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Systematic Review On Metaverse: And Its Future Considerations

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Abstract

The new normal of the world is the metaverse and many researchers, scientists, and educationists are probing into the fact. Metaverse is now a subject of interest locally and globally in every part of the globe. The virtual environment of the Metaverse offers great platforms for a computer-generated and interactive virtual world. The aim of this study is to conduct a Systematic Review of Metaverse and the immersive future that it will create. The major objective of this study is to find out the future applications of the Metaverse. This article offerings the findings of a methodical review that aimed to understand the usage and importance of metaverse in various fields by using augmented and virtual realities. A total of 38 studies have been reviewed through the Scopus database, which was published between 2019 to 2022. Results indicated that the metaverse has a significant role in different areas of human life. This study also revealed the challenges or problems which people may face in the future.

Keywords: Metaverse, Virtual reality (VR), Augmented reality (AR), Digital Twins, Extended reality (XR).

1. Introduction

Metaverse is a current addition to the lexicon of technology commentators and academics alike; this word is derived from a Greek word meaning “beyond” . It modifies the human experience, using technology to go beyond our physical reality. Metaverse is described as the decentralization of a computer-generated world where the users feel a real sense of existence in these spaces for learning, work, and leisure. The metaverse is designated as a reiteration of the internet that employs blockchain technology, VR headsets, and avatars which make a connection between the physical and simulated worlds (Lee et al., 2021; The Verge, 2021). The metaverse has been a topic of great debate since 2021; many types of research have been conducted to explore the effect of a computer-

generated world on people's socialization, academics, and professional behaviours. Now people can interact with each other from any part of this world. They join through spaces, share their opinions and thoughts about any social and moral issue, and get another point of view. The novel metaverse notion, as drawn by Mark Zuckerberg defines a combined mesmeric ecosystem where the fences between the cybernetic and real worlds are unified to users, letting the use of holograms and avatars to work, socialize, and interact through virtual communal experiences (Meta 2022). He combined all his social media Apps (Facebook, Instagram, and WhatsApp) under the umbrella term Meta, because it integrated people via a computer-generated world.

Metaverse enables people to explore the virtual world's innovations through extended reality (XR) platforms. It shifted people's attention toward emerging technologies like Blockchain, 5G, artificial intelligence, and 2D graphics to 3D graphics. Extended reality (XR) is an immersive technology used to assess the metaverse, mixed, virtual, and augmented worlds. This advancement in technology brings a lot of changes in daily life tasks. The XR is poised to make the jump from laboratories to our homes and is altering how people work, play, socialize and learn. People spend more time in a simulated world than ever before; millions of people are using Snapchat, Roblox, Fortnite, and Meta’s Horizon Worlds.

Meanwhile, the gaming community may argue that a game such as Fortnite qualifies as a prototype metaverse. The game boasts 350 million registered users globally (a population equal to the US) and includes in-game currency that can be earned and traded. With growing technology, the cyber security of people is a very important issue nowadays; governments are investing in and preparing laws and legislation that would oversee peoples' activities in Metaverse (Dede & McGivney. 2021).

Literature suggests that the metaverse needs a secure and mature Digital twin technology in the count to Parallel Intelligence to enable it to develop independently. We suggest that the fundamental components are not required at once when Blockchain is merged with other fields. We take the unchallengeable properties of Blockchain and develop BlockNet, a safe multidimensional data storage solution, to maintain the security of the Internet of Things digital mapping process and boost the data consistency of digital twins. A digital twin is described as a virtual copy of the physical environment, process, and system that seems like and acts identically to its corresponding real-world items. Metaverse is the growth of digital twins in society and people. Even though the metaverse emerged almost a decade before the advent of digital twins but it is still in the concept stage while digital twins have been extensively used in business and industries. Blockchain is the characteristic of digital twins, which ensures users' data security, known as BlockNet. BlockNet ensures the digital mapping process of the internet of things, improving the reliability of digital twins (Lv, 2022).

The metaverse sets new trends in education systems; the well-informed and knowledgeable community of teachers, educators, content creators, and developers are making institutions approachable to all people and giving them preparing this society for what it means to be

(Vivekanandan, 2019). Beyond gaming in the fields of healthcare, education, business, and the creative sectors, the metaverse may lead to new developments. The metaverse, for instance, offers the opportunity to enable knowledge sharing, much like the internet. Algorithms might be developed to learn from children's behaviour, figuring out how to design more efficient learning environments and teaching methods, both online and off. Children could learn in a way that is less passive and more engaged. The metaverse will open up fascinating new avenues for amusement and artistic expression by enabling people to develop their distinct worlds or to modify the real ones, adorning them with digital artwork and populating it with digital creatures.

A study conducted by Mystakidis (2011) on the metaverse described that metaverse has a significant role in the education system. Meta-education emphasizes online distance education, which connects people from around the world. The computer-generated technology in the education system breaks the final boundary between social linking and casual learning. The study showed that it also greatly impacts a person's psychological well-being, cognition, and emotions. Hence, the metaverse is a persistent multiuser platform that connects a network of social, networked immersive experiences. Lee (2021) described that metaverse has an important role in altering people's attitude toward the stock market by connecting the virtual and real world through hyper-convergence. This study suggested that stakeholders must learn about the growth of 3D metaverse next-generation immersive environment in the business community. Metaverse connects people through the virtual world. To engage in or simulate real life in a virtual metaphorical world free from temporal and spatial restrictions, participants in the metaverse communicate with themselves through avatars they have created (Díaz, Saldaña, & Avila, 2020).

A study conducted by Shen, Tan, Guo, Zhao, and Qin (2021) explained that commercial activity executed in an immersive environment is described as virtual commerce because it is the modern expansion of e-commerce. Virtual commerce, from the technology's perspective, entails e-commerce substructure such as electronic payment and electronic product catalogues and accepts computer-generated technology to make new environments for commercial activities. Damar (2021) executed the bibliometric assessment of the metaverse, carried out by extracting the data from all the documents, research, journals, and institutions between the years 1999 to 201 from the web of science database. The findings of this study indicated that the metaverse entered our lives many years ago, and it gradually controlled our education system, business, and digital marketing field. Gadekallu, et al (2022) conducted a study on the importance of Blockchain for the metaverse. After Mark Zuckerberg brought all his social media apps under the umbrella term metaverse, it became a new trend for social networks and the 3D virtual world. With this new norm, users' privacy and security was the biggest concern of that time. Blockchain is a promising solution to deal with users' content and data management by owning its distinct features of transparency and decentralization.

During the COVID-19 pandemic emergencies, education was one of the biggest concerns people were thinking about how they learn and teach. Metaverse connected the real world with a

virtual world, joined people through these spaces, and became the new trend for future education. The role of the metaverse is clearly defined in different kinds of education, blended learning, computer-based learning, and inclusive education. The findings of this study indicated that the metaverse is a new concept in the educational field, so it can harm some areas like security and ethics (Zhang, Chen, Hu & Wang, 2022). Tlili et al. (2022) carried out a thorough review of the literature on the metaverse in the field of education, including a discussion of research trends, areas of specialization, and research limitations, such as the lack of studies on lifelogging, audience profiles, mobile learning, hybrid learning, micro-learning, and the use of the metaverse for students with disabilities.

2. Background

Metaverse is defined as a three-dimensional ecosystem that is created using virtual and augmented reality, where by using the avatars people connect with each other (Ball, 2022). Metaverse is of great importance in all fields of life, whether it is gaming, business, or education. (Abbate, et al, 2022). In the Literature, Metaverse is understood and defined in multiples forms. Herrman and Browning (2021) labelled the metaverse as a computer-generated and digital world that happens outside the physical ecosphere. In unpretentious words, it is a plethora of interconnected worlds. It is a set of virtual spaces which arrange for prospects for individuals to intermingle with others who are not in the same physical space.

The reciprocal topographies of the metaverse are multi-technology, hyper spatiotemporality, and sociality (Ning, et al, 2021). Metaverse integrates a lot of new technologies that include Mixed Reality, Virtual Reality, Blockchain, and Augmented Reality. And a lot of other multi technologies that lay the foundations of the economic system.The metaverse is violating the precincts of universe and time by joining the cultural, legal, and economic systems in a virtual world. Augmented Reality (AR) undertakes that the virtual environment is an association between the real world and the users, but the way it enhances real-world understanding and experiences may vary between context and tools.

The study conducted by MacCallum and Parsons (2019) on the role of augmented reality in education and the classroom described that educators need to be trained and guided about the use of mobile augmented reality in the classroom and its impact on student's performance. The teachers could experience augmented reality using Metaverse AR devices or tools. Their responses indicated that teachers with an understanding and training in AR tools focus on content rather than the device. The metaverse has been growing rapidly worldwide as the virtual world (VR) provides openings for highly interactive and cybernetic experiences. Like all other fields, metaverse has progressively gained acceptance in medicine and treatment with the development of technologies such as the 5G mobile network, the Internet of Things, and big data. Its demand may vary in different subspecialties with different levels of disease. The findings of this study provided insight

into the applications, development, and potential of a metaverse in the medical field (Wu & Ho, 2022).

Literature demonstrated that metaverse is determining the prospects and future of end user research and practice, which pronounced that future research recommended that metaverse will be beneficial to public relations, digital advertising, branding, significance creation, and customer behavior. In these spells, individuals mostly do virtual spending, which hold back their time as well as energy. So in the future metaverse will transform the advertising and commercial community (Belk, Buhalis, Flavian & Lartey, 2022). In the context of avatar meeting and innovative biometrics sideways the buyer expedition, the communicating and immersive rudiments of the metaverse will crop a momentous level of data. At a similar time, customer behaviour research empirically measures the consumer interactive reactions (e.g., level of recognition and acquisition intention) compressed by specific design pieces. In contrast, research on submission strategy makes and assesses strategy artifacts to involve operators and outpouring user depletion using the arrangements found through customer behaviour lessons (Flavián, Ibáñez-Sánchez, & Orús, 2019).

3. Methodology

3.1. Research question

The presented systematic review on metaverse seeks an answer to the given question;

How will the metaverse shape our future?

3.2. Objectives

The primary goal of this study was to conduct a systematic review of the significance of the metaverse in our daily lives and to present an overview of how the metaverse will influence different aspects of our lives, such as education, the medical field, business, digital marketing, branding, and advertising, etc.

This systematic review aimed to assess the extensive quality of studies and explore the significance of virtual and augmented realities through the metaverse. Another goal of this study was to highlight the challenges and problems people may face in the future and explore the implication of Metaverse virtual reality in the physical world.

3.3 Research Procedure

The Scopus database was used for the systematic review of this research. This study addressed the question of a systematic review of metaverse virtual reality and digital twins. This research explored the use of the metaverse in various fields of life and addressed how our future is changing with the metaverse. The reason behind the use of the Scopus database was to focus only on the

metaverse and its interlinked technologies to avoid the dispersion of results and subsequently circumvent the less focus on the main topic.

3.4. Inclusion and Exclusion method

The designated studies for systematic review cumulatively met the following inclusion procedures:

a) Studies have been published between 2019 to 2022.

b) Address Metaverse from the standpoint of growing technology.

c) Adequately described the use of virtual and augmented reality to promote the technology

d) Offers a metaverse virtual computer-generated world in a different field.

e) Nominated studies present adequate knowledge and highlight the importance of the metaverse.

f) Selected studies describe the significance of metaverse VR in the future and its challenges.

4. Results

There were 38 studies located in references, including 7 duplicates. Initially, 31 studies were gone through. However, 20 of these 31 studies were examined, starting with an appraisal of their titles and abstracts. 12 out of the 20 studies were accepted; these met the inclusion criteria. The remaining 11 out of 31 studies were excluded as they did not meet the defined inclusion method. The full text screened 6 out of 11 studies; an additional five were excluded when examined in greater depth, as these studies did not meet the inclusion criteria. In the end, 18 out of 31 studies fulfilled the inclusion criteria.

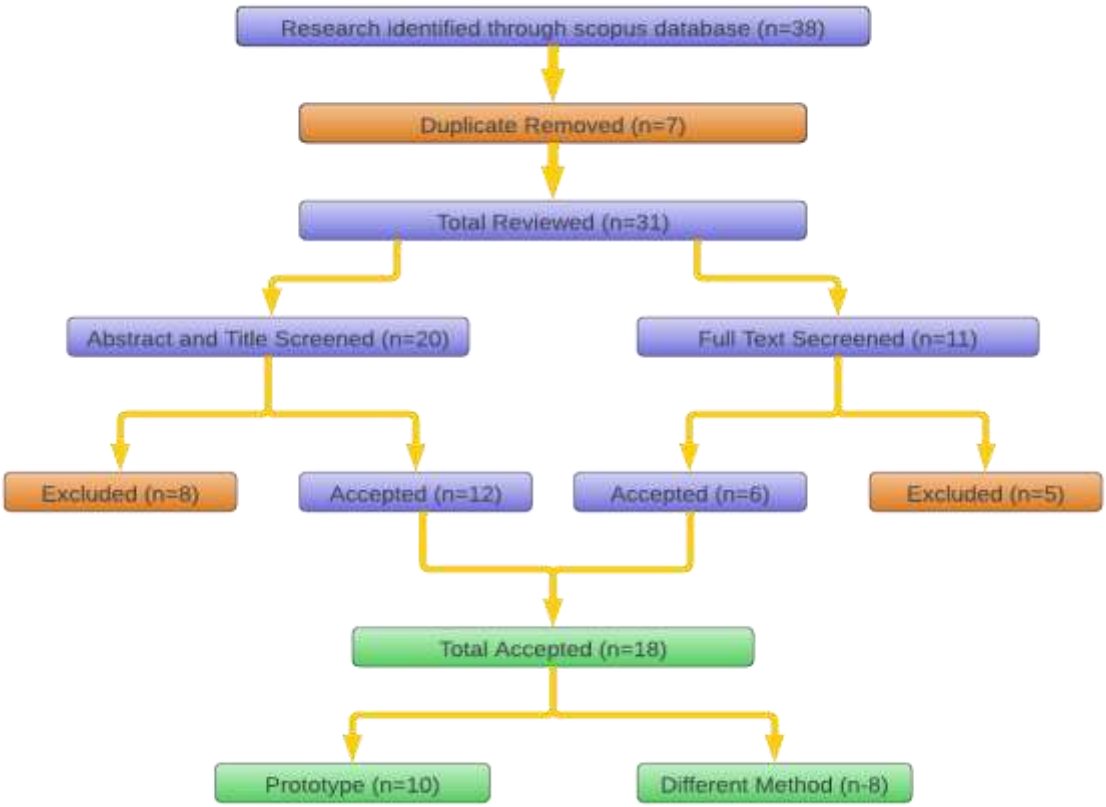

Figure 1. Graphical representation of results

4.1. Quality Appraisal:

All study titles, references, and abstracts were checked. However, after reading and analyzing the texts of 20 publications, it was discovered that 11 did not match the study's inclusion requirements, which resulted in the systematic review's removal. After that, a quality evaluation was conducted. Higgins and Altman (2017) advised against using statistical scales for grading; therefore, emphasis was put on evaluating bias and the danger of bias from trial attrition, selection, and selective conclusion reporting.

4.2. Data Extraction

The strobe checklist has updated the development of an electronic data form for descriptive cohort publications. The research environment, publication date, study design, study goal, unique methodologies employed in the studies being presented, and results were all extracted as data. The abstracted data were separately compared to the full-text articles.

Dates of publication and data collection:

The included studies were conducted, data collected, and published between 2019 to 2022.

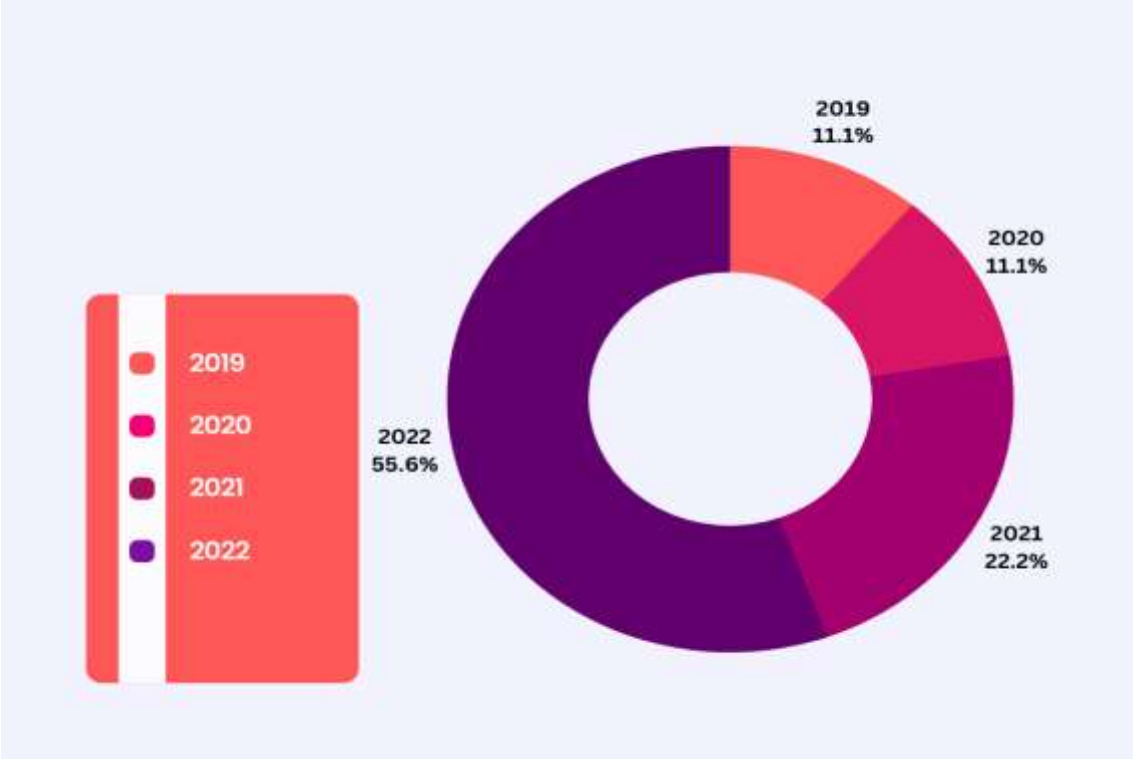

Figure 2. Percentage of publication in different years.

4.3. Review studies design and method

All 31 selected studies were based on metaverse and interlinked technologies. Ten studies were based on the development of prototype applications and systems, and 8 studies remaining are based on literature reviews, surveys, or chapters. Most of the nominated studies use augmented reality (AR) and virtual reality (VR) methods to offer the computer-generated world through metaverse review. The following table describes the studies developing a metaverse prototype application.

Table 1. Review of the studies and prototype methods

Sr#	Authors and Year Published	Title and Goals	Results
1.	Mystakidis, S. (2022).	**Title:** Metaverse **Goal:** This study was aimed at exploring the effect of the metaverse on the education system. Meta-education emphasizes online distance education, which connects people from around the world.	The results showed that meta-education is a new model of online distance education. Students are learning in the informal 3D virtual environment. It is also described that the metaverse can enable merged activities

			that substitute profound and long-lasting knowledge.
2.	Lee, J. (2021).	**Title:** A Study on Metaverse Hype for Sustainable Growth. **Goal:** This study examines search traffic to examine user attention. Additionally, it gathers information from news outlets that act as a channel for communicating about cutting-edge technologies.	The results of this study showed that search traffic increased all over the world. Researchers anticipated that the next-generation platform known as metaverse would replace online portals, e-commerce, and e-learning.
3.	Shen, Tan, Guo, Zhao, and Qin (2021)	**Title:** How to Promote User Purchase in Metaverse? A Systematic Literature Review on Consumer Behavior Research and Virtual Commerce Application Design **Goal:** This study aimed to emphasize the virtual commerce for both consumer behavior and application design to promote the purchase in virtual commerce. Significant design artefacts and purchasing influencing factors were found throughout the review.	In a novel effort, this study attempts to compile research on computer-generated commerce systems from consumer behaviour and system design studies. After establishing such a continuity between application design and behaviour analysis, we anticipate further research outcomes in the future.
4.	Abbate, (2022)	**Title:** A first bibliometric literature review on the metaverse **Goal:** The metaverse technology, explored in the literature since the 1990s, is evaluated bibliometrically in this study. Field research is conducted specifically for the metaverse, a recent and popular topic.	The findings of this study indicated that the metaverse entered our lives many years ago, and it gradually controlled our education system, business, and digital marketing field. Metaverse shapes our lives in many ways through a virtual world.
5.	Gadekallu, et al (2022)	**Title:** Blockchain for the Metaverse: A Review **Goal:** The Internet of Things, digital twins, multisensory and immersive applications, artificial intelligence, and big data were some of the primary	The findings revealed several blockchain technical advancements made available for the metaverse, improving prospective apps and services' functionality and usefulness.

		metaverse enablers that were the subject of this study. To highlight the function of Blockchain in metaverse apps and services, we also offer some significant projects.	
6.	Zhang, Chen, Hu and Wang, (2022).	**Title:** The metaverse in education: Definition, framework, features, potential applications, challenges, and future research topics. **Goal:** This study aimed to examine the effect of a metaverse in the educational field and explore the challenges people can face in meta-education. The role of the metaverse is clearly defined in different kinds of education, blended learning, computer-based learning, and inclusive education.	Results: the results of this study described that metaverse changes our education system in many ways. Metaverse connected the real world with a virtual world, joined people through these spaces, and became the new trend for future education. But it also has some controversial issues like security and ethics, which further need to discuss and studied in the future. Otherwise, the metaverse can be metaworse.
7.	Ning et al. (2020).	**Title:** A Survey on Metaverse: the State-of-the-art, Technologies, Applications, and Challenges **Goal:** This study aimed to explore the metaverse's development status from various perspectives of network organization, such as virtual reality object connection, virtual world conjunction, and management technology. This study also focused on the first application of the metaverse and the challenges it can face.	This paper collected data from different countries, examined the metaverse status and predicted the problems and challenges it can face.
8.	Tlili et al. (2022).	**Title:** A systematic literature review of the Metaverse applications in education. **Goal:** A thorough review of the literature on the metaverse in the field of education, including a discussion of research trends, areas of specialization, and research limitations, such as the lack of studies on lifelogging, audience	The findings described that metaverse has a significant role in education, hybrid learning, mobile learning, and microlearning.

		profiles, mobile learning, hybrid learning, micro-learning, and the use of the metaverse for students with disabilities.	
9.	MacCallum and Parsons (2019).	**Title:** Teacher Perspectives on Mobile Augmented Reality: The Potential of Metaverse for Learning **Goal:** This study aimed to examine the role of augmented reality in education and the classroom, which described that educators need to be trained and guided about the use of mobile augmented reality in the school and its impact on student performance.	Their responses indicated that teachers who were given training in mobile AR tools were more focused on the content of learning rather than the understanding of the device. It is concluded that teachers should be provided with the proper training so they can realize the potential of Metaverse Augmented Reality in the educational field.
10.	Wu and Ho, (2022).	**Title:** A scoping review of a metaverse in emergency medicine. **Goal:** This study aimed to explore the role of the metaverse in the medical field and the clinical management of patients.	Findings indicated that the metaverse has progressively gained acceptance in the field of medicine and treatment with the development of technologies such as the 5G mobile network, the Internet of Things, and big data. The findings of this study provided the insight into the applications, development, and potential of a metaverse in the medical field.

4.4. Metaverse, digital twins and future

Studies showed that using Extended reality (XR), VR headsets, Augmented reality (AR), and haptic gloves allows users to enjoy high levels of assignation and immersive experience fully, and this technology is quickly developing to enable the establishment of the metaverse. A digital twin is a virtual copy of the physical environment, process, and system that seems identical to its corresponding real-world items. Metaverse is the growth of digital twins in society and people. Metaverse plays a significant role in education, industries, digital marketing, healthcare services, and research activities (Kim, 2021).

Due to the excessive usage of a metaverse in various areas, the stresses of Augmented Reality and Virtual Reality increased in the last few years. Therefore, the systematic review results showed that 10 out of 31 studies were based on metaverse. These studies indicated that the metaverse is described as a 3D space representation established in augmented and virtual reality, where people could use their avatars to work, play and communicate with each other (Ball, 2022). These studies described that metaverse changes people's attitudes towards meta-education, digital marketing, online banking, branding, and the business community.

Table 2. List of reviewed studies that used different approaches for the metaverse.

Sr#	Authors and Year Published	Title	Methods and Tools
1.	Anderson and Reine (2022)	Title: The Metaverse in 2040	This study used a theoretical approach to the metaverse.
2.	Dwivedi et al. (2022)	Title: Metaverse beyond the hype; Multidisciplinary perspectives on emergency challenges, opportunities, and agenda for research practice and policy.	This study used augmented, virtual, extended, and mirror worlds.
3.	Fernandes and Werner, (2022)	Title: A systematic literature review of the metaverse for software engineering education; Overview, challenges, and opportunities.	Systematic literature review.
4.	Sweeney (2019)	Foundational principles and technologies for the metaverse.	This study used computing methodologies and human-centred computing.
5.	Duan, Li, Fan, Lin, Wu and Cai, (2021).	Metaverse for social good: A university campus prototype.	This study used a method that offers implemented blockchain metaverse.
6.	Nica, Poliak, Popescu & Parvu (2022).	Decision Intelligence and Modeling, Multisensory Customer Experiences, and Socially Interconnected Virtual Services across the Metaverse Ecosystem.	This study used data visualization tools such as dimensions and VOS viewer.

7.	Jun, (2020)	Virtual reality church as a new mission frontier in the metaverse: exploring theological controversies and missional potential of virtual reality church.	Convergent digital technology was used.
8.	Narin, (2022).	A content analysis of Metaverse articles.	A systematic literature interview.

5. Discussion and conclusion

Rendering to the complete calculation of study excellence, the design plus methods were discussed in detail and, in furthermost circumstances, possibly will be recurrent. In the current systematic review, it remained conceivable to devour an exhaustive consideration of in what way the metaverse profiles our existence and appreciative of the usage of technological equipment. In this literature, the study used Scopus data platforms for exploration queries on 38 papers that were published between 2019 to 2022. Finally, the study revised 31 papers that emphasized on metaverse and its significance in the future. Metaverse, including AR and VR methodologies, has the highest percentage of application, 58% (18 out of 31 studies), while in the studies that used different approaches ratio was 42%.

Additionally, a systematic review exposed that the metaverse is a developing ad emergent technology; it's a simulated ecosphere where individuals sort out their avatars to do performance onn their behalf. The avatar also work and play beyond their physical actuality. It is concluded that the metaverse has a noteworthy starring role in our forthcoming days in all the fields of life, such as learning, commerce, online banking, and digital advertising.

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