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Use Cases and Applications of Blockchain Technology in IT Industry

Deepak Kumar Verma[1*], Varsha Katheria[2], Mazhar Khaliq[3]

[1,2] Dept. of Computer Science, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Raebareli Road, Lucknow, India -226025
[3] Dept. of Computer Science, KMC Urdu Arbi Farsi University , Liucknoow, India- 226021

[*]*Corresponding Author: deepak.discrete@gmail.com, Tel.: +91-9452834077*

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***Abstract*—**Blockchain is a new technology with strong implications for the future of how we exchange information and currency as a globally networked society. It is so new that there is relatively only few academic works done on it, but this is changing quickly. Blockchain technology has been known as a digital currency platform since the emergence of Bitcoin, the first and the largest of the crypto currencies. In this paper, we have compared and compiled various use cases with blockchain technology applications collected from different sources, such as scientific papers, industry expert blogs, Master Theses and research. This paper will help to understand the necessity for development of a detailed blockchain usability model.

***Keywords*—** Blockchain, Cryptocurrency, Bitcoins.

I. INTRODUCTION

"Blockchain technology continues to redefine not only how the exchange sector operates, but the global financial economy as a whole." – Bob Greifeld, Chief Executive of NASDAQ. "In financial markets there's always a mechanism to correct an attack. In a blockchain there is no mechanism to correct it people have to accept it."- Robert Sams, founder and chief executive of London-based Clearmatics. "Blockchain technology has the ability to optimize the global infrastructure to deal with global issues in this space much more efficiently than current systems." – Marwan Forzley, Founder of Align Commerce Almost a decade ago Satoshi Nakamoto, the unknown person/group behind Bitcoin, described how the blockchain technology, a distributed peer-to-peer linked-structure, could be used to solve the problem of maintaining the order of transactions and to avoid the double-spending problem (Nakamoto, 2008). Blockchain has been successfully applied into digital currency – bitcoin for serving as a public ledger for transaction. The nodes of the network (*miners*) are responsible for linking the blocks to each other in chronological order, with every block containing the hash of the previous block to create a blockchain (Crosby et al., 2016). Thus, the blockchain structure manages to contain a robust and auditable registry of all transactions. Blockchain is the backbone Technology of Digital Crypto Currency BitCoin. The blockchain is a distributed database of records of all transactions or digital event that have been executed and shared among participating parties. Each transaction verified by the majority of participants of the system. It contains every single record of each transaction. BitCoin is the most popular cryptocurrency an example of the blockchain. Blockchain Technology first came to light when a person or Group of individuals name 'Satoshi Nakamoto' published a white paper on "BitCoin: A peer to peer electronic cash system" in 2008. Blockchain Technology Records Transaction in Digital Ledger which is distributed over the Network thus making it incorruptible. Anything of value like Land Assets, Cars, etc. can be recorded on Blockchain as a Transaction. A blockchain is a digital ledger that records transactions both chronologically and publically. Blockchains are the underlying technology that power cryptocurrencies, dApps, and other crypto technologies. The technology was first conceived in 1991 and elements of blockchain were used in P2P technologies like Tor, torrents, cloud computing, and more.

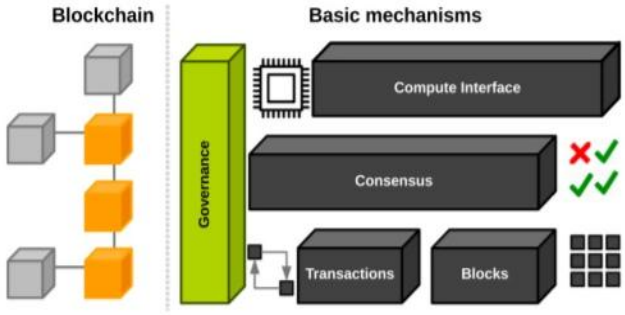


Fig. 1 An Overview of Blockchain Architecture

In the case of Bitcoin, instead of bank validating financial transactions – like sending money from A to B – checking

the digital ledger of who owns what stored on their server, a P2P network of computers running the bitcoin protocol validate transactions by majority consensus. The consensus rules of the Bitcoin network govern how the participants in the network interact with each other. They define::

- Under which conditions a transaction – sending money from A to B – is valid.
- Transaction costs related to sending money from A to B.
- Game theoretic incentive mechanism for validating transactions with a cryptographic token.
- Rules of how to change current consensus rules.

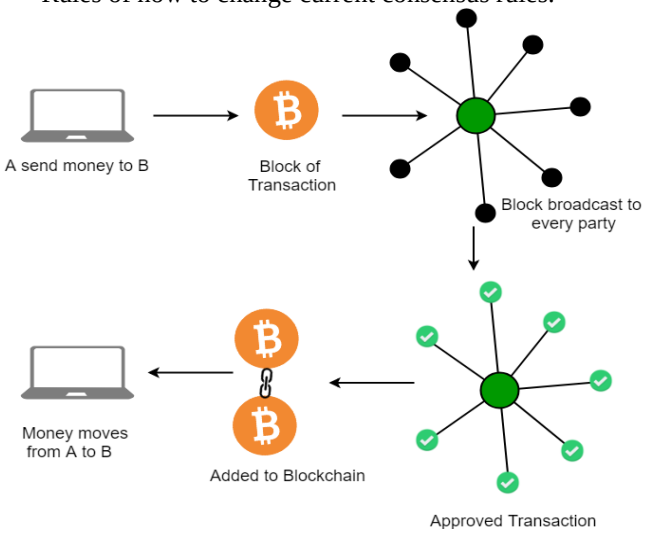


Fig. 2 Process of Blockchain Transaction

One of the famous use of Blockchain is Bitcoin. The bitcoin is a cryptocurrency and is used to exchange digital assets online. Bitcoin uses cryptographic proof instead of third-party trust for two parties to execute transactions over the internet. Each transaction protects through digital signature

II. RELATED WORK

There are numerous blockchain definitions by different authors there is no single, internationally agreed definition; therefore, it is important to understand the main parts of blockchain. Some have the opinion that blockchain technology has not been clearly defined yet therefore, they use Bitcoin as a reference point and use its three main parts – transactions, consensus, and network.

Debate about the definition of blockchain becomes especially important, when dealing with legal matters, such as passing laws regarding the use of blockchains. As Jeffries points out, large differences in definitions may cause unpredictable problems in the future as states pass blockchain-related legislation. Currently some countries (Estonia, Switzerland, Arizona in the U.S.) have in place the basic legal framework for blockchain, which also contains its definition. Walch and Stark have made comprehensive research about blockchain definitions and law, where it is indicated that most subjects, who are passing blockchain-related legislation, mainly do it to demonstrate how crypto-friendly they are, but the quality of technology description is lagging.

Brocke et al. describes the third phase as the literature search. In this phase we explain the methodological framework for conducting the literature search. According to Webster and Watson and Brock et al., the search can be conducted in different ways. Webster and Watson suggest starting the search for relevant literature in leading journals. However, the literature search in this paper was divided into four phases. First, we establish a common ground by searching generally for the concepts across various platforms to identify a knowledge base as the foundation for the literature review. As established above, the primary focus has been on the keyword Blockchain, due to the fact that extensive literature exists on both ecosystems and platforms. Second, when the common ground has been established, we identify the primary drivers within the IS research field. We take foundation in the senior scholars basket of journals, in which we identify the basket of eight, consisting of the essential journals within IS research. However, there exist various ways of identifying literature with high quality.

III. METHODOLOGY OF BLOCKCHAIN

There is no Central Server or System which keeps the data of Blockchain. The data is distributed over Millions of Computers around the world which are connected with the Blockchain. This system allows Notarization of Data as it is present on every Node and is publicly verifiable.

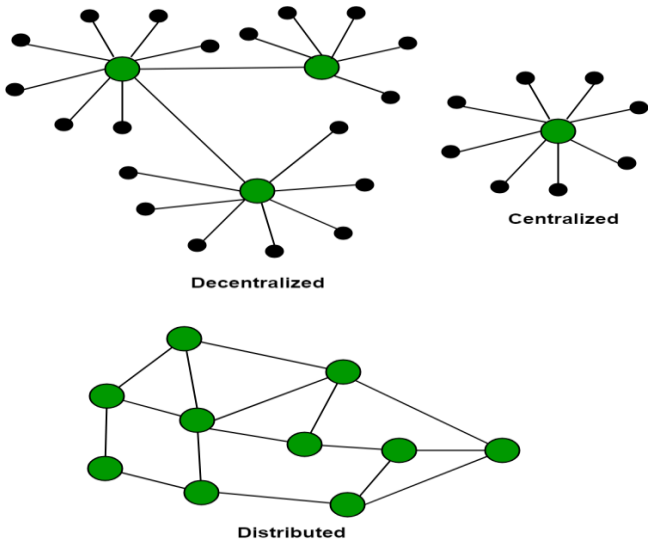


Fig. 3 Notarization of Data

A node is a computer connected to the Blockchain Network. Node gets connected with Blockchain using the client. Client helps in validating and propagates transaction on to the

Blockchain. When a computer connects to the Blockchain, a copy of the Blockchain data gets downloaded into the system and the node comes in sync with the latest block of data on Blockchain. The Node connected to the Blockchain which helps in the execution of a Transaction in return for an incentive is called Miners.

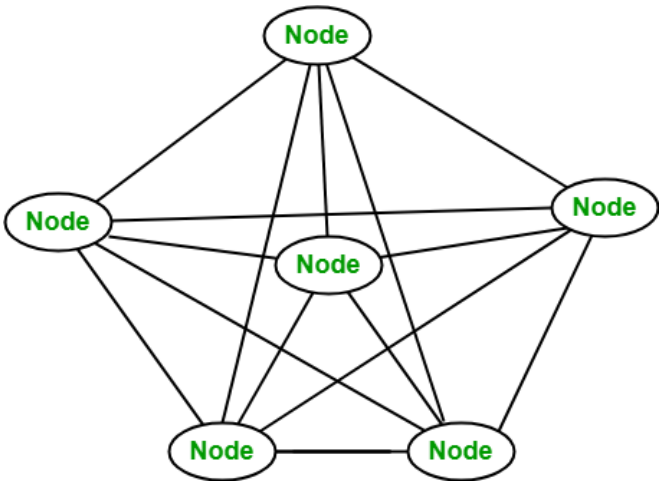


Fig. 4 Computer/nodes in a Blockchain Network

Types of Blockchain

There are different types of blockchains possible in the ecosystem.

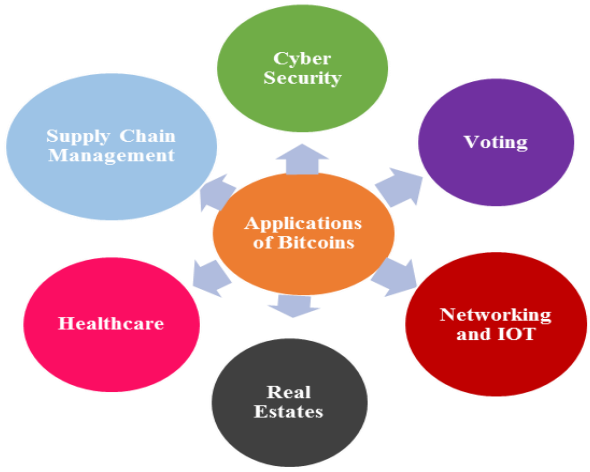
- **Public:** A public blockchain is also known as permission-less blockchain. Here, everyone can be a part of this blockchain and can participate by running as a node, by mining a block or by making transactions in the blockchain. Bitcoin and Litecoin are examples of public blockchains.

- **Private:** A private blockchain is also known as permissioned blockchain. Here, there are restrictions on the participation as only selected individuals or member of an organisation can be a part of the blockchain. Multichain and Hyperledger projects (Fabric, Sawtooth) are examples of private blockchain.

- **Consortium:** A consortium blockchain are said to be partially-decentralised or semi-decentralised. It is controlled by a group of organisations unlike one organisation as in private blockchain. The member organisations has the authority to participate by running as a full node, by mining etc. R3 and EWF (Energy Web Foundation) are examples of consortium Blockchain.

IV. Business Use Cases of Blockchain Technology

Blockchain's verifiable and networked data structure is suitable for application across many other industries. Companies undertaking digital initiatives to gain a competitive advantage should not overlook blockchain. We have discussed the significant commercial applications of blockchain technology taking hold within a year, and several industries will feel its impact. Few major Use Cases and applications of Blockchain technology are:



- **Cyber Security:** Using blockchain's ledger methodology and cryptographic techniques, data can be sent across a network securely. A blockchain technique will ensure that the data is from the correct sources and that nothing is intercepted in the interim. If this technology is more widely implemented, the probability of hacking can go down. Blockchain is more robust than the legacy systems in your organization. Thus, blockchain technology minimizes cyber security risk by simply removing the need for human intervention.

- **Voting:** During elections, authentication of a voter's identity is crucial. It also requires a secure mechanism for keeping track of votes and trusted tallies to determine the winner. Here, blockchains can act as the medium for casting, tracking and counting votes. Voters can cast votes as transactions within the blockchain. Using this methodology, there will be no voter's fraud or foul play as blockchain audit trail can verify that no votes were changed or removed, and no illegitimate votes were added.

- **Networking and IoT:** Blockchain technology can act as the backbone of a decentralized network of IoT devices. Blockchain can serve as a public ledger for a massive amount of devices, which would no longer need a central hub to mediate communication between them. Without a central control system to identify one another, the devices

can communicate with each other automatically and can manage bugs, software updates, etc.

- **Real Estate:** In several cases of real estate procurement, there is a lack of transparency during and after transactions. Additionally, there are copious amounts of paperwork, and possibilities of fraud. Blockchain offers an effective way to reduce the need for paper-based record keeping, to speed up transactions by tracking the records of transfer land titles, property deeds, liens etc. and to ensure that the documents are accurate and verifiable.

- **Healthcare:** Several healthcare institutions are not able to securely share data across platforms. Blockchains facilitate better data collaboration between providers which means a higher probability of accurate diagnoses. Also, it increases the ability of healthcare systems to provide patients with cost-effective care and facilities. Blockchains allow concerned healthcare providers and hospitals to share access to their networks without compromising on data security and integrity.

- **Supply Chain Management**: With blockchain technology, monitoring transactions have become more secure and transparent. Supply chains are basically a series of transaction nodes that link to move products from one point to other. By utilizing this technology to document transactions in a supply chain, companies can reduce time delays, costs, and human errors.

V. RESULTS AND DISCUSSION

During 2016 and 2017, blockchain started to gain recognition in wider audiences, which led to a significant increase in the proposed services and software applications, which would be based on blockchain[4]. Table 1 below shows a summary of some known software applications and use cases, where blockchain has been used as one of the main components:

Category	Use case	Applier
Data verification	Photo & video proofing	Uproov
	Document notarisation	BitCourt, Blocksign, Enigio Time, Stampery
	Work history verification	APPII
	Academical certification	Sony Global Education
	Identity verification and key management	Microsoft, Authentichain, Everpass
	Product quality verification	Everledger, Verisart, Bitshares, Bitreserve
	Proof of origin	Provenance, Tierion, ArtPlus, Stampery
	Network infrastructure	Eris, Mastercoin, Chromaway, Nxt
Data management	Content and resource distribution	Swarm
	Cloud storage	Storj, Maidsafe, PeerNova
	Data monitoring	Modum.io
	Identity data management	UniquID, SolidX, OneName, Trustatom, uPort Microsoft, IBM,
	Contract management	Ethereum, Mirror, Ottonomos, Symbiont
	Inter-organisational data management	Multichain
	Tamper-proof event log and audit trail	Chronicled, Factom, Securechain
	System metadata storage	Blockstack
	Data replication and protection from deleting	Securechain
	Digital content publishing and selling	Alexandria.io, Ascribe
	IoT sensor data purchasing	DataBrokerDAO, Chimera, Filament
Financial	Trade finance	Barclays, Santander, BNP Paribas
	Currency exchange & remittance	Kraken, Bitstamp, Coinbase, BitPesa, Bitso, Coincheck,
	P2P payments	Codius, BitBond, BitnPlay, BTCjam
	Crowdfunding	Waves, Starbase
	Insurance	Insurechain
	Stock share and bond issuing	Chain
	Central bank money issuing	Sweden, Russia (on idea level)
	Supply chain management	Eaterra, Profeth.
	Value transfer and lending	Ripple, Monero, Bitcoin, Litecoin, Zcash, etc.
Other	Prediction recording	Augur, Gnosis
	Social voting system	ThanksCoin
	Ridesharing	Arcade City, La'Zooz
	Domain name registration	Namecoin
	Healthcare record storing	DNA.bits, Medicare, BitHealth, MedVault
	Software license validation	IBM
	Lottery	Lastis, EtherPot
	Property right registration	Georgia Land Register, Ascribe, ChromaWay,
	Social rating creation/monitoring	SOMA
	Voting in elections	European Parliament, Ballotchain
	Marriage registration	Borderless.tech
	Court proceedings	PrecedentCoin
	Donations	BitGive
	Computational power outsourcing for scientific purposes	SETI@home, Folding@home
	Electronic locks	Slock.it
	Electro energy selling	TransActive Grid
	Product tracing	Blockverify
	Gaming	PlayCoin, Deckbound
	Reviews & endorsement	TRST.im, Asimov, The World Table

The above table describes few popular software applications and use cases, where blockchain has been used as a major component. Thus we can say that by using Blockchain Technology following the major Benefits can be achieved that would lead the business at higher growth.

- **Time-saving**: No central Authority verification needed for settlements making the process faster and cheaper.
- **Cost-saving**: A Blockchain network reduces expenses in several ways. No need for third-party verification. Participants can share assets directly. Intermediaries are reduced. Transaction efforts are minimized as every participant has a copy of shared ledger.
- **Tighter security**: No one can temper with Blockchain Data as it shared among millions of Participant. The system is safe against cybercrimes and Fraud.

VI. CONCLUSION AND FUTURE SCOPE

After review and analysis of existing studies and currently available Use Cases and Applications with Blockchain Technology, we conclude that it is clear that a majority of blockchain applications relate to data management and data verification. These applications are mostly developed and used within the financial sector. In blockchain technology every participant of a transaction has a copy of the blockchain. Thus, any participant can validate a given transaction. This methodology has removed the need for having a centralized, trusted third-party transaction validation. Thus the blockchain technology provides a time saving, cost saving and tighter security in electronic financial transactions. Blockchain technology has a broad applicability range and has great transformative potential. So the business leaders must use this technology to explore the range of possibilities available to their business and their sector.

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Authors Profile

Dr. Deepak Kumar Verma, MCA, UGC-NET, Ph.D.(CS), pursed Bachelor of Science and Master of Computer Application from University of Lucknow, India in year 2011.

Dr Verma completed his doctrate in Computer Science in the year 2016 and currently working with Department of Computer Science, Babasaheb Bhimrao Ambedkar University(A Central University), Lucknow, India. His research interests are Artificial intellegence, data security and Software Engineering. He has published number of research papers in reputed national/international journals and conferences.

Ms. Varsha Katheria pursed Bachelor of Computer Application (BCA) from MJP Rohilkhand University, Bareilly. She is currently pursuing Master of Computer Application (MCA) from Department of Computer Science, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, India. Her Research Interests are Internet of Things, Blockchains and cloud computing.

Dr. Mazhar Khaliq, MCA, Ph.D., is working as an Assistant Professor & Incharge, Department of Computer Science & Information Technology, KMC Urdu Arbi-Farsi University, Lucknow. Dr. Khaliq has published more than thirty Research Papers in various National/International Journals.