Review of Blockchain Technology with respect to Applications, Platforms and Architectures

D.Nithya

Research Scholar, Department of Computer Science and Engineering, Kalasalingam Academy of Research and Educatiin, Krishnankoil 626126, Tamilnadu, India

nithu.1026@gmail.com

Dr.R.Kanniga Devi

Associate Professor, Department of Computer Science and Engineering, Kalasalingam Academy of Research and Education, Krishnankoil 626126, Tamilnadu, India

r.kannigadevi@klu.ac.in

Abstract — **Blockchain is a novel technique for securing digital data transmitted over the internet. The distributed database is used to store data in a digital format. Blockchain is well-known in a variety of fields including education, government, healthcare, and financial services. It relies on distributed ledger technology and establishes trust in digital data to provide secure services for digital information to record transactions. In a decentralised system, blockchain creates blocks for each transaction. The features of blockchain, as well as their platforms and applications, were explored in this case. Blockchain is a digital data transaction security method based on cryptography. A hash function connects the blocks and creates a database record.However it can be implemented in automated software. This survey describes the benefits of blockchain technology in a distributed system and their features in many facilities. It is more efficient than other security services, and sharing the information across a decentralised network . In a distributed system, blockchain enhances traceability and allows for immutable transactions. It is a system that allows remote nodes in a network to agree on something. Market places have recently adopted blockchain technology for critical applications. This section will inform us about the necessity of Blockchain in current trends.**

Keywords — *Blockchain; distributed ledger technology, automated software, platforms*

I. INTRODUCTION

A computer network is a collection of computers that connect several nodes. The term "internet" refers to the connection between a network and the internet. A network is a computer system that has communication channels and transmission medium connected to it. Over the internet, a network can exchange resources. The internet was created in 1982, and it connects computers all around the world. Business agencies began using the internet in 1991 to share information and communicate with a large number of people. Web browsers, electronic mail, search engines and other internet services are examples. Communication, research, education, financial transactions and other current technology are all supported by these application services. The Internet is a worldwide information system that provides end users with unique resources and information. Internet Service Providers can give the user access to the information. During the transmission of resources over the internet,they need security services in order to secure the digital data.In the past year,multiple number of security techniques can be introduced to secure digitalized form of information. Recently, to introduce the word 'Blockchain Technology' is a newly security techniques to secure digital data from online hackers and malware attackers in decentralized network.The methodology as blockchain to serve digital verification and records of digital files and security mechanisms provide services to identify the status of digital data and protect them.In order to protect the resources over the network transmission,security mechanisms perhaps cryptography techniques.In which follows encryption and decryption,the technology to protect resources,devices over the network.

Blockchain is the decentralized system to provide the security services against unauthorized access to digital data.The most important aspects of blockchain are govern,protect,detect and respond.The service identity and manage security rules.In order to implement the security controls to reduce security risks.Blockchain respond and recover from threats,it involves the practice of hardware and software solution and they provide recent technological information,security services are confidentiality,integrity and availability.Blockchain technology were intrwoduced in 2009 by Satoshi Nakamoto.Initially it creates the digital cryptocurrency called Bitcoin.Blockchain is a structure that store transaction history of digital records known as Block,several database in public called as chain.Blockchain is a network connected through peer-to-peer nodes,the data in blockchain is referred to as digital ledger and it creates a decentralized distribution chain.

The Blockchain developed using cryptography, hash functions, digital signatures, and distributed consensus algorithms. The document's integrity is preserved by the transparent ledger, which builds trust in the asset. Third parties cannot interfere with a transaction that has already been registered. Permissioned and permissionless blockchain technology exist, with the permissioned blockchain providing additional blockchain security by allowing specific actions to be conducted only by identifiable participants. Permissionless blockchain is a sort of decentralised blockchain. Members have the ability to conduct all operations such as creating and validating transactions, smart contracts and participants set the layout and scale of the blockchain.

Blockchain Feature

We explored the context of blockchain technology and its uses in this paper. Blockchain is an technological ecosystem has a large number of data-gathering actions and monitoring devices. Recent techniques is efficient data-sharing with security services. Blockchain is a combination of peer-to-peer network,cryptography keys and digital ledgers. The cryptographic keys are used to create digital signature to provide unique identity is the important aspect in blockchain technology. The transaction in the blockchain are approved and verified in the distributed network. In this section,we discussed the following contributions of blockchain technology.

Immutability

Blockchains [2] are immutable in nature, meaning they can't be updated or altered. Every node in the network contains a copy of the digital ledger and every operation checks its validity and adds to the ledger on a continuous bbasi. According to the technology, the blockchain enables transparency and proof of corruption, as well as backing up the key list. Integrity can be provided by the feature of immutability. It strengthens the system of trust and auditing, the information verification is essentially redundant. It maintains the full historical records and enables the shared source of truth. In the Bitcoin,it plays the core benefits for the businesses and immutable gains control of the hash power. Each block generates the alphanumeric hash value and digital signature for the previous block and the consensus righty maintains the originality of the digital data. The immutable nature bringing more efficient secure transaction.

Decentralized

Decentralized means that the network is maintained by a group of nodes with no central authority. The blockchain technology allows people to obtain information directly from the web. It distributes the common control over the decentralised structure on their assets using cryptocurrency technology. The decentralized nature has various drawbacks such as lower failure rates and greater user control, as well as digital data transparency and authenticity. The decentralization environment is inherently untrustworthy, in the distributed ledgers. Each member owns a copy of the exact same type of digital data. With the common view of data, it enhances data reconciliation and access to each entity. Decentralization can improve resource distribution performance and consistency while reducing the risk of catastrophic failure. In the blockchain uses the decentralized Application (dApp) and Decentralized Autonomous Organization (DAO) for the digital transaction.

Enhanced security

Using [3] encryption it ensures security over the internet built by cryptographic algorithm that provide the firewall.Every information is hashed cryptographically hide the true nature during the data transmission.The block in the transaction built by hash value, it is difficult to tamper the data due to mathematical algorithm.Digital data related to blockchain is cross-checked and remain backed in the network.Rapid advancements in digital data by implementing authentication and cryptography key mechanisms.The high level of security offered in blockchain to secured business records in immutable form,without require the third party trust and they can disrupt global services and solutions for business customers.It offers the validation and encryption mechanisms in a distributed system to enhance security in digital data storage.Blockchain is a revolutionary technology is used in industries,education and so many applications.

*Distributed Ledger*s

Every transaction is recorded in a public ledger that everyone in the system may access. digital transactions benefit from distributed computational power because they execute better results. Distributed ledgers are synchronous ledgers that are implemented by independent computers. It enables peer-to-peer communications and the sharing of digital data value. They have the technology infrastructure and standards in place to undertake simultaneous digital data validation access and recording in an immutable manner across many entities. It allows the secure transmission of digital data across a decentralized network. The data is stored in a secure environment using a cryptographic technique that follows the network's regulations. DLT (Distributed Ledger Technology) has a lot of promise for businesses, institutions and government. In addition to many industries such as micrisoft,IBM reaches the DLT rules over the blockchain.

II. BLOCKCHAIN ARCHITECTURE

Immutability, decentralization, transparency, distributed ledger and tamper-proof transactions are all aspects of blockchain. The blockchain in a peer-to-peer network is made up of a large number of nodes. Blocks, nodes and miners are the three components of the blockchain, every chain has several blocks and each chain is made up of three essential elements: data in the block, generation of the block and creation of the hash value for the blocks. Miners are individuals who mine digital data in a distributed system to create new blocks.
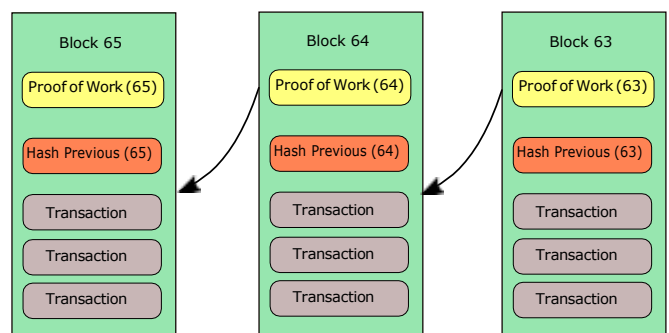

Fig. 1. Structure of Blockchain Technology

In the blockchain technology commit transaction stores list of blocks.The new block are grown appendendly,each block consist of two hash value as one for current block and another value for previous block. The hash value can be operated by SHA-256 cryptography algorithms to provide user security and ledger consistency. Blockchain distributes the user information in the open record format,it cannot be alter or eradicated by someone in it. The activity of book keeping mechanism can be followed in the process of each and every digital data in the network. The proof of work and proof of stake are the consensus mechanisms involved in cryptocurrency blockchain application achieve distributed consensus over the network. Due to the cryptocurrency techniques, to avoid the security issues over the network. It can be used for startup and business people, there is no possibility of corruptibility by the implementation of blockchain. The new method is an innovative technology and it provides self examining biological system. The five phases of blockchain are distribution, tokenization, encryption, immutability and decentralization. Blockchain sorted out the database, it keeps historical backups of every data.

A blockchain protocol operates on a distributed system and peer-to-peer network to deliver ledger transactions across the network. The distributed ledger is based on pre-defined rules that are agreed upon by all system members. Blockchain is a new technology that eliminates risks and fraud in distributed applications by bringing transparency.

III. RELATED SURVEYS

Blockchain described the database system designed by unitary memory unity, the blocks are connect by hash identifier value for the previous block (Nikola Bozic, Guy Pujollie, Stefano Secci 2016). Blockchain technology is highly effort for shape the urban future and highly destructive (Charles Shen and Feniosky Pena-Mora 2018). Blockchain has become the security breaches and innovative potential and database structure using the format as STIX (Pieter Hartel, Quingze Hum 2018). Blockchain objects are inter connect and interact with environment to collect information, performed certain tasks (Tiago M.Fernandes-caramas and Paula Fraga-Lamas 2018).

The study "Securing digital data using blockchain technology" is based on papers obtained from Scopus, Web of Science, and a variety of open access journals. The first section describes blockchain criteria and features, while the second section discusses blockchain security applications in real-world settings such as healthcare, education, social media and contracts. Secure digital data, contract-based application between 2012 and 2019 that contains the consensus algorithm and SHA 256 security services are the subjects of the survey. Furthermore, the survey study provides a comprehensive overview of blockchain technology.

A. Government

Blockchain technology[19] can be used in government resource models to share information. It promotes the shift of government affairs from management to service by increasing trust in government resource sharing. The service-oriented e-government paradigm is built on blockchain. It creates the architecture for analysing interactions between the government and users. It detected the fault and ensures the security of distributed storage, consensus, plugins and asymmetric encryption. Blockchain can be used for information sharing with security service-oriented models thanks to a legal agreement. It allows the framework to provide legal agreement in government financial services. In a legal agreement, API provides the verification and voting system in the blockchain technology. Blockchain allows the transformation of smart services and attracts government attention. Distributed Ledger Technology can facilitate information sharing (DLT). The government sector keeps track of scattered transactions.

B. Finance

Blockchain shaping the financial and banking services of the future. The information is stored in GoogleLevelDB in a financial service. In this scenario, the stack is maintained by stacking blocks on top of each other, with the bottommost block serving as the foundation. The hash function can be used to identified each individual block. [20] The hash value sequence connected the other blocks to their parent block. The ancestor block of all other block is the Genesis block. The secure root is created by the structure of the genesis block and hash value. Genesis block is used in financial services as an SMS message. It satisfied the security services are authentication, integrity and non-repudiation

Decentralization, reliability and transparency are the characteristics of financial services.

The financial investors are provided by RES (Renewable Energy Sources) [21]. All the nodes in distributed system are monitored the performance of system. The smart contract with turing comprehensive language provided by blockchain technology linked to financial services and the digital tokens transferred under the smart contracts. Electricity Grids shaped Renewable Energy Sources. In a decentralized system, RES presents reverse power flow. DLS-OCS (Distributed Ledger Services for Online Contract Settlement) was used to do research for digital financial systems.

A. Healthcare

In the previous year, the proposed paper introduced MedRec, a decentralized record management system that included an Electronic Medical Records (EMR) system that shows an immutable log and easy access to the treatment site. As blockchain miners, design integrated manage sensitive information and the public health authority. Health records are in a jumbled state. The data is retrieved by the patient and shared on the decentralised system.

In [22], two sorts of chains are introduced: private and public in the side chain, which scanned the patients genuine IDs, while the main chain scannned the patients temporary IDs. The completed transaction is saved in a peer-to-peer network. In a distributed system, main chain transaction generates additional transaction. The medical institution keeps track of the timestamp, data type, data link, hash value, and prior the hash block. The transaction verification mechanism is described in this case.

The integrated design's underlying technique has evolved via several rounds of hash function such as mathematical processes and human fingerprints. The hash function can be quickly identified and replicated the data.

B. Education

In higher education, new technology is introduced. To make effective interaction between the faculties and students to store the record untampered and validated in centralization system. To enhance the education system by innovate the various method and contract based on blockchain. The learning data form the hub to the students and subjects. In [17] Learning Management System (LMS) and Learning Record Pools (LRP) provide availability, reliability and immutability,access control, security and privacy in learning process. The resources and study material in digitalized form as e-Books,video and audio to minimized the budget of governing body.

In the learning process, [18] uses computerised evaluation software for professional credentials. The term "electronic learning contract" refers to a contract between a teacher and a student. The periodic meetings are held to facilitate decision-making in the learning process. POA is an entirely consensus-based combination of quantitative and qualitative student evaluation. The student's curriculum evaluate their performance.

As a result, the blockchain is transformative in terms of enabling and coordinating economic activities. Intermediaries costs and time are reduced, making the transaction and information sharing easier and safer. To improve an ecosystem's trust, blockchain records are permanent and irresversible.

TABLE 1. COMPARATIVE STUDY OF EXISTING ARTICLES

Author Name and Year	Domain	Technique used	Para-meters	Limitations
Fedro Neves Maka, Muhammad Najib Razali Ruimiguel Dantas, Norkidayah Mohd Yunos (2020)	Land registration system	Symmetric and Asymmetric encryption Server Flask Application	Block mining	Issues in key management and scalability
Shu Yun Lim, Pascal Tankam Foksing, Abdullah Almani, Omar Musa, MiLss Laiha MatKiah, Tanpong Ang, Reza Ismail (2018)	Security	Identity management system, Trusted platfotm modulre, Mobile trusted module, Public key infrastructure	Proof of identity and membership, Cloud based solution (Blockchain as a service)	Key management problem, Issues in verification of user identity
Mohammad Jabed, Morshed Chowdhury, Alan Colman, Muhammad Ashad Kabir, Jan Han, Paul Sarda (2018)	Security	Personal dara store (PDS), Servuce based system	Reduce the turnaround time, Imoroves decision making and reduce overall cost	Data termination, Anonymity cannot keep it in longer time
WeiluChen, ZibunZheng, Jiahui Cui, Edith Ngai, PeilinZheng, YurenZhou (2018)	Data mining	Ethereum Virtual Machine (EVM), Classification model	Detect the ponzi-schemes, High accuracy, Feature Extraction	Opcode Ends up
Qiuhong Zheng YILI, Ping When, Xinghua Dong (2018)	Storage optimization	Inter planetary file system (IPFS)	Data compression speed up the process and security synchronization	Lot of hassles in installation and consumes lot of bandwidth
Yiwei Zhang (2019)	Data Manage ment System	Baen based technique	Guarantee of technical and management dimension	It is difficult to identify the personal Entry-Exit model
Muhame Turkanovic, Marko Holbl, Kriskjan Kosic, Marjan, Hericko, Aida Kamisalic (2018)	Education	European Credit Transfer and Accumulation System (ECTS)	Grading system offers a globally unified viewpoint for Higher Education Instituition (HEI)	There is no adaptation in EduCTX and prototype inefficient
Nurilla Mahamatov, Avaz Kuvnakov, Bakhtiyor Yokuboy (2021)	Education	Smart contract platform and Tokenization system	To fill the gap in the student knowledge data and to increase the transparency security	Outdated of relevant training program
n Duan, Ying Zhong (2017)	Learning outcomes and meta diploma	Electronic Learning Contract (ELC)	Qualitative and Quantitative combination of grade process	No autonomy
Nadeem Abdullah Makiberi (2020)	Blockchain based Application in Education	School Information Hub (SIH)	Reliability, Security and Data Veracity	Increase volumes of records slow down the block transaction
Asaph Azaria (2016)	Medical Data Access	MedRec and EMR system	Anonymized large-scale medical data	Difficult to make framework
Liviu Hirtan (2017)	e-health data access with privacy protection	Hyperledger fabric framework	Better quality medical service	Difficulty in integration process
Matthias Mettler (2017)	Healthcare	Gem health network	Counterfeit the pharmaceutical sector	Scale down potential mechanism
Asad Ali Siyal, Aisha Zahid Junejo, Muhammad (2018)	Healthcare	Electronic Health Records (EHR), Medical Fraud Detection mechanism	Secure data sharing, Personslized authentic, Autonomy, Manage storage capacity	Interoperability issues, Few focal points
Cornelius C.Agbo, Qusay H. Mahmoud, Jimikael Ekiund (2019)	Healthcare	Preferred Reporting Items for Systematic Review (PRISMA) Meta analysis and Systematix mapping technique	Improved data security and privacy, Availability and Robustness verifiability, and Data Trust	Interoperability issues, Need care coordination

Author Name and Year	Domain	Technique used	Para-meters	Limitations
Ayesha Shahnaz Usman Qumar Ayesha Khalid (2017)	Healthcare	Electronic Health Records (EHR), Consensus Mechanism	Scalability, secueity and Integral blockchain based solution	Interoperable timing issues, Discrepancies workflow breakup
Matthias Mettler (2016)	Blockchain in healthcare	Bitcoin and Hyperledger	Health informayion in a efficient secure environment	Strongly affect the balance of power
Mousumi Mitra, Aviroop chowdhury (2020)	Voting system	Fuzzy logic with blockchain validation system	One way views can be represented, Identify the constituency	Less quality of software application
Ashish Singh, Kakali Chatterjee (2018)	Voting system	Digital voting system, AES DES, Merkle root hash function	Voter confidentiality, secure from the existing attacks	Duplication and forgery
Jen-Ho Hslao, Raylin Tso, Chien-Ming Chen, Mu-En Wu (2018)	Voting system	Registration server, Authentication server, Voting website and Recording server	Anonymity of users, Identity, Verifiability of bullots	Malware attacks and Denial-of-service
Shireesh Apte, Nikolai Petrovsky (2016)	Supply chain	Mathematically linked trapdoor function	Caculating modulus function of the data	Difficult to compute in the opposite direction
XianglinBao, ChengSu, Yan Xiong, Wenchao Huang (2019)	Marketing	Federated Learning chain (FL chain)	Low latency, Reduce total time cost, Less power consumption	Multiple trainers results in abort training
Ozden Tozanli, Elif kongar Surendra M.Gupta (2020)	Marketing supply chain	Discrete event simulation	Optimal trade-in-to upgrade policy	Missing hard drives and supply disc drives
Yang Lu (2018)	Cryptocurre ncy	Simplified payment verification, Broadcast protocol, Merkle tree	Integrity, Non-repudiation, security, Timestamp	It offers the source without downloading the full blockchain

TABLE 2. COMPARISON BETWEEN BLOCKCHAIN DOMAIN

Author& year	Domain	Technolgy
Han Sun, Xiaoyue Wang, Xinge Wang (2018)	Healthcare	Chronological logical order method, Data Encryption method
Untung Rahardja, Achmad Nizar Hidayanto, Taqwa Hariguna Qurotul Aini (2019)	Education	Edu-tech model
Fedro Neves Maka, Muhammad Naji b Razali Ruimiguel antas, Norkidayah Mohd Yunos (2020)	Land registration system	Symmetric and Asymmetric encryption Server Flask Application
Mousumi Mitra, Aviroop Chowdhury (2020)	Voting system	Fuzzy logic with blockchain validation system
Arim Park, Huan Li (2021)	Marketing supply chain	Blockchain based supply chain
Abderahman Rejeb, John G.Keogh, Horst Treiblmaier (2019)	IOT based supply chain	Deploy Blockchain Technology with IOT
Yang Lu (2018)	Bitcoin	Simplified payment verification, Broadcast protocol, Merkle tree
Faiza Loukil Shirine, Ghadira-Guegan, Hiuloud Bookadi, Aloha &Nabila Benharkat, Elhadj Benkhelifa (2017)	IOT based blockchain	IOT device behaviour control

TABLE 3. SUMMARY OF ALGORITHM USED

| Author name & year	Algorithm	Domain	Disadvantages
Weizhi Meng Eimar Tischhausar Qungju Want, Yu Want Jinguang Han (2018)	DOMINO	Security	Overhead traffic, Limited signature coverage, Inaccurate profile, Massive false alerts
Weizhimeng Elmar, Tischhausor, Qingju Wang, Yu wang (2018)	DOMINO	Security	Overhead traffic, Limited signsture coverage, Inaccurate profile, Massive false alerts
Han Sun, Xiaoyue Wang, Xinge Wang (2018)	Encryption algorithm	Online education	Inefficient in control of academic identity
Fedro Neves Maka, Muhammad Naji b Razali Ruimiguel Dantas, Norkidayah Mohd Yunos (2020)	Encryption algorithm	Land Registration system	Issues in key management and scalability
	Hyperledger framework	Healthcare	Difficulty in integration process
	Hyperledger framework	Healthcare	Hyperledger framework

OUTCOME OF THE LITERATURE SURVEY
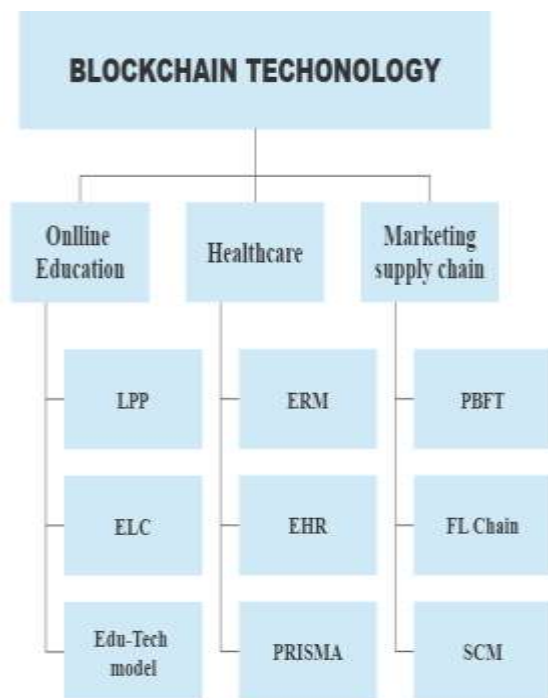
Fig 2. Blockchain Diagram for Literature Survey

According to a thorough analysis of the literature, a security method that is scalable, dreadfully inefficient, mutable, and not truly decentralised is required. Congestion in the network is a problem caused by the breakdown of the consensus mechanism in a current security measures. In the conventional system, network data loss is the result of the lack of chronological order. Therefore, this research suggests creating a blockchain technology that can address the shortcomings of current efforts.

IV. BLOCKCHAIN PLATFORMS

Blockchain is a network-wide distributed digital ledger. Platforms are decentralised and implemented as public and private blockchain. Public network release the data in public and the information is secure and immutable. Public blockchain creates the cryptocurrency with open source computing code. The major advantage of blockchain provide maximum security,open source environment, retrieves the anonymous,decentralized and transparency. Public blockchain limitation as data modification and uses private keys. The most common examples of public blockchain as Bitcoin and Ethereum.

A. Bitcoin

The first digital asset approaches based on the cryptocurrency mechanism were introduced in 2009, after Bitcoin's invention in 2008. ([5] Bitcoin is a peer-to-peer network that uses public key cryptography, a proof-of-work and proof-of-stake system to validate node processing, and a new block is generated every 10 minutes. The output for unspent transactions A byproduct of the bitcoin cryptocurrency, the UTXO paradigm offers transactions that handle independent data while avoiding heavy traffic in legal organisations. The blockchain is a public distributed ledger that stores transactions made by digital nodes using the cryptography method. Bitcoin generates rewards through a process known as mining, and these rewards can be used to exchange for goods, services, and other currencies. Several local and national governments use this technology.

B. Ethereum

In order to facilitate cryptocurrency transactions and apply the technology to regulate fraud, downtime, or interference from a third party, Ethereum launched decentralised digital applications, or Dapps, in 2015. [5] We are able to reach agreements, carry out transactions, and process the digital assets automatically by the vending machine thanks to Ethereum, which operates on a global network of computers. To achieve coordination between the digital transmission systems, the POW and alternate POS can be built using a consensus mechanism. Ethereum currently uses the Dagger-Hashimoto memory hard hash algorithm, which creates a lower block time than the other systems, leading to a higher rate of block stale.

Private blockchain design by private key access by single organization.The permission from the govern body of the blockchain to read and write on the ledger.The mechanism of blockchain access depends on the network creator.The benefits of private blockchain process the higher number of transaction per second and to reduce the consensus time,stability etc.The limitations of blockchain as private or permissioned as space complexity and reservation of block The most widely used private blockchain is Hyperledger.

C. Hyperledger

A cross-industry, global corporate blockchain system called Hyperledger was developed in 2016. Because consensus protocols require a network that may be customised, they can offer the Practical Byzantine Fault Tolerance (PBFT) consensus protocol to increase the network's latency. Hyperledger is a term for a permissioned blockchain where the participants in a consensus process are industry leaders in banking, manufacturing, the internet of things, and finance. To develop high-performance

blockchain-based distributed ledger technology, Hyperledger fosters widespread collaboration. It serves as a focal point for distributed systems' digital data transactions and offers the framework and guidelines needed to build a blockchain. With everyone coming to a consensus, Hyperledger is able to create a commercial blockchain.

TABLE 4. COMPARATIVE STUDY OF BLOCKCHAIN PLATFORMS

Blockchain platform name	Blockchain platform type	Advantages	Limitations	Cost (Rs)
Bitcoin	Public	Maximum Security and open source environment	Uses private leys and data modification	26,87,285.13
Ethereum	Public	Autonomous and uses compuehensive set of tools	Platform generator is much more	1,92,569.90
Hyperledger	Private	High speed	Block reservation	19,885.69

V. CONCLUSION AND FUTURE SCOPE

Thus a review of a various blockchain technology with respect to platforms and applications is prescribed.We discussed multiple number of domains and their applications. The database records the digital data and stored in a blocks with the formulation of hash function. Blockchain completely depends on DLT technology,the data loss rate is minimized.The blockchain framework is a foundational technology,it is potential for engender applications.

Blockchain technology majorly lies in field of cybersecurity and its shows the unfold potential.And,there will be a huge demand for blockchain engineers,across all these markets.By 2024,blockchain is expected to become a 20 billion market.

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