Review of Blockchain Technology and its Applications in Different Aspects

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Abstract - With the continue headway in the aeon of digital trends, various cryptographic algorithms are used but still security and transparency are the biggest confrontation in our country. The Blockchain technology superannuated an engrossing research field and we are constantly exploring its practical applications. The Blockchain technology (BT) offers great potential to stimulate various sectors with its unique characteristics such as distributed, decentralization, immutability, security and transparency. This paper presents relevant theories and an overview on blockchain technology. Furthermore, we analyze some practical applications such as healthcare systems, agriculture field and voting system, how the block chain is applied .Through this paper we strive to bring a new applicable direction for the research area and expansion of the blockchain in the back to back stage.

Keywords - BCT, EHR, DPOS, POS, E-voting, IPFS.

1. INTRODUCTION

Today's in the era of virtualization, Bitcoin is one primordial digital currencies to use technology to open door instant transaction in world. Bitcoin is a form of crypto currency has become a universal phenomenon common among people [6]. Individuals and businesses who own the controlling power of computation get in on the Bit coin network, "the miners" are inspired by rewards and transaction amount having received in a bit coin[7]. The most important feature of a cryptocurrency is decentralization, transparency and immutability. Satoshi Nakamoto, the unknown discovered new electronic cash system that's fully peer-to-peer, distributed with no trusted third part. Block chaining technology involves the highly secured and transparent network where each users having its own block of data which contain hash code, consensus algorithm, cryptographic signature and smart contracts.

The central goal of blockchain is to profess digital facts and data to be recorded plus distributed, but not molded. Most of the financial systems such as bank, online payment system are risky because lack of security due to third party interruption. In this paper we have described the block chain architecture, features and specifically we focuses on how it works on the practical applications such as healthcare system, voting systems and agriculture sector [11].

1.1. Blockchain Architecture

The block chain architecture has following fields:
Block - Individual block in a block chain encompass an systematized set of records or transactions, the version number of software interprets the internal arrangement of the data in the block, a hash of the preceding block in its header (starting from an initial block labeled the 'genesis' block), hash of ongoing block, timestamp (current time) and Target value these all three on them miners work with to attempt, and combined candidate block to the block chain.

Distributed Ledger - A distributed ledger, is scattered to eliminate yearn for fundamental authority or intermediary to take further actions, authenticate transaction. A blockchain rely upon network of peers or 'nodes' that routinely provide the computing power to carry out consent for example by 'mining' if unanimity is obtained by 'proof of work'. Each block chain has distributed immediately replicated file spread beyond all 'nodes' or computers in the peer to peer network of that blockchain. Entire information on it is shielded and scrupulously stored using cryptography. The information can be obtain and crack using keys and cryptographic signatures [3].

Consensus Algorithm - The aim of a consensus method is to Cary entire nodes in agreement, that is, trust to each other, in a context where the nodes dubiety one another. There are distinct algorithms, the most familiar one existing 'proof of work' in that a node must solve a cryptographic puzzle thus label it to confirm the new block created on crypto-currencies to get a coin. All the transactions in the new block are then certify and the recently created block is then surplus to the blockchain [13].

Smart Contracts - A smart contract is similar to a contract in the physical world still it's digital and is serve by a very small code of programming instructions stored inside a blockchain. Smart contracts work on an 'If-Then'

principle, which means that the ownership will be passed on to the buyer only when the agreed upon amount of money is sent to the system. A smart contract abolishes the trust on a mediator when fixing business relations, the parties composing a contract can transact straightforwardly with one another [16].
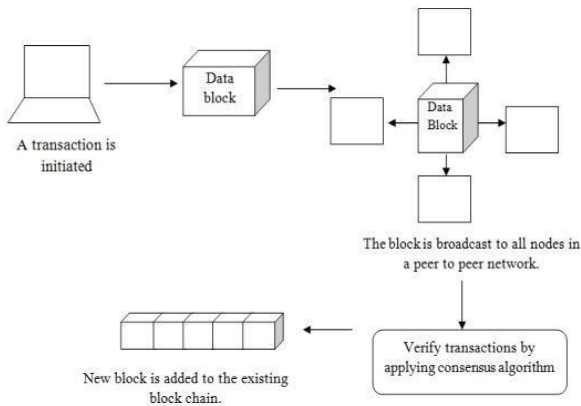

Fig. 1. Working of Blockchain Technology

2. LITERATURE SURVEY

Ayesha shahnaz presents paper using blockchain for electronic health records [2]. Through this paper, author applying blockchain technology for electronic health record and to demonstrate guarded storage of electronic records. The EHR system too faces certain problems which are interoperability, information asymmetry and data breaches. It describe the challenges encounter by blockchain are scalability, storage capacity and lack of social skills. Here the algorithm buildings the framework which having patient record with smart contract. It too explains how the rules are actually granting access to a particular functionality.

The proposed framework is a sequence of secure record storage in combination with granular access rules for the particular records. It helps to ensure the system make effort to solve the problem of data storage as it efficiently uses the off-chain storage mechanism of IPFS. This also clarifies the issue of information asymmetry of EHR system. For the future, we plan to implement the payment module in the existing framework. For this we require to have certain considerations as we need to decide how much a patient would pay for consultation by the doctor on this system which is not use centralize functioning on the blockchain.

Zibin Zhang presents research paper on An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends [1]. It gives an overview of blockchain architecture first off and study some typical consensus algorithms used in different blockchains. It is a series of blocks, which contains a full list of transaction records such as the traditional public ledger. It has contributed the features of decentralization, anonymity, transparency and persistency. We then discuss the typical consensus algorithms used in blockchain such as Proof of stake (POS), Delegated proof of stake (DPOS), Ripple and Tender mint. We analyzed and compared these protocols in different respects. Furthermore, this paper explains some challenges and problems including scalability, storage optimization of blockchain and redesigning of blockchain that would prevent blockchain development. Some possible future directions including bigdata analytics and data management.

Vinay Surendra Yadav and A. R. Singh paper, A Systematic Literature Review of Blockchain Technology in Agriculture presents the study about many blockchain application in agriculture but only few countries are able to tenure it where China is leader followed by the USA, Italy, India and Spain [4]. This paper also reviews the recent trends about blockchain research in agriculture and subsequently provides future research directions. It describes the definition of blockchain in different ways. Technically, it is a back-end database which manages a distributed ledger and has the facility to be checked freely. Business-wise, it is an exchange network for transfer of assets, transactions between peers, without need of intermediaries. There were only few articles which literally focus on implementation aspect of the blockchain based system. The literature review was also observed under four heads of research dimensions namely traceability, architecture and security, information systems and other applications in agriculture field. It has been examined that blockchain based research in agriculture is basically focused on traceability and specific.

Through this paper, few important issues related to blockchain implementation exists, such as scalability, interoperability, use of blockchain for accuracy in agriculture and food supply chain.

Alperen Kantarci and Serif Bahtiyar present a paper Blockchain-Based Electronic Voting System for Elections in Turkey unfolding Blockchain in order to suppress all disadvantages of traditional elections [5]. It introduces a system that has a aimed structure in keeping with necessity of country. At the ground level of this chain system, there will be a chain that having nodes (machines / voting centers) where people can vote on the elections. The person reaching to the center is able to cast vote with the help of unique id proof. If a particular person has not voted yet, so it will be able to vote one of the candidates. Candidates list will be kept in a database which can be stored at

government site. When the means of verification and authorization, satisfies, the individual can vote citizen either by selecting one of the projected candidates or by choosing empty vote for those who do not want to vote any of the candidates. In this system, chosen candidates will be taken from database that comprises relation between ballot boxes and candidates. This paper provides trusted, reliable and safe voting system for Turkey. This paper states that this type of system is suitable to apply in another country also.

3. APPLICATION BASED ON BLOCKCHAIN

3.1. Medical Health Record

Through Blockchain technology we decentralizing patient health history, tracking patient health record, improve security of health record, maintain transparency between patient doctor interactions and improving transactions, it is turn into a beneficial and expensive tool for healthcare systems, transform tool of the industry worldwide[9]. There are many factors which plays crucial role to preserve the integrity and confidentially of medical health record.

Patient Data Management

- Firstly, Patient who provides clinical data to doctors, and decides permission to share with it.

- Once only a doctor build a record, it is verified by healthcare organizations, and its viewing privilege are certified by the patient and saved in a database and list in the block (in the form of list) inclusive of permissions given by patient.

- Records of each patient are distributed among the blocks and it cannot be changed without the contract of bulk nodes in the blockchain. All the medical data is digitally signed and encrypted. Thus Blockchain shows an ingenious technology to supervise medical records and interoperability with safe guards. It also conserves patient privacy, by allowing patients to choose who can look into their information.
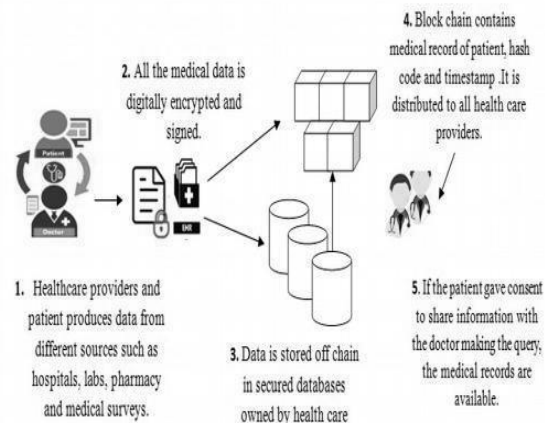

Fig. 2. Procedure of blockchain based Health care system

Expenditure into this technology would be overcome by send back as to integrate of systems experience to increased association between patients and healthcare providers, and enhance the health outcomes. Our focal point is on how Electronic Medical data particularly can be managed by Blockchain, and how modern technology can built a more skilled and interoperable framework to handle records that force to improved healthcare consequence, while keeping patient data ownership and without compromising prevention of sensitive data. Blockchain improves patient doctor interactions.

In Blockchain, to record patient, provider interactions via smart contracts. Once a doctor generates s a record, it is checked, and its permissions are authenticate by the patient .this info then saved in a smart contract. The information cannot be modified without the permission of a majority of nodes. Medical chain is used to smartly interact with various nodes in health care department such as insurer, labs, pharmacy, health provider and doctors. Medical chain uses blockchain to shield and manage health records for a cooperative, smart approach to healthcare. Users adapt to grant doctors immediate access to their health record via their mobile devices while data is kept secure on the blockchain. Patients can also wear wristbands, which medical professionals can scan to access a person's medical history if they are unconsciousness.

Pharmaceutical Companies

Through blockchain we approach the clinical history of a particular patient. We can access a database of patients who have opted in to being contacted by doctors.

Patients

Patients can grant to access to their electronic health records (EHR) to other entity also and revoke access by setting up a time limited gateway, hence improving experience and protecting data from unauthorized access

Medical insurance

Without the involvement of third person, validated health information directly from patients allows you to access their accurate and up to date record in more cost and time effective manner.

Monitoring Health Records

All the members in blockchain are fairly keep an eye on the records of patient.

4. BLOCKCHAIN POTENTIAL HEALTHCARE CHALLENGES AND BENEFITS

Blockchain in healthcare can discourse a variety of issues, such as care coordination, data security, and interoperability problem. Every day, the healthcare industry is creating new data regarding medical ,laboratory test, billing, clinical trials, monitoring of remote area, and other also which are often waylay abundant disparate, isolated databases [12]. Blockchain can gear up the data stream to boost the quality of care provided by adapting the sharing of medical record, Protecting sensitive information from hackers, and giving patients more command over their information. For example, blockchain technology can accumulate a patient's type of records from multiple sites/providers to generate a single, up-to- date records which an doctor can refer to when prescribing and dealing with a patient.

4.1. Electronic Interoperability to maintain Health Records (EHRs)

Blockchain expedite nation level interoperability of health records, electronically, which bequest providers, access to patients' medical histories, current medications, and prior imaging studies. This system containing critical and acute information for determination and judgement in healthcare. These data are a gems source of healthcare intelligence. The sharing of healthcare information is toward making the healthcare system smarter and enhance the quality of such service. Through blockchain, digital form of a patient's health related data is routinely stored by and spread among multiple hospitals, clinics, and health providers. These providers typically have primary access to the records, preventing easy access to past data by patients .If patient data stored using a blockchain solution where control, ownership and access to that is assigned to the patient when information is de-identified and deployed to a distributed ledger, requests can be conveniently and cost-effectively broadcast to patients and healthcare records may be revealed only if there is a positive match

and patients agree to participate in the research. The ability to execute analytics across all patient data would be an important benefit for research.

4.2. Supply Chain Integrity

Blockchain can verify every transaction among drug manufacturers, wholesalers, pharmacists and patients, as well as secure drug supply. A supply chain is a network of people and businesses involved in creating and distributing a product or service. It includes everything from the extraction of raw materials to the end consumers who purchase the product or service. A basic supply chain system involves suppliers of materials, manufacturers who turn it into a commodity, the logistics companies that manage the transportation of the raw material and commodities, as well as the final retailers that sell goods to consumers.

As supply chains have become global, the simple network of suppliers, manufacturers and retailers described above has developed into a complex environment where various products and materials move through multiple stages managed by different parties and geographically distinct processes. Thus, supply chain management involves integrating sourcing, procurement, manufacturing, distribution, and logistics into a cohesive system. This requires cooperation among a multitude of stakeholders and plays a critical role in the success of a business.

However today's supply chains are inefficient, expensive and inflexible when compared to new and innovative technologies that are impacting business around the world. Blockchain technology is transforming business in lots of different ways, from production and processing to logistics and accountability. Supply chain management is one particularly important use case, as every stage in the process can be registered and verified to create transparent and immutable records. As the distributed ledger is decentralized, each stakeholder maintains a copy, which prevents a single point of failure or data loss. This also means blockchain are highly resistant to altering or tampering. Such accurate and tamper-proof records secure data integrity and can be accessed to make regulatory compliance easier. Ultimately, blockchain can increase the efficiency and transparency of supply chains and positively impact everything from warehousing to delivery to payment.

4.3. Smart Contracts

Blockchain can generate rule-based protocols where contracts are executed when conditions are met. For example, a patient with health insurance has guideline details linked to their profile that are generated when they need medical care, ensuring correct payment to providers. Through the use of smart contracts, business will become briskly and more by offering the ability to learn from previous contracts, providing an understanding of the risk-

taking capacity of the organization and Creating adaptable contracts. It has potential purpose within the manufacturing, government, healthcare, and education sectors as well [15]. This includes how those industries run and enforce contracts. Blockchains that take advantage of distributed ledger technology allows for contracts that are self-verifying, self-executing, and autonomous. Companies can replace terms, events, and information throughout the lifecycle of a contract without relying on brokers or middlemen. The nature of blockchains and distributed ledgers means that as these contract milestones are reached and payments are made, they are recorded in such a way that neither party can repudiate or manipulate the record.

4.4. Blockchain Based Agriculture Industries

Today in this global world 40% of the people get job through agriculture either directly or indirectly lots of jobs provide by agriculture industries, since agriculture is vast in itself plus it is important for life. An agriculture industry becomes more complex with the improvement of industrialization of agriculture so heavy regulations needed [14]. Leading transparency to the supply chain will grant us to recognize and discard bad actors and poor mechanisms. This provides fitting conditions from farm to market, and we can diagnose source quickly in the event of a food safety outbreak. This could minimize time, money, and lives. So tends food safety. Blockchain provides traceability which helps to check food fraud, fake labeling and superfluity of mediator. Traceability means from growing to production of food we find details through blockchain. On doing business it is necessary to individually knowing fellow before you could belief them. Different Companies likes making ways for translucent and efficient supply chains using the use of block chain technology.

4.5. Challenges in Agriculture Sector

Opening new markets by using blockchain the problem of trust among different parties (farmers) involve in business is also solved so reduced requirement to classify each person individually on their honesty and ability to execute. Hence reduces the demand of broker trust (and take a margin) in the middle.

Anybody who worked with this chain a notice confronts that come with logistics. Handling the products that often have a tiny shelf life in dubious conditions in large quantities with countless dollars on the line. Blockchain gives a unique, rigid source of facts about the condition of individual bodies involve in this system. Since as a farmer not use digital data, blockchain's ability to improve automation, digitization, and food tracking, there's no doubt that the technology is must for modern agriculture.

4.6. Advantages of using Blockchain

Food safety that verifies the certification of a company would be much quicker and more efficient.

The grower well above the value of conventionally grown crops. Of course, doing so will enhance data entry performance, and even better; increase data verification frequency via the blockchain. To obtain the crops of higher quality crops and put trusted information in the hands of farmers, distributors, and consumers It should also be remembered that traceability will help increase the distribution of quality goods to food producers or purchasers of grains. Through this paper bridges that gap by reviewing all applications based on blockchain comprehensively.

4.7. Blockchain based E-Voting

In every democracy, the election security is an issue of our nation. Now-a-days, election fraudulent is the major issues in the existing voting system. In the recent years traditional elections not satisfy citizens [8]. There are various issues on voter's privacy and transparency.

Through this paper on reviewing some proposed Block chain based voting systems we points some disadvantages of conventional elections. Since the large crowd is not satisfied with their election system and most of the countries still suffer from a flawed electoral system. In this paper, we are analyzing the advantages, the challenges of bad election voting. Block chain based system will use decentralized system which is different than centralized offline system. Different algorithms, method technology based solutions are proposed to get better voting systems to achieve security, transparency, fast transactions plus more parameters.

Election the main entities and voters which are involve in voting system are very crucial weighty for a system which governed by representatives who are elected by the people. India, in this respect, brings its own challenges [10]. A lot of assets and capital are spent for conducting elections. At times, people are not capable to go to polls because they are incapable to back track.
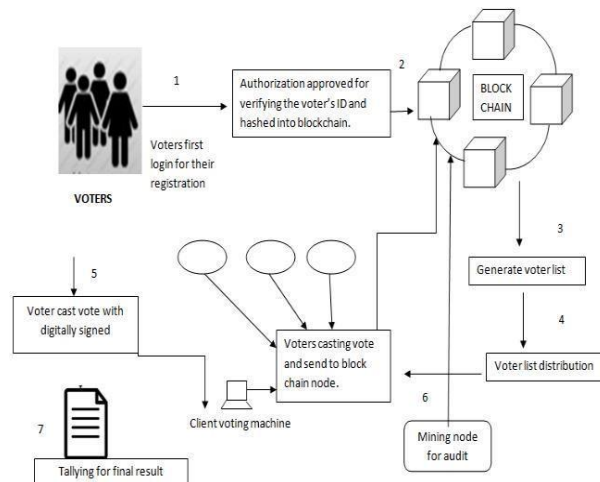
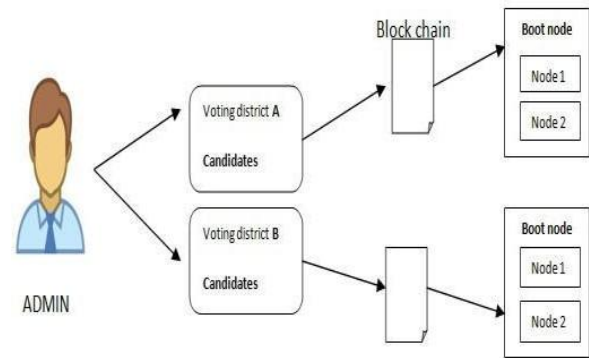**Fig. 3. E-Voting Process using blockchain**

Fig. 4. Levels of voting process

Basically this process contains four major processes:

- Requesting to vote
- Casting a vote
- Encrypting votes
- Add people votes in database

4.8. Working of E-Voting Using Blockchain
Step 1
Firstly candidate login and verify its Voter Id , Voter with unique identification number can allow to vote, if its information is matched with regarding unique ID number then only it is eligible to vote

Step 2
Then added information to the block chain which will represent the candidate. This stage will create a building stone that contains the name of the candidate that will assist with any vote that the candidate brings in front of it.

Step 3
A protest vote will allow our voter-used e-voting program to refuse his vote for current political system and/or election candidates. Make voting list

Step 4
Voter is casting their votes. We will used some system at the place of vote and some nodes or system at the district level having block chain technology concept so will reduce chance of corruption, error and we will perform secure voting with transparency. We distribute the voters list among the district level block chain. We maintain hierarchy inside the voting process.

Step 5
Encrypt voters vote. Different types of algorithms will used to encrypt and decrypt the vote of particular voter for security of data.

Step 6
Finally, the blockchain contain the data in node. This data send to root node and mining for the summarized result of voting.

5. CONCLUSION
Blockchain technology growing fast on transforming the old traditional methods. In this paper, we present comprehensive overview on blockchain technology including practical applications like healthcare systems, agriculture field and voting system. We discussed how useful this novel technology for healthcare sector and how can it be worked for managing the patient history through electronic health records. Furthermore, we describe this technology will help in agriculture field to establish a proven and trusted environment to construct a transparent , secure and more sustainable food production and distribution, integrating key stakeholders into the supply chain. We discussed and list out some challenges and problem faced in election voting in our country and how blockchain technology applied in voting process for maintaining the transparency among the voters.

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