A Technical Report on

Metaverse And Role of Cloud, Artificial Intelligence in Metaverse

Submitted in partial fulfillment of the

Requirements for the award of degree of

Bachelor of Technology

in

Computer Science and Engineering

by

M Suhas Rao
18H61A05M2

Under the Guidance of

Mr. Madar Bandu
Assistant Professor

Department of Computer Science and Engineering
ANURAG GROUP OF INSTITUTIONS
(Formerly CVSR College of Engineering)
(An Autonomous Institution, Approved by AICTE and NBA Accredited)
Venkatapur (V), Ghatkesar (M), Medchal(D)., T.S-500088
(2018-2022)

Anurag Group of Institutions
An Autonomous Institution
(Formerly CVSR College of Engineering)
Venkatapur (V), Ghatkesar (M), Ranga Reddy (Dist.)
Ph: 08499953666, 08499963666. www.anurag.edu.in

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Technical Report entitled **"Metaverse And Role of Cloud, Artificial Intelligence in Metaverse"** being submitted by **M Suhas Rao** bearing the Hall Ticket number **18H61A05M2** in partial fulfillment of the requirements for the award of the degree of the **Bachelor of Technology** in **Computer Science and Engineering** to **Anurag Group of Institutions (Formerly CVSR College of Engineering)** is a record of bonafide work carried out by him under my guidance and supervision from JAN 2022 to MAY 2022.

Internal Guide
Mr. Madar Bandu
Assistant Professor

Dr.G.Vishnu Murthy,
Professor & Head,
Dept. of CSE

ACKNOWLEDGEMENT

It is my privilege and pleasure to express profound sense of respect, gratitude and indebtedness to my guide **Mr. Madar Bandu, Assistant Professor**, Dept. of Computer Science and Engineering, Anurag Group of Institutions (Formerly CVSR College of Engineering), for his/her indefatigable inspiration, guidance, cogent discussion, constructive criticisms and encouragement throughout this dissertation work.

I express my sincere gratitude to **Dr. G. Vishnu Murthy, Professor & Head**, Department of Computer Science and Engineering, Anurag Group of Institutions (Formerly CVSR College of Engineering), for his suggestions, motivations and co-operation for the successful completion of the work.

I extend my sincere thanks to **Dr. V. Vijaya Kumar**, **Dean,** Research and Development, Anurag Group of Institutions, for his encouragement and constant help.

M Suhas Rao
18H61A05M2

DECLARATION

I hereby declare that the Report entitled "**Metaverse And Role of Cloud, Artificial Intelligence in Metaverse**" submitted to the **Anurag Group of Institutions(Formerly CVSR College of Engineering)** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology (B.Tech)** in Computer Science and Engineering is a record of an original work done by me under the guidance **Mr. Madar Bandu, Assistant Professor** and this report has not been submitted to any other university for the award of any other degree or diploma.

M Suhas Rao
18H61A05M2

ABSTRACT

The popularization of the Internet in the 1990s, the cyberspace has kept evolving. We have created various computer-mediated virtual environments including social networks, video conferencing, virtual 3D worlds (e.g., VR Chat), augmented reality applications (e.g., Pokémon Go), and Non-Fungible Token Games (e.g., Upland). Such virtual environments, albeit non-perpetual and unconnected, have bought us various degrees of digital transformation. The term 'metaverse' has been coined to further facilitate the digital transformation in every aspect of our physical lives. At the core of the metaverse stands the vision of an immersive Internet as a gigantic, unified, persistent, and shared realm. While the metaverse may seem futuristic, catalyzed by emerging technologies such as Extended Reality, 5G, and Artificial Intelligence, the digital 'big bang' of our cyberspace is not far away. The functional entity of a given world is a dynamic dataset for training strong AI. In this case, it can be stated that just as natural intelligence is a product of the natural environment, artificial intelligence will be produced from the artificial environment. The presence of an environment in which the human actor is an ontological subject, i.e., co-existing with artificial actors in the same forms and with the same algorithm of actions on an ongoing basis while introducing stochastic parameters into the work of the world-system, can be the evolutionary factor in the awakening of AI. The metaverse will employ augmented and virtual realities (AR/VR) integrated with AI, machine learning, blockchain, and cloud computing to build massive and true-to-life virtual universes.

CONTENT

1 INTRODUCTION

The metaverse is a concept of a persistent, online, 3D universe that combines multiple different virtual spaces. You can think of it as a future iteration of the internet. The metaverse will allow users to work, meet, game, and socialize together in these 3D spaces.

The metaverse isn’t fully in existence, but some platforms contain metaverse-like elements. Video games currently provide the closest metaverse experience on offer. Developers have pushed the boundaries of what a game is through hosting in-game events and creating virtual economies.

Although not required, cryptocurrencies can be a great fit for a metaverse. They allow for creating a digital economy with different types of utility tokens and virtual collectibles (NFTs). The metaverse would also benefit from the use of crypto wallets, such as Trust Wallet and Meta Mask. Also, blockchain technology can provide transparent and reliable governance systems.

Blockchain, metaverse-like applications already exist and provide people with liveable incomes. Axe Infinity is one play-to-earn game that many users play to support their income. Second Live and Decentraland are other examples of successfully mixing the blockchain world and virtual reality apps.

1.1 MOTIVATION

Meta's early metaverse platform, called Horizon Worlds, already allows people to socialize virtually while represented by avatars. The kinds of experiences you'll have in the metaverse are beyond what's possible today," Zuckerberg said as he opened a conference aiming to offer a glimpse inside Meta's development labs. That's going to require advances in a whole range of areas from hardware devices to software for building and exploring worlds.

Artificial intelligence is key to unlocking those advances, according to Zuckerberg, who noted that future platforms will need to be able to understand virtual worlds, and provide translation services for the many languages used in them. Hit global video games such as Fortnite, Minecraft, and Roblox, which run on traditional gaming platforms, are seen as precursors to the metaverse. But rivals are not letting Meta's claim to the metaverse go unchallenged. Google, which stumbled early with augmented reality glasses, has a team of engineers, designers, and scientists "building the foundations for great immersive computing," according to an online job posting.

Apple, meanwhile, has bought start-ups specializing in the field and is rumored to be working on its own mixed-reality headgear. Microsoft, a video game industry powerhouse through its Xbox system and titles such as "Minecraft," has made a $69 billion deal to buy Activision Blizzard, mentioning the metaverse as part of its motivation for the merger.

1.2 OBJECTIVE

Digital technologies have fundamentally become a part of our lives. They automate and optimize our activities and provide opportunities for the efficient use of resources. However, the introduction of technologies involuntarily connects people with them. The paradigm of the digital world just begins to take shape and reality as a metaverse. This work will consider the phenomenon of the metaverse, its components, the necessary technologies for its development, and its future. This topic is relevant because it implies the study of an innovative approach to the digital world. People, companies, and even countries are switching to a digital version of interaction, thereby discovering new ways of development and creation, reinforcing the topic’s relevance.

The physical world becomes a kind of appearance of the human body, while our mind gradually moves into the virtual space. The metaverse can become a platform for the further development of person and all humanity. However, the functioning of the virtual world requires a financial structure, the idea of which is just beginning to take shape. Currently, there are digital worlds with functioning economies where many people earn money. Still, these are only some of the opportunities of the digital world that are offered to the user. The metaverse as a trend can develop into a tendency. Due to the lack of an understanding of this phenomenon, it is necessary to study it carefully.

2 LITERATURE SURVEY

Shin et al. (2008) study various application areas for augmented reality technologies in industrial construction based on technology suitability. The research assesses different work tasks from the human factors perspective and presents a comprehensive map, which identifies eight work tasks including layout, excavation, positioning, inspection, coordination, supervision, commenting, and strategizing out of seventeen classified work tasks which could potentially benefit from AR systems.

Wang (2009) gives a detailed review of AR in the AEC industry, and gives a review of several major research efforts prior to 2009, and categorizes various AR technologies with their advantages and disadvantages.

Wang et al. (2013) reviews 120 articles published between 2005 and 2011 in various journal and conferences databases with a focus on augmented reality technologies in the built environment. The paper classifies all available toolkits for augmented reality prototyping in five categories: 2D marker AR-PC and web-cam based, 2D marker AR-mobile, 3D objects recognition-mobile, marker-less tools, GPS-compass based AR. In their research, AR literature is classified in three categories: (1) application area; (2) AR system layers: concept and theory (with four sub-layers including: algorithm and modelling, conceptual framework, evaluation framework, and technology adoption), implementation (with two sub-layers: software and hardware), evaluation (with two sub-layers: effectiveness and usability), and industry adoption; (3) other technical criteria. The paper explores state-of-the-art technologies in each category and proposes future research directions.

Chi et al. (2014) discusses trends in AR applications for the AEC/FM with a specific focus on four AR technologies: localization, natural user interface, cloud computing, and mobile devices. The paper reviews 101 articles and outlines future trends and opportunities for applying AR in the AEC/FM industry in six directions: (a) field exploration based on hybrid localization, (b) in-field gesture or kinesthetics control of AR interface, (c) integration with location-specific information, (d) accessing field information using ubiquitous services, (e) portable AR devices in the field, (f) context-aware augmented reality in AEC/FM fields.

Metaverse Shape of Your Life for Future: A bibliometric snapshot Authored by Muhammet Damar, describes about the metaverse the metaverse was first introduced in 1992. Many people saw Metaverse as a new word but the concept of Metaverse is not a new term. However, Zuckerberg's press release drew all the attention to the Metaverse. This study presents a bibliometric evaluation of metaverse technology, which has been discussed in the literature since the nineties. A field study is carried out especially for the metaverse, which is a new and trendy subject.

3. METHODOLOGY

Due to the interdisciplinary nature of the metaverse, this section aims to explain the relationship between the fourteen focused areas under two key categories of technologies and ecosystems, before we move on to the discussion on each focused area(s). Figure 3.1 depicts the focused areas under the two categories, where the technology supports the metaverse and its ecosystem as a gigantic application. Under the technology aspect, i.e., the eight pillars for the metaverse, human users can access the metaverse through extended reality (XR) and techniques for user interactivity (e.g., manipulating virtual objects). Computer vision (CV), artificial intelligence (AI), blockchain, and robotics/ Internet of-Things (IoT) can work with the user to handle various activities inside the metaverse through user interactivity and XR. Edge computing aims to improve the performance of applications that are delay-sensitive and bandwidth-hungry, through managing the local data source as pre-processing data available in edge devices, while cloud computing is well recognized for its highly scalable computational power and storage capacity. Leveraging both cloud-based and edge-based services can achieve a synergy, such as maximizing the application performance and hence user experiences. Accordingly, edge devices and cloud services with advanced mobile network can support the CV, AI, robots, and IoT, on top of appropriate hardware infrastructure.

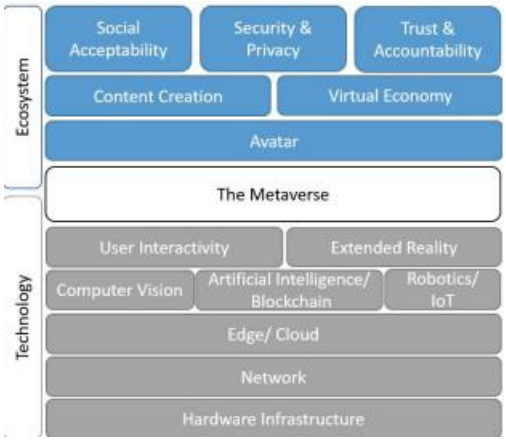

FIG 3.1

3.1 METAVERSE CHARACTERISTICS

This section will discuss the essential characteristics of the Metaverse. As a new web application, Metaverse combines different technologies called multi-technologies. Since Metaverse is forming new social norms, its sociability characters need to be considered. Its closeness to the real world virtual has spatiotemporally characteristics.

Multi-Technology: Metaverse combines multiple technologies such as augmented reality, digital twin and blockchain. Augmented reality is the essential development technology of Metaverse since it uses development concepts of gaming engines and other AR-related tools and techniques for its development. The digital twin is the concept of mirroring some things as the Metaverse mirrored the real world into the virtual world, so use concepts of digital twin technology. Blockchain is in the economics system basis of Metaverse.

Sociality: According to the definition of Metaverse describe, it is a new form of social values. Metaverse has its legal system, economic structure, and culture, which are very close but not equal to the real world.

Hyper Spatiotemporally: Hyper Spatiotemporally is a term used for existence in both space and time. In other words, Metaverse is a virtual world counterpart of the natural world, breaking the barrier of space and time of the real world. In its core concept, Metaverse is a virtual world similar to the accurate word but with its spatiotemporal values.

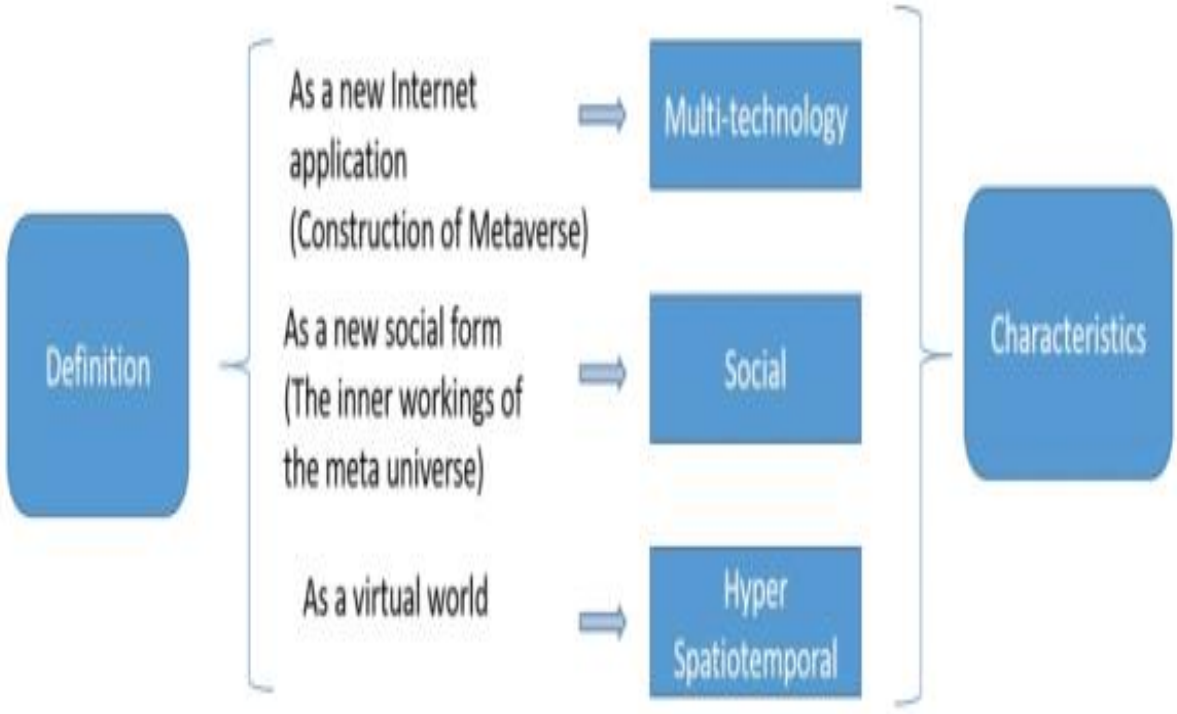

FIG 3.2

4. APPLICATIONS

4.1 Healthcare

One of the first answers to “What are the applications of metaverse?” would point towards the healthcare sector. The best example of metaverse applications in the healthcare sector refers to the use of augmented reality. AR has emerged as a vital technology for empowering the skills and knowledge base of medical students. For example, surgical assistive tools supported by technology such as Microsoft Hololens help surgeons in various surgical procedures.

The use of such technologies showcases the most popular metaverse applications for improving the precision and speed of surgical procedures. Apart from the pre-operative pictures obtained from MRI, CT, and 3D scans, AR headsets can help in viewing important real-time patient data. Therefore, the metaverse can help in easier monitoring of patient data such as body temperature, respiration rate, heart rate, and blood pressure.

The metaverse examples also point towards the use of augmented reality for enhancing vein identification. As a result, the use of metaverse technologies can help in solving the problem of locating a vein, especially in highly pigmented skin or the tiny size of blood veins. Visual-based technology such as CT scans and X-rays are also eligible candidates for transition of healthcare into the metaverse. Imagine a virtual world that allows medical practitioners and healthcare staff to look inside the patients’ bodies and figure out the problem.

4.2 Real Estate

The next promising entry in metaverse applications list would point towards the real estate sector. Virtual reality is one of the significant technologies for driving experiences in the metaverse. It can offer realistic and immersive experiences to clients, and this strength can work in favor of metaverse applications in real estate. For example, real estate agents can leverage the power of VR for offering immersive virtual tours of properties to buyers.

In addition, the potential of the metaverse also allows better prospects for integrating different multimedia features in particular VR tours. For instance, VR real estate tours can have ambient music, light, and sound effects alongside narration. All these factors enabled in most popular metaverse applications in real estate can offer an almost real-time experience of the properties. As a result, real estate marketers could easily boost clients’ confidence by allowing them to explore the property in real-time. Clients can be assured about the various criteria before making a purchase, and real estate agents can save a lot of time and money. On top of it, agents can use metaverse examples to their advantage and tailor custom tours according to the taste of clients.

4.3 Education

The uses of metaverse technologies in the education sector have also started gaining momentum in recent times. Virtual reality is a promising tool for transforming traditional teaching approaches by emphasizing learning concepts through visuals. The top metaverse applications in the education sector can help in creating engaging and immersive learning environments for students in different learning institutions. How does metaverse help in empowering education with its different applications? Virtual reality could support the easy and frequent detection of errors alongside offering real-time editing capabilities. Most important of all, the best metaverse applications in the education sector can remove the barrier of learning in education. Technology can allow the incorporation of any language in a metaverse platform for education, thereby crushing the language barrier.

4.4 Military

Another top entry in the metaverse applications list would take you towards the military sector. The military applications of VR and AR showcase the proven potential of metaverse to support military applications. Tactical Augmented Reality or TAR is one of the notable examples of metaverse technology used in the military. It is almost similar to night-vision goggles, albeit with enhanced capabilities. TAR could easily display the precise location of a soldier alongside the positions of allies and hostiles. As a matter of fact, TAR proves as the ideal substitute for the common handheld GPS gadgets and headsets. The metaverse examples in the military sector also point towards the Synthetic Training Environment. It is an augmented reality system tailored for offering a realistic training experience for soldiers. The Synthetic Training Environment provides an immersive training experience by simulating physically and psychologically intensive combat settings in virtual environments.

4.5 Manufacturing

The search for answers to “What are the applications of Metaverse?” would also take you towards the manufacturing sector. As one of the top metaverse technologies, VR applications can help in training employees on safety precautions alongside fostering participation in the simulation of risk scenarios. As a result, metaverse applications can definitely contribute a lot in reducing the risks of accidents. The most popular metaverse applications in manufacturing could facilitate the development of better products in the long run. For example, a VR headset can help manufacturers examine all elements of a product in detail. In addition, the metaverse applications also help in landscape planning for manufacturing plants and better positioning of equipment. Ford is a huge name capitalizing on virtual reality technology for accessing their locked-down models through a metaverse.

4.5 Cloud and Aritificial Intelligence applications in Metaverse

According to Roy (2021), in client-oriented applications, artificial intelligence (AI) performs an essential part through face detection, natural language processing (NLP), rapid computing, and many other operations and procedures. Time was the only restriction for AI development and application in augmented and virtual reality to create more intelligent immersive spaces. AI can analyze massive amounts of information at lightning speed to forge insights and prompt action. Operators can either use AI for solution-taking (which is appropriate for numerous business applications) or pair AI with mechanization for low-touch operations. The metaverse will employ augmented and virtual realities (AR/VR) integrated with AI, machine learning, blockchain, and cloud computing to build massive and true-to-life virtual universes.

Blockchain is currently the most important technology for creating a digital economy. According to Lee et al. (2021), this technology will make it possible to conduct transactions without intermediaries, store information, and create Web 3.0, where each user will be part of a single system. At the same time, tokens that are created on the blockchain system will become the main assets in the digital world. It follows that tokens will be digital assets and substitutes for securities and assets in the virtual world. However, the use of these technologies largely depends on state regulation.

Now, many countries have mastered the blockchain and see the potential in it. In 2021, UNESCO (2021) member countries adopted global ethical standards for artificial intelligence. 193 countries will have to finalize their regulatory frameworks in such a way as to make smart systems safe for citizens. On November 25, 2021, a document was presented that defined common values and principles for creating new legal norms focused on AI. It regulates cyber protection of personal data, human surveillance and data analysis, control, and evaluation of AI, and environmental safety.

One of the major uses of AI by digital people is language processing. AI can assist in disintegrating natural languages such as English, transforming it to a machine-readable configuration, conducting analysis, getting a reply, transforming the outcomes to English, and transmitting it back to the operator (Roy, 2021). This full procedure makes up only a fraction of a second - similar to a real discussion. The most promising feature is that the outcomes can be translated into any language, given the practicing the AI so that operators globally can access the metaverse.

Additionally, AI can also be valuable with human-computer interaction (HCI). When a user puts on a refined AI-stimulated VR headset, its detectors will be used to read and indicate his/her electrical and strength patterns to be sure how he/she desires to progress within the metaverse (Lee et al., 2021). AI can allow recreating an accurate feel of touch in VR. Besides, it can support voice navigation to communicate with virtual entities without using hand regulators.

5 CONCLUSION

While specific companies try to capitalize on the metaverse development, the latter potentially evolves in fits and beginnings, with some more time before across-the-board adoption. This is given that essential technologies still require optimizing their functionality, comfort of service, and price. Retail, digital design, art, concerts, performances, entertainment, and esports are all projects that will be in demand in the digital meta-market in the coming years. At the same time, it must be said that the market for such solutions is still growing. Over the years, the demand for projects will increase, based on the experience of already completed transactions.

Like any other pilot technological project, the metaverse, its concept, and the interaction between the players require significant improvements. In addition to implementing technological solutions, this concerns legal regulation while developing new economic opportunities, there are risks associated with the currently unresolved issue of introducing legal norms affecting different categories of legal relations in the virtual space since it has no physical boundaries.

The content of the new universe includes different technologies and devices, and therefore it is challenging to build it within the framework of one company. The metaverse is a new virtual reality world, where ample opportunities will be available for business and everyday life.

The most important quality of digital objects is the possibility of interpretation. A skin once won or bought in one virtual world can be recognized, interpreted, and integrated into another: from fantasy worlds to Instagram filters. Objects will be adapted in different ways: algorithms, neural networks, the hands of living artists and designers. Both users and game creators need this: the former will be able to move between worlds, to some extent retaining the qualities of their characters, and the latter will be able to motivate users to move into their worlds with the support of external objects.

6 FUTURE ENHANCEMENTS

Extended Reality. The metaverse moves from concept to reality, and VR/AR/MR is a necessary intermediate stage. To a certain extent, virtual environments are the technical foundation of the metaverse.

User Interactivity. Mobile techniques for user interaction enable users to interact with digital overlays through the lens of XR. Designing mobile techniques in body-centric, miniature-sized and subtle manners can achieve invisible com putting interfaces for ubiquitous user interaction with virtual environments in the metaverse.

IoT and Robotics. IoT devices, autonomous vehicles and Robots leverage XR systems to visualize their operations and invite human users to co-participate in data management and decision-making. Therefore, presenting the data flow in comfortable and easy-to-view manners are necessary for the interplay with IoTs and robots. Meanwhile, appropriate de signs of XR interfaces would fundamentally serve as a medium enabling human-in-the-loop decision making. To the best of our knowledge, the user-centric design of immersive and virtual environments, such as design space of user interfaces with various types of robotics, dark patterns of IoT and robotics, subtle controls of new robotic systems and so on, are in their nascent stage. Therefore, more research studies can be dedicated to facilitating the metaverse-driven interaction with IoT and robots.

Content Creation. Content Creation should not be limited to professional designers – it is everyone's right in the metaverse. Considering various co-design processes, such as Participatory design, would encourage all stakeholders in the metaverse to create the digital world together. Investigating the Motivations and Incentives would enable the participatory design to push the progress of content creation in the metaverse. More importantly, the design and implementation of automatic and decentralized governance of censorship are unknown. Also, we should consider the establishment of creator cultures with cultural diversity, cross-generational contents, and preservation of phase-out contents (i.e., digital heritage).

Virtual Economy. When it comes to the currency for the metaverse, the uncertainty revolves around the extent to which cryptocurrency can be trusted to function as money, as well as the innovation required to tailor it for the virtual world. Moreover, as the virtual world users will also be residents of the real world, the twin virtual and real economies will inevitably be intertwined and should not be treated as two mutually exclusive entities. Therefore, a holistic perspective should be adopted when examining what virtual economy truly means for the metaverse ecosystem.

7 REFERENCES

1 Ball, M. (2021). Framework for the metaverse. Retrieved February 11, 2022, from https://www.matthewball.vc/all/forwardtothemetaverseprimer.

2 Chow, A. (2021). 6 Lessons on the future of the metaverse from the creator of Second Life. Time. Retrieved February 11, 2022, from https://time.com/6123333/metaverse-second-life-lessons/.

3 Facebook is building the future of connection with lifelike avatars. (2019). Tech Facebook. Retrieved February 11, 2022, from https://tech.fb.com/codec-avatars-facebook-reality-labs/.

4 George, A.S.H., Fernando, M., George, A.Sh., Baskar, T., & Pandey, D. (2021). Metaverse: The next stage of human culture and the Internet. International Journal of Advanced Research Trends in Engineering and Technology, 8(12), 1-10.

5 Herrman, J. & Browning, K. (2021). Are we in the metaverse yet? The New York Times. Retrieved February 11, 2022, from https://www.nytimes.com/2021/07/10/style/metaverse-virtual-worlds.html.

6 Huddleston Jr., T. (2021). This 29-year-old book predicted the 'metaverse' — and some of Facebook's plans are eerily similar. Retrieved February 11, 2022, from https://www.cnbc.com/2021/11/03/how-the-1992-sci-fi-novel-snow-crash-predicted-facebooks-metaverse.html.

7 Isaac, M. (2022). Meta spent $10 billion on the metaverse in 2021, dragging down profit. The New York Times. Retrieved February 11, 2022, from https://www.nytimes.com/2022/02/02/technology/meta-facebook-earnings-metaverse.html.

8 Into the metaverse. (2021). Wunderman Thompson. Retrieved February 11, 2022, from https://www.dx2025.com/wp-content/uploads/2021/11/new_trend_report_entering_the_meta_universe-1.pdf

9 Jenkins, B. (2021). The future of immersive social networks. Forbes. Retrieved February 11, 2022, from https://www.forbes.com/sites/forbestechcouncil/2021/08/18/the-future-of-immersive-social-networks/?sh=7f0daee1216c.

10 Lee, L.-H., Braud, T., Zhou, P., Wang, L., Xu, D., Lin, Zh., Kumar, A., Bermejo, C., & Hui, P. (2021). All one needs to know about metaverse: A complete survey on technological singularity, virtual ecosystem, and research agenda. Journal of Latex Class Files, 14(8), 1-66.

11 Oculus Connect 6: Introducing hand tracking on Oculus Quest, Facebook Horizon, and more. (2019). Oculus. Retrieved February 11, 2022, from https://www.oculus.com/blog/oculus-connect-6-introducing-hand-tracking-on-oculus-quest-facebook-horizon-and-more/.