Thus, complements the pleasant of our life. It is extensively utilized in healthcare imparting centers to sufferers and physicians. Patients may be monitored remotely thru distinct forms of IoT gadgets for this reason growing healthcare high-satisfactory and reducing healthcare costs [17].

### **3.5. Edge/Cloud Computing**

Edge/Cloud computing is a brand new idea with inside the computing area in which computing operations are completed at the brink of the network. This generation pursuit to offer computing offerings toward the starting place of data [18]. With the improvement of the Internet of Things (IoT) and part devices, the boom of facts extent is growing each passing day. To triumph over those demanding situations area computing idea become brought that is a brand new computing mode towards the threshold of the community devices. It complements safety and privacy, records optimization, and real-time business.

### **3.6. Artificial Intelligence (AI)**

Artificial intelligence (AI) is a famous era that has been utilized in each field from production industries to agriculture, healthcare to human resources, and gaming to businesses [19]. Artificial intelligence allows machines to imitate the human mind and it learns from the enjoy similar to a human does. Based on experience, it plays specific styles of tasks. Artificial intelligence (AI) is the principle generation with the intention to assist pressure the development, assist, And useful resource with inside the attention of the concept of the metaverse. AI algorithms (i.e., gadget learning, deep learning, reinforcement learning, laptop vision, etc.) are the "key" to connecting the digital international and the actual international [20]. By the use of synthetic intelligence technologies, the metaverse can properly and freely participate in social and financial sports past the bounds of the actual world [21].

### **3.7. Digital Twin**

The virtual dual refers to a virtual illustration of bodily objects [22]. The virtual reproduction of the actual items is created with inside the digital world. It has been used in lots of fields along with healthcare, manufacturing, and

clever cities. This era has 3 primary components: the actual object, its virtual reproduction or digital equivalent, and the relationship of records among the bodily and digital object. In the healthcare sector, the virtual dual performed an essential position throughout the COVID-19 pandemic. It enabled docs to reveal sufferers clearly whilst monitoring their important symptoms and symptoms such as Blood pressure, coronary heart rate, and temperature thru wearable gadgets including smartphones, etc. [23].

### 3.8. Computer Vision

Computer imaginative and prescient allows the laptop to examine and spot objects. It permits XR gadgets to perceive and recognize visible records of the real-global surroundings supporting to create digital environments. This generation is massively utilized in AR/VR and XR programs for the reconstruction of 3-D items in cyberspace. In the metaverse, laptop vision-primarily based totally algorithms are getting used to construct a higher and extra correct person surroundings in a 3-D immersive surroundings [24]. Computer imaginative and prescient can carry out item detection, item classification, item segmentation, and item localization with excessive accuracy the usage of its brand new algorithms inclusive of Mask RCNN, YOLO, etc. [25].

### 3.9. Blockchain

Blockchain era is one of the essential technology that make the metaverse environment invincible. Blockchain turned into delivered through Nakamoto Satoshi for the primary time in 2008 [26]. Blockchain is likewise called a dispensed ledger, and it includes consecutive blocks connected with every different bearing the hash cost of the preceding block header. It shops data in a decentralized community with virtual signatures. The saved records aren't issue to change. Blockchain is specially used with inside the economic domain; however, it is able to be utilized in other regions including hazard management, healthcare, education, asset tracking, cyber security, and social services.

### 3.10. Avatar

The word "Avatar" is a Hindi idea which means the incarnation of the Hindu god with inside the normal global with inside the shape of a human or animal. In the metaverse, people seem as avatars with inside the digital global which can be the real duplicate of human beings. Users can regulate the appearance or the general look in their avatars in line with their very own choice. A traditional instance is a situation in superior video games together with Fortnite.

## 4. THE METAVERSE PROJECTS

This section briefly introduces some well-known the metaverse projects: Decentraland, Sandbox, Axie Infinity, and Illuvium, which have exploited blockchain as the core technology of the metaverse foundation and development, and additionally to deliver multifarious blockchain-based services and applications in the virtual world, from real estate to Ecommerce and real estate. The virtual worlds of the projects are shown below.



**4.1. Decentraland:** Decentraland (MANA) is a decentralized virtual reality platform powered by the Ethereum blockchain. It allows users to create, own, and trade virtual land and assets within the platform. MANA is the native cryptocurrency of Decentraland and is used for purchasing virtual land, trading virtual goods, and participating in

the platform's governance. Users can explore the virtual world, interact with other participants, and engage in various activities such as gaming, socializing, and attending events. Decentraland aims to provide a fully immersive and user-driven virtual experience, where individuals have full control over their digital assets and experiences.

**4.2. Sandbox:** The SAND (The Sandbox) project is a decentralized virtual world and gaming platform built on blockchain technology. It was created by Animoca Brands, a leading digital entertainment company. The Sandbox allows users to create, own, and monetize digital assets and experiences using the platform's native cryptocurrency called SAND. IN The Sandbox, users can build and design their own 3D voxel-based virtual worlds, games, and interactive experiences. These creations can be shared, explored, and played by others within the platform. The project emphasizes user-generated content and creativity, empowering individuals to become creators and entrepreneurs in the virtual world. It provides a means of exchange and value within the virtual economy of The Sandbox.

**4.3. Axie Infinity:** Axie Infinity is a blockchain-based play-to-earn gaming project developed by Sky Mavis. It is built on the Ethereum blockchain and gained significant popularity for its unique gameplay and economic model. In Axie Infinity, players can collect, breed, battle, and trade digital creatures called Axies. Axies are cute and fantastical creatures that can be owned and controlled by players. They have distinct characteristics, abilities, and traits, making each Axie unique. Players can engage in turn-based battles with their Axies against other players to earn rewards in the form of the platform's native cryptocurrency called AXS.

**4.4. Illuvium:** Illuvium is a blockchain-based, decentralized, and open-world RPG (Role-Playing Game) built on the Ethereum blockchain. It aims to combine the elements of traditional RPGs with the benefits of blockchain technology. Illuvium offers a visually stunning and immersive gaming experience where players can collect and battle with creatures called Illuvials. Illuvials are unique and powerful creatures that exist as NFTs (Non-Fungible Tokens) on the Ethereum blockchain. Each Illuvial has distinct attributes, abilities, and rarity levels, making them valuable and sought after. Players can collect, trade, and upgrade their Illuvials, forming a strategic lineup to engage in turn-based battles against AI-controlled opponents or other players.

## 5. CONCLUSION

In conclusion, the metaverse represents an exciting area of technology with tremendous potential for innovation and growth. As the technology behind the metaverse continues to mature, we can expect to see increasing adoption of this technology across a range of industries, and more sophisticated and immersive virtual environments that blur the lines between the virtual and physical worlds. At the same time, we can expect to see continued innovation in areas such as user-generated content, blockchain, and cryptocurrency, which will enable new models of virtual commerce and interaction within the metaverse.

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