IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

A Systematic Analysis of the Blockchain Technology and its Applications on Different Industries

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ABSTRACT

The Blockchain is the newest and perspective technology in modern economy. A blockchain is essentially a distributed database of records or public ledger of all transactions or digital events that have been executed and shared among participating parties. It provides provenance, immutability and finality for the transfer of value within a business network. - It enables value exchange in real time, reducing costs and errors. Based on a network consensus approach, whereby trust between the parties involved in a transaction is provided by cryptography. The BT can cause considerable changes in every aspect of human lives and might have a significant influence for the subsequent couple of decades. This technology changes the way as we are seeing processes of business and has transformed our existing economy. The BT is a peer-to-peer decentralized immutable public database technology that has changed management of various systems and was developed by Satoshi Nakamoto during the 2008 through the digital money or cryptocurrency called Bitcoin. The interest in BT has been growing since the thought was conceived in 2008. The motive for the concern in BT is its Decentralized and Distributed features that give security, anonymity, and data integrity with no intermediary agency on top of things of transactions. Blockchain is used more and more for registering, authenticating, and validating digital assets (Financial assets, land, etc.) and transactions, governing interactions, recording data, and managing IDs among multiple parties in a very trusted, decentralized, and secure manner. A term that every time arises when discussing about Blockchain is the Bitcoin, many peoples still confuse with Blockchain and Bitcoin; regardless, both are different. Bitcoin is simply one of the applications that uses BT. This paper aims to show brief overview of Blockchain Technology, applications and have discussed limitations in the perspective of future research on security in fanatical transaction.

KEY WORDS: *Digital transaction, encryption, Bitcoin, Ledger, Applications, cryptocurrency, cryptography, network security, etc.*

INTRODUCTION

A blockchain is just one type of distributed ledger, not all distributed ledgers necessarily employ blocks or chain transactions. The blockchain is an indestructible digital ledger for keeping track of economic transactions which can be programmed to maintain not only financial transactions but virtually everything that has value." Don & Alex Tapscott, authors Blockchain Revolution 2016. A blockchain (originally two-words: block chain) is a continuously growing list digital records in packages (called blocks) which are linked and secured using cryptography. These digitally recorded "blocks" of data are stored in a linear chain. Each block in the chain contains data (e.g., bitcoin transaction), is cryptographically hashed, and time stamped. The blocks of hashed data draw upon the previous-block (which came before it) in the chain, ensuring all data in the overall "blockchain" has not been tampered with and has not been altered. A blockchain is a chain of chronological blocks. A block is an aggregated set of data that is collected and processed to fit inside it through the process of mining. Each block is identified via a cryptographic hash and timestamp. When a new block is formed, it will contain a hash of the previous block, so that blocks can form a chronologically ordered chain from the first block ever generated in the entire blockchain (also called the Genesis Block) to the newly formed block. This process is repeated over-and-over again to grow and maintain the network. Now this means that this decentralized ledger is not controlled by any financial institution or government for that matter. In fact, it can be accessed by everyone who has a good internet connection. Other than virtual currencies, there are many companies such as messaging apps, critical infrastructure security, ride sharing, cloud storage, etc. are harnessing the power of blockchain technology.

OBJECTIVES OF THE STUDY

- To study the Fundamentals of Blockchain Technology
- To describe the Types of Blockchain Technology
- To identify the Mostly used technical terms in Blockchain Technology
- To find out the Applications of Blockchain Technology
- To study the Advantages and Disadvantage of Blockchain Technology

RESEARCH METHODOLOGY

The kind of Research being conducted here is "Analytical Research" and adopted descriptive and comparative methodology for this paper. In this Research the facts & the information as so gained from various secondary sources have been used to make an analysis of the current situation about block chain technology in the economy with the driving forces behind these situations. The data for the present study is collected from the newspapers, journals, online databases and on the views of writers in the same discipline. As well as the reference books, magazines, Government publications, Press notes and Internet also used for the purpose.

FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY

The BT is the combination of two different parts, as follows:

- **Blockchain Transaction:** Every action triggered by user is represented by the Blockchain transaction or we can say that any changes done by user over the blockchain is called transaction.
- **Block:** A block may be represented as a database that contain collection of information related to

transactions and some other details such as block creation timestamp value, exact sequence of blocks etc.

TYPES OF BLOCKCHAIN TECHNOLOGY

- **Public Blockchain:** In which all the participated users can perform read and write operation such as Bitcoin, in which anyone can join and become the part of the Blockchain. However, some public Blockchains are restricted with access the data of Block, it can either to read or write down only not both.
- **Private Blockchain:** Only the trusted participants can access the data of blockchain, mostly used by private organizations where they don't want any interaction of public on blocks because the blocks may contain sensitive or private information of company.
- **Consortium Blockchain:** The consortium Blockchains are semidecentralized. When multiple companies want to become the part of blockchain, control its operations and access control protocols simultaneously, instead of one particular organization have fully controlling access to it.

Figure 1 represents the working of blockchain transactions, from trigging the transaction to addition of node in the blockchain. Here Ram wants to transfer money to Shyam. First of all, monetary transaction is initiated when the transaction is generated by ram then thistransaction is broadcasted to all over the network's Nodesor parties. After Broadcasting the transaction get approval as the transaction is "valid" or "invalid" by the Blockchain system. When the transaction gets approval as a valid with their hash code of that successive node are supplied to a current new node or block and communicates with every participated block to be successively attached with currently present blockchain of blocks within the computerized or digital database as ledger.

APPLICATIONS OF BLOCKCHAIN

Blockchain technology (BT) offers the potential to impact a wide range of industries. The most promising applications exist where transferring value or assets between parties is currently cumbersome, expensive and requires one or more centralized organization.

BT in Food Industry: The blockchain gets more and more integrated into the food industry it'll make the entire process more transparent and safer. These are the benefits of a transparent food system

- BT strengthen the safety of food.
- It makes sure about fresher food because nobody will take any risk for transferring "non-fresh" food in a public decentralized system.
- In which a very small amount of waste product found because all record of data about food is stored in which.
- Food fraud also stopped by using BT because anyone can determine anything from this open system.

Blockchain Technology in Cybersecurity: On 7 September 2017, Equifax, one in all the world's bigger bank line reporting agencies, shocked the planet once they revealed that they'd just faced an enormous cybersecurity breach. They faced unauthorized data access from mid-May through July 2017, which they found on July 29. Around 145.5 million consumers were in danger of getting their personal information stolen which included:

- Names of customer
- Social Security identification

- Dates of birth of customer
- Residence Addresses
- License numbers of Drivers

These are some features of blockchain that helps in preventing cyberattacks:

- **Immutability:** This is one of the most effective features of Blockchain in which when a user entered the data then the data can't be tampered by anyone, this can be called as "immutability." The BT permits us to keeping information safer by employing its several properties of cryptography like some cryptographic algorithms, digital signatures and various hashing algorithms.
- **Decentralization and Consensus:** BT is a P2P, decentralized and distributed block system in which a group of nodes can be created and any changes in the nodes needs consensus algorithm and verify first these changes then perform all operations. So, rather than a central authority, a democratic and decentralized system that control all over the transactions of Blockchain.

Blockchain Technology in Voting: These are some common problems related to the system of paper ballot:

- After getting the cast of a vote you can't change the transactions.
- The election can be hijacked or we can change the transaction via the inserting the bogus ballot papers.
- It is very difficult to track or access your vote.
- The total amount of time consumes for counting the votes is too much high.
- The amount of wastage paper in paper ballot system may be harm to the environment.
- The cost of paper ballots expenditure is very high. The solution of all these problems is given by Blockchain technology

By using Blockchain technology we can make this voting process transparent where anyone can see the transaction of voting system and casting of vote will be hidden by integrating the blockchain. The voter can give vote securely by login their personal government-issued ID card and their own webcam. The voter for vote can then create their own transaction, this process make it unique and differentiate with others. During the casting of vote, we can easily verify that the vote is valid or not and confirm that the votes are not tempered. We can simply verify the vote by voter's public key to test whether the who did the vote is authorized or not.

Blockchain Technology in Healthcare: There are various applications of Blockchain in healthcare in which some popular applications are:

- **Electronic Medical Records:** The main use cases of BT in healthcare is EMR (Electronic medical records). By using this we can achieve tamper-proof and longitudinal patient record because Blockchain provides distributed ledger technology that helps to place all records of medical like vaccines records, results of lab report, treatment strategies, and history of prescription with a decentralized way excepting a central location of all records.
- **Tokenized Healthcare:** Through tokenization the users can share the personal medical information, earn and learn something new by using their unique medical information. To Prevent the diseases or for treatment of patients may well be incentivized by using tokenization. For building a healthcare general population we

can use tokens that inspire society peoples to enhance public health consequences records.

Blockchain Technology in Vehicle Industries: Auto or vehicle companies have many application areas for BT by the cause of, it's a component-based industry. The centralized BT based supply chain with trust-based distribution is that the latest model for a way we construct, procure vehicles for day to day uses. IoT may well be accustomed automatically renew BT-based ledgers to maintain a transparent and immutable vehicle report. This may useful to extend transparency beyond the industry and provide purchasing a "lemon" impossibly. Parts are received from various vendors and developing blockchain applications, IoT for tracking these movement of pieces in an exceedingly tamper- proof and authenticated system would enhance the way of vehicles are sold, bought, constructed, and distributed.

Blockchain Technology in Smart Devices: Smart devices currently play a vital role in every field, used in new houses and office buildings all have appliances that can connect with other appliances, mobile apps, and also the internet. instead of storing this data during a central server or cloud-based storage solution, smart appliance data might be stored on the blockchain. this is able to help to secure personal information and keep home IoT webs secure. Data can be accustomed improve things like energy costs for a complete grid without linking the data to the human by applying public/ private key cryptographic algorithm to analyze out personal identity from currently available data, while keeping the info is authentic.

Blockchain Technology in Supply Chains: It involves globally many parties across time zones and is a multi-layered chain. Moving the provision chain to the blockchain is usually discussed by distributed ledger enthusiasts. From food distributors to pharmaceutical enterprises, many supply chains may benefit from employing a combination of IoT and blockchain to streamline processes. Transfer of ownership and placement can be tracked in real time between IoT instruments, the freights themselves or each object individually. Using the "things" within the Internet of Things ability to attach and migrating the connection and related data to the blockchain automates supply chain verification and transactions.

BASIC FEATURES OF BLOCKCHAINS

Understanding how a blockchain works from a technical point of view, is valuable only to the extent of developing or troubleshooting one. In order cohesively grasp the potential unto apply blockchain technology, you must also understand the characteristics of a blockchain. It is important to note that not all characteristics listed below will apply to all blockchains. The above presentation provides the necessary background to identify the key characteristics and principles of blockchains.

These are the following:

- **Privacy:** Blockchains store no personal information and use private/ public encryption to authenticate users undertaking transactions. Mining blockchains to obtain personal information that could be sold to third parties for a profit is not feasible.
- **Transparency:** All blockchain metadata and information is available to all nodes and users in real-time. It is not possible to hide or redact blockchain information. Distributed transparency is thus feasible, but also introduces new issues.

- **Pseudo-anonymity:** Nodes and users do not need to provide names or personal details to be part of the network. However, full anonymity is not achieved as linking users to network activity is feasible and can thus lead to revealing their identities
- **Integrity:** This works in two ways. First, data integrity: it is virtually impossible to change and falsify blockchain blocks. This is also called immutability. Second, user integrity: metadata about the transactions undertaken by a node and/or end user are recorded on the blockchain and can be linked to the user undertaking them. Users cannot fool the network or try to complete an invalid transaction
- **Security:** Use of blockchains requires cryptographic tools and public/private keys by all participants, being nodes or end users.
- **Distributed trust, governance:** The blockchain successfully bypasses the need for a trusted central authority. Instead, trust is spread across the network. The same goes for governance mechanisms where, in principle, different types of users and nodes have the same 'political' leverage.
- **Sustainability:** Built-in economic incentives provide a clear path for network economic sustainability.
- **Open source:** Software required to use blockchains is freely available to all, including cryptographic tools. Furthermore, users with adequate capacities can actually help enhance and refine blockchain technologies, in addition to catching bugs. This can also facilitate the spread of blockchain innovations.

ADVANTAGES OF BT

- **Decentralization:** Blockchain is a peer-to-peer decentralized technology, it removes the requirement of third-party as middleman and also preventing all the additional operating expenses and fees of transaction.
- **Immutability and Data integrity:** whenever a new transition has been recorded in the computerized based blockchain database, it cannot be altered directly or can be deleted only after applying consensus. Participants of Blockchain can reduce fraud while strengthening regulatory compliance.
- **Greater Accessibility and availability:** In BT data are stored in a decentralized way that's why anyone can easily access the data whenever they need the data with accuracy. • Processing Time: Transaction's processing time also reduced by using the BT, it is almost reduced from 3 days to minutes or seconds.
- **Security:** In which every transaction assigned with a unique timestamped cryptographic hash code, it may be a 64- or 128-digits alpha-numeric key signature value which is entered corresponding to transaction each block.
- **Reliability:** In BT chances of failure are very less because it is regulated by different control centers not a single point.
- **Transparency:** All the transactions involved in BT are transparent. Everyone can see the details of other transactions and each node contains the complete ledger. The shared digital ledger contains all the information of the actual source, destination, date and time of the block transactions.

BLOCKCHAIN LIMITATIONS

As an emerging technology, blockchains face a series of limitations that might prevent widespread adoption not only in the financial sector but also in other areas. These can be summarized as follows:

- **Scalability:** As it stands today, Bitcoin blockchain can only add a new block of transactions every ten minutes or so. This translates into a low volume of transactions per second (less than five), a far cry from the volumes reported by traditional transactional networks.
- **Block size:** The above is the result of the small block size defined by the original Bitcoin source code. The maximum size for each block is one megabyte which can accommodate 2,200 transactions. Increasing block size is currently under discussion but so far, no final decision has been reached.
- **High costs:** Miner nodes use sophisticated and expensive hardware to run proof of work algorithms. Consequently, only certain nodes in the network can effectively compete in this process, even though in theory all nodes have the software required to mine the network. Nakamoto's notion of "one-CPU one vote" is no more as hardware and electricity costs prevent most nodes from participating in this process.
- **Cryptography:** Use of cryptographic tools is still incipient and the average Internet user cannot be expected to embrace its use in the short term.
- **Complexity:** Blockchain technologies appear to be almost incomprehensible to the average person and the tech speak around it does not help. Only a selected few seem to understand the technology.
- **Environmental impact:** A by-product of the above is also proof of work's inefficiency in terms of energy resources. Some estimates on energy consumption suggest that, by Spring 2017, Bitcoin use of electricity was comparable to that of 280,000 US households per year.
- **Bandwidth:** Full nodes that want to be active in the network must have access to the right Internet bandwidth. Slow, unreliable connections are not welcome, especially when the current size of the blockchain is over 120 Gigabytes.
- **Centralization:** Mining is now centralized with a few nodes controlling a large share of the market.55 Figure 6 below depicts market shares of the top miner nodes or companies. Note that the top five companies alone control over percent of the market.
- **Usability:** Blockchain technology requires the secure management of public and private keys by end users and nodes. While existing wallet software has come a long way, losing private keys is still a serious risk. None of the existing solutions are resistant to physical theft and only a few can protect n users from malware.
- **Immutability as liability:** If the blockchain is hacked or the software code has a bug that allows a particular exploit, then its immutability can in fact become a liability. This was the case for example with the Ethereum hack of last year where one rogue node was able to seize over 64 million dollars.

The blockchain technology ecosystem is indeed proactive and already working to address some of these limitations. The fact that the code is open source is critical here. On the other hand, changes to both the code and blockchain operations can only be accomplished by either consensus or if a majority of nodes agree on a way forward.

CONCLUSION

The Blockchain technology is now one of the useful and versatile concern for our world, Due to the large facilities in most of the systems in the different industries, but in spite of everything it is new and it`s major implementation is little studied issue on practice. Today's Blockchain technology promises us the bright future for information technology without the fraud and any deception. due to some benefits of the Blockchain technology. The challenges of the Blockchain are large, but the results of the Blockchain using have a greater preponderance than disadvantages. It is necessary to keep exploring the Blockchain development and application in the different areas for the nearest future, because this new technology can help to solve many difficult problems, which are disturbing and preventing correctly systems work. Blockchain is technology with features of decentralization as well as distributed and P2P (Peer to Peer) based technology that provides security and immutability to data. The use of Bitcoin generation and transactions increases the demand of Blockchain Technology for providing the security. BT provides high security of data but takes lots of time for verification and validation process of transactions. The main characteristics features of its privacy and security, traceability and time-stamping has watched its acceptation beside its primary application areas. BT can transform people's ways of forming trust from building it by the third-party organization to assembling it by technology. There is no need of interaction with third party or no need to pay any transaction fee to third party. The transparency, permissionless and borderless nature of BT provide the everybody to equal opportunity of the technology and as a result the blockchain network constructed with it. In public Blockchain everyone can access and use an electronic wallet on blockchain network for personal or professional work. In Electronic Wallet or cryptocurrency, we need to perform mining process of coins that require lot of computation power like CPU's and GPU's power. Lot of time requirements for complex verification and high energy requirements bounds the blockchain technology. In future we will work on it and try to reduce the both of computation time and energy of verification and mining process.

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