An Empirical Study on Unexplored Applications of Blockchain Technology

Anirudh Jain

Grade 12 Student, Modern School, Barakhamba Road, New Delhi, India

ABSTRACT : *The Blockchain is an encrypted, distributed database that records data, or in other words, it is a digital ledger of any transactions, contracts - that needs to be independently recorded. Blockchain technology was created for the digital cryptocurrency Bitcoin in 2008. However, its applications are much wider than alternative currency and it is poised to be "the next big thing" in applied sciences. The capabilities of this technology are not restricted to the innovation of usage in the form of digital tokens but go far beyond that. The purpose of this paper is to examine the scope of blockchain technology with a view to the changing needs of today's world. This study gives a proper understanding of this latest technology by taking one through the inception of this concept and how the need for augmented cyber security led to this solution which is cheap, effective, and tamper-proof. The paper enumerates the components of a block and also the features and types of blockchain. The application is explained by citing an example of a financial transaction between two hypothetical bodies. A case study of Walmart has been showcased to show its immense use in the Fin Tech sector.*

KEYWORDS - *Blockchain Technology, Blocks, Cryptocurrency, Cyber Security, Database*

I.   INTRODUCTION

Modern business world is powered by technology and data, and there is a need for more connectivity. This increased connectivity comes at a risk, the risk of privacy. In the changing world, cyber-security plays an important role in ensuring user-privacy and protecting invaluable data. Blockchains, a Distributed Ledger Technology (DLT), which started as the technology behind crypto-currencies like Bitcoin, has changed the way we think about cyber-security. This decentralized technology prevents power from going into the wrong hands. It's immunity against hackers has helped businesses take security to a whole new level.

II.   HISTORY

"The principle of blockchains has redefined how humans define trust. From depending upon a centralized authority to having a system of trust amongst one another. It is like shifting from monarchy to democracy." Blockchain is not a thing, it is an architectural principle. It was invented by a person (or group of persons) under the name of Satoshi Nakamoto in 2008 after the financial crisis to solve the problems faced in traditional methods of payment involving fiat currencies. The one key feature that made blockchains so popular was the hash like timestamps which did not require approval from any central authority. Ever since its discovery, blockchain has grown in popularity and made its way into several fields.

III.   NEED

In the modern day world, security and privacy are losing their meaning. With increasing invasion of privacy and lack of knowledge regarding cyber-security, most people fall prey to frauds and scams. This growing problem can be solved with effective use of the Blockchain technology.

Transparency and decentralization are the two pillars of this technology that ensure that power is distributed equally among all people. This inter-dependency on one another creates a strong environment that is tough to hack into and provides a cost-effective solution to the underlying problem of cyber-security.

IV. DATABASE VS BLOCKCHAIN

In regular architecture of World Wide Web, a client -server network is used where all the required in formation is kept in one place, making it easy for the administrator to control and update it.

But in Blockchain technology a chain of blocks contain a specific data in a secure way that is grouped in a peer-to- peer network. This makes blockchain a decentralized network of computers linked to each other and not to any server. Here each participant maintains, approves and updates new entries. It can be compared to many people working on the same Google Doc. Figure-1 shows the comparative features of client server and P2P network.
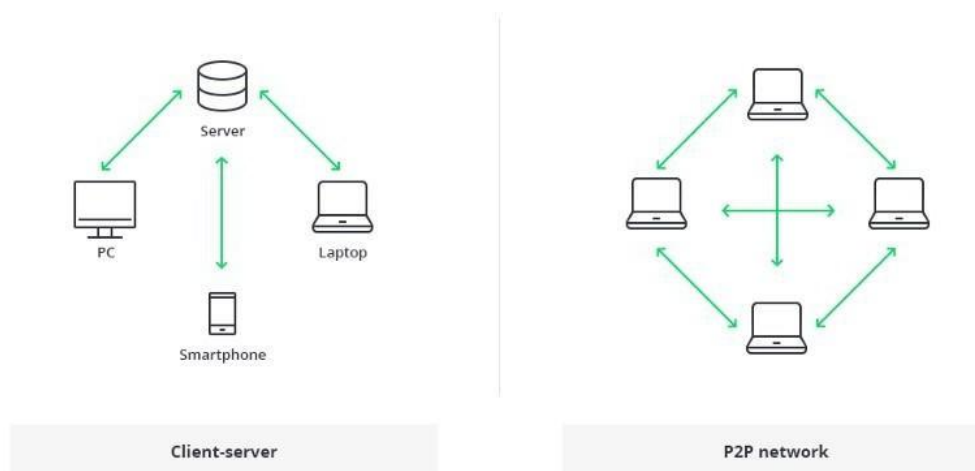

Figure 1- Database VS Blockchain

V. COMPONENTS OF A BLOCKCHAIN

To understand the characteristics of blockchain, it isimperative to understand what a block is made up of-

- **Nodes**-User or computers within the blockchainarchitecture.
- **Block**-Digital database used for keeping a set of transactions that is distributed to all the nodes in the network.
- **Transaction**-Smallest building block of ablockchain system
- **Chain**-Sequence of blocks in a specific order
- **Wallet**- A digital wallet that allows users to storethe cryptocurrency.
- **Nonce**- Short form for "Number Only Used Once", it is a one-time randomly generated 32-bit number to create a new block or transaction.
- **Cryptographic Hash** – A cryptographic hash is a bunch of letters and numbers generated by an algorithm that takes data and translates it into a unique output string of uniform length. These hashes can differ depending on the type of hashing function used. Ex: Bitcoin uses SHA256, Ethereum uses ETHASH. This unique hash ensures consensus and helps in transaction authentication.
- **Timestamp** – As the name suggests, a timestamp is a small data value that stores a unique value signifying the moment at which the block wascreated and verified.
- **Transaction data** – Since blockchain is a ledger, it is important to record and store details of every transaction. Since blockchain is a decentralized technology, it sends this data across several node, hence creating permanent records of every transaction.
- **Miner**- Block verification is done by these specific codes before adding anything to the blockchain structure.
- **Consensus Protocol**-Set of rules and designs tocarry out blockchain functions.
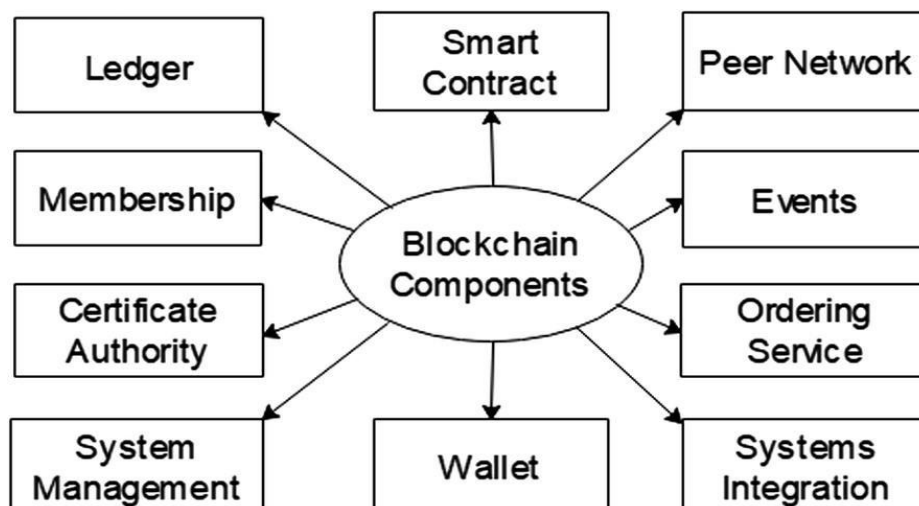
Figure 2 -shows the components of a blockchain

Figure-2- Components of a Blockchain

VI.   FEATURES OF A BLOCKCHAIN

- Decentralization is the keystone of blockchain technology. The ability of blockchains to store and manage data without a central authority, while decreasing chances of data corruptibility is what has made blockchains so popular.
- Since users are assigned unique identification codes by the technology, their identities are masked. Hence, maintaining the anonymity.
- Unlike an ordinary bank transaction, transactions made through blockchain technology are immutable which means that they cannot be reversed by any person on this Earth. This is because information entered in a block can never be changed. This helps maintain the integrity of the data.
- With all the data stored at different nodes, there is duplicated information that is stored across devices which creates a situation of data redundancy.

VII.   TYPES OF BLOCKCHAIN

The vast applicability of blockchain requires different functions which is why there are several different types of blockchains.

7.1   PUBLIC BLOCKCHAIN
A Public blockchain is one with absolutely no restrictions in terms of access. This means that anyone in the world with Internet can access this blockchain and participate as a validator (someone who verifies the transactions by a Proof of Work algorithm.)

7.2   PRIVATE BLOCKCHAIN
As the name suggests, this type of blockchain has restricted access and can only be accessed by people who have been invited on this network. This type of a blockchain is particularly useful in supply chain management.

7.3   HYBRID BLOCKCHAIN
Certain use cases require a combination of the different features of blockchain technology. This involves combination of centralization and decentralization, and the blockchain hence formed is called a hybrid blockchain.

VIII.   APPLICATIONS

How does a transaction take place? If A wants to send \$B5 (5 bitcoins) to B, A will create such a transaction online using his/her Private Key (password). The data of this transaction will be stored in the form of a block, which will be linked to other blocks (hence blockchain). This data is now permanently stored in the blockchain and cannot be changed. This update in data is made in the entire network across all devices around

the globe. Further, it is verified if A is eligible to make this transaction (if A owns 5 bitcoins). Once the transaction is authorized, the transfer of money is done and 5 bitcoins are deducted from A's balance sheet and added to B's balance sheet.

If the same transaction were to be made with the help of traditional banks, then the data would need to be updated at two places: - at A's bank and at B's bank. This exchange of data, and ensuring its authenticity, would require large efforts, and lot of coordination and synchronization. Whereas with blockchain technology, a single ledger has to be maintained which requires little effort. Additionally, a traditional bank would charge transaction fees since the process is centralized unlike blockchains.

Figure 3- shows industries that are most advanced in blockchain. Figure 4- shows region wise revenue in blockchain in world market.
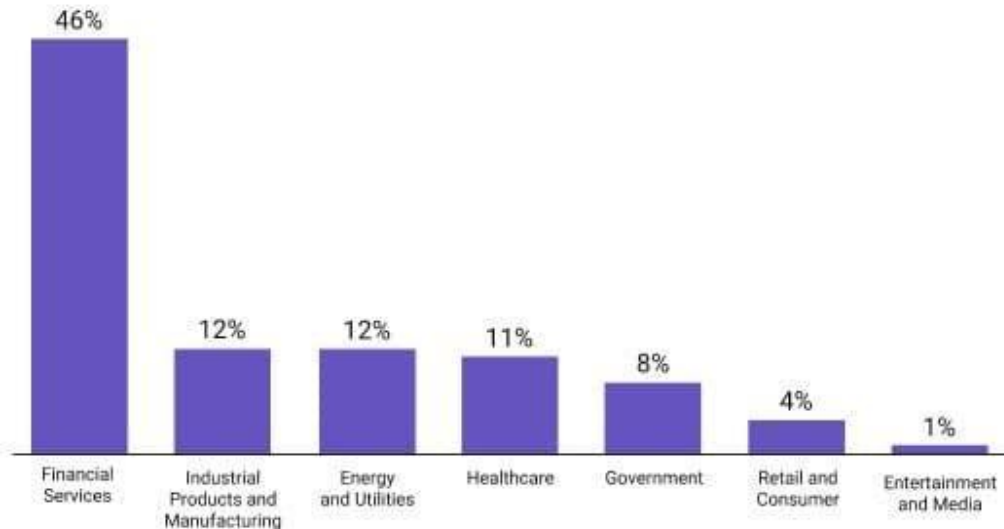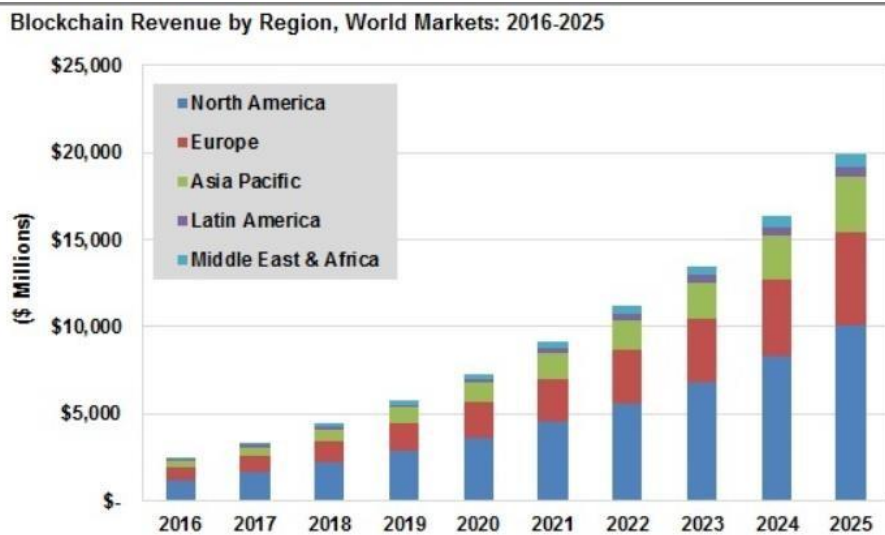

Figure-3-Source-softjourn.com

Figure 4- Source-quora.com

IX.   CASE STUDY

In October 2016, Walmart faced major issues of food safety in its supply chain because of rotten fruits/vegetables. These led Walmart to tie up with IBM and use blockchain technology to tackle this problem. They created a food traceability system which made the supply process much more transparent. At every stage of their supply chain, the suppliers were made to upload their data through web - based interface. All the data was stored in form of blocks and constituted a block chain. This allowed for faster traceability of the infected batch and reduced the tracking time from 7 days to 2.2 seconds!

Likewise, the principle of blockchain technology can be used to solve problems in any domain. Blockchain technology has changed the landscape of the Fin-tech sector.

X.   USAGE IN DIFFERENT SECTORS

• Banking sector- It is saving the largest banks billions of dollars by eliminating bureaucratic red tapes, making ledger systems online and reducing third party fees.

• Medical Industry-Helps in secure transfer of sensitive medical information between doctors and patients

• Media-Giants like Spotify use this technology to make smart contracts to get musicians the money they deserve.

• Real estate-They are using decentralized title registry system and offering property that can be purchased using crypto currency.

• Gaming Industry-Gamers use bitcoins to purchase rare skins, accessories and emotes which sellers can opt to exchange for cash.

• Cyber surveillance-Government and finance institutions are using it to detect fraudulent transactions, compliance violations and laundering cases.

• Internet of Things cases- Blockchain adds higher level of security to prevent data breaches in products like Amazon Alexa to smart ACs

• Non-Fungible Tokens (NFTs) - Owners can claim full rights to the most desirable digital assets. Works like - music, arts, GIFs, videos, sport moments are being sold for millions making the buyer own that digital moment which would long outlive the artist.

XI.   PROPOSED APPLICATIONS

Based on its infallibility, efficiency and cost effectiveness the following usage of blockchain technology are proposed.

• Transparent Functioning of Government-In a country like India with a massive population and multilayered bureaucratic system with multiple parties holding chairs in multiple states, it would be a revolution of sort to secure all government documents and contracts through blockchain technology. It would bring transparency, accountability and efficiency into the system and reduce huge financial burden on the government.

• Electoral Process- The eternal accusations and counter accusations of political parties over the genuineness of the ballot process can be put to rest for once and for all. Blockchain based voting process could increase voter count and make it fully incorruptible. This level of security can enable voting through mobile devices leading to saving billions to the exchequer.

• Personal Identity Security- According to theft expert LifeLock, an identity is stolen every 2 seconds through forged documents or hacking into personal data. Government can create a blockchain ledger to store birth certificates, Aadhar numbers, PAN numbers, passport numbers and other sensitive information. This can surely lead to a drop in identity thefts.

• Healthcare Usage-Use of Blockchain technology can be further extended to reducing healthcare costs. It can help trim down this bloated sector by streamlining business processes leading to cost-cutting at every stage. All medical records of a patient including insurance information can be made available securely to the present health provide. Then it would be easy and quick for any doctor to safely diagnose any patient.

• Logistics -Industries like shipping, can benefit by using blockchain technology that can help build better trust within the industry. The entire logistics process can be made more transparent, automated and leaner which can help in reducing errors and saving billions in losses every year. It can also be used to track goods digitally across international borders in real time.

• Media Usage – The more the digitization the more are copyright and piracy issues. With the advent of music and video apps, OTT platforms and many other social media sites it's difficult to know copy from original. A transparent ledger system can help preserve ownership making piracy impossible. Even advertising agents can get insight into customer's preferences without compromising data security endless opportunities associated with it. Although it has its drawbacks like issues of scalability, excess energy consumption and the fear of a "51% attack", the security aspects associated with blockchain technology bring hope of controlling the cyber-security concerns all over the globe.

XII.   CONCLUSION

This promising technology fixes the loop-holes in existing systems of transactions, and brings about much-needed changes in existing technologies. With growing issues of cyber-security, blockchain technology is at the rescue by maintaining decentralized data, anonymity and data integrity. The various types of blockchains – public, private, and hybrid – make it suitable for fulfilling all purposes, be it universal or personal. Since blockchain is a foundational concept and not a trend, it may not "explode" enormously anytime soon. Rather, it would grow slowly and steadily; but it is sure that in the coming decades it will change our lives drastically.

From contract management to NFTs, it is unarguable that it has brought about endless opportunities. It can potentially cut down the costs of transactions and help us evolve into a new economy. It is evident that Blockchains are broader than finance, and its growing applications like e-voting systems, contract management, and digital ownership management, all make the future uncertain but exciting. Although it has its drawbacks like issues of scalability, excess energy consumption and the fear of a "51% attack", the security aspects associated with blockchain technology bring hope of controlling the cyber-security concerns all over the globe. As the physical and digital worlds integrate, the applicability of blockchains will increase vastly and will facilitate further development.

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