TITLE OF PROJECT REPORT

Security Research Upon the Metaverse

A PROJECT REPORT

Submitted by

Harsh Rawat *20BCY10037*
Veeraboina Gnaneshwar *20BCY10215*
Zainab Mujtaba *20BCY10217*
Pushpanjali Bharadwaj *20BCY10225*

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING WITH SPECIALISATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SCHOOL OF COMPUTING SCIENCE AND ENGINEERING

VIT BHOPAL UNIVERSITY

KOTHRIKALAN, SEHORE
MADHYA PRADESH - 466114

23 APRIL, 2022

BONAFIDE CERTIFICATE

Certified that this project report titled **"SECURITY RESEARCH UPON THE METAVERSE"** is the bonafide work of "**HARSH RAWAT(20BCY10037), VEERABOINA GNANESHWAR(20BCY10215), ZAINAB MUJTABA(20BCY10217), PUSHPANJALI BHARADWAJ(20BCY10225)"** who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported at this time does not form part of any other project/research work based on which a degree or award was conferred on an earlier occasion on this or any other candidate.

PROGRAM CHAIR
Dr. R. Rakesh, Assistant Professor
School of Computer Science and Engineering
VIT BHOPAL UNIVERSITY

PROJECT GUIDE
Dr. PRAVEEN LALWANI
School of Computer Science and Engineering
VIT BHOPAL UNIVERSITY

The Project Exhibition II Examination is held on 23 April,2022

ACKNOWLEDGEMENT

First and foremost I would like to thank the Lord Almighty for His presence and immense blessings throughout the project work.

I wish to express my heartfelt gratitude to Dr. R. Rakesh, Program Chair, School of Computing Science and Engineering for much of his valuable support and encouragement in carrying out this work.

I would like to thank my internal guide Mr. Praveen Lawani, for continually guiding and actively participating in my project, and giving valuable suggestions to complete the project work.

I would like to thank all the technical and teaching staff of the School of Computing Science and Engineering, who extended directly or indirectly all support.

Last, but not least, I am deeply indebted to my parents who have been the greatest support while I worked day and night on the project to make it a success.

LIST OF ABBREVIATIONS

2-D	2 Dimension
NFT	Non-Fungible Token
VRML	Virtual Reality Modeling Language
X3D	Extensible 3-Dimensional
COLLADA	Collaborative Design Activity
HTML	Hypertext Markup Language
URL	Uniform Resource Locator
VR	Virtual Reality
AR	Augmented Reality
MR	Medical Representation
CPU	Central Processing Unit
GPS	Global Positioning System
IT	Information Technology
SSMI	Sample Survey of Manufacturing Industries

LIST OF FIGURES AND GRAPHS

ABSTRACT

The Metaverse (future version of the internet) is a persistent, online, three-dimensional reality that integrates numerous virtual spaces. Video games provide the closest metaverse experience presently, emphasis on 3D virtual reality.

Our contribution starts by analyzing the foundations of the Metaverse. Metaverse will become an integral part of every person's life. But people don't have the required knowledge of Cyber Security, they don't know how to secure themselves and how secure they are in this virtual world. . There is no single solution to the problem of making the Metaverse a safer place.

This project work will compensate for their lack of knowledge regarding the security issues in Metaverse and it will provide information and solution for the safety of their privacy, data, and personal information.

TABLE OF CONTENTS

CHAPTER-1

PROJECT DESCRIPTION AND OUTLINE

INTRODUCTION

The metaverse is a persistent, online, three-dimensional universe that combines various virtual spaces You can think of it as the next generation of the internet. Due to the metaverse, users will be able to collaborate, connect, meet, and game in these 3D spaces. In its entirety, the metaverse does not exist as of now, but there are some elements that are similar. One of the closest or similar experiences of it is currently provided by video games. Through in-game events and virtual economies, developers have redefined what a game is. Even though cryptocurrencies are not necessary, they can be a good addition to a metaverse. A digital economy can be enabled with the use of various utility tokens and virtual collectibles (NFTs). Trust Wallet and MetaMask are examples of crypto wallets that would be beneficial for the metaverse. Moreover, the emergence of blockchain technology may improve transparency and resiliency.

MOTIVATION OF WORK

People can work, play, shop, and interact in the Metaverse, which is a graphically rich virtual world with a certain degree of realism. It's a network of three-dimensional virtual environments centred on social interaction. A metaverse platform is a virtual platform that enables developers to construct virtual to augmented reality experiences. The

Metaverse is a technological segment that has come a long way, thanks to investments from leading tech companies such as Meta Platforms, Microsoft, and Epic Games. In comparison to social media and other major products, the metaverse is considered a niche product. While it's impossible to predict when the metaverse will supplant social networks, it will undoubtedly open up new social and commercial opportunities unlike anything we've seen before. This makes us want to know more about is and also share awareness and information regarding the Metaverse.

ABOUT INTRODUCTION TO PROJECT INCLUDING TECHNIQUES

This is a simple research work project which will provide all the necessary information about the concept of a virtual reality, what is Metaverse, and how to protect oneself and our personal information on this platform.

After conducting a survey we can conclude that everyone has heard about the term “metaverse”, but not everyone has a clear understanding of it. This is where our research work comes in handy, making people aware of the security issues and how can these issues be resolved.

PROBLEM STATEMENT

Our contribution begins with an examination of the metaverse's fundamentals, followed by an examination of the novel privacy and security challenges that have arisen. Finally, we widen our horizons, as a result of this new paradigm, by examining some of the far-reaching implications yet, the metaverse's logical consequences on a many domains, not all of them in the field of technology. Several advanced technologies that are representative of the the essential notions of the metaverse have

already been established. We'll go through the basics here, the components, features, and functions of the metaverse as well as the long-term. Extensions that could be made in the future.

A metaverse that incorporates current technology, social media, advanced algorithms, and a constant and boundless flow of data from the developing sensor systems will be even more comprehensive than what is currently available.

OBJECTIVE OF THE WORK

In addition to exploring some of the far-reaching yet logical consequences of the Metaverse, we analyze some of the novel privacy and security issues presented by this new paradigm.

ORGANIZATION OF THE PROJECT

We researched on the internet all about the Metaverse and its security and have compiled all the gathered information into an easy-to-understand format. This research paper will help people with their understanding of the Metaverse, its working, and all of its security issues.

SUMMARY

Our team's survey on the metaverse received a large number of responses. Approximately 75% of those polled were familiar with the term and had a basic understanding of the Metaverse. According to popular belief, 43.8 percent of people believe Metaverse is simply a rebranding of Facebook, while 56.3 percent believe Metaverse is a new innovation rather than a rebranding. According to the responses we received from our survey, the

description of the Metaverse varies from person to person. Some refer to it as "a world with next-level technology," while others refer to it as a "virtual space, image of the real world."

Metaverse, like any other existing application, has its issues and problems regarding the safety and security of the personal information of its users. The company needs to work on its security and privacy issues and new laws need to be passed which are up to date with the latest developments in technology for the safety of its users.

CHAPTER-2

RELATED WORK INVESTIGATION

INTRODUCTION

Technologies developed by Meta help people find communities, connect, and grow businesses. Since the launch of Facebook in 2004, people have been connecting in entirely new ways. Billions of people around the world were empowered through apps like WhatsApp, Instagram, and Messenger. As we move beyond 2D screens, Meta is developing immersive experiences such as augmented and virtual reality to help build the next generation of social technologies. Facebook operates today under the restrictions provided by Apple and Google, which develop and control the world's dominant smartphone operating systems. Facebook, however, is attempting to develop its own operating system and set of rules in this new world that will probably use VR/AR headsets and digital sensors.

CORE AREA OF THE PROJECT

Several of the technologies that represent the metaverse's core concepts are already well advanced. Several other technologies are not yet ready to be used in practice, however. Here we describe the fundamental elements, characteristics, and functionalities of the metaverse, along with the long term extensions that may be possible in the future. While taking into account generalities, we take as our starting point-and then elaborate-the vision of the metaverse presented by Zuckerberg, since it is the most comprehensive view yet. A metaverse that incorporates current technology, social media, advanced algorithms, and a constant and boundless flow of data from the developing sensor systems will be even more comprehensive than what is currently available. The significance of security and privacy

concerns in this context is obvious, but they will also be transformed completely.

EXISTING APPROACHES/METHODS

VRML (Virtual Reality Modeling Language) was the first widely cited standard virtual world. It was then created as a counterpart for the HTML document standard. It captures a single 3D space as a single "world" file that can be downloaded and viewed with any VRML-capable browser. VRML, like HTML, used URLs to facilitate navigating between worlds, allowing for an early type of virtual world interoperability.

VRML was succeeded by X3D then COLLADA.

COLLADA’s acceptance across the board would make it easier to transfer objects and behaviors from one virtual world system to another; in reality, COLLADA's scope isn't restricted to virtual worlds because it can be used as an essence 3D object interchange mechanism.

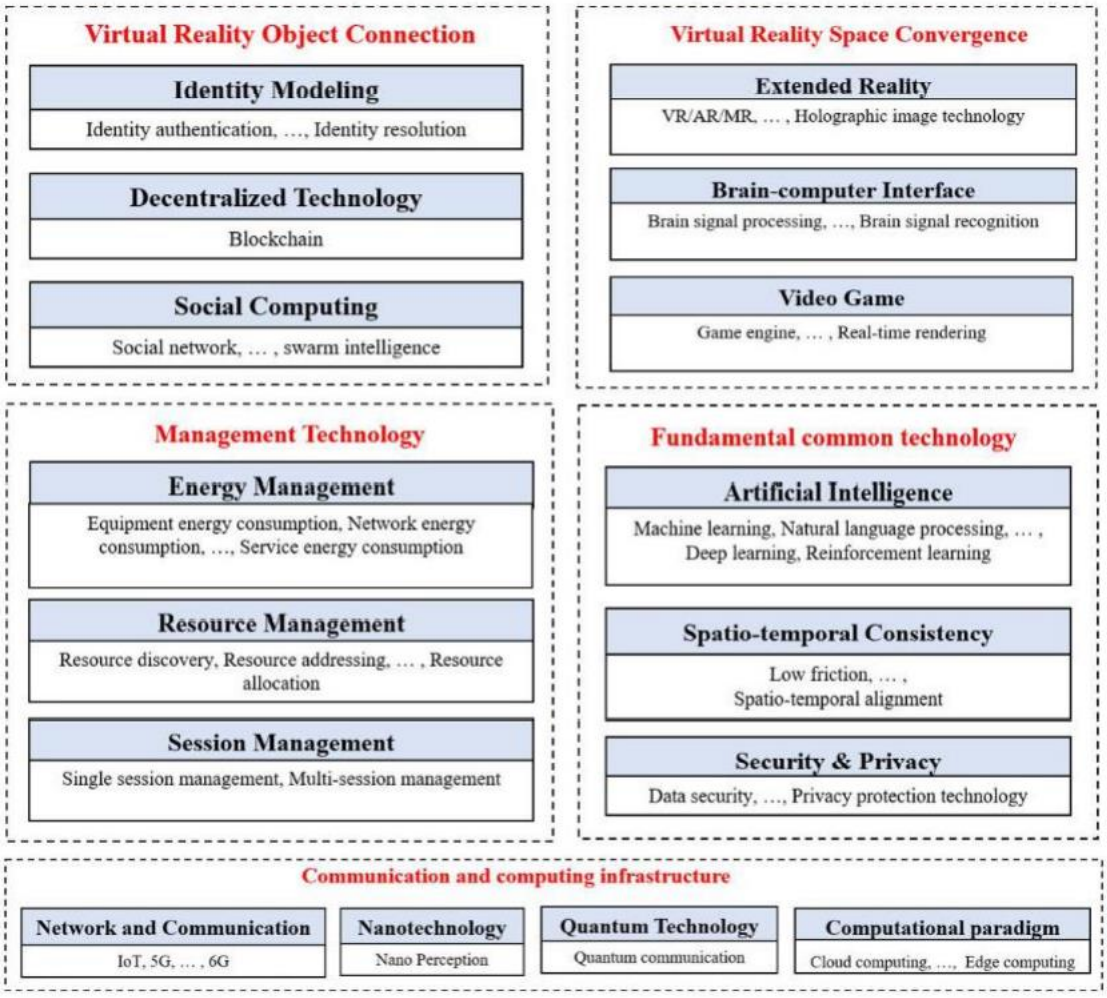

Figure 2.1 Virtual reality

After augmented reality (AR) and virtual reality (VR), the metaverse is a relatively recent notion in real estate technology (VR). Large amount of investors are comfortable with the notion of the metaverse, which is causing a surge in digital land trading and virtual real estate investment. Following virtual site tours, online bookings, and chatbots, many real estate investors regard it as the next big step toward digitization in the real estate industry.

Meta announced that the 1,550-square-foot Meta Store, which will open on May 9 at the company's Burlingame location in California, will contain demos for its Quest 2 VR headset and Portal video conferencing gadget, as well as smart glasses it manufactures with Ray-Ban.

Except for the Ray-Ban glasses, all of the devices will be commercially available at the store. According to the corporation, the products can also be purchased online through a new shopping tab on meta.com.

ISSUES OBSERVATIONS FROM INVESTIGATION

In the social Metaverse, digital footprints can be monitored to disclose a user's real-world identity as well as other sensitive information like location, shopping habits, and even financial information.

The value of privacy has a significant impact on how the social Metaverse is shaped.

Traditional social networks make it considerably easier to implement privacy-preserving strategies since users may choose who they want to share their social media content with.

SUMMARY

In the social Metaverse, such privacy control is not possible because users cannot change the virtual features of the created virtual world, making user privacy maintenance difficult. Assume you are browsing a mall in the social Metaverse, and an avatar follows your avatar and records everything you buy, as well as your travel history, this information may be used in a social engineering attack that is used to violate your privacy in the real world. Furthermore, unlike traditional social media, we cannot choose whether or not we want to allow people to follow our avatars in the Metaverse. The second example of privacy in the Metaverse is that we all want to feel as private in our homes as we do in the real world. Currently, virtual social networks have no restrictions on avatars navigating the map

and even visiting your house, and you can't call the police in the same way you would if you were invaded in your own home.

CHAPTER-3

REQUIREMENT ARTIFACTS

INTRODUCTION

Hardware and Software requirements:

- RAM 8+GB
- Active internet connection
- CPU with 1.5GHz
- The AR/VR/MR technology
- two-dimensional, three-dimensional, GPS, somatosensory, facial and other detected

SUMMARY

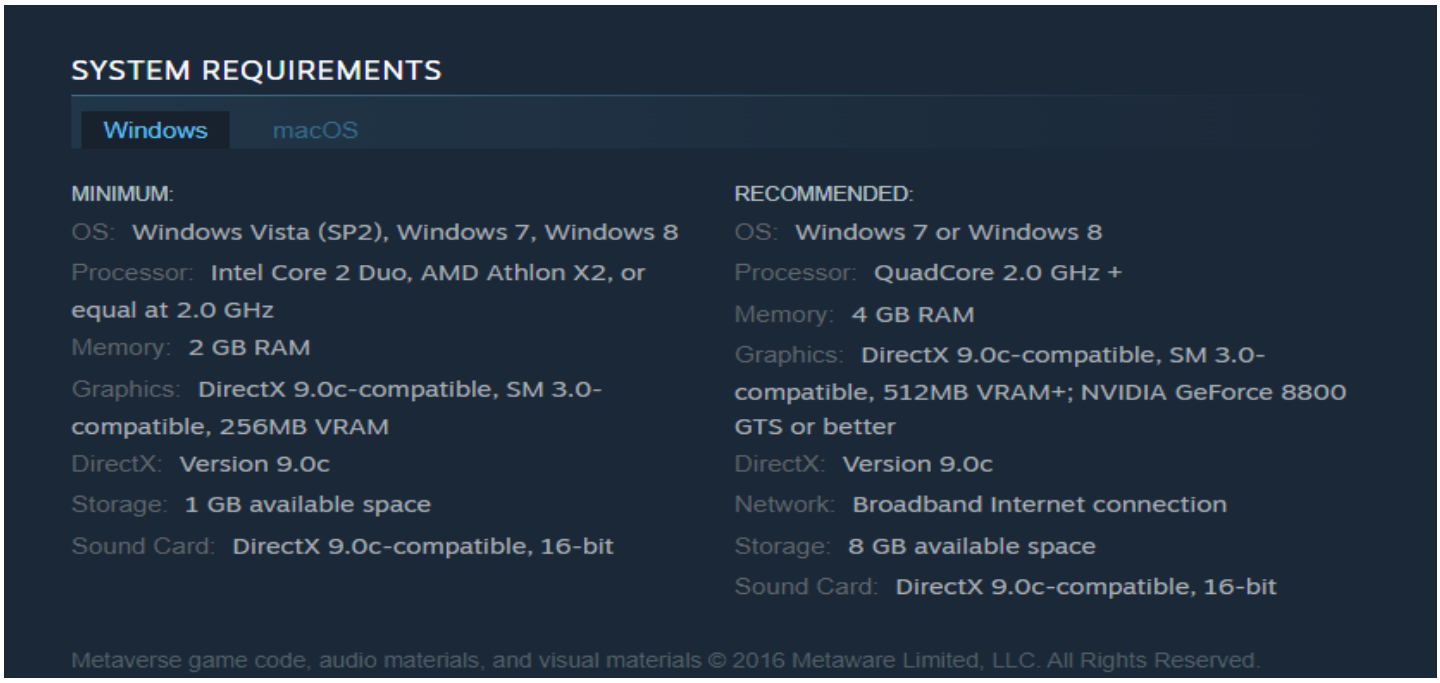

Fig 3.2 System Needs

All the devices required to get the full experience of the Metaverse come at a big cost.

CHAPTER-4

DESIGN METHODOLOGY AND ITS NOVELTY

METHODOLOGY AND GOAL

1. We have taken the most basic concepts and the most asked questions and have worked our way through these while preparing our research paper.
2. Defining the concept of Metaverse and of a virtual reality.
3. How are Facebook and Metaverse linked with each other, and the security and privacy issues that we faced with Facebook that may also occur in the Metaverse

SUMMARY

Due to the involvement of cryptocurrency and NFTs in the world of Metaverse, the need for security also increases. This is not just about the protection of the crypto money of its users but also about the safety and security of personal information.

Collectors can easily be tricked by replicas coined by cybercriminals acting as legitimate authenticators, just as they can be duped of fakes minted by legal authenticators. Scammers are also squatting. eth websites, under the guise of Ethereum's security, may be jeopardized, if another organization's name is used. Cybercriminals might take advantage of the fact that the easily identifiable existing companies can be used to create fictitious Ethereum domains similar to domain spoofing, names, and smart contracts

are used. Transactions are only as secure as the entity enforcing them, which can be difficult to determine on the internet.

CHAPTER-5

TECHNICAL IMPLEMENTATION AND ANALYSIS

OUTLINE

In order to have an evident result of the widespread knowledge of the metaverse around our generation, we conducted a survey.

WORKING LAYOUT OF FORM

The survey consisted of 6 questions asking about Metaverse. The questions were:

1. Are you aware of the term Metaverse?
2. Is Metaverse just a rebranding of Facebook?
3. What comes to your mind when you think of the term, Metaverse?
4. Did you know that you could own virtual land and NFTs in the Metaverse.
5. Are you aware of cryptocurrency being a large part of the Metaverse?
6. Does the involvement of cryptocurrency raise more concerns about security policies of the metaverse.

SUBMISSION RESULTS

Here are some of the responses we received on the following question:

What comes to your mind, when you here the word, Metaverse?
15 responses

- Sims
- A virtual universe.
- Artificial world
- A new form of oppression and brainwashing. We do not need any more meta products to destroy the social construct of friends and family. Meta/facebook products have been proved to cause mental issues and social ineptness.
- A virtual world that comes to reality
- A world with next-level technology
- Leakage of informatics data from users
- Virtual space
- Virtual space, the image of the real world
- A virtual reality space
- Concepts related to gaming and AI
- something more exciting
- Metaverse
- No
- Multiple universe and spiderman

TEST AND VALIDATION

The survey organized by our team gained a lot of responses regarding metaverse. About 75% of the people were well aware of the term and basic understanding of the Metaverse. According to the general opinion, 43.8% of people argued that meta is just a rebranding of Facebook and 56.3% believed that Metaverse is a new innovation rather than a rebranding. From the response, we collected through our survey, the description of Metaverse varies from person to person. Some call it “A world with next-level technology” and some call it a “ Virtual space, image of real-world”. We can also conclude that more than 50% knew that cryptocurrency is a large part of the metaverse. Continuing this discussion, the concern of people about the involvement of cryptocurrency shows various moods. Majorly

people tend to disagree with the above fact and 12.5% of the volunteers do not have enough knowledge to conclude anything solid.

PERFORMANCE ANALYSIS(GRAPHS/CHARTS)

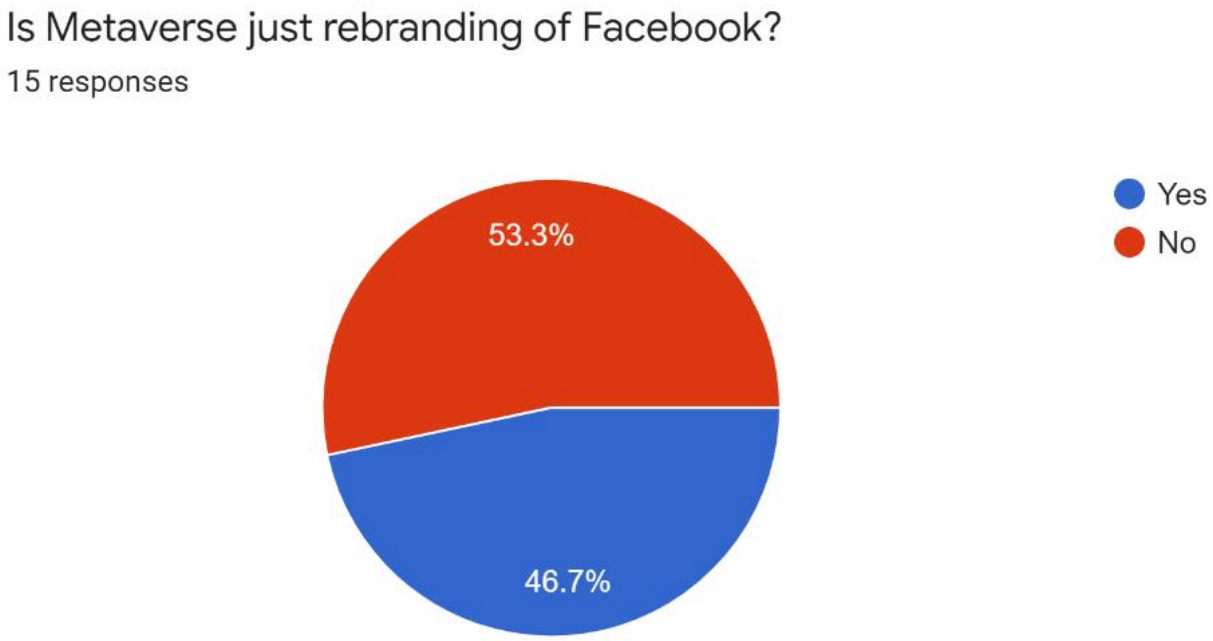

Figure 6.1 Survey Response 1

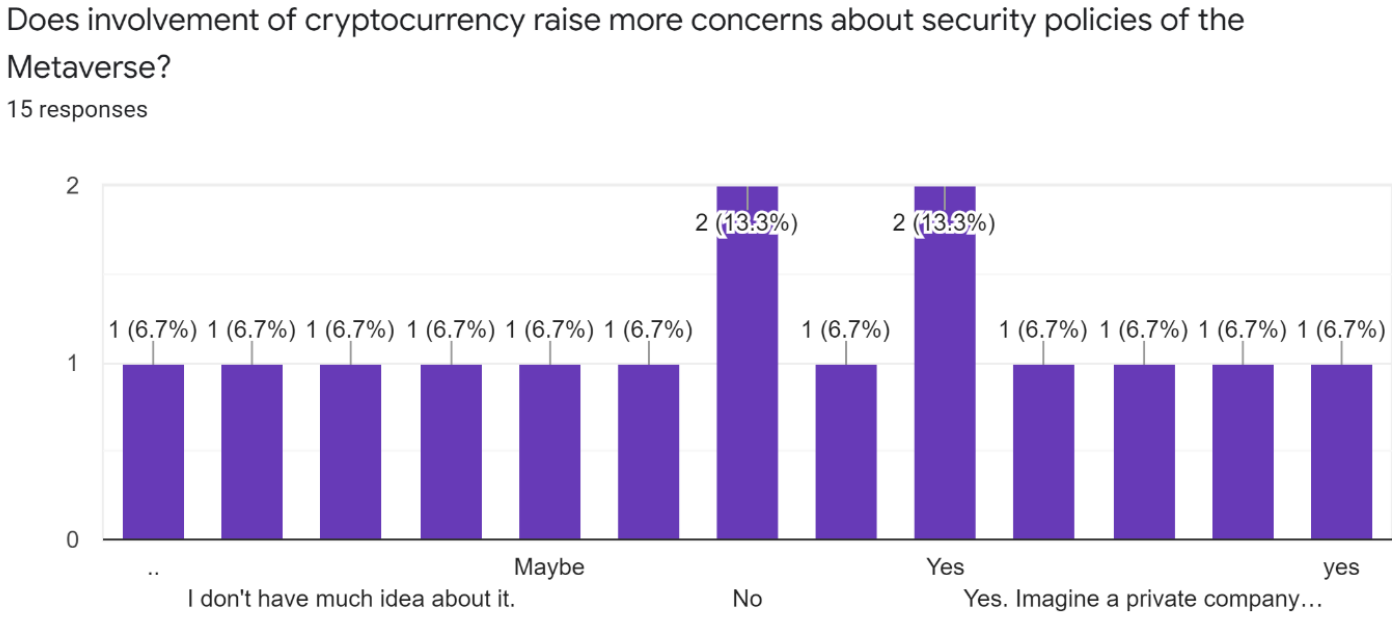

Figure 6.2 Survey Response 2

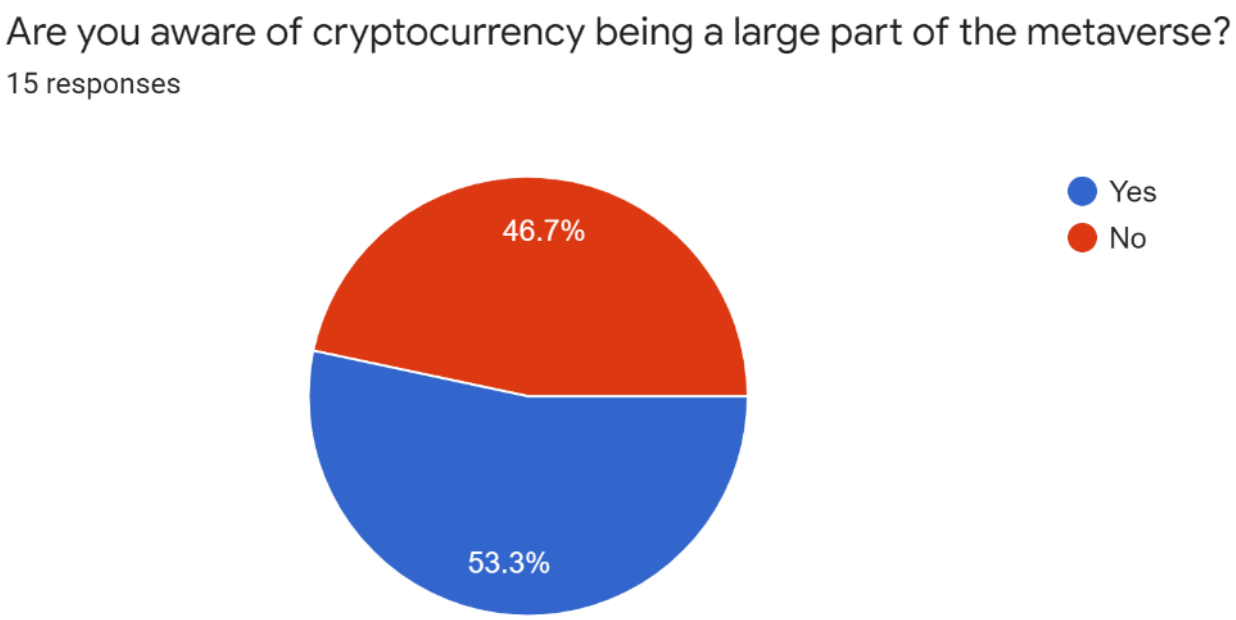

Figure 6.3 Survey Response 3

SUMMARY

It is a digital space where people get to use their avatars—their online representations—to virtually meet, attend meetings and concerts, collect exclusive NFTs, and so on.

these are plots on the digital metaverse platforms that are bought as non-fungible tokens (NFT) using cryptocurrencies.

The whole point of the metaverse is to enhance physical life. In Web 2.0, we can order food and shop online. In Web 3.0, we may be able to walk the streets and see offers from brands and restaurants, try clothes and attend concerts virtually, etc. It will indeed change the way we do things but it may not replace the physical world,

Thousands of people and many corporations have already spent millions of real dollars on virtual pieces of land in digital worlds like Decentraland and

The Sandbox. The metaverse has seen several big-ticket entrants in the form of leading brands like Adidas, Samsung, JP Morgan, and HSBC, among others, with many others considering jumping on the bandwagon.

Global interest in the metaverse has quickly risen to prominence and will grow further. The lines between the virtual and physical world are blurring. Metaverse is here to stay and will continue to evolve.

CHAPTER-6

PROJECT OUTCOME AND APPLICABILITY

OUTLINE

As we all know Metaverse is a new upcoming virtual world. It will become an integral part of everyone’s life. But people don’t have the required knowledge of Cyber Security, they don’t know how to secure themselves and how secure they are in this virtual world. So, this research work will compensate for their lack of knowledge regarding the security issues in Metaverse and it will provide safety for their privacy, data and personal information.

KEY IMPLEMENTATION OUTLINES OF THE SYSTEM

Cyber currencies in virtual worlds are merely a new quantitative dimension, although one that is ostensibly very huge. Money laundering is encouraged by metaverses that provide economic activity with their own currency that may be swapped for real money.

Cyber currency, a plethora of business options, and an almost limitless choice of location currently provide everything needed to conceal money laundering and make it virtually unmanageable. Second Life could play a role in the money laundering circuits since it contains all of the necessary ingredients.

• It's nearly impossible to see the metaverse, the alternate reality, functioning without cryptocurrency.

• Crypto becomes a must rather than an option in a world where speed, transparency, and security are almost essential.

• Cryptocurrency is, at its core, the ideal means of trade for this rapidly evolving hybrid society.

PROJECT APPLICABILITY TO REAL-WORLD APPLICATIONS

Consider that for a moment. First, prompt, swift, and frequent transactions, such as selling your vintage and immediately purchasing a new one, or even obtaining that NFT, necessitate decentralization and transparency, in which the power to approve and validate your desired transactions rests with everyone in the network collectively, rather than with a single centralized authority or hub, making it more democratic, accessible, and quick! You do not place your trust in just one individual.

Second, because cryptocurrencies like bitcoin use highly powerful cryptographic technology for encryption and fund protection, you can rest certain that your funds are safe when you use a public ledger like blockchain, where every transaction you make is irreversible, traceable, and secure.

INFERENCE

There is no single solution to the problem of making the metaverse a safer place. There will almost certainly always be an element of anonymity that protects criminals, just as there is on the internet. This gives them the ability to get away with things like stealing, cyberstalking, doxxing, and online abuse.
Increased internet control is a possibility. The internet, on the other hand, is one of the final bastions of free speech and knowledge. Governmental

control of the internet on a large scale in the future is both implausible and unethical.

People and businesses can stay safe on the internet and, in the future, the metaverse by focusing on education and prevention. Recognizing the dangers that come with internet participation and putting measures in place to protect yourself.

CHAPTER-7

CONCLUSION AND RECOMMENDATION

OUTLINE

With the predictions of Metaverse being the future of the internet, we get an idea of how hugely it is going to be a part of our lives which makes it almost a compulsion for the world to learn about it and know how to keep themselves and the personal information secure.

LIMITATIONS OF THE SYSTEM

There is no provision in the present IT Act for handling sensitive and personal data of children. Despite the fact that the PDP Bill (Section 16 of the Bill) provides for this, the bill does not consider the impact of virtual reality and augmented reality. As a result, under the current legal framework, children's sensitive and personal data on metaverse platforms is not protected.

The Metaverse has substantially increased demand for virtual assets, giving criminals who engage in money laundering a safe haven in which to hide their proceeds of crime. Criminals can convert their unlawful gains into cryptocurrency, which they can then use to buy virtual assets.

There is no hard and fast rule that a virtual female avatar must have "modesty." The current IT Act, which addresses cyber crime x against women, was not written with the possibility of crimes occurring in the metaverse in mind. Furthermore, there is currently no law that punishes sexual assault committed via the internet.

FUTURE ENHANCEMENTS

The Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021

- Key Features of the Rules
- Social media intermediaries, with registered users in India above a notified threshold, have been classified as significant social media intermediaries (SSMIs). SSMIs are required to observe certain additional due diligence such as appointing certain personnel for compliance, enabling identification of the first originator of the information on its platform under certain conditions, and deploying technology-based measures on a best-effort basis to identify certain types of content.

- The Rules prescribe a framework for the regulation of content by online publishers of news and current affairs content, and curated audio-visual content.

- All intermediaries are required to provide a grievance redressal mechanism for resolving complaints from users or victims. A three-tier grievance redressal mechanism with varying levels of self-regulation has been prescribed for publishers.

INFERENCE

The Metaverse has substantially increased demand for virtual assets, giving criminals who engage in money laundering a safe haven in which to hide their proceeds of crime. Criminals can convert their unlawful gains into cryptocurrency, which they can then use to buy virtual assets.

There is no hard and fast rule that a virtual female avatar must have "modesty." The current IT Act, which addresses cyber crime against women, was not written with the possibility of crimes occurring in the

metaverse in mind. Furthermore, there is currently no law that punishes sexual assault committed via the internet.

RELATED WORK INVESTIGATION

Mark Zuckerberg sees the metaverse as the “successor to the mobile internet,” an invention that reshaped all our lives by allowing us to go online anywhere, and made it possible for Facebook’s current business to exist.

It’s the metaverse — defined most simply as a virtual world where people can socialize, work, and play — and Facebook’s CEO Mark Zuckerberg believes it is the future of the internet and of his trillion-dollar company.

We get the idea that Facebook and Metaverse are linked in some ways. A controversial history of Facebook and the privacy issues and data leaks that we saw in it make us question, What existing and new issues are we going to face with the Metaverse.

REFERENCES

1. https://www.vox.com/recode/22799665/facebook-metaverse-meta-zuckerberg-oculus-vr-ar

2. https://www.theverge.com/22588022/mark-zuckerberg-facebook-ceo-metaverse-interview

3. https://www.livemint.com/companies/news/what-is-metaverse-why-facebook-is-investing-billions-in-this-new-project-11635218124731.html

4. https://fortune.com/2021/10/29/mark-zuckerberg-metaverse-privacy-facebook-meta/

5. https://arxiv.org/ftp/arxiv/papers/2111/2111.09673.pdf