KLE Society's
KLE Technological University, Hubballi.

A Minor Project Report

on

Virtual Meet – Metaverse using Blockchain

submitted in partial fulfillment of the requirement for the degree of

Bachelor of Engineering

in

Computer Science and Engineering

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2022 -23

KLE Society's
KLE Technological University, Hubballi.

2022 - 2023

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that Minor Project titled "Virtual Meet – Metaverse using Blockchain" is a bonafied work carried out by the student team comprising of Akshay Joshi (01FE20BCS102), Bharat Jain (01FE20BCS113), Kartik Kalal (01FE20BCS116) and Dhiraj Bhandare (01FE20BCS117) for partial fulfillment of completion of sixth semester B.E. in Computer Science and Engineering during the academic year 2022-23.

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1.	
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Acknowledgement

We would like to thank our faculty and management for their professional guidance towards the completion of the project work. We take this opportunity to thank Dr. Ashok Shettar, Vice-Chancellor, Dr. B.S Anami, Registrar, and Dr. P.G Tewari, Dean Academics, KLE Technological University, Hubballi, for their vision and support.

We also take this opportunity to thank Dr. Meena S. M, Professor and Head, SoCSE for having provided us direction and facilitated for enhancement of skills and academic growth.

We thank our guides Dr. Narayan D G, Professor, SoCSE and Mrs. Rachana N for their constant guidance during interaction and reviews.

We extend our acknowledgement to the reviewers for critical suggestions and inputs. We also thank Project Co-ordinator Mr. Uday N. Kulkarni and Mr. Guruprasad Konnuramath for their support during the course of completion.

We express gratitude to our beloved parents for constant encouragement and support.

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ABSTRACT

The metaverse has emerged as the new standard for social networks and three-dimensional (3D) virtual environments ever after Facebook formally changed its company name to Meta in October 2021. The latest buzzword, "Metaverse" has received a lot of interest from both business and academics. By utilising a variety of useful technologies, the metaverse intends to provide users with 3D immersive and personalised experiences. It seamlessly merges the physical and digital worlds, enabling avatars to engage in a wide range of activities like trading, social networking, entertainment, and production. By exploring the metaverse, it is thus possible to create an engaging digital environment and alter the physical world for the better. Despite widespread interest and advantages, protecting the digital data and content of users in the metaverse is a legitimate concern. The decentralisation, immutability, and transparency of blockchain makes it a promising answer in this area. Blockchain is a decentralised, unchangeable ledger that makes it easier to keep track of assets and record transactions in a network of businesses. Because blockchain represents a shared version of the truth, it fosters trust. New technologies will be powered by data that everyone can trust. Thus, in this work, we present a metaverse application powered by blockchain, called the "Virtual Meet", to exploit the benefits of fusing metaverse and blockchain together.

Keywords : *blockchain, metaverse, decentralization, virtual meet, avatars*

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Chapter 1

INTRODUCTION

Metaverse is a term used to describe a virtual world or space where users can interact with each other and digital objects in a shared environment. It is a concept that has gained significant attention in recent years due to the rapid advancement of technology and the increasing popularity of online gaming and social networking. The metaverse is a single, shared, immersive, persistent, 3D virtual space where humans experience virtual life. One of the defining features of the metaverse is its open and decentralized nature. This means that it is not controlled by any single entity, but rather a network of participants who contribute to the development and maintenance of the space. This has given rise to various blockchain-based metaverse projects, where the blockchain is used to enable secure, transparent, and decentralized transactions within the metaverse.

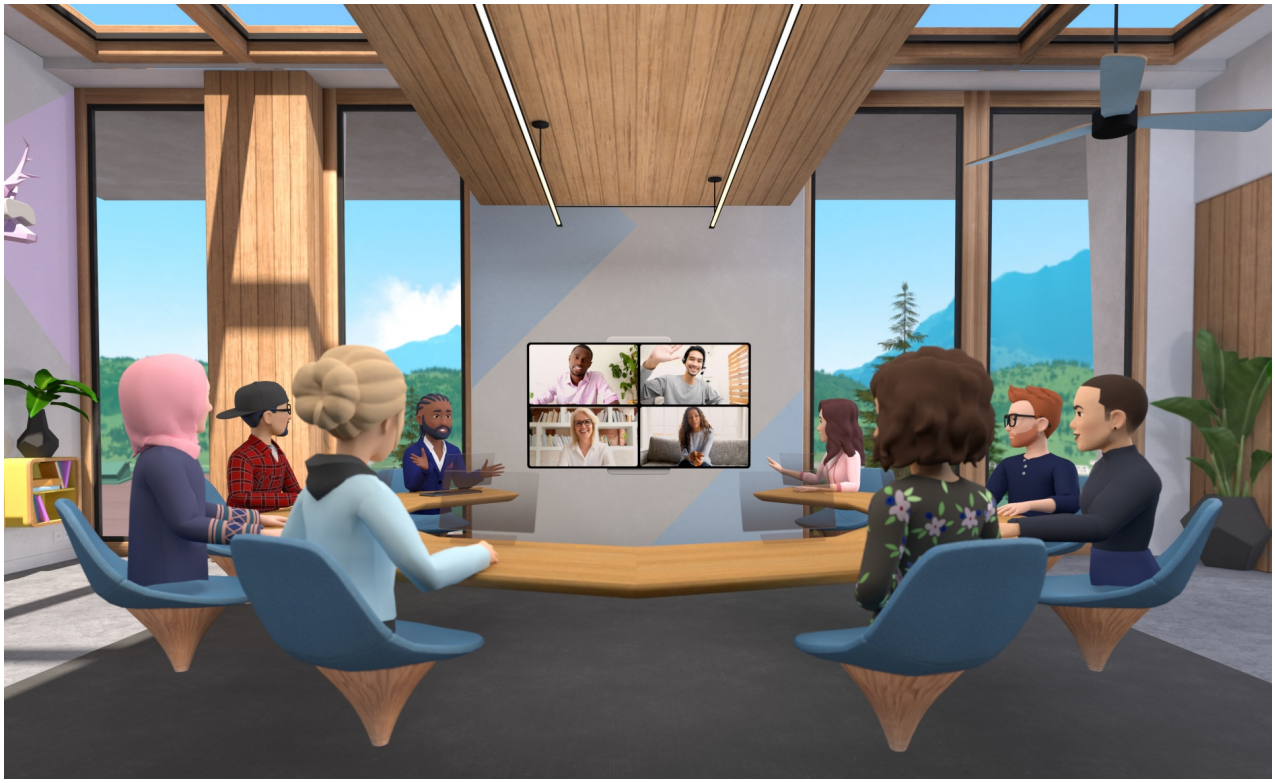

Figure 1.1: Metaverse - a virtual world

Blockchain is a distributed ledger technology that has gained significant attention in recent years due to its potential to revolutionize various industries. Originally introduced as the underlying technology for cryptocurrencies, such as Bitcoin, blockchain has evolved to offer a wide range of applications beyond financial transactions. At its core, a blockchain is a decentralized and immutable ledger that records transactions in a chronological order and stores them across a network of computers.

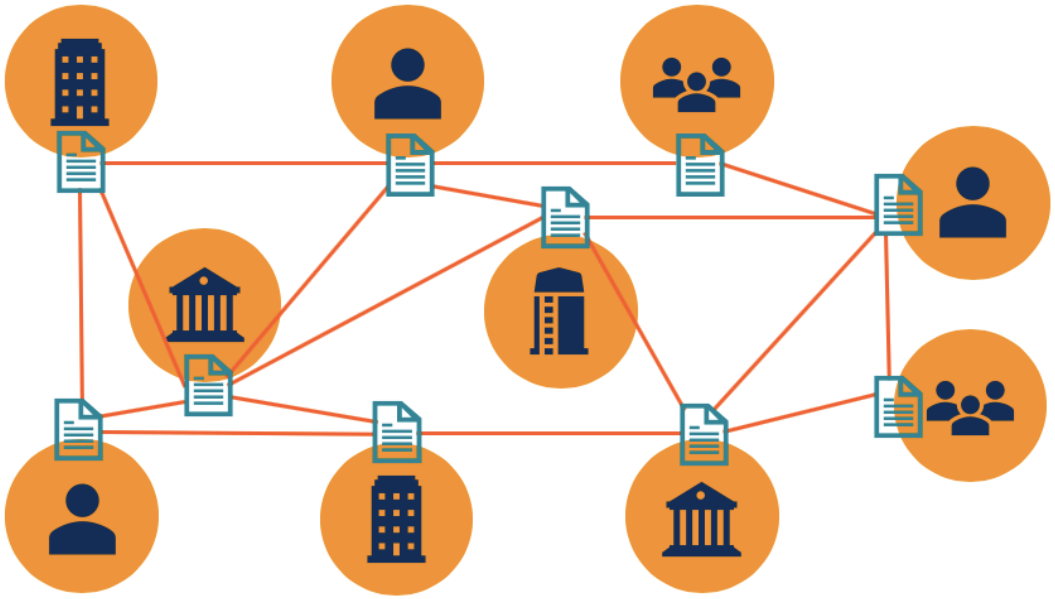

Figure 1.2: Blockchain - a distributed ledger [8]

Each transaction is cryptographically secured and verified by a network of participants, known as nodes, before being added to the blockchain. This makes it virtually impossible to alter or tamper with the records, ensuring the integrity and security of the data. The decentralized nature of blockchain eliminates the need for intermediaries to validate transactions. This reduces costs and increases efficiency, making it a highly attractive technology for various use cases. Apart from cryptocurrencies, blockchain has found applications in various industries, such as supply chain management, healthcare, real estate, and now, in metaverse.

This chapter begins with the introduction to blockchain technology and its usage in metaverse applications. Further it talks about the motivation behind our project and the survey related to blockchain and metaverse. Lastly it points several applications of metaverse and the objectives of our project.

1.1 Motivation

The metaverse can be thought of as a virtual reality world that connects multiple virtual environments, allowing users to interact with each other and with virtual objects in a seamless and natural way. Metaverse offers new and exciting ways for users to engage. It provides new opportunities for e-commerce, allowing users to buy and sell virtual goods and services within the metaverse. It also allows users to build and share their own virtual creations with others. Successful implementation of Blockchain for Metaverse can enhance the level of security and privacy.

1.2 Literature Review

In [1], Huawei Huang et. al. have spoken about how Metaverse is different and much better than real-world applications in terms of singularity, virtual ecosystem, security and fairness. They have described how the metaverse is much more secure and economical option to have in the future. Making the interaction more virtual helps in reducing the gap between real-life ecosystem and virtual systems.

Gadekallu et. al. in [2] have proposed their work of fusing blockchain with metaverse and how it would help in making the network more secure and fair. Users can collaborate the assets of blockchain such as digital creation, digital currency and digital market with metaverse since it will make the metaverse more secured and decentralized. This integration of blockchain may help in creating good economic system inside the metaverse.

In [3], Lee et. al. have introduced the concept of metaverse and how it can use applications of blockchain such as online video conference, digital eal estate, digital arts and more. This may help in data privacy and security, ensuring quality of data, enabling seamless and secured data sharing, enabling data interoperability, ensuring data integrity, financial system and smart contract deployment.

In [4], authors Jeon et. al. have proposed connection between real world and virtual world. Here, they have used a combination of real and virtual world in metaverse making it best of both the worlds. Blockchain based metaverse here we may use Ethereum code, Ethereum-based metaverse. We may also use Artificial intelligence with the metaverse helping it to get high quality in learning data, Reusablity of data and making it with rich with content.

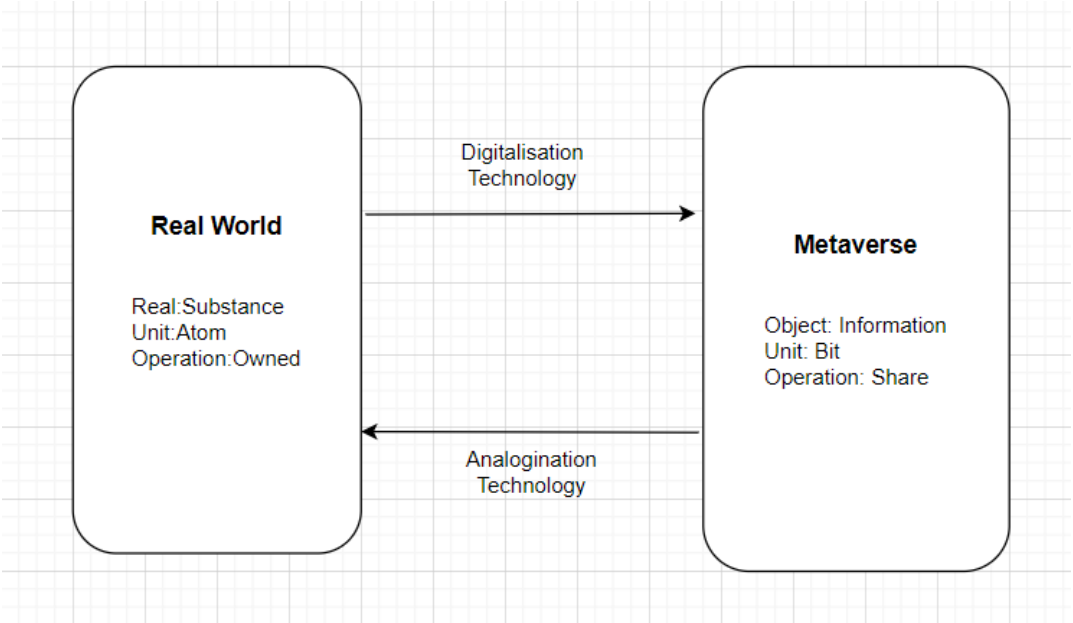

Figure 1.3: Relating the real world to the virtual world

Huansheng et. al. in [5] have spoken about the development of Metaverse, from the five perspectives of structure of interior structure, technology used for managing, metaverse and real world object connection, and bringing together the various inspects of VR together that he.this paper also speaks about how the metaverse changes with respect to time and space, and tells various applications and future scope of the metaverse.

In [6], Saritas et. al. have proposed the model in which the metaverse is used in the field of education, socialising .They have strongly looked the pros and cons of introducing the metaverse in the field of education and its impact on students and their development.

1.3 Problem Statement

Our aim is to develop a virtual meet powered by blockchain where users can virtually meet and interact with each other using their unique avatars.

1.4 Applications of Metaverse

- **Online Chatting:** Metaverse can be used to create a different way of chatting, instead of the traditional method.
- **Gaming:** Metaverse applications can be used to create immersive gaming experiences where users can explore vast virtual worlds, complete quests, and engage in role-playing activities. These games can be multiplayer and have social features that allow players to interact with each other.
- **Social Interaction:** Metaverse applications can offer a virtual space for users to interact with each other in real-time, form communities, and engage in shared experiences. This can be especially useful for individuals who may have difficulty connecting with others in real life.
- **Education and Training:** Metaverse applications can be used for education and training purposes. For example, a virtual classroom can be set up where students can attend classes and engage in interactive learning experiences. Metaverse applications can also be used for training purposes, such as virtual simulations for emergency responders or military training.
- **Real Estate:** Metaverse applications can be used in real estate to simulate properties, giving potential buyers a virtual tour of the property. This can provide a more immersive and engaging experience than traditional photos and videos.

1.5 Applications of Blockchain

- **Cryptocurrencies:** The most well-known application of blockchain technology is in the creation and exchange of cryptocurrencies, such as Bitcoin and Ethereum. The blockchain provides a secure and transparent ledger to track transactions, without the need for a central authority.
- **Supply Chain Management:** Blockchain technology can be used to track and verify the authenticity of goods throughout the supply chain, improving transparency, reducing fraud, and increasing efficiency.
- **Identity Management:**Blockchain technology can be used to provide secure and decentralized identity management solutions, improving data privacy and security while reducing the need for intermediaries.
- **Financial Services:** Blockchain technology has the potential to revolutionize the financial industry by reducing costs, increasing transparency, and improving security. It can be used for secure and fast cross-border payments, digital identity verification, and the creation of smart contracts.
- **Healthcare:** Blockchain technology can be used to create secure and efficient health data exchange networks, improving patient data privacy, reducing costs, and increasing transparency.
- **Voting Systems:** Blockchain technology can be used to create secure and transparent voting systems, reducing fraud and ensuring the integrity of the voting process.
- **Real Estate:** Blockchain technology can be used to create secure and transparent property ownership and transfer systems, reducing fraud and streamlining the real estate process.
- **Metaverse:** Blockchain can be used as a use case in metaverse applications to provide secure and transparent environment.

1.6 Objectives of the project

- To provide a virtual environment for social interaction.
- To embrace communication in an innovative way.
- To provide security and privacy of data.
- To enable decentralized control over data.

Chapter 2

REQUIREMENT ANALYSIS

2.1 Functional Requirements

Functional requirements are the features, capabilities, and functionalities that an application must have to meet the needs and expectations of its users. These requirements describe what the application should do and how it should behave under different conditions. The functional requirements of our application are given below:

- User shall be able to create account and select a unique avatar at the time of creation.
- User can select avatar at the time of account creation and cannot change the selected avatar.
- User shall be able to view other users in the network.
- User shall be able to add users as their friend.
- User shall be able to start meeting with other users.
- User shall be able to join meeting.
- User shall be able to communicate via text or audio.
- User shall be able to delete meeting history after completion of the virtual meet.
- User shall be able to permanently store meeting history in the blockchain.
- User shall be able to view meeting history if it is stored permanently.
- User shall be able to logout of the application.

2.2 Non Functional Requirements

Non-functional requirements are the characteristics and qualities that an application must possess, but that are not related to its specific functionality or features. These requirements define the overall performance, usability, and reliability of the application.

- Transaction initiation must happen within 10 seconds.
- Transaction confirmation must happen within 15 seconds.
- Each user should have a Metamask wallet to buy NFT in the form of avatar.
- Existing user will login automatically upon connecting to their Metamask wallet.

2.3 Hardware Requirements

The hardware requirements for running the proposed application are as follows:

- RAM: 8GB (minimum)
- SSD: 256GB (minimum)

2.4 Software Requirements

The software requirements for running the proposed application are as follows:

- OS: Windows or Ubuntu
- Metamask extension needs to be installed on the web browsers.

Chapter 3

SYSTEM DESIGN

3.1 Architecture Design

Fig. 3.1 describes the architecture design of the proposed application. The design begins with an end-user wanting to create a new account. At the time of account creation, the user can select his/her unique avatar. This avatar cannot be changed once the account is created. Avatars are NFTs (Non-Fungible Tokens) that are unqiue in their own way. Transaction takes place during the sign-up process. Account will be created once the transaction is confirmed. If the user has an existing account, then the user can automatically login to the application with his/her Metamask wallet. Once the user has logged in, the user will be able to see all the other users in the network.

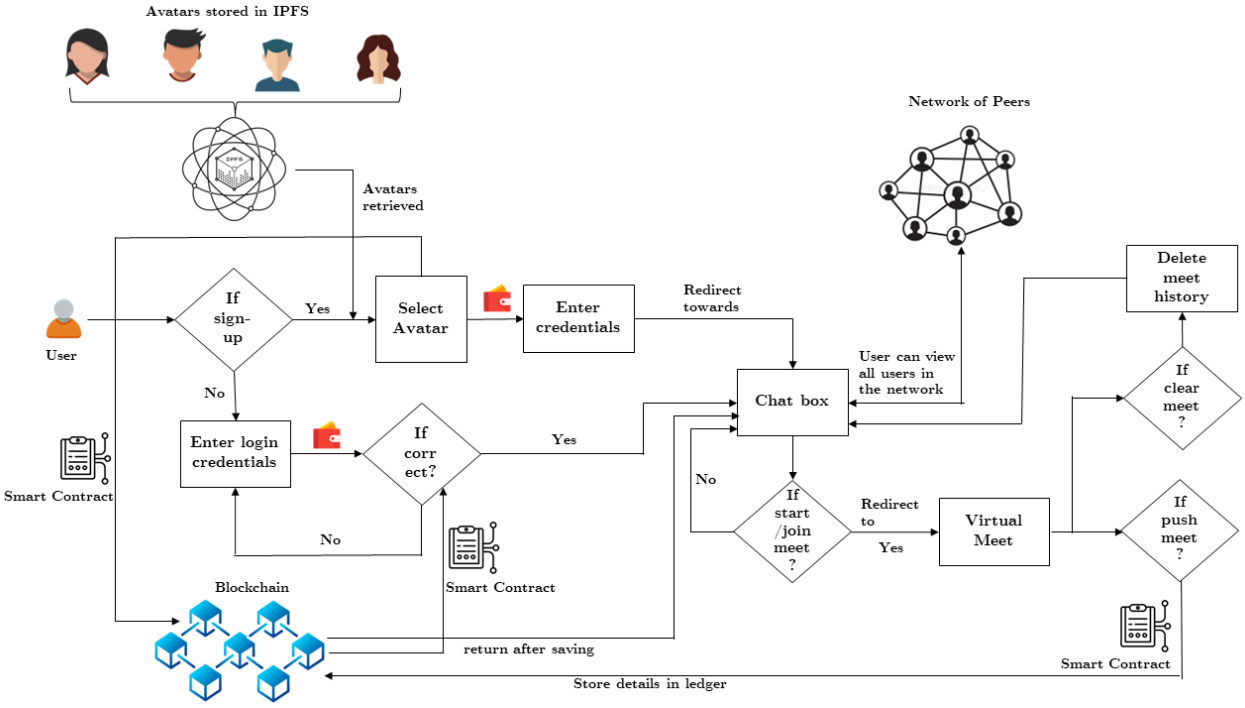

Figure 3.1: Architecture Design of Virtual Meet

The user can add other user as friend. A user can start meeting with other user only if they're friends. Users can join the meeting, where they will be redirected to the virtual meet room. Once the users are in the virtual meet room, they can start interacting with each other via text or audio and can move their avatars in the virtual world. The users will have 2 choices when the meeting ends; first choice is that users can delete the meeting history if they don't find it useful enough for future reference; the last choice is that users can permanently store the meeting history by pushing the details into the blockchain. In this way, the data can be stored in a decentralized manner. This stored data can be viewed by the users.

3.2 User Interface Design

The application has several web pages such as sign-up page, home page, all users page, my avatar page, virtual meet room page and chat page.

Table 3.1: User Interface Design

Content	**Details**
Sign-Up page	Allows a new user to create an account by purchasing an NFT in the form of an avatar.
Home page	Lists all the links to other web pages.
My Avatar page	Displays the current user's avatar.
All Users page	Lists all the users in the network and allows a user to add other users as friend.
Chat page	Lists the chat details between two users and allows them to start and join virtual meeting.
Virtual Meet Room page	Allows user to experience the virtual world and to interact with each other with audio or text.

3.3 Algorithms

This section gives a brief description about algorithmic details of the system by describing each component.

3.3.1 Avatar Movement Module

Algorithm 1 shows the implementation details for tracking the avatars movement in the virtual room.

Algorithm 1 Avatar Movement

Begin
$directionOffset \leftarrow 0$
if $forward \leftarrow true$ **then**
    if $left \leftarrow true$ **then**
        $directionOffset \leftarrow -Math.PI/4$
        $right \leftarrow true$
        $directionOffset \leftarrow Math.PI/4$

    $backward \leftarrow true$
    if $left \leftarrow true$ **then**
        $directionOffset \leftarrow Math.PI/4 + Math.PI/2$
        $right \leftarrow true$ $directionOffset \leftarrow -Math.PI/4 - Math.PI/2$

    $directionOffset \leftarrow Math.PI$
    if $right \leftarrow true$ **then** $directionOffset \leftarrow Math.PI/2$
    else if $left \leftarrow true$ **then** $directionOffset \leftarrow -Math.PI/2$
    end if

    End =0

3.3.2 Add Friend Module

Algorithm 2 shows the implementation details for adding other users as friend in the network.

Algorithm 2 Check Friends

Input: PublicKey1, PublicKey2, Length, Index
Output: True, if they're friends; otherwise False
PublicKey1: Address of Sending User
PublicKey2: Address of Receiving User
Length: Number of Friends of Sending User
Index: Position of the User
Temp: Temporary address type variable
Begin
if $UserList[PublicKey1].FriendList.length \geq UserList[PublicKey2].FriendList.length$ **then**
    $Temp \leftarrow PublicKey1$
    $PublicKey1 \leftarrow PublicKey2$
    $PublicKey2 \leftarrow Temp$
end if
$itr \leftarrow PublicKey1$
$len \leftarrow userList[PublicKey1].FriendList$
if $itr == NULL$ **then**
    $returnFALSE$
end if
if $itr.FriendList[i] == PublicKey2$ **then**
    if $i == len - 1$ **then**
        $returnTRUE$
    end if
end if
End =0

3.3.3 Hash Function

Algorithm 3 shows the implementation details for computing the hash of the user addresses.

Algorithm 3 Hash Function

Input: Address1, Address2
Output: Hashcode of 32 bits representing hash
PublicKey1: Address of Sending User
PublicKey2: Address of Receiving User
Begin
$x \leftarrow keccak256(address1)$
$y \leftarrow keccak256(address2)$
$sb1 \leftarrow newStringBuilder(20)$
$sb2 \leftarrow newStringBuilder(20)$
$random1 \leftarrow newRandom()$
$random2 \leftarrow newRandom()$
for i from (0,20) **do**
    Attempt inserting random character into $Sb1$
end for

for i from (0,20) **do**
    Attempt inserting random character into $Sb2$
end for

$x \leftarrow x + Sb1$
$y \leftarrow y + Sb2$
return $sha256(abi.encodePacked(x, y))$
End

Chapter 4

IMPLEMENTATION

4.1 Experimental Setup

The environmental setup was configured on a single physical machine with an Intel Core i5 9th Gen running at 2.40 GHz. The physical machine runs on Windows 11. The machine has 8GB RAM and 512GB SSD. Table 4.1 shows the experimental setup needed for implementing the application.

Table 4.1: Experimental Setup

Component	**Software/Language**	**Version**
Operating System	Windows	10
Blockchain Local Client	Geth	1.11.6
Blockchain Public Client	Mumbai Testnet	MATIC
Smart Contract	Solidity	between 0.7.0 and 0.9.0
User Interface	React.js	18.2.0
Database	Firebase	9.19.1
Frontend	Next.js	13.3.0
3D API	Three.js	9.64.0

4.2 NFT Creation Module

Creation of NFT is essential in the metaverse since metaverse is all about reflecting the real world aspects in the virtual world, where users must have unique avatars. Uniqueness is a property of Non-Fungible Tokens (NFT) that can be purchased by the users. As seen in Fig. 4.1, avatar in the form of NFT is created using Blender software. Initially, the avatar will be in .fbx (Filmbox) format having 'T' or 'A' pose. This is imported in the blender and various animations such as walk, idle, jump, run are added to it. Finally, the avatar is exported in .glb (GL Transmission Format Binary file) format. Thus, the NFTs are ready to be purchased by the users.

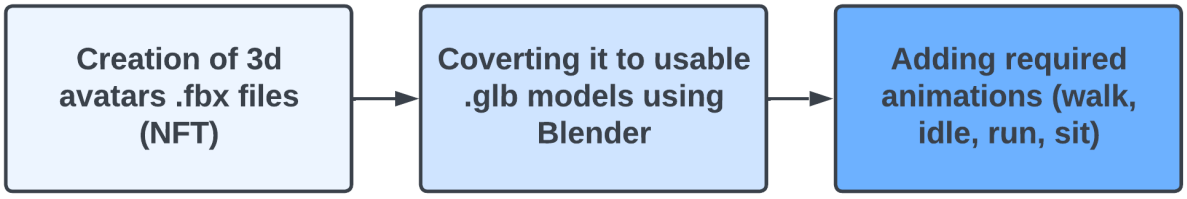

Figure 4.1: Creation of Non-Fungible Token (NFT)

4.2.1 Avatar Creation using Blender Software Tool

Figure 4.2: Avatar present as a .fbx file

Figure 4.3: Importing the .fbx file and adding the animations

Figure 4.4: Exporting the avatar in .glb file that includes all animations

4.3 Data Structures used for the implementation

Fig. 4.5 describes the various data structures utilized for implementing the application.

- User structure is used to store user details such as their name, NFT purchased by them and their friends list.
- Friend structure stores the name and address of a user's friend.
- Meeting structure stores the conversations between the two users. Each pair of users have a unique meeting code that is computed by hashing the address of both the users.
- AllUsers structure is used to store the list of all users in the network.

```
//USER STRUCT
struct user{
    string name;
    string avatar;
    friend[] friendList;
}

struct friend{
    address pubkey;
    string name;
}


struct meeting{
    string name;
    string[] messages;
}

struct AllUserStruck{
    string name;
    address accountAddress;
}

AllUserStruck[] getAllUsers;

mapping(address => user) userList;
mapping(bytes32 => meeting[]) allMeetings;
```

Figure 4.5: Data structures used

4.4 Add Friend Module

Fig. 4.6 describes an essential function in our application that is used to add users as friend. A user can start virtual meet with the other user, if and only if, they are friends. Hence, this function helps in maintaining the above feature. On the Metamask network if an user adds another user as a friend the other user may be automatically added as a friend to another user and have an conversation started with them. This function uses trie data structure to optimise it search and the function is called recursively.

```
    bool checkAlreadyFriends(address pubkey1,address pubkey2, int i,
                                                    int len)
{

       if(userList[pubkey1].friendList.length > userList[pubkey2].friendList.length){
            address tmp = pubkey1;
            pubkey1 = pubkey2;
            pubkey2 = tmp;
        }


    address itr=pubkey1;
    int len=userList[pubkey1].friendList;
    if (itr == NULL)
        return false;

    if (itr.friendList[i] == pubkey2 && i == len - 1) {

        return true;
    }

    return checkAlreadyFriends(pubkey1,pubkey2, i + 1, len);
}
```

Figure 4.6: Add Friend module

4.5 Hash Function

Fig. 4.6 describes an hash function custom based using pre-defined hash function already available.The inputs are the address of the sender and receiver.This addresses are encoded by using keccak algorithm .Their are strings of 20 characters added to each of the input making the input more random and secure this data is then addded to SHA256 algorithm which encodes both of the data and give an hashcode as output.

```
function hash_fun(string memory address1,string memory address2) internal pure returns(bytes32)
{
 bytes32 x=keccak256(address1);
 bytes32 y=keccak256(address1);
StringBuilder sb1 = new StringBuilder(20);
StringBuilder sb2 = new StringBuilder(20);
Random random1 = new Random();
for (int i = 0; i < 20; i++) {
    char c = chars[random.nextInt(chars.length)];
    sb1.append(c);
}
String output1 = sb1.toString();
x=x+output1;

Random random2 = new Random();
for (int i = 0; i < 20; i++) {
    char c = chars[random2.nextInt(chars.length)];
    sb2.append(c);
}
String output2 = sb2.toString();
 y=y+output2;
return sha256(abi.encodePacked(output1,output2));

}
```

Figure 4.7: Hash function that computes the hash of the user addresses

4.6 Avatar Movement Module

The real time movement of the avatars in the environment is controlled by this module. We use some knowledge of Mathematics and an nested if-else structure to implement this commands on the avatar to have an appropriate needed movement. We use 4 commands as of now, namely left,right,front and backward.

```
const directionOffset = ({forward, backward,left,right}) =>{
    var directionOffset = 0; //w

    if(forward) {
        if(left){
            directionOffset = Math.PI/4; //w+a
        }
        else if (right){
            directionOffset = -Math.PI/4;   //w+d
        }
    }else if (backward) {
            if(left) {
                directionOffset = Math.PI/4 +Math.PI /2; //s+a
            } else if (right){
                directionOffset = -Math.PI/4 - Math.PI/2; //s+d
            }   else{
                directionOffset = Math.PI ; //s
            }
        }else if(left){
            directionOffset = Math.PI/2; //a
        } else if(right) {
            directionOffset = -Math.PI/2; //d
        }

        return directionOffset;
    };
```

Figure 4.8: Movement of Avatar in the Virtual Room

4.7 Push Meet to the blockchain

A vital feature in our application is to store the meeting details permanently into the blockchain. This feature can be exploited by using the Push Meet function shown in Fig. 4.9. Each pair of users will have a unique meeting code. If the users want to save the meeting permanently into the blockchain, they need to assign the meeting with a meeting name. The history will be stored by mapping the meeting details with the meeting code.

```
function _getChatCode(address pubkey1, address pubkey2) internal pure returns(bytes32){
    if(pubkey1 < pubkey2){
        return keccak256(abi.encodePacked(pubkey1, pubkey2));
    } else
    return keccak256(abi.encodePacked(pubkey2, pubkey1));
}

//SEND MESSAGE
function pushMeet(address friend_key,string memory meetname, string[] calldata _msg) external{
    require(checkUserExists(msg.sender), "Create an account first");
    require(checkUserExists(friend_key), "User is not registered");
    require(checkAlreadyFriends(msg.sender, friend_key), "You are not friend with the given user");

    bytes32 chatCode = _getChatCode(msg.sender, friend_key);
    meeting memory newMeet = meeting(meetname, _msg);
    allMeetings[chatCode].push(newMeet);
}
```

Figure 4.9: Push the virtual meeting details to the blockchain

4.8 GETH Node Setup

4.8.1 Genesis.json file

Genesis file used to setup Go Ethereum node. The configurations are Chain id -"1337" that is of Ethereum currency. The hash of starting block would be zero. This network is based on blockchain proof-of-work concept. The difficulty is set to 0x20000 and the gas limit would be 0x8880000.

Command to start the network:
- geth –http –http.corsdomain http://remix.ethereum.org –allow-insecure-unlock –http –http.port 8545 –http.addr 127.0.0.1 –http.corsdomain "*" –http.api "eth,net,web3,personal,miner" –datadir node1 –nodiscover –networkid 1337 –port 30303 console –rpc.enabledeprecatedpersonal

```
{
"config": {
"chainId": 1337,
"homesteadBlock": 0,
"eip150Block": 0,
"eip155Block": 0,
"eip158Block": 0,
"byzantiumBlock": 0,
"constantinopleBlock": 0
},"alloc": {},
"difficulty" : "0x20000",
"gasLimit"   : "0x8880000"
}
```

Figure 4.10: Contents of Genesis File for setting up Geth environment

4.8.2 Geth Network

Commands to create an account and start mining process: personal.newAccount()
miner.setEtherbase(account)
miner.start(1)

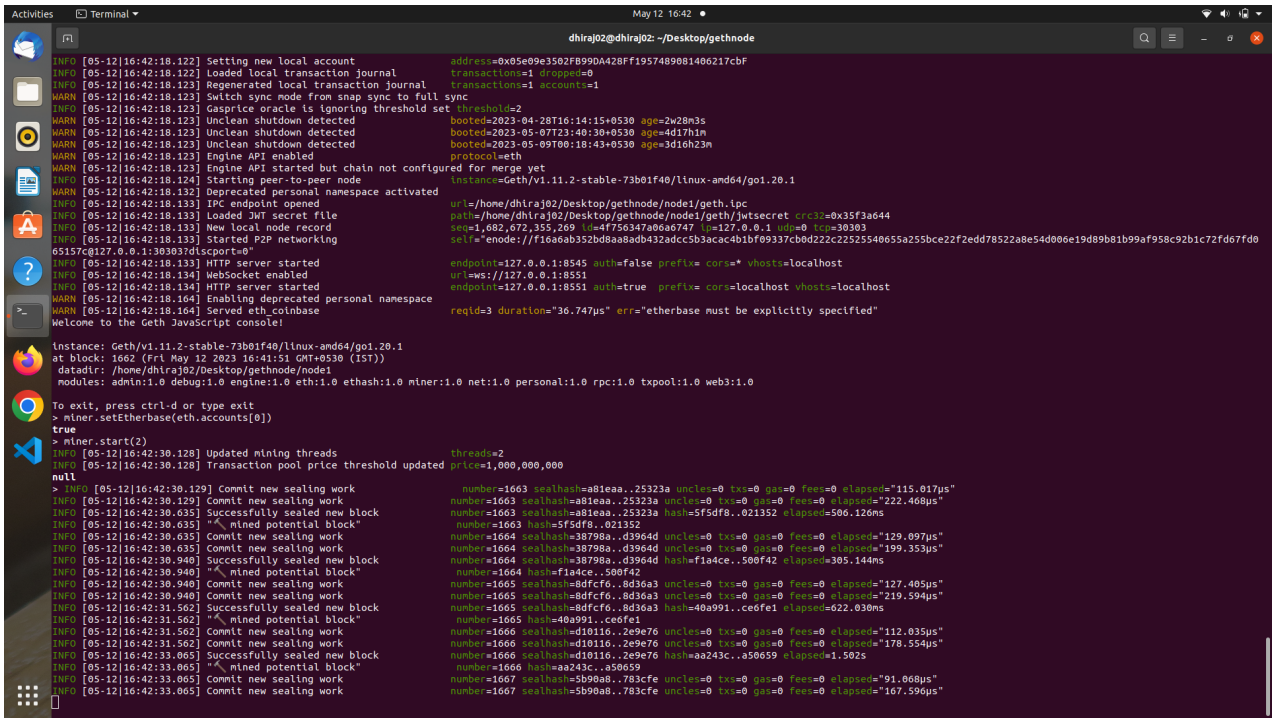

Figure 4.11: Geth network

Chapter 5

RESULTS AND DISCUSSIONS

5.1 Various 3D models used in designing the virtual room

This section gives an insight of the various 3D models used in designing the virtual meet application.

5.1.1 Virtual Room

Fig. 5.1 shows the layout of the virtual room where the meeting takes place.

Figure 5.1: Virtual Room

5.1.2 Reception Counter

Fig. 5.2 describes a 3D model of a Receiption Counter that is present in all offices/organizations.

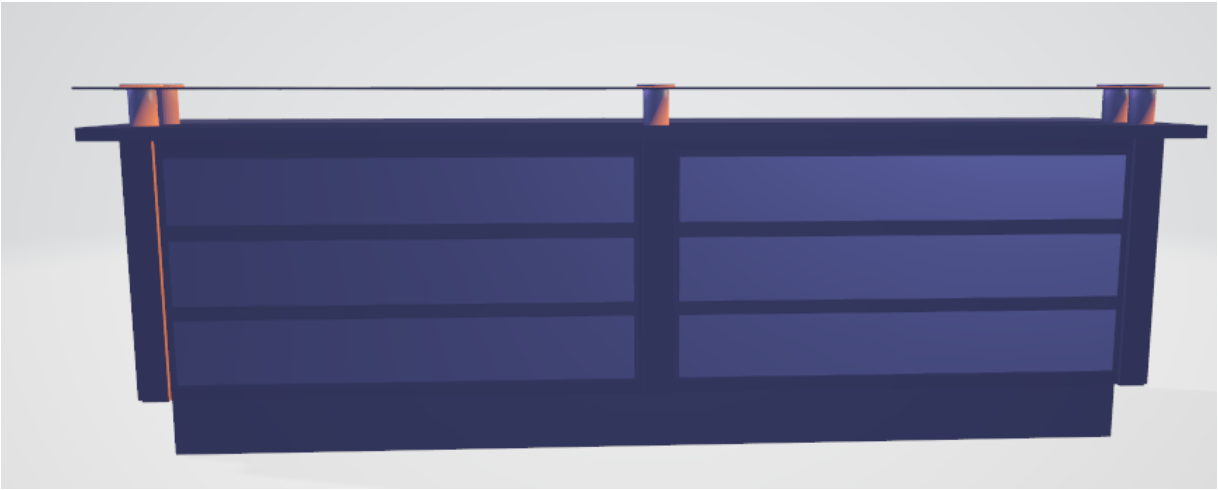

Figure 5.2: Reception Counter

5.1.3 Desktop

Fig. 5.3 describes a 3D model of a work desk with a desktop.

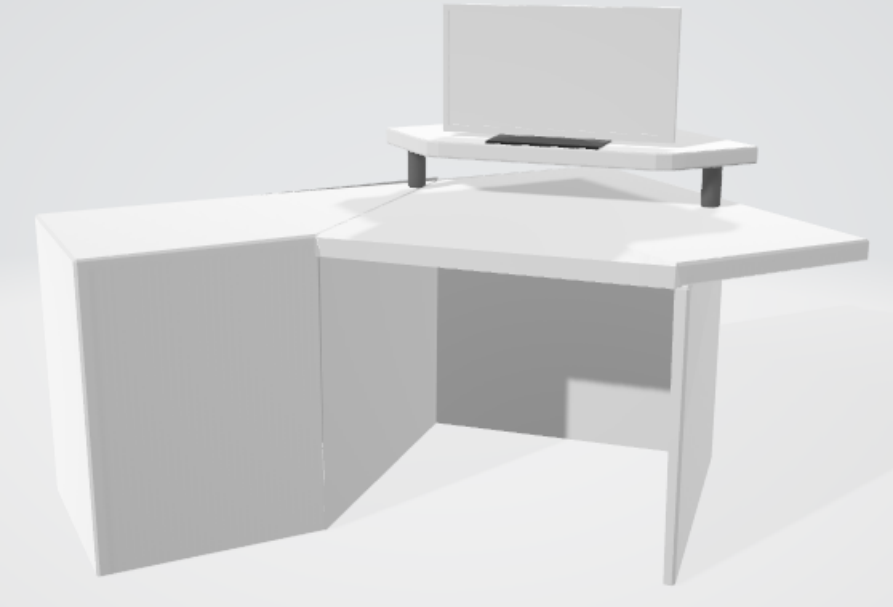

Figure 5.3: Work table with Desktop

5.1.4 Chair

Fig. 5.4 describes a 3D model of a chair.

Figure 5.4: Chair

5.1.5 Bench

Fig. 5.5 describes a 3D model of a bench.

Figure 5.5: Bench

5.2 Virtual Meet

5.2.1 Account creation

A new user should first create an account. During this process, the user needs to buy Non-Fungible Token (NFT) in the form of avatar. An estimated 0.00017872 MATIC (gas) is required for buying an NFT and creating the account.The avatars are all unique which would be choosen by user according to his/her preferences, this could be further expanded to chat to select the given avatar according to the personal details of an induvidual given in his input like age, gender,preferences,etc.

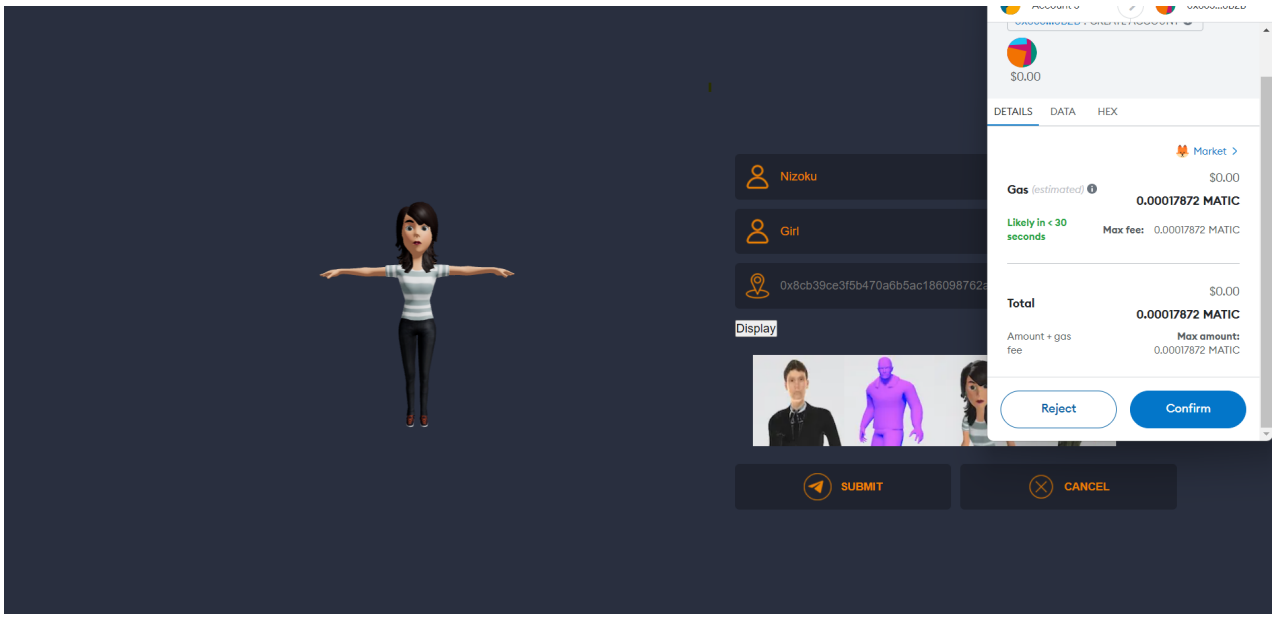

Figure 5.6: Sign-Up page

5.2.2 List of Avatars

Fig. 5.7 shows the available list of avatars that a user can choose during the purchase of avatars. Avatars are NFTs that can be purchased by users with cryptocurrencies such as ETH, MATIC, etc.

Figure 5.7: List of avatars

5.2.3 All users in the network

All registered users in the network are displayed in the application as shown in Fig. 5.8. In this, a user can add other users as friend in order to interact with them. When a user clicks on Add Friend button, a transaction will be initiated, which will be stored in the blockchain. This all users are connected by Mumbai Matic network making the contracts available to all of them. Any user added as friend then mutually becomes friend of other person as well.

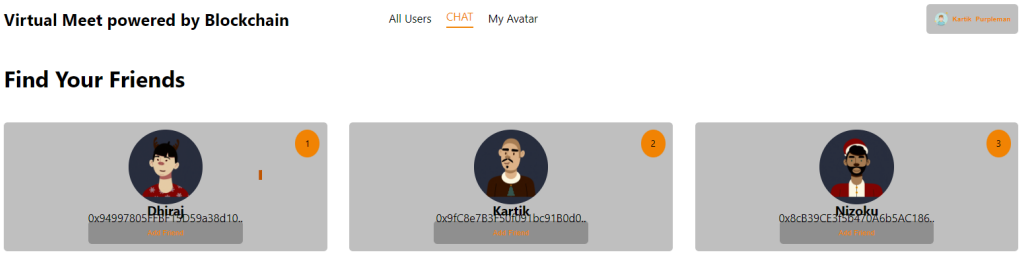

Figure 5.8: List of all users in the network

5.2.4 Meeting Room

Fig. 5.9 displays the design of the virtual meet room that consists two different users, interacting with each other.The environment could be changed according to a conversations theme in future scope making it more interactive and interesting to make an conversation between two people more fun.The number of persons having chat can be scaled up-to from two to more in future scope making an group chat reducing the redundancy of keeping chats minimum.

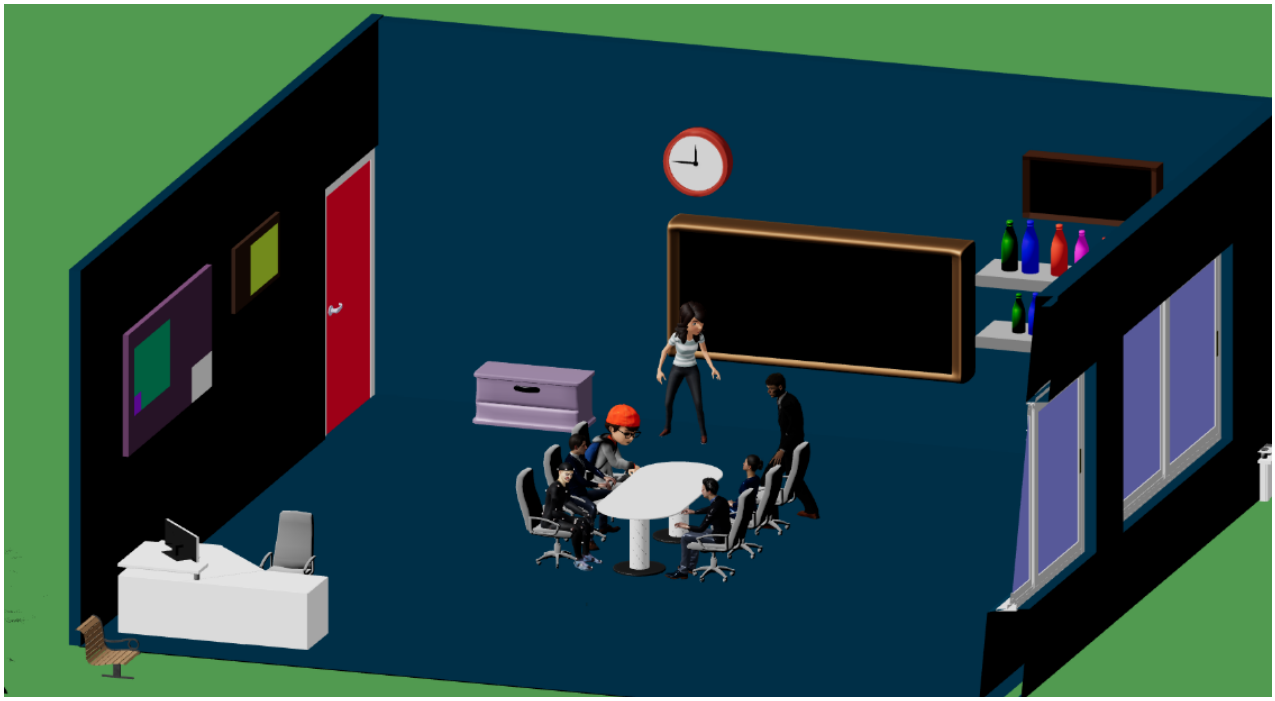

Figure 5.9: Virtual Meeting Room

5.2.5 Clients (Dummy avatars) present in the Virtual Meet Room

Fig. 5.10 lists the various dummy avatars that the users can see during the virtual meet. These avatars are NFTs that are non-buyable by the users, but are the assets of the application.

Figure 5.10: Various clients in the virtual room

5.2.6 Presentation screen within the virtual meet room

Fig. 5.11 describes the design of the presentation screen of the virtual meet room that exists within the virtual room.

Figure 5.11: Presentation screen where presenter can discuss topics with the viewers

5.2.7 Sender sends a message

A user can send messages to the other user via audio or text. In Fig. 5.12, a user with PurpleMan avatar sends a message "Hello" to the other user with Manager avatar. As seen in the figure, the sender will notice that the message is sent with a white background text.Sender as have an capability of sending any type of message textual or audio, this messages recieved by the receiver will be speaked out loud in the speaker of the receiver making the room chat more like an real chat between the two avatars.The sender or receiver can listen or read the stored chats in the conversation making the data available till its been deleted or pushed to the blockchain

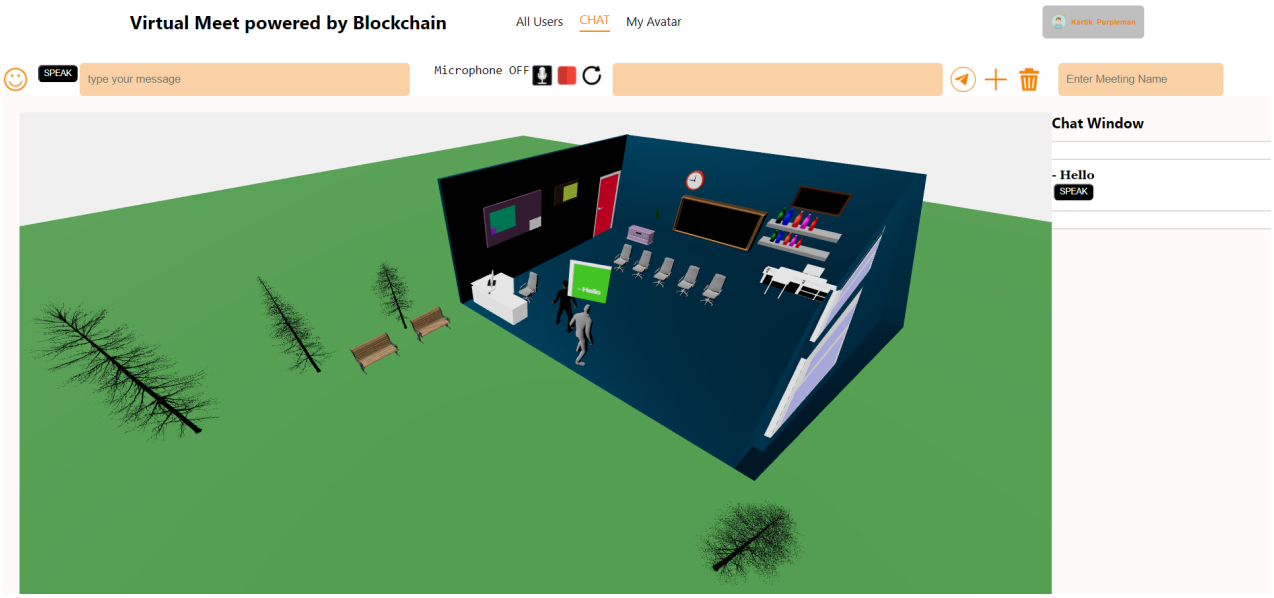

Figure 5.12: Describes a user sending messages to other user

5.2.8 Receiver receives the message from sender and replies to it

The user with Manager avatar receives the messages sent by the user with PurpleMan avatar as shown in Fig. 5.13. As seen in the figure, the receiver will notice that the message is received with a green background text.

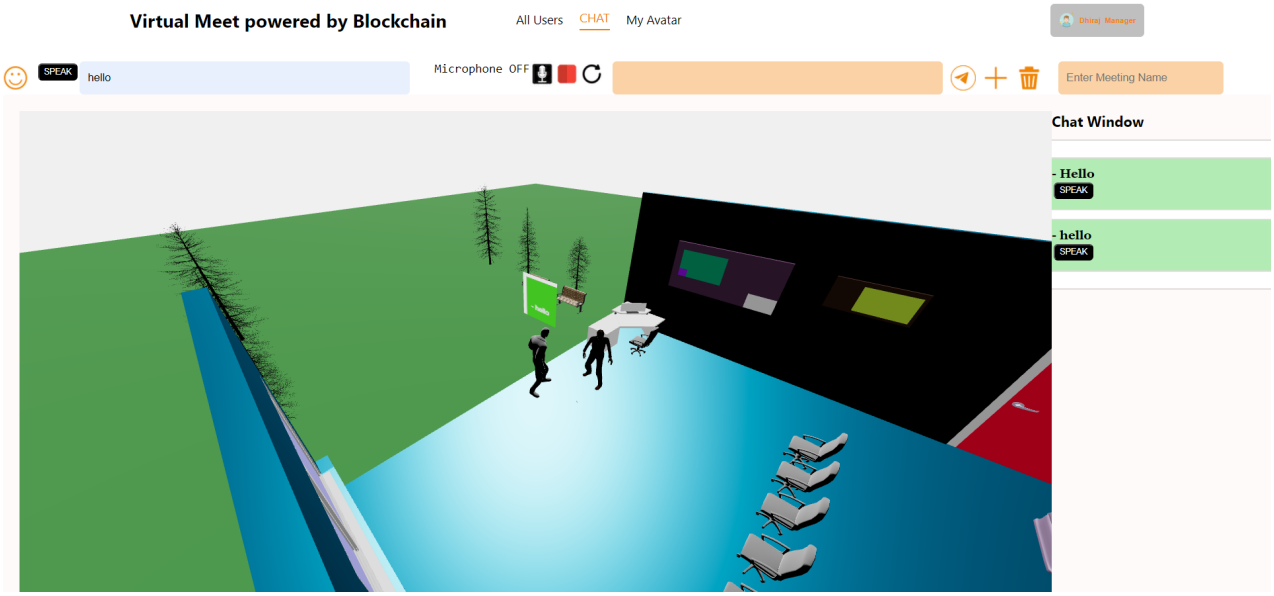

Figure 5.13: The receiver receives the message from sender in Fig. 5.12

5.2.9 Restore previous meet's data

Fig. 5.14 shows the details of the past meetings with the respective user. Meeting history can be stored before ending the virtual meet by clicking on the + button. When a user clicks this button, a transaction will take place and the meeting history, along with the meeting name, will be pushed to the blockchain.

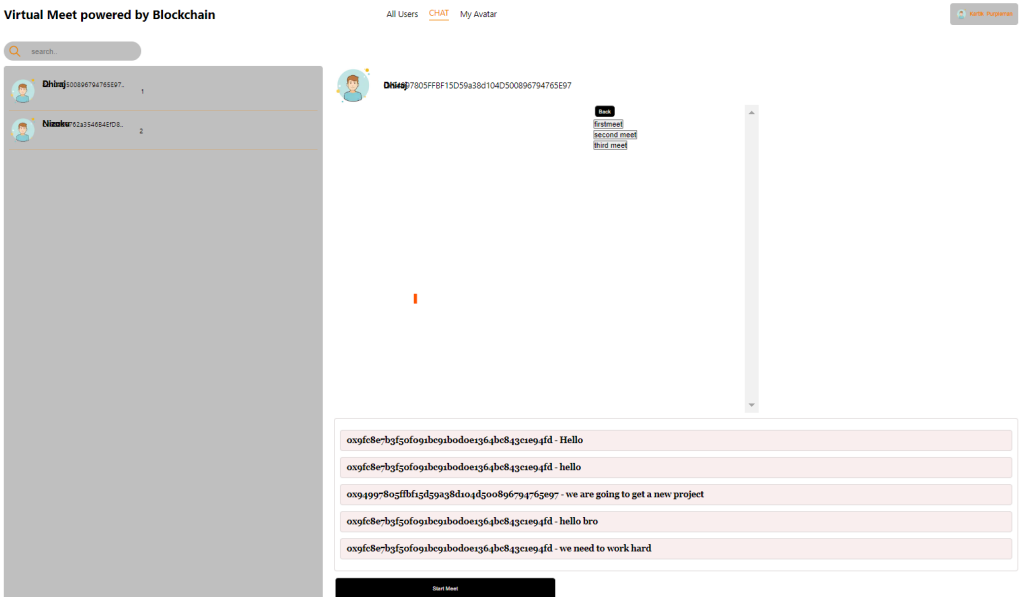

Figure 5.14: Lists the details of the previous meeting history

Chapter 6

CONCLUSION AND FUTURE SCOPE

The combination of the metaverse and blockchain technology offers a promising new frontier for innovation and collaboration. The metaverse provides a shared virtual space where people can interact, engage, and collaborate in ways that were previously impossible. Blockchain technology provides a decentralized and secure infrastructure that enables transparent and trustworthy transactions within the metaverse. Our project demonstrates the usage of blockchain for metaverse in the form of a Virtual Meet application where users can interact with each other with the help of their purchased avatars. Despite this, there are also significant challenges that need to be addressed. The technical complexity of building a fully functional metaverse, the legal and regulatory challenges surrounding virtual worlds are all factors that need to be considered. Virtual Meet powered by Blockchain can further be scaled from having conversation between 2 people to having conversation between a group of people. The scenario's can be changed upon the theme of the group. As the trends catch up, a number of avatars can be scaled up, with each being customized by the users themselves.

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