BLOCK DRIVE : A DRIVE FOR IMAGE STORAGE AND SHARE BY USING THE BLOCKCHAIN TECHNOLOGY

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I, Pawan Sharma, 2K22/ISY/11 student of M.Tech (ISY), hereby declare that the project dissertation titled "**BLOCKDRIVE :A DRIVE FOR IMAGE STORAGE AND SHARE BY USING THE BLOCKCHAIN TECHNOLOGY** " which is submitted by me to the Department of Information Technology, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Technology is original and not copied from any source without proper citation. This work has not previously formed the basis for the award of any Degree, Diploma Associateship, Fellowship or other similar title or recognition.

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I hereby certify that the Project Dissertation titled "**BLOCKDRIVE :A DRIVE FOR IMAGE STORAGE AND SHARE BY USING THE BLOCKCHAIN TECHNOLOGY** " which is submitted by Pawan Sharma, 2K22/ISY/11, Information Technology, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Technology is a record of the project work carried out by the students under the guidance of "Dr. Priyanka Meel". To the best of my knowledge this work has not been submitted in part or full for any Degree or Diploma to this university or elsewhere.

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ABSTRACT

The project entitled “Decentralized Secure Cloud Storage Using Blockchain” is a P2P net- work where each node provides the storage service to the client’s data. The developed system is concerned with storing parts of a single encrypted file, each part being stored on different nodes such that only client can retrieve the parts to remake the original file.

The purpose of the system is to experiment and demonstrate a working Secure File Storage System for small sized credential files, based upon the Cryptography and Blockchain tech- nology. The P2P network is designed using the Kademlia protocol that allows each node to join and leave the network anytime, identify it’s closest nodes, update it’s routing table and search for any node. Using different cryptography and network algorithms a new protocol for such a system has been implemented in this project. Using blockchain to apply Service Term Agreement, files can be chunked and distributed to a completely decentralized storage network without any loss of accountability and integrity.

The project has been successfully deployed and tested for Android client by maintaining a P2P network of several nodes. However it is evident that a web application can be more feasible for large size files and Android application for small sized files and portability.

Keywords:*Decentralize Network, P2P, Shamir’s Secret Sharing, Secure File storage, Cryptography, Blockchain*

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INTRODUCTION

Blockchain [7] is nothing but a open kind of distributed ledger in which all the transactions and operations are very efficient and scalable, the transactions under the blockchain are the permanent one and all the nodes under transactions first verify the dataset after that it will make a transactions.

In the past years, when we want to access the same file at the same time or when we want to do some operations at the particular file , that is the serious task to do the operations . For example suppose we have two students and Both the students are the project partner and they are maintaining a report file on the project .If person A is doing some changes or task on the report file at the same time person B cannot do all the things , Because first of all he has to see all the work done by the person A , But in the concept of Blockchain we can perform some operations at the same file simultaneously .And [7] the other person can see the changes at the performed file at the same time . This one advantage leads the blockchain into the picture.

Blockchain [13]is decentralized system in which every node (local system) have a sample copy of a ledger (ledger is one kind of the database) . If one node will do any changes in the database then at

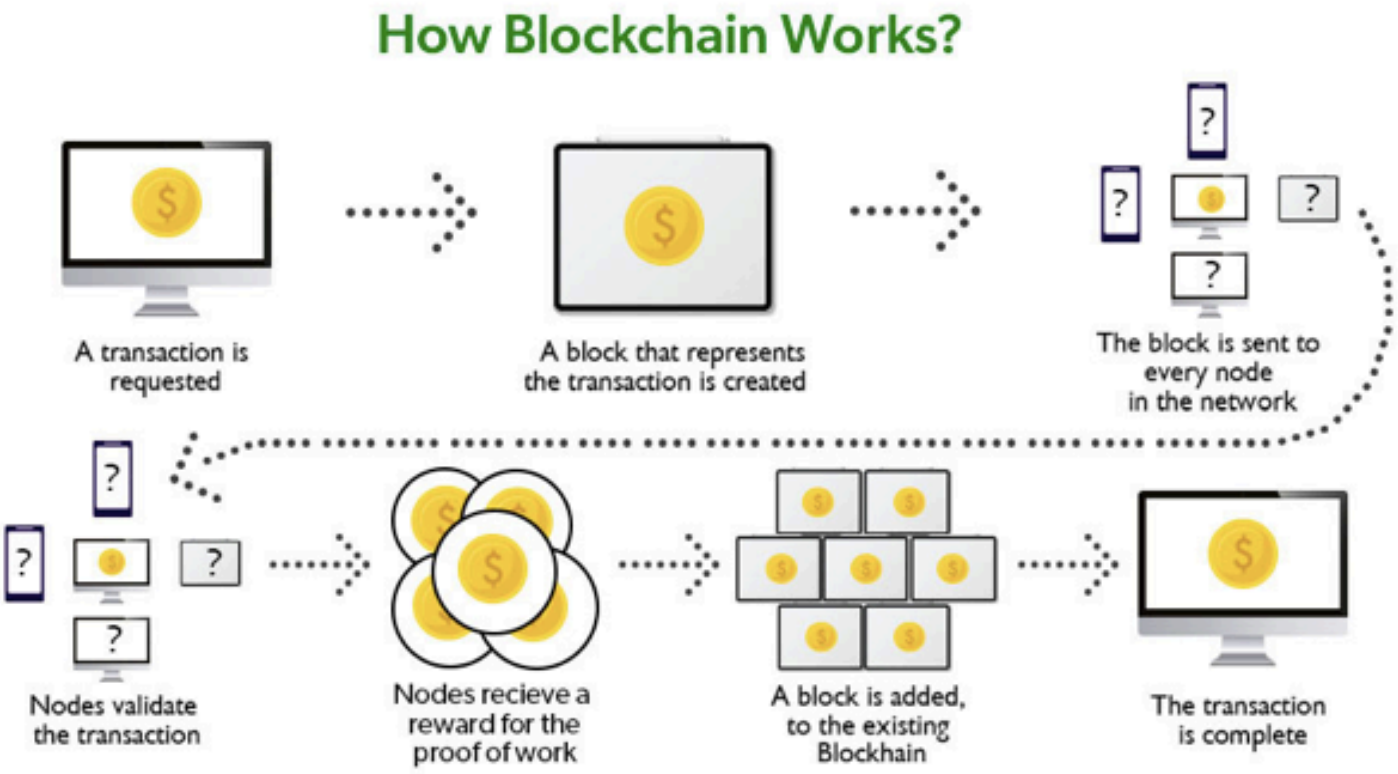

Figure 1.1 Working of Blockchain

the same time all nodes can access the changes at the same time.We[13] have linking of the blocks in the blockchain.

1.1 Key Features of Blockchain

- Open to all - The database or the files in the system is open to all in the system .Every individual node can access the file at the same time.
- Distributed - Blockchain [1]Is based on the decentralized concept. Means we do not have the central authority which is accessing the data or act as the mediator in the system . A node can directly communicate with the other node without having the mediator.
- Ledger - It [7]is a one kind of local copy of database , so that every single node can access the data at the same time.
- Efficient - It is very secure, scalable and fast as compared with the other system.
- Verify - It will [13]verify first all the transactions before proceeding it.Every single node first verify the data. For eg suppose a person A wants to send the money to person B , then every single node will check the database that how much money person A have , if it is having the sufficient money in his account only then the transaction will happen.
- Permanent -All [7]the transactions are persistent and the permanent, means a one c can not change or delete the transactions .
- Confidentiality - Whenever in the system if a person A wants to send the data from A to B , Then the others nodes can not access that data . The data is confidential. Data is secure until and unless , the respected node shares the data with the other nodes.
- Integrity - The ledger or the database cannot be modified with the other nodes, A node cannot do the single change in the ledger or in the database .
- Non- Repudiation - No single node can say that the this task is not done by itself. And not a single not can hide its actions from the other nodes. There would be proof of every step and all the actions or operations have been recorded in the blocks[7].
- Authentication - Every node have a fixed identity which is known to be as the block number. So that. We can easily identify from where this action is performed and which task is done by the

which nodes . We can store every operations value . And will give the data from which node this action is performed.

1.2 HOW DOES BLOCKCHAIN WORKS ::

In the blockchain , [7]we have different set of blocks and every single block have the different features like we have block number, nonce number , data, previous hash (PH) , hash.The hash value is the hexadecimal value of 64 characters. Every block have the unique hash value.

Block number will store the numerical value of that particular block .for example block number 1 will store value 1 in the block number attribute. And in the field of data will store the [4]respective data. PH(previous hash) will store the hash value of the last block and in the last we have hash value , hash value will be calculated by the hash function and it is the unique identification value of the [5]

particular block.

Nonce number plays a vital role [7]to calculate the hash value of a particular block . Suppose if we have a target hash value or we have range of hash value and according to our hash function we are not getting the hash value in our range . Then we have a restriction that we can not change the block number , data values, previous hash value . But nonce gives us this facility we can change the value of nonce attribute for infinite number of times , so that we will be in the range of the hash values[13].

The first block will contain the zero in the previous hash value . And the second block will store the hash value of the first block in the previous hash attribute.The storing of hash values is repeated many times to form a chain . And this chain of blocks is known to be as the Blockchain[7].

Distributed peer to peer network :

Suppose we have a million [13]of nodes in our system and every node have the the local ledger in which all the database is present. Suppose we currently 10 blocks are present in the ledger and and we have a person named jolly and we have a bank statement of jolly in the block number 3 and suddenly a hacker [13]change the bank statement of jolly at a particular node and after that the hash values of all the blocks are changed because we will calculate the hash values according to the data set values and here our data is changed . So after the block number 3 we changed all the hash values for the particular node[7].

In this case we have a advantage of the blockchain and every node is connected with each other . So when they all communicate with each other and they will find that one node have the different hash values of block number 3 and so on . So in this type of scenario majority wins [6].

For example if we have 20 nodes and 15 nodes have the same data and the remaining nodes have the different data than in this case we will consider the ledger of 15 nodes . Because according to the algorithm we have to support the majority[9].

1.3 CONSENSUS OF BLOCKCHAIN ::

This[11] is protocol or mechanism in which when there is any new transaction entered in the system , then we have different set of rules to validate that transaction.And this type of mechanism prevents the system from the malicious things and removes the unwanted data from the system[14].

We have different types of the algorithms in the consensus mechanism of the blockchain.

- Proof of work (PoW)
- proof of stake (PoS)
- proof of elapsed time (PoET)
- proof of deposit (PoD)
- proof of capacity (PoC

We have proof of work algorithm which is world famous.

1. Proof of work (pow)::The computational power required for proof of work is substantial, as it is used to solve complex mathematical puzzles. In PoW, users compete with each other, employing powerful computers to tackle these challenging computational tasks. The privilege to create a new block and verify transactions is granted to the individual who successfully generates the 64-digit hash first. Moreover, the successful miner is rewarded with a "block reward," a fixed amount of cryptocurrency[3].

2. The operational costs associated with PoW are widely recognized for being high, as the process of generating new blocks requires substantial computer power and energy. This poses a challenge for new miners seeking to enter the field, leading to concerns regarding centralized control and scalability.

3. Proof of work [7](PoW), which is used by Bitcoin, Ethereum, and several other public blockchains, was the first consensus mechanism ever developed. Though there are several scaling

difficulties, it is usually considered to be the most dependable and safe of all the consensus systems. Although the phrase "proof of work" was initially used in the early 1990s, Satoshi Nakamoto, the creator of Bitcoin, was the one to use the concept in the context of digital currency[13].

4. Proof of stake(pos)::

As the name [8]suggests, this popular consensus approach is based on the staking process. In a proof of stake (PoS) system, miners must put up a "stake" of digital currency to be randomly chosen as a validator. Similar to a lottery, the more coins you stake, the higher your chances of being selected[7].

5. In contrast to PoW, where block rewards (newly created currencies) are used to motivate miners, the PoS system just pays contributors with a transaction fee.

6. PoS is thought of as a more resilient and environmentally friendly substitute for PoW that is also more safe from a 51% assault. The PoS method has garnered criticism for its potential to promote centralization because it favours entities with more tokens. Popular PoS platforms include Tezos, Cardano (ADA), and Solana (SOL) (XTC)[11].

7. Proof of Elapsed Time(PoET) ::

This principle works mainly on the things by which we can easily conclude that the older the timestamp of the system means the more power of the validation is having for a particular nodes.If a node is older than a node 2 , then here the validation power is concluded on the basis of the node which is very older as compares with the other nodes.Timestamp plays a vital role in this great mechanism of the system , And it boost the blockchain system and makes it more decentralized[15].

8. PoET, a consensus mechanism based on timelotteries, operates by distributing various wait periods among all network nodes at random. Each of these nodes enters a state of "sleep" for the duration of the waiting period. The mining rights are given to the person who wakes up first and has to wait the least amount of time. This randomization ensures fairness inside the network by ensuring that each player has an equal chance of winning[12].

The PoET consensus process is scalable, extremely effective, and requires fewer resources. It has been integrated into Sawtooth by Hyperledger.

9. Proof of Burn (PoB)::

This is totally based on the system in which when a new transaction entered in the system then the validation of the transaction is totally decided by the energy burnt by the node, the validation of the transaction is directly proportional to the energy released by the a particular node .If a node 1 is having the power to release the more energy as compare with the node 2 then we can easily say that the validation of the new transaction is totally agreed by only the consideration of the node1.This is one of the great protocol to execute the [6]consensus mechanism and a better way of solutions to the problems of the centralized materialistic things , so we can totally rely on this mechanism. But this is having some advantages as well as disadvantages over the other things or others consensus protocols[7].

10. Proof of capacity (POC) ::

Rather than investing in costly hardware or burning coins, validators in the Proof of Capacity consensus are required to allocate their hard drive space. Validators have a higher chance of being selected to mine the next block and receiving the block reward if they possess more hard drive capacity[12].

1.4 PROTOCOLS OF BLOCKCHAIN

what is protocol :

Set of rules [13]and guidelines that are used to achieve a particular task.It provides a framework to transfer the data over the internet.The rules and the regulations assures that the data is transferred efficiently and securely.All the protocols in every field are meant to be for this.

There is no difference in the case of the blockchain.Blockchain protocols are designed to maintain different aspects of blockchain[15].

Why does Blockchain need a protocol :

As we know that[7] the centralized authority is absent in the field of blockchain and it is a decentralized system. Peers or nodes need to be connected and maintain a ledger copy.consensus method works to validate transactions into blocks, and ones these blocks are created they can not be altered .We have different types of protocols in the blockchain:

- Ethereum
- Solana

- Polygon
- Polkadot
- Hyperlazer
- Quoram
- Corda
- Ripple

1.4.1 ETHEREUM ::

In the starting [15]when the blockchain is only initiated , it is totally based on the cryptocurrency and we do not have any development things for the blockchain . So ethereum Will be acts a service provider in the field of the development in this technology . We can easily develop the new things in this area of the development.It gives a front view and provides the support [7]of the user interface for the new things.

Ethereum is the[15] only new platform of thr blockchain which is giving us the support of the web development .There are many projects exists in the field and like we can say that is blockvote,it is the project in which we can easily plan a voting system, a one can do the voting and here we are using the near protocol of the blockchain and the react js for the front end purposes . A one account can do the vote at once only.And if he or she [13]will try another time then it will definitely show some error in this and we can't proceed further in this manner.

The another [15]main project is the google drive to store the images and the titled of the project is the blockdrive. We are having the data like images we can store that data in a very efficient manner by using the blockchain.IPFS is the only way to store the things on the network by using the pinata ,first of all it will create the api key for public and the private transactions .For the public level support we can directly share and access the data without any new things of the system.

We are having the set of the smart contracts in this system like we are having the share access , display, disallow ,add prompt image, add user , allow .Every single smart contracts is having a separate meaning for this .Metamask extension is used and the hardhat blockchain protocol is used for the Hardhat blockchain protocol. We will easily add a new account first and the plan the such things for our purposes of the system.

1.4.2 ETHEREUM ACCOUNTS ::

In the [15]beginning, when the blockchain is first initiated, it relies solely on cryptocurrency, lacking any development infrastructure. Therefore, Ethereum serves as a pivotal service provider in advancing this technology. It offers ample opportunities for innovation and development, providing a front-end view and user interface support for new initiatives in this field..

Ethereum [13]stands out as a leading platform in blockchain technology, offering extensive support for web development. Various projects, such as Blockvote, leverage this infrastructure. Blockvote, for instance, enables the creation of a voting system, allowing users to participate in voting activities. The project integrates the Near protocol of the blockchain and React.js for front-end development. Each user account is restricted to one vote, preventing multiple attempts and displaying errors to deter further action[7].

1.4.3 ETHEREUM BLOCKCHAIN

Another [13]significant project is Blockdrive, which functions similarly to Google Drive for storing images. By leveraging blockchain technology, we can efficiently store image data. IPFS, utilized through Pinata, is the primary method for network storage. Initially, Pinata generates API keys for both public and private transactions. Publicly, users can easily share and access data without requiring additional system components[15].

Within this [13]system, we possess a collection of smart contracts, each serving distinct purposes such as share access, display, disallow, add prompt image, add user, and allow. Each smart contract holds specific functionalities. We utilize the Metamask extension and the Hardhat blockchain protocol for our blockchain operations. To initiate, we seamlessly integrate a new account and proceed with planning our system's functionalities accordingly[15].

1.4.4 SOLANA

This is totally[14] based on the proof of history .For every new transaction of the system ,we can easily conclude that it will firstly stored in the local replica of the distributed ledger and after that when it is confirmed once from the node side , then only it is originated for a fixing of the memory in a proper manner.The transaction and the new event is only validates through the proof of he history of the blockchain[7].

In a non-partitioned state, there is always just one Leader present in the network. Through PoS-based elections, each Verifier node has the same hardware capabilities as a Leader and is eligible to be elected as one[9].

Consistency is nearly usually chosen above availability in the context of the CAP theorem in the case of a partition. This study suggests a method for regaining network control in the event of a major partition, regardless of its size[13].

1.4.5. PROOF OF HISTORY:

A series of calculations known as "Proof of History" can be used to cryptographically confirm the interval of time between two occurrences. It makes use of a cryptographically secure function that was created such that the output could not be anticipated from the input and that it had to be fully performed in order to produce the outcome. The function is called repeatedly on a single core while its previous output serves as the three current inputs and the current output is periodically recorded. After then, the output may be recalculated and independently checked on several cores of remote computers[13].

By adding the data (or a hash of some data) to the function's state, data may be timestamped into this sequence. A timestamp provided by the recording of the state, index, and data as they were added to the sequences ensures that the data was produced before the next hash in the series. Because several generators may synchronise with one another by blending their states into one another's sequences, this architecture also permits horizontal
scalability[15].

1.4.6. Timestamp for Events

This series of hashes may also be used to prove that a certain piece of data existed prior to the creation of a specific hash index. combining the data with the current hash at the current index using the "combine" function. Simple cryptographically unique hashes of any event data can be used as the data. Any action that is collision-resistant can be used as the combine function, including a straightforward data add. The next hash, which could only have been produced after that particular piece of data was input, acts as a timestamp for the data[14].

1.4.7. HYPERLAZER

A distributed [7]ledger based on blockchain was developed with the help of the open source initiative known as Hyperledger. With the help of many people, Hyperledger has developed the frameworks, protocols, tools, and libraries required to construct blockchains and associated applications[11].

Since Hyperledger was founded by the Linux Foundation in 2016, companies including IBM, Intel, Samsung, Microsoft, Visa, American Express, and blockchain start-ups like Blockforce have all contributed to the project. All all, the relationship spans the manufacturing, IoT, supply chain management, banking, and production-based industries[13].

Different distributed ledger frameworks and libraries are brought together by Hyperledger. With this, a company may, for instance, employ one of Hyperledger's frameworks to enhance the effectiveness, speed, and transactions of its business processes[1].

The way that [13]Hyperledger functions is by offering the infrastructure and standards required for creating blockchain systems and applications. The frameworks and tools that make up Hyperledger are used by developers to create commercial blockchain initiatives. Participants in the network are all familiar with one another and may take part in consensus-building procedures[7].

These layers are used by hyperledger based technologies to function:

- A consensus layer that decides on the order and verifies the validity of each transaction in a block[4].
- A layer for smart contracts that evaluates and approves transaction requests.
- A layer of communication that controls the transit of P2P messages.
- A blockchain communication API that enables interaction between different apps.
- Identity management services, which verify users' and systems' identities.

1.5 APPLICATIONS OF BLOCKCHAINS

Nowadays , Blockchain [3]technology playing a vital role in the human life . We have a lot of advantages of the blockchain technology over the other technology. Ethereum is having a advantage over the bitcoin.

These are some famous real world applications of the blockchain

- Asset Management : Blockchain is[7] very suitable to maintain the assets. In different fields it is sufficient to maintain all the assets. Nowadays just because of the blockchain we do not need a centralized authority to make the payments ,like initially we have to send the payments through the bank and the bank charges a lot , according to the amount level and if the amount is very high . Then [7]we have to pay a lot charges for the money transfer. Blockchain can be quite helpful in these circumstances since it eliminates the need for dealers and the middelmens and the settlement system, blockchain provides us a better way of straight forward in which we can sort out things naturally, it provides us a pure straight way which eliminates the chance of error from the system[13].

- Cross Border payments : If you want to s[14]end the payments in other countries , that is very costly and sometimes it leads to impossible and sometimes it is very time taking. Suppose if we want to send the money through the bank but the bank is not working for a whole week . So it is not a time suitable system. This system does not have a full solution of problem . We have[13] blockchain in which if the giver and taker are both ready to do the operations and the transactions, the the third party can not make any disturbance or cannot take any charges for that [13] .

- Healthcare : Blockchain plays a vital role in the healthcare industry. In the field of health system , blockchain system comes as the emerging system . A one can not do any changes with the report issued by the doctor. [8]And also cannot modified the previous report. Nowadays if a doctor gives a incorrect report of the patient and later patient relies that the doctor is fraud then at that time the patient can claim the doctor for the fraud report and doctor can not denies this offence, because now he can not do any changes or can not modify the report[9].

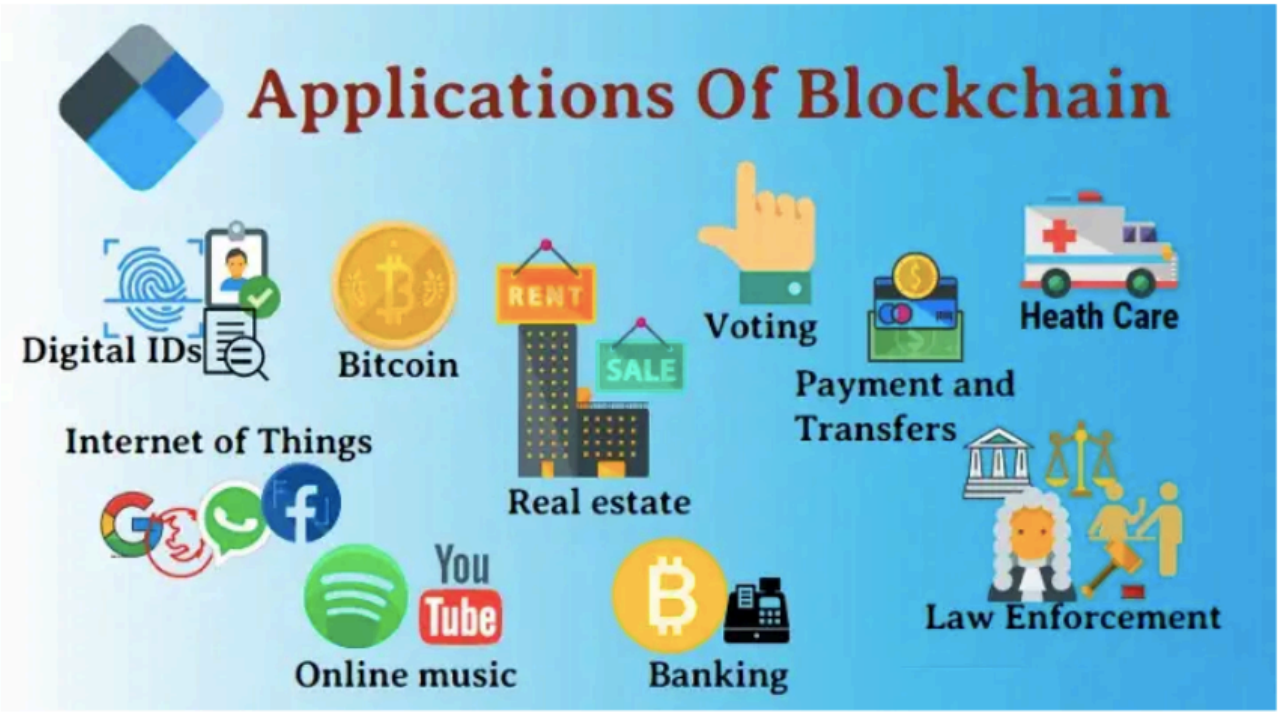

Figure 1.2 Applications of Blockchain in Real World

- Cryptocurrency :It is [14]the better way of solution to the digital payments and for the e-shopping things ,there is always a better solution because it saves the payments modes from the malicious things and we have a set of distributed data which is responsible for the all the payments under this site. And to secure this data from the hacking it provides us a way of decentralization , so, this technology provides us a better way to sort out the things, the technology underpinning cryptocurrency, brings about a new revolution. Assuring that all user identification-related information is kept anonymous, BC verifies every transaction and keeps a permanent record [9]of it.

- Birth And Death Certificates : Sometimes[9] people plays with the certificates to decrease the age issue. When a child is born ,doctor issues a birth certificate and after that if the guy faces problems of age issue in the respective of jobs . Then he can able to reissue the certificates but if we use the blockchain system ,then we can not modify the[7] birth certificate as well as the can not modify the age . On the other side if the govt make such plans to give scholarhips to the widow women the they people make a fake certificate of death , but if we use the blockchain technology in this system then the men will not alive after some time , it means that

if a one make a fake certificate of death then he can not do any changes with that and he will considered to be as died person after that[9].

- Online identity verification :We [13]have Nonce Identification number in the field of the blockchain and also a unique block number which can not be modified once it is declared and we can not make any changes in this .Every individual will get a unique block number , so that in future if we want to make any transactions in future ,we can do that easily.

- Payments and Transfers: The [9]import use of blockchain is fund transfer from one place to another(respected account). The. Blockchain system is very fast as compare with the other system and these types of transactions will be settled within the fractions of seconds.Transactions trough the blockchain is very secure and we can say that it is intgritable in nature[14].

- Copyright and [7]Realities : In the industry of music and the cinema ,copyright and realities are the major problems .So , Blockchain leads to the solution of this problem and suppose if a one is launching his music album and later another guy blames that the music had stolen by the guy. So here copyright plays a vital role . A one who is deserving will definitely get the justice . In the field of blockchain , a one who created the music will take the copyright of that particular music and if another guy or any hacker try to steal that data or try to make any changes in the ledger . Then we can catch that men easily[9].

CHAPTER 2

LITERATURE REVIEW

2.1 Current Data Storage System

At present, individuals[1] utilize offline storage devices and other secondary storage options for data backup and protection. Cloud services such as Amazon, Google, Dropbox, and Microsoft are commonly used for storing significant amounts of user data. However, it's essential to recognize that when data is stored in the cloud, it essentially resides on someone else's computer or storage devices, giving the hosting organization complete control over user data. Recently, there has been a rising trend of companies utilizing user data without explicit consent, leading to concerns about privacy and unauthorized use for their own gain.

2.2 Need of a distributed database

In an era of relentless technological progress and the continual miniaturization of powerful devices, there exists an opportune moment for the evolution of information systems composed entirely of distributed devices. While the internet serves as a prominent example, it adheres to a hierarchical client-server structure with numerous intermediaries, raising questions about trustworthiness. As devices and data proliferate, the demand for both physical and logical mechanisms to manage this data grows. A contemporary race among formidable entities to accumulate vast amounts of data for future analysis has led to an unprecedented surge in data search and storage. Even on a personal scale, we now link digital data closely to our lives, making data the contemporary equivalent of currency and knowledge[3].

Yet, the crucial question arises: how should we store our personal data? Whether locally, on DVDs, or utilizing cloud services, there's a prevailing trend to entrust significant data to servers provided by companies promising security and integrity. This reliance on external services, surpassing self-trust, is emblematic of an era where individuals place faith in such services to safeguard their data. However, this practice of handing over control to entities with higher authority exposes our critical data to potential misuse and replication, as central authorities in any system wield hierarchical power[1].

In light of technological progress in computation power, data transfer rates, and decentralized storage across various devices, there arises an alternative. The conventional model of centralized networks with authorities and hierarchies for secure data storage and transfer may no longer be necessary. Instead, recent developments in completely distributed systems, facilitated by involved parties and bolstered by Blockchain technology, offer a promising avenue for secure and trustworthy data management without the need for central authorities and the inherent risks they pose.

2.3 Necessity of blockchain for a distributed storage system

The necessity[1] of blockchain in a distributed storage system becomes evident when considering the risks associated with centralized authorities, as highlighted in a paper introduced in 2008 by an individual or group known as Satoshi Nakamoto. Following the global financial crisis, Nakamoto's paper, "Bitcoin: A peer-to-peer Electronic Cash System," proposed a peer-to-peer distributed currency to address the vulnerabilities of centralized power structures in various domains such as economics, finance, and technology.

Blockchain, originally associated with Bitcoin, addresses issues beyond "Double Spending" and presents a comprehensive solution to challenges involving fraud, intermediaries, transaction throughputs, and stable data. This solution is encapsulated in the FITS model, defining an environment susceptible to fraud, reliant on intermediaries, characterized by high transaction volumes, and necessitating stable data[5].

Furthermore, blockchain enables the creation of a Distributed Autonomous Organization, where an organization operates independently without a central authority, relying on "Smart contracts" and member collaboration. This advancement goes beyond traditional client-server systems, providing an expansive and trustworthy framework akin to centralized servers, as seen in cloud platforms for data storage.

In conventional [3]data storage services, trust is established through continuous service and policies of the central authority. However, implementing such trust in a distributed storage network, where no central authority exists, proves challenging. Blockchain technology addresses this challenge by allowing the creation of a distributed system with an inherent trust mechanism. This trust mirrors the confidence placed in dedicated servers or popular cloud storage services like Google Drive,

making blockchain a crucial component for building and maintaining a distributed storage network owned and utilized by the community[4].

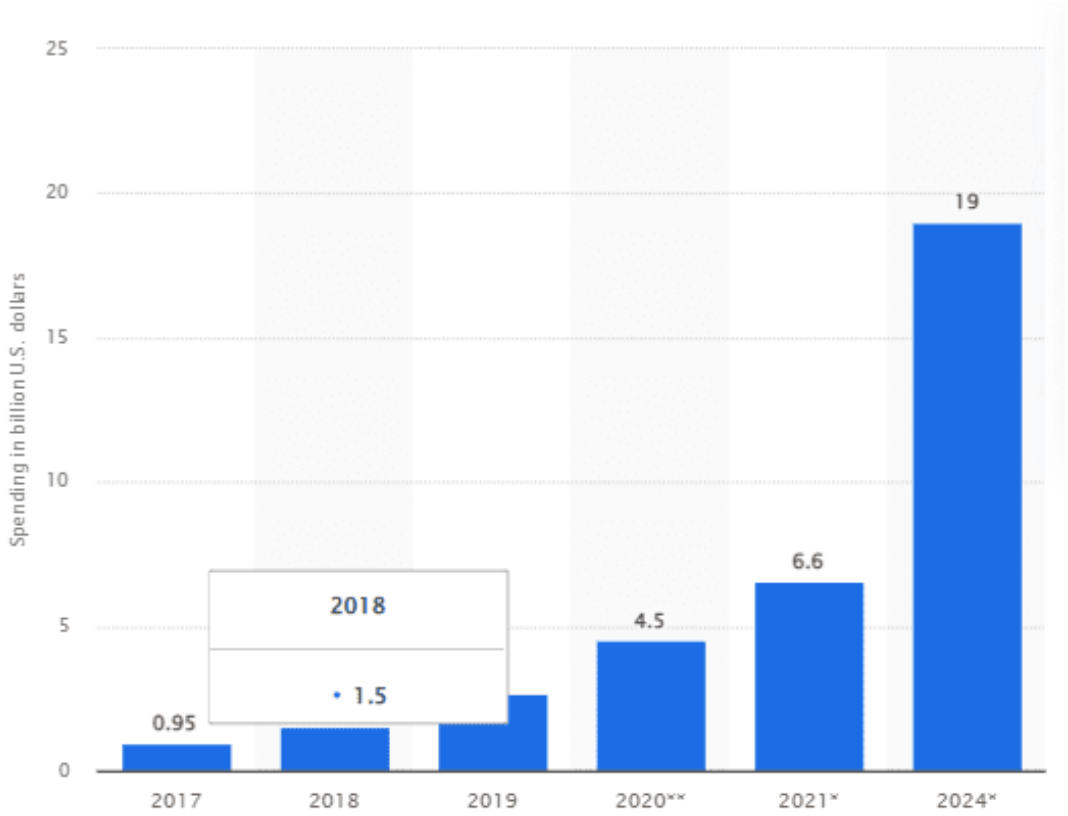

Fig 2.1: Blockchain growth Prediction [7]

2.4 Blockchain's Role in Preventing Data Tampering

In blockchain[2], data integrity is maintained by storing file hashes, metadata, transaction details, ownership information, storage data, and access control data. Through the use of asymmetric key encryption and shared secrets, an additional layer of security and access restrictions is implemented. Following the global financial crisis in 2008, Satoshi Nakamoto introduced the concept of a peer-to-peer distributed currency in a paper titled "Bitcoin: A peer-to-peer Electronic Cash System." Blockchain technology, initially associated with Bitcoin, addresses issues such as fraud, intermediaries, transaction throughput, and data stability. The FITS model, encompassing Fraud, Intermediaries, Throughputs, and Stable data, defines the environment where blockchain can provide an effective solution. Moreover, blockchain enables the creation of DistributedAutonomous Organizations, self-sustained entities without a central authority, using "Smart contracts" for trust[1].

2.5 What is Distributed Ledger

A peer-to-peer network[7], Blockchain relies on a protocol for communication between nodes and the validation of blocks. Satoshi Nakamoto introduced Blockchain in 2008 with the aim of serving as the transparent transaction ledger for the cryptocurrency bitcoin. Within the blockchain, blocks function as repositories of valid transactions, undergoing hashing and encoding in a Merkle tree. Each block includes the cryptographic hash of preceding blocks, coupled with its own data, forming a continuous chain. This iterative process within each block ensures the integrity of the previous blocks, extending all the way back to the genesis block [7].

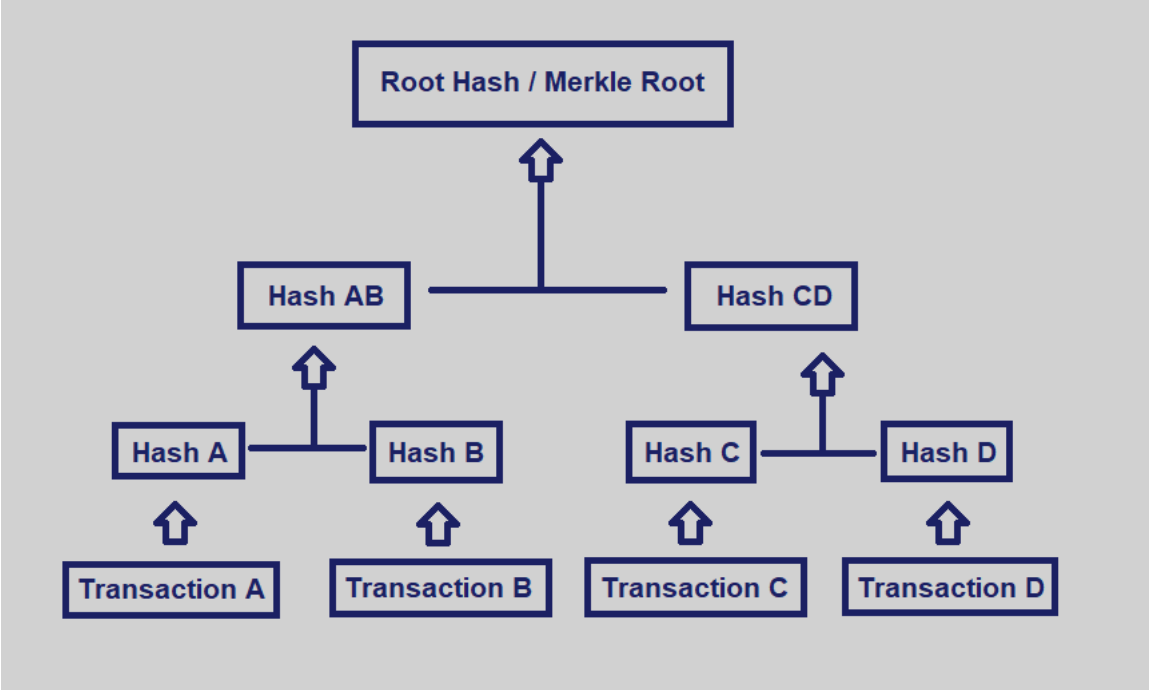

Figure 2.2: Merkle tree [1]

2.6 What is Blockchain

Blockchain technology[1] is a structure that stores transactional records, also known as the block, of the public in several databases, known as the "chain," in a network connected through peer-to- peer nodes. Typically, this storage is referred to as a 'digital ledger.' Every transaction in this ledger is authorized by the digital signature of the owner, which authenticates the transaction and safeguards

it from tampering. Hence, the information the digital ledger contains is highly secure. In simpler words, the digital ledger is like a Google spreadsheet shared among numerous computers in a network, in which the transactional records are stored based on actual purchases. The fascinating angle is that anybody can see the data, but they can't corrupt it[1].

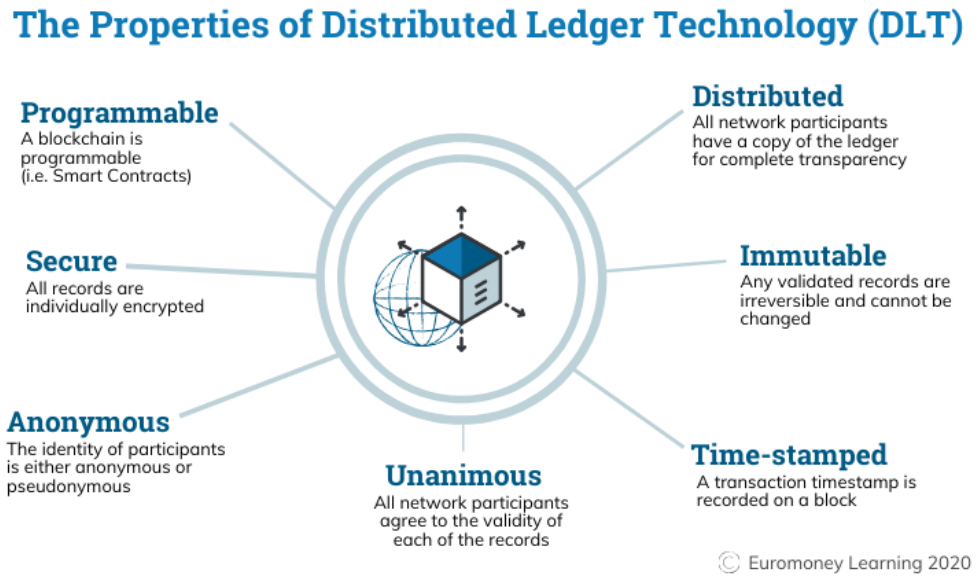

Fig 2.3: Properties of Blockchain [3]

Blockchain is simply a database which solves issues based on data, it is decentralized ledger and every transaction is being recorded in ledger and which are non-reversible.these transactions are stored in block, Depends on type of blockchain each block carry different number of transactions.

Each block have block header which consist of following information :

- Timestamp
- Version
- Merkel Tree Root
- Difficulty target

- Nonce

- Previous Hash

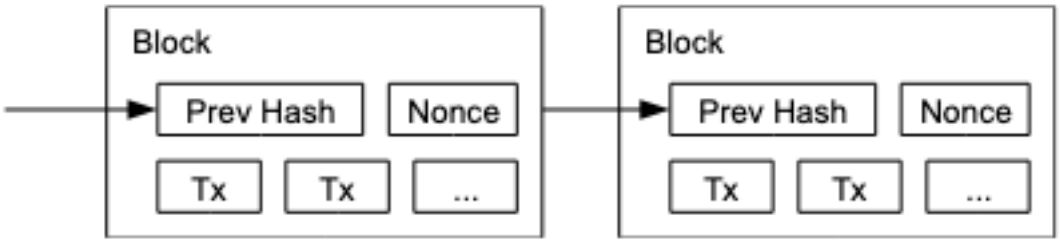

Fig 2.4 : Block structure in blockchain [8]

Any device, mobile Phone/computer or router are nodes on blockchain, there are two kinds of nodes in blockchain, based on type of node, it does perform different operations.

- **Full Node:** Full node[6] which has the entire blockchain, which is ethereum is 679 GB, bitcoin is 403 GB. To be a full node needs a huge amount of storage. Full node verify nodes/ blocks that are added. Full Node can be miner with huge computing power.

- **Partial Node:** Any node that has blockchain software we can call it a partial node. E.g Mobile phone.

  The Internet is a really great [8]innovation and it has all business but mostly the internet is controlled by few top companies, so we don't want any company to have central powered.Blockchain provides trust as each and every transaction stored in one online ledger so transactions will be transparent. It is decentralized, secure and immutable.Blockchain works on principle of cryptography[8].

2.7 Evolution of Web

2.7.1 Web1.0

The period of early internet between 1991-2004 is known as web1.0. During this time the World Wide Web (www) was different from what we know it today; websites used to be static only[7]. Most users are consumers only, mostly users only read the published content on the web.

Advantages

1. It provides knowledge to users online. Information is just one click away.

2. It allows users to create their portfolio on the web and present it to the world.

Disadvantages

1. Mostly read-only.
2. Only admins have privileges to modify content on the website.
3. Programming language required to post any information on the web.

2.7.2 Web2.0

The next big evolution of the www also known as world wide web, the Internet we are using from 2004-today, majorly falls under the category of web2.0[7], where a user reads published content and generates content on the web. Most websites are dynamic in nature. Web2.0 is often called the social web. Social media, Email, Video streaming, Multiplayer online gaming, etc., are examples of Web2.0.[8]

Advantages

1. Read and write nature.
2. It provides platform users to generate and share content, not only consume.
3. Developer-friendly tools make life easy for website developers.
4. Improved person-to-person communication and created great opportunities for busi- ness.
5..It provides interactivity on the web.

Disadvantages

1. Most web2.0 is centralized and controlled by tech giants like Google, Amazon, Meta, etc.
2. Censorship of content on the web.
3. Web services are costly.
4. Collection, selling, and misusing user data without the user's permission. e.g., Cambridge Analytica.[15]
5. Piracy of content of the user Issues.
6. Admin can remove user content from their platform.

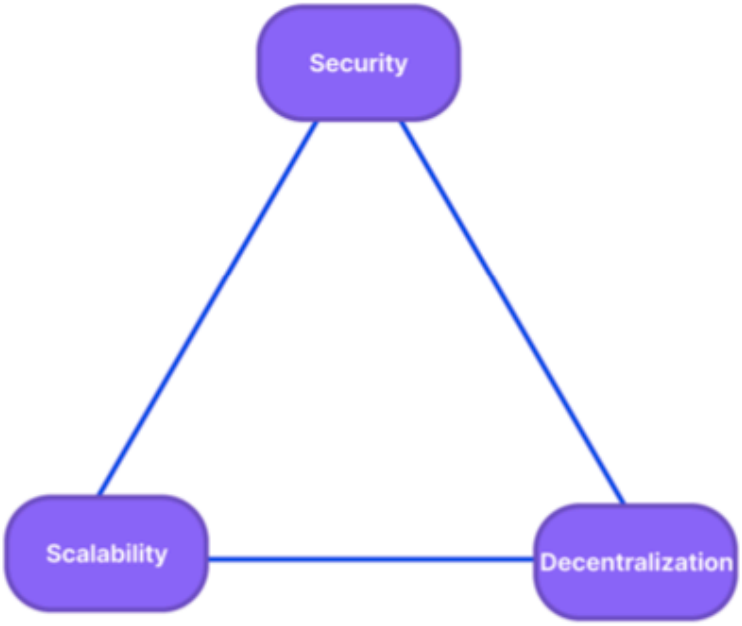

Figure 2.6 Blockchain Trilemma

2.7.3 Web3.0

Web3.0 is the latest generation of www also known as the World Wide Web[6]. Web3.0 uses artificial intelligence and machine learning to achieve maximum decentralization through Blockchain. This enables people-to-people communication, and the User keeps his ownership of the data or digital property and can sell without the involvement of a central authority.

Tim Berner Lee is behind the core principle from which the current world wide web originated[7]. He backs the idea of transforming the web into a giant database on which we can perform complex and valid queries. He has also coined the term ”Semantic Web,” the capability of web2.0 combined with the semantic web will enable access to massive data. Netflix CEO Reed Hashting believes web3.0 will be Full video web as bandwidth will be 10Mb all the time[8]. There are different definitions of web3.0 from experts according to their expertise. Web3.0 be can be defined in the following :

1. Intelligent: It is said that web3.0 will be Intelligent and able to execute innovative applications built on artificial intelligence. It will enable the web to human-computer interaction more intelligent. It will make the web powerful as it can understand different languages with proper semantic meaning; therefore, Users can interact on web3.0 in their native language.

Parameter	Ethereum	Near	Hyperledger Fabric	Corda
Consensus Protocol	Proof of Work	Delegated PoS	Raft, Kafka, Solo	Single Notary, Raft, BFT-SMaRt
TPS	15	100000	20000	1600
Block Time(sec)	14	1	2	No Concept of Block
Smart Contract Languages	Solidity	AssemblyScript, Rust	Go, JS	Kotlin, Java
Smart Contract type	Stateful	Stateful	Stateless	Stateful
NFT development Supported	Yes	Yes	Yes	Yes
Type of Blockchain	Public	Public	Private	Private

Table 2.1 Comparison of Different Blockchain Protocols

2. Personalized: In web3.0 Blockchain is the core technology that focus on personal- izing user data. The User owns his data while storing and sharing data with other peers.

3. Interoperable: Web3.0 promotes open source projects, which leads to sharing of knowledge and information that can be customized to make software that can run on different devices. Web3.0 applications are interoperable between various devices like computers, mobile, TV, microwaves, etc.

4. Virtualization: Web3.0 enables high bandwidth and High-resolution graphics, making it easier to create a 3D virtual life experience.

CHAPTER 3

TECHNOLOGY

3.1 What is NEAR

NEAR[6] is a smart contract blockchain platform which is an efficient community based and developer friendly build in 2018. From a whiteboard series on youtube founders of near took great features of different blockchain and incorporated them together to build their own

blockchain. In 2019 they released a very restricted version of blockchain which was made unrestricted and decentralized in october 2020.

NEAR is a layer one, sharded, proof-of-stake blockchain built for usability and scalability. Near is a delegated proof of stake blockchain with smart contract compatibility. It uses sharding to maximize efficiency and is governed by holders of its native near cryptocurrency token.

Near is also interoperable with ethereum via theory rainbow bridge, a trustless bridge which allows you to transfer assets like erc20 token and nfts between ethereum and near. It will be possible to interact with smart contract and decentralized applications on both sides of the aisle using near's rainbow bridge.

3.2 Architecture of NEAR

NEAR[6] uses sharding architecture called "Nightshade". Basically instead of creating multiple side chain as in cryptocurrency like polkadot shard chain on the near blockchain are modeled as a single blockchain in simple words every block produced on the near blockchain contains snapshots of the transactions occurring on each shard, each shard is maintained by its own allocated network of validator nodes, these shards all work in parallel. This design makes the near blockchain about as fast as Ethereum2.0's upcoming beacon chain. Near blockchain can process around 100,000 transactions per second[6].

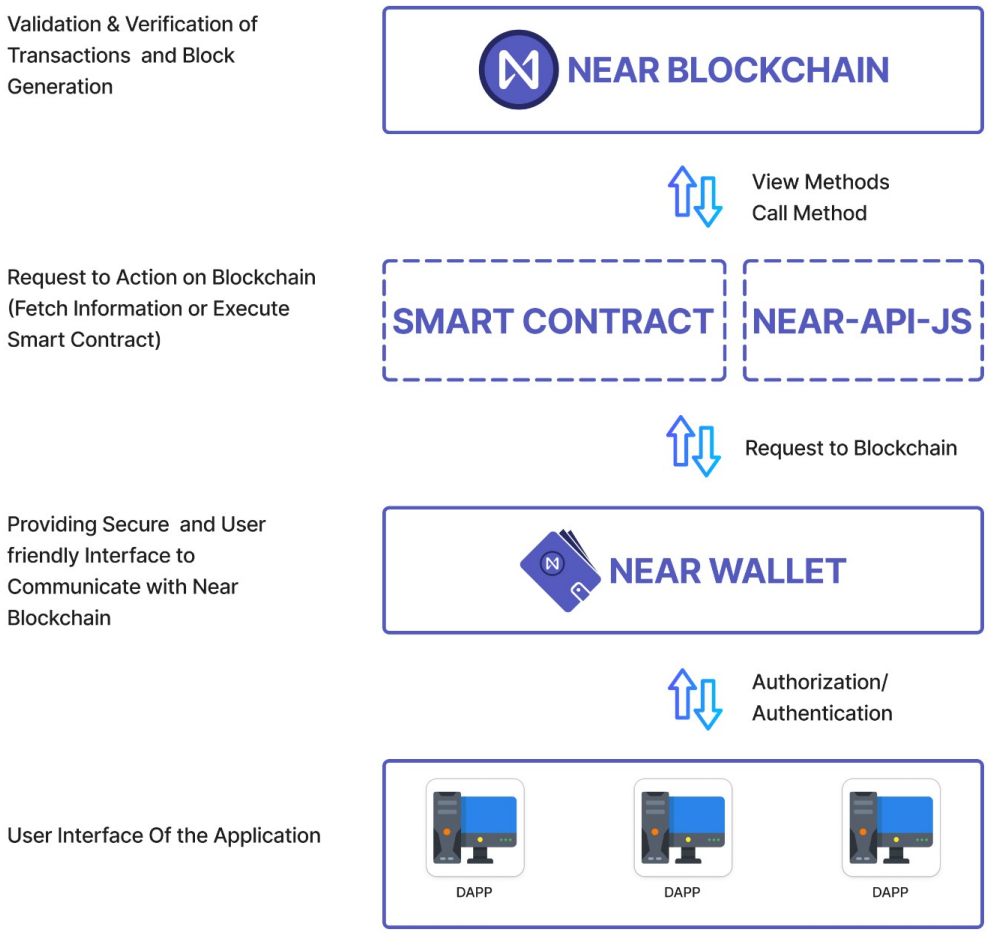

Fig 3.1 : Architecture Of Near [3]

As far as block production concern near uses a mechanism they have titled “Doomslug”,it involves letting different validators take turns producing blocks in accordance with how many near tokens they have staked, As a validator you can unstake at any time but it you do something naughty, you will get slashed. Amount of tokens you need to stake to become a validator is dependent on how many near tokens other validators are staking in particular shard.

Currently Near blockchain has only one shard, the decision to implement additional shards will be decided by community vote if they deem them necessary. At that point of time blockchain itself will automatically create, destroy or merge shards based on network conditions[3].

3.3 Smart Contract

Smart contracts[1] are self-executing contracts in which the contents of the buyer-seller agreement are inscribed directly into lines of code. According to Nick Szabo, an American computer scientist who devised a virtual currency called "Bit Gold" in 1998, Smart contracts are computerized transaction protocols that execute contract conditions. Using it makes the transactions traceable, transparent, and irreversible.

Using [3]smart contracts increases Accuracy, Speed, and Efficiency The contract is immediately executed when a condition is met. Because smart contracts are digital and automated, there is no paperwork to deal with, and No time is spent correcting errors that can occur when filling out documentation by hand. Trust and Transparency There's no need to worry about information being tampered with for personal gain because there's no third party engaged and Encrypted transaction logs are exchanged among participants. Security Because blockchain transaction records are encrypted, they are extremely difficult to hack. Furthermore, because each entry on a distributed ledger is linked to the entries before and after it, hackers would have to change the entire chain to change a single record. Savings Smart contracts eliminate the need for intermediaries to conduct transactions, as well as the time delays and fees that come with them[3].

Using [3]Blockchain in the voting process can eliminate common problems. A centralized voting system faces difficulties when it comes to tracking votes – identity fraud, miscounts, or bias by voting officials. Using a smart contract, certain predefined terms and conditions are pre-set in the contract. No voter can vote from a digital identity other than his or her own. The counting is foolproof. Every vote is registered on a blockchain network, and the counting is tallied automatically with no interference from a third party or dependency on a manual process. Each ID is attributed to just one vote. Validation is accomplished by the users on the blockchain network itself. Thus, the voting process can be in a public blockchain, or it could be in a decentralized autonomous organization-based blockchain setup. As a result, every vote is recorded on the ledger, and the information cannot be modified. That ledger is publicly available for audit and verification.

Smart contracts[6] allow you to create voting systems in which you can add and remove members, change voting rules, change debating periods, or alter the majority rule. For instance, you can create a vote for a decision within a decentralized autonomous organization. Rather than a central authority making a decision, a voting mechanism within the organization can determine whether the proposal is accepted or rejected[5].

CHAPTER 4

DEVELOPMENT

Development[4] of the project is completed using the NEAR platform[6]. For front-end purposes we have React and back-end we write smart contracts in typescript.To bring solution to our problem statement we are using NEAR blockchain that has been built from the ground up to be high-performant, incredibly secure, and infinitely scalable all while supporting sustainability. Near provided as with boilerplate code generation with react and typescript which is easy to develop your front end and smart contract with typescript[4].

4.1 Front End Development

Front end development[1] completed using ReactJS. React is a free and open-source front-end JavaScript library for building user interfaces based on UI components. It is maintained by Meta and a community of individual developers and companies. For front end development we have used react mostly which is a free and open-source front-end JavaScript library for building user interfaces based on UI components. React is provided with components that make development of the user interface faster and scalable[5]. We have developed a front end very user friendly with easy to use. Our front-end contains following components:

Home

1. Upload Image
2. View Image

It is responsive in nature.

4.2 Near-sdk-js :

Near-sdk-js[7] is a software development kit (SDK) designed for building decentralized applications (dApps) on the NEAR Protocol blockchain. NEAR Protocol is a scalable blockchain platform that aims to provide a user-friendly and developer-friendly environment for building and deploying decentralized applications.

Near-sdk-js simplifies the process of creating smart contracts on the NEAR Protocol by providing a set of JavaScript libraries and tools. It allows developers to write smart contracts using familiar

programming languages and tools, such as TypeScript and JavaScript, which makes it more accessible for developers with web development backgrounds[7].

The SDK offers a range of features and functionalities that facilitate the development of dApps. It provides an object-oriented approach to building smart contracts, allowing developers to define contract methods and data structures using classes and decorators. It also includes a set of built-in data types, utilities, and interfaces that make it easier to interact with the NEAR blockchain and implement common blockchain operations.

4.3 Backend/Smart Contract Development

Smart Contracts [3]are the back-end of your application that runs code and stores data on the blockchain. We use javascript to smart contract in NEAR, and we import “near-sdk-as” library to build smart contract, In our electoral voting on blockchain we need to write some contract which we make sure:

Node : stores client data,earns tokens .
Client : stores data on node, pays tokens.

Functionalities to be followed properly. Below following smart contracts are:

- getUrl
- addImage
- getUser
- getAllow
- getPermit
- disallow
- display

- shareAccess
- view

```
struct Access{
    address user;
    bool access; //true or false
}
```

Figure 4.1 Structure for the Block

```
mapping(address=>string[]) value;
mapping(address=>mapping(address=>bool)) ownership;
mapping(address=>Access[]) accessList;
mapping(address=>mapping(address=>bool)) previousData;
```

Figure 4.2 Mappings For Accessing

```
function disallow(address user) public{
    ownership[msg.sender][user]=false;
    for(uint i=0;i<accessList[msg.sender].length;i++){
        if(accessList[msg.sender][i].user==user){
            accessList[msg.sender][i].access=false;
        }
    }
}
```

Figure 4.3 Disallow Smart Contract

```
    function allow(address user) external {//def
        ownership[msg.sender][user]=true;
        if(previousData[msg.sender][user]){
            for(uint i=0;i<accessList[msg.sender].length;i++){
                if(accessList[msg.sender][i].user==user){
                    accessList[msg.sender][i].access=true;
                }
            }
        }else{
            accessList[msg.sender].push(Access(user,true));
            previousData[msg.sender][user]=true;
        }

    }
```

Figure 4.4 Allow Smart Contract Code

```
    function shareAccess() public view returns(Access[] memory){
        return accessList[msg.sender];
    }
}
```

Figure 4.5 Smart Contract for Sharing The Images.

```
38              }
39          }
esktop/DDesktop1/GDRIVE3.0/package-lock.json
41
42      function display(address _user) external view returns(string[] memory){
43          require(_user==msg.sender || ownership[_user][msg.sender],"You don't have access");
44          return value[_user];
45      }
46
47      function shareAccess() public view returns(Access[] memory){
48          return accessList[msg.sender];
49      }
```

Figure 4.6 Smart Contract for Display The Images.

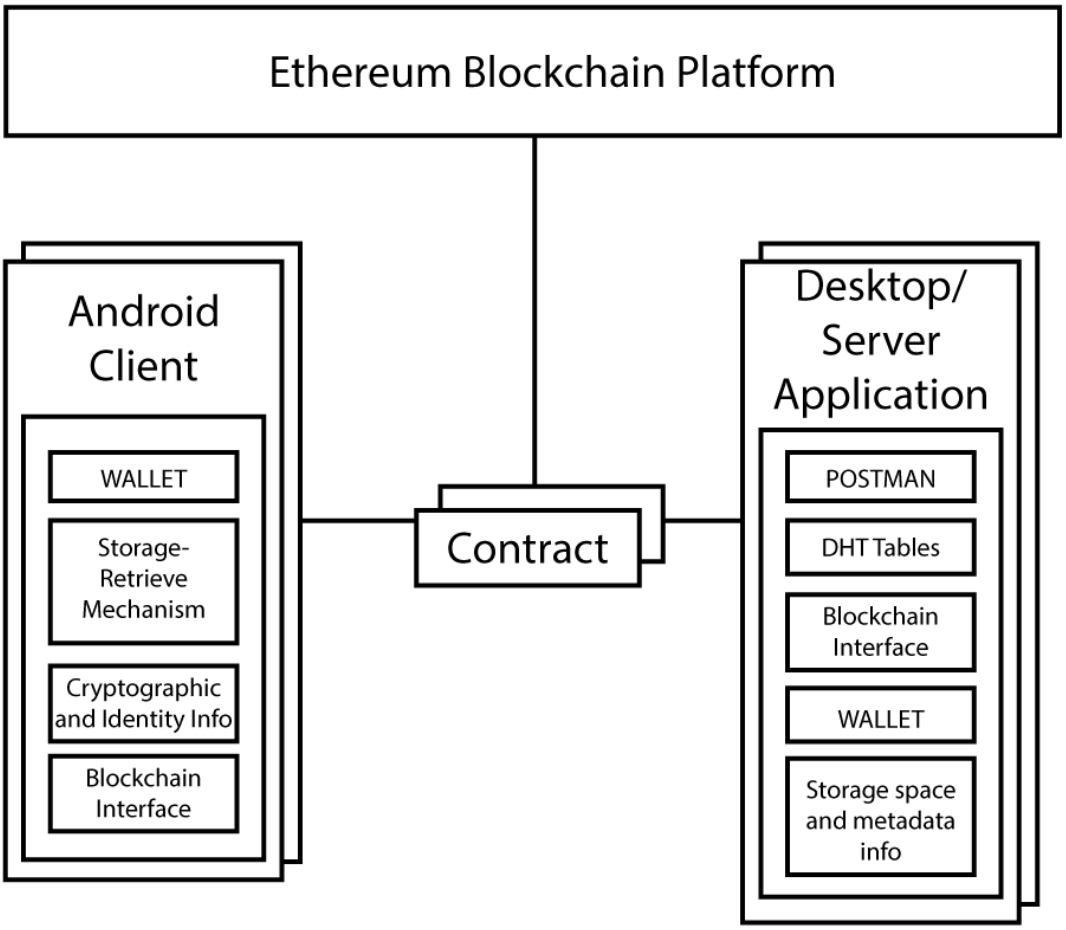

Figure 4.7: User Level Architecture [1]

4.4 **Other Technical Requirements**

Hardware Requirement : As per as Hardware requirement is concern we have implemented Our project on Operat- ing System backed by Apple Inc. MacOS Monetery version 12.3.1, and project required storage of 20GB+ SSD and RAM 8GB requirement shown in Table 3.1.

4.4.1 Developement Tools

1. Visual Studio Code: Visual Studio Code (VS Code) is a popular and highly re- garded source code editor developed by Microsoft. It has gained widespread adop- tion among developers due to its flexibility, extensive feature set, and strong com- munity support. VS Code is known for its lightweight yet powerful nature, making it suitable for a wide range of programming languages and development workflows.

2. ReactJS: React JS, often referred to as React, is an open-source JavaScript li- brary for building user interfaces. Developed and maintained by Facebook, React has gained widespread popularity due to its efficiency, modularity, and component- based approach. React utilizes a virtual DOM (Document Object Model) to effi- ciently update and render user interfaces. It focuses on the concept of reusable UI components, which are modular building blocks that can be composed together to create complex and interactive web applications. One of the core principles of React is the concept of unidirectional data flow. This means that data in a React applica- tion flows in a single direction, from parent components to child components. This approach simplifies application logic and makes it easier to understand and maintain complex UIs. React also embraces a declarative programming style, where develop- ers describe the desired state of the user interface, and React takes care of updating the actual DOM efficiently. This declarative nature helps in building robust and scalable applications.

3. Bootstrap: Bootstrap CSS is a widely-used front-end framework that provides a collection of pre-designed and customizable CSS styles and components. Developed by Twitter, Bootstrap offers a comprehensive set of tools and features that sim- plify web development and enhance the visual appeal of websites. With Bootstrap, developers can quickly build responsive and mobile-first websites. The framework utilizes a grid system that enables the creation of flexible and responsive layouts. It allows content to be easily organized into rows and columns, adapting seamlessly to different screen sizes and devices. Bootstrap provides a wide range of pre-styled com- ponents such as buttons, forms, navigation bars, cards, modals, and more. These components can be easily integrated into web pages, saving development time and effort. Additionally, Bootstrap offers various utility classes that provide additional styling options for typography, spacing, alignment, and more. One of the key bene- fits of Bootstrap is its extensive documentation and community support. The official Bootstrap documentation provides clear instructions, examples, and guidelines for utilizing its features effectively. Furthermore, the Bootstrap community actively contributesthemes, templates, and plugins, expanding the framework’s capabilities and offering additional resources for developers.

Hardware	Requirement
Operating System	MacOS version 12.3.1
Storage	20GB+
RAM	8GB

Table 4.1 Hardware Requirement

4. NodeJS: Node.js is a powerful, open-source, and cross-platform JavaScript runtime environment that allows developers to run JavaScript code outside of a web browser. It uses the V8 JavaScript engine, originally created by Google for use in Chrome, to execute JavaScript code on the server-side[38].

5. NPM: NPM, short for Node[38] Package Manager, is a powerful and widely-used package manager for JavaScript. It provides a vast ecosystem of open-source li- braries, tools, and frameworks that developers can leverage to build applications more efficiently. At its core, NPM is a command-line tool that comes bundled with Node.js, a JavaScript runtime environment. NPM allows developers to easily in- stall, manage, and update JavaScript packages and dependencies required for their projects. With NPM, developers can access a vast repository of packages, referred to as the NPM registry. The registry hosts millions of packages contributed by the community, covering various functionalities and use cases. These packages can be easily installed and integrated into projects, saving developers significant time and effort. NPM provides a simple and intuitive command-line interface, allowing devel- opers to perform a wide range of operations. Developers can use commands like npm install to install packages, npm init to initialize a new project with a package.json file, npm publish to share their own packages with the community, and more. NPM also manages package versioning, enabling developers to specify the desired version of a package and easily update to newer versions.

6. Yarn: Yarn is a fast and efficient package manager for JavaScript created by Face- book. It was developed as an alternative to NPM (Node Package Manager) and provides several improvements and features to enhance the package management workflow[40].

7. Rust: Rust is a modern systems programming language that aims to provide devel- opers with a safe, concurrent, and efficient programming experience[41].

CHAPTER 5

RESULTS

Figure 5.1:User Interface Of Block-Drive

Figure 5.2 : Image Selection From different Drives

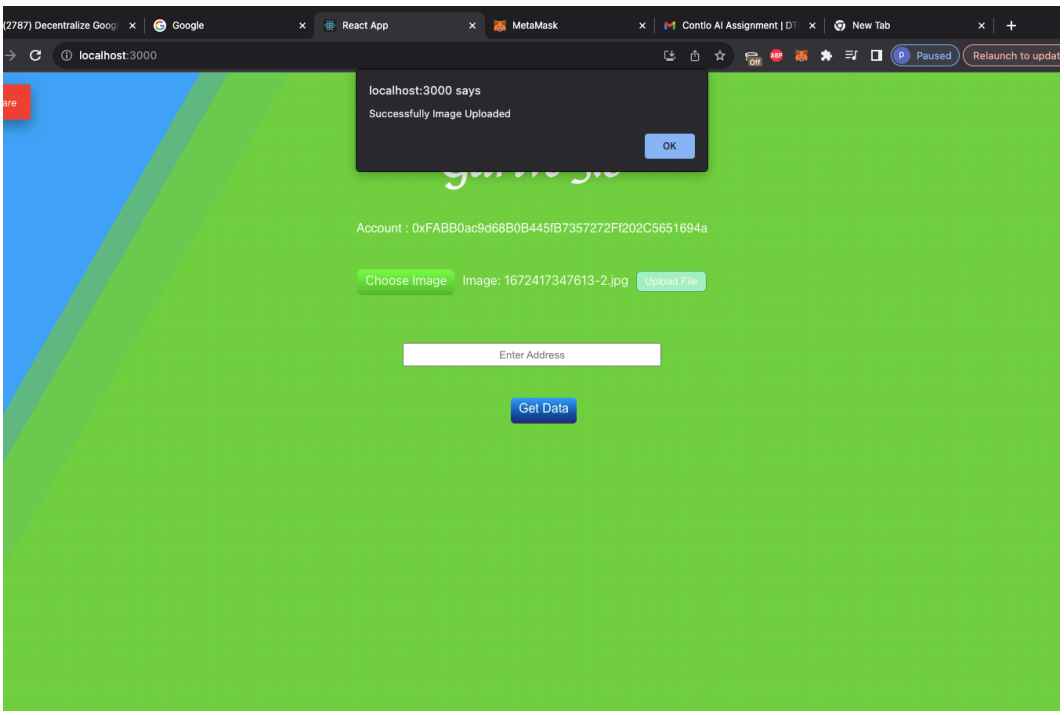

Figure 5.3 : Image Successfully Uploaded

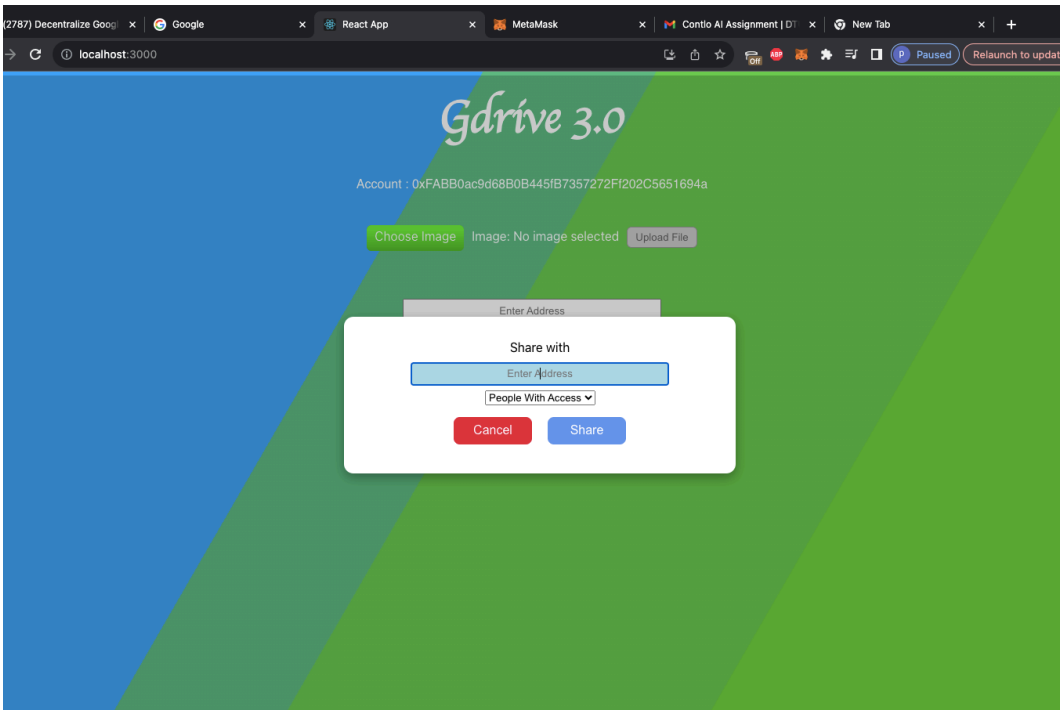

Figure 5.4 :Accessing the Images from different Accounts.

CHAPTER 6

CONCLUSION

The project [1]encompasses a peer-to-peer (P2P) network wherein a node has the ability to join and offer storage services to clients. Employing various cryptography and network algorithms, the system delivers two primary services to clients: Secure File Storage and Secret Sharing. The agreements between involved parties are governed by Smart Contracts, utilizing ERC20 tokens as a value for services. Additionally, the system's two layers can be implemented as separate components for distinct use cases. The project concluded with an exciting exploration and research in the fields of Cryptography and Blockchain, acknowledging the ongoing potential for improvement in any project. Enhancements could include the development of a web app for clients, facilitating the encryption, splitting, and merging of large-sized files, considering the current limitation to a mobile app. Moreover, a compensation mechanism for faulty parties could be introduced, potentially through the incorporation of a central authority or by utilizing a randomly selected third auditor node from the network. Fine-tuning of the algorithms and protocols employed in the cryptography processes is another avenue for further improvement[1].

Presently, our clients exclusively utilize a mobile app. Consequently, a web app can be developed to cater to client needs, allowing for the seamless encryption, splitting, and merging of large files.

• Enhancements in our system can involve the incorporation of a compensation mechanism for parties experiencing faults. One possible solution is introducing a central authority, or alternatively, utilizing a randomly selected third auditor node from the network.

• The algorithms and protocols employed in cryptographic processes can be refined for improved efficiency[5].

CHAPTER 7

LIMITATIONS

Below are the constraints of our system:

1. Security[1] concerns may arise within the system. Detailed attention to potential pitfalls and security loopholes was not given during the development phase.

2. The current file storage system has a size limit, restricting users to store only small files within the network.

3. The system[1] requires the use of cryptocurrencies, which may not be legally accepted worldwide. Consequently, our market size is diminished due to this limitation.

CHAPTER 8

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1. Pawan Sharma , Priyanka Meel . Block Drive : A Drive For Image Storage And Share by using The Blockchain Technology . Accepted and Registered for presentation at 1st International Conference on Advances in Computing, Communication and Networking, IEEE (16-17 December, 2024), Greater Noida, India.

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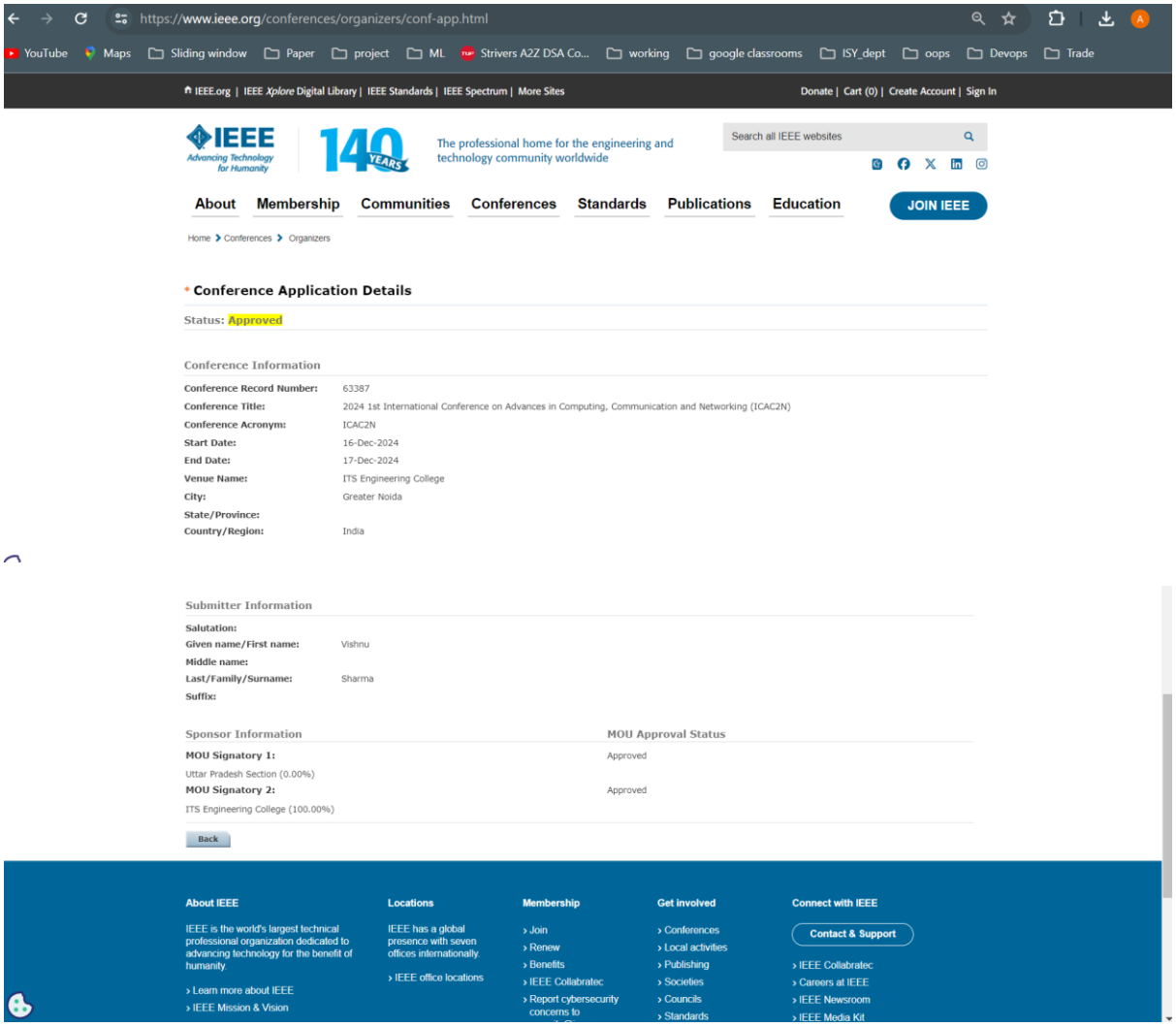
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