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BLOCKCHAIN TECHNOLOGY IN HEALTH CARE

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Abstract **-** Blockchain is a decentralized system that can address trust and security concerns, high upkeep cost issues, etc. And now, Blockchain innovation has increased generous consideration as of late with expanded enthusiasm for a few different fields, including the internet of thing, food industry, energy management, financial management sector, social insurance industry, Healthcare. Blockchain offers a secure, conveyed database that can work without a any centralised system. Blockchain utilizes a conveyed, distributed system to make a persistent, developing rundown of requested records called squares to frame an advanced record.

Blockchain innovation has lately developed in the field of healthcare. Blockchain has also developed systems to keep record of human service information through many use cases, from keeping up consents in Electronic Health Records (EHR). In this article, we depict the how can be the utilizations of this innovation inside the medicinal services industry.

Index Terms **- Bitcoin , Crypto currency , IoT(Internet of things), timestamp, Ethereum, QR code(Quick Response code) , hash ID**

I. INTRODUCTION

Blockchain is a distributed ledger technology which consist chain of blocks, the blocks have information. Blockchain is originated in 1991, originally intended to timestamp the digital documents and lastly used tin crypto currencies like Bitcoin .

Perhaps, the most obvious and outstanding benefit of blockchain is the fact that it removes the need for a centralized trusted third party in distributed applications. By making it possible for two or more parties to carry out transactions in a distributed environment without a centralized authority, blockchain overcomes the problem of single point of failure which a central authority would otherwise introduce. It also improves transaction speed, by removing the delay introduced by the central authority, and at the same time, it makes transactions cheaper since the transaction fee charged by the central authority is removed. In place of a central authority, blockchain uses a consensus mechanism to reconcile discrepancies between nodes in a distributed application. The differences between centralized and decentralized systems.[1]

II. WHAT IS BLOCKCHIAN AND HOW DOES IT WORK?

Blockchain is a peer-to-peer (P2P) distributed ledger technology for establishing trust and consensus in decentralized networks. On the one hand, to address the challenges in a unreliable distributed environment, consensus mechanism is adopted in blockchain in a decentralized way to reach agreement for transactions among individual users. On the other hand, using digital signature and hash algorithm based on encryption, security can be assured in the decentralization blockchain system [2].

Blockchain record has three fundamental ideas: transaction, block and chain. The ‘transaction’ in

blockchain isn't confined to exchanging. Actually, all the important data can go about as an exchange to be communicated in the blockchain arrange. The blocks are capacity units to record transaction, which are made and communicated by those clients approved by agreement system. Each block is recognized particularly by its hash esteem, which is referenced by the block that came after it. This builds up a connection between the blocks, therefore making a chain of blocks, called the record. With the blocks aggregating successively in an accord process, the expense of assault and vindictive adjustment would be expanded exponentially

III. TYPES OF BLOCKCHAIN NETWORK

There are many ways to build a blockchain network. The network can be public, private, built by a consortium.

A. Public blockchain networks:

An open blockchain is one that anybody can join and take an interest in, for example, Bitcoin. Downsides may incorporate generous computational force required, almost no protection for exchange and feeble security.
Ex: Bitcoin and Ethereum

B. Private blockchain networks:

Business who set up a private blockchain, will commonly set up a consent blockchain arrange. This spot limitation on who is permitted to take an interest in the system, and just in certain exchange. Members need to acquire a greeting or consent to join the system.
Ex: Hyperledger and R3 Corda.

C. Consortium blockchains or hybrid blochchains :

Various associations can share the duties of keeping up a blockchain. These pre-chosen associations figure out who may submit exchange or access the information. A consortium blockchain is perfect for business when all members need to authorised and have a mutual duty regarding the blockchain.
Ex: Dragonchain

IV. APPLICATIONS OF BLOCKCHAIN

Since we are going to discuss about how blockchain technology applied in healthcare, except healthcare there many sectors in which this technology has being used and those are

- Secure sharing of medical data
- Music royalties tracking
- Cross-border payments
- Real-time IoT operating systems
- Personal identity security
- Anti-money laundering tracking system
- Supply chain and logistics monitoring
- Voting mechanism
- Advertising insights
- Original content creation
- Crypto currency exchange
- Real estate processing platform

V. BLOCKCHAIN APPLICATIONS IN HEALTHCARE

While talking about applications of Blockchain we talk more about its usage in finance. Heritage frameworks ordinarily just offer human services assets inside in the clinical and social insurance field and are not completely perfect with outer frameworks. Regardless, proof demonstrates various profits by coordinating these systems for interconnected and better human services, calling for interconnection between different associations for healthcare informatics scientist.

One of the most basic issues is multi-authoritative information trade, which requests that clinical information gotten by a social insurance supplier. This is effectively accessible to different associations, for example, a doctor or on the other hand examine establishment. In numerous social insurance executions, blockchain innovation reclassifies information handling and administration. This is to its versatility and phenomenal division, secure and sharing of clinical information and administrations. In the social insurance industry, blockchain innovations have numerous present improvements.

A. Patient data management

In this patient data management in healthcare industry we mainly we come across two issues.
First is each person will be having different health issues, for example each patient will not have common disease and affect of treatment won't be the same for all the patients having same disease. One

patient might recover quickly than other because of inter-individual variability. So it is essential to access record of medical history of the patient in order to provide good treatment and personalised care.
Second is sharing those medical records of the patient among the medical community is a major concern. Those records might have some personal information and which should be kept confidential. For maintaining confidentiality and sharing data without leak is a big challenge.

- **Blockchain application in Patient data management scenario-**

As we know Blockchain provides peer to peer data sharing with certainty. In order to maintain patient record, Health maintenance department collects patient's information like name, gender, date of birth, health issues, previous test records, prescription, etc. The collected data is stored in local database or in cloud system of the organisation.

Blockchain offers an open door for interoperability in human services frameworks. As having a decentralized record of acknowledged actuality in clinical records where all social insurance suppliers approach this record. This implies however the UIs (User Interfaces) might be extraordinary, their records will be identical over all suppliers. A test that exists identifies with the present condition of healthcare records across suppliers, which contain huge measures of a similar data under various identifiers that may not be connected. This makes duplication and as the blockchain develops, the presentation debases and this degree of replication of information across records would expect avoiding of duplication to keep up a sensibly performance of system with one of a kind, anonymous identifiers to recognize patients over all database. This is a business challenge all by itself of receiving a blockchain healthcare record.

B. Drug Tracking

In pharmaceutical industry Drug counterfeiting is a major obstacle. Some statistics revealed by the World health Organisations [3]

- In the global pharmaceutical, nearly 10%-15% of the market contains counterfeit drugs and those are sold illegally in black market.
- Currently estimated counterfeit drug revenue is around $200bn
- Counterfeit drugs are sold in different ways, or directly to patients via doctor prescription or through internet.
- 16% of counterfeit drugs contain wrong elements (ingredients) while 17% contain wrong amount of necessary portion.

Here in the following graph we could observe a rate of annual increment of pharmaceutical crime count worldwide. And the major cause is counterfeit drugs.

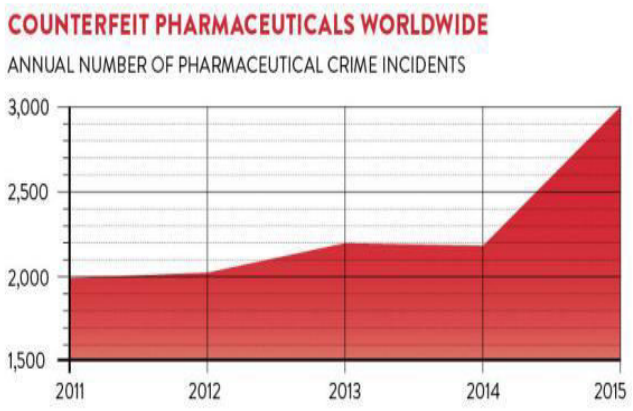

Figure 1 pharmaceutical crime incidents [4]

In the above graph ,
X axis refers to 'Number of pharmaceutical crimes'
Y axis refers to 'Year'

Form the above graph we can see that during the year 2011-2012 , the number of crimes are about 2000 and they have been increasing gradually. In the year 2015 , number of crimes registered are 3000

- **Blockchain application in drug tracking scenario:**

Step 1: Manufactures makes the medications and adds QR code to it
A manufacturer delivers the medications and adds the QR code to it, containing fundamental data like timestamp, item name, manufacturing date and expiry date and location.

The data will be added to Blockchain record and it makes stakeholders possible to keep a track of the drug.
When the data is added to the blockchain, a hash ID is created that can be utilized for following back the exchanges.
The medications can be sent to the manufacturer by means of IoT-empowered vehicles with temperature sensors to empower cold-chain dispatching.
It tends to be conceivable to trade and store the information accumulated by temperature sensors on the blockchain. The straightforward and permanent circulated record can spare a lot of time if there should arise an occurrence of a review of capacity states of temperature-sensitive medications.
The medications moved through IoT-empowered vehicles can likewise send the continuous area to the blockchain with the goal that stakeholders and government offices could discover at what time the medications were shipped and received.

Step 2: Distributors send the drugs to hospitals/pharmacists
Once the drug is distributed, they can verify medicines with hash ID of original medicine. And also they can quality check the product by examining item name, location, manufacture date and expire date.
If the product get pass quality check then validate and sign the transaction and then it will be added to the Blockchain.

Step 3: Pharmacologists receive the drugs and verify its source
If they come across with any illegal drug distribution, counterfeit drugs which have fake drug ID, the transaction will become invalid.

Step4: Patients purchase the medications and output the QR code to follow back its source
Patients can make sure weather the medicine they are buying is safe and legal or not. By scanning the QR code of the drug via their mobile app.
The hash ID which is linked with QR code of the drug can fetch essential information from the Blockchain and patient can verify the details with original drug.
Patients can also enter feedback and rating for the drugs and that information will be stored in Blockchain.

C. Clinical Trials / device tracking

Buying and reselling the devices or clinical equipments need effective examining and transparency during the process. When it comes to examining the drugs, it usually takes several years to know the features of the drug.
During clinical trials the quality reports, blood tests , images , survey reports are essential . One false report or defected data can cause defective products (drug).
Clinical trials and the management of trial subject consent are an area where blockchain has the potential to increase transparency, ability of examining and accountability of medical practitioners and researchers [5].

By keeping up a changeless log of patient assent, controllers can without much of clinical standards and clinical preliminary measures, guaranteeing that the trials meets the country's informed assent guidelines. This is especially significant as created fabricated informed structures have been among the most widely recognized kind of clinical fraud. This incorporates altering records and misrepresenting tolerant consent, which shows that a level of trail subject verification would be required to prevent this kind of fraud. This system could be additionally enlarged; as proposed by Benchoufi, Porcher and Ravaud, executing a smart contract system that keeps clinicians from utilizing fake information until a key has been discharged toward the finish of an auditable brilliant agreement process requiring consent at each phase of the preliminary. This procedure ought to likewise take into consideration the renouncement of patient assent.
Implementing Blockchain clinical Trail assent log gives clinical Trail subjects responsibility for own information while giving a review trail to clinical staff, scientists (researchers), and controllers.

VI. TECHNICAL ISSUES OF BLOCKCHAIN

A few potential disservices exists contrasted and customary information stockpiling draws near, including potential issues with the conveyance of by and by recognizable medicinal services information inside an open record, scaling the blockchain, and the cost-adequacy of execution. These are the disadvantages compared to traditional data storing approaches.

To begin with, blockchain has information which is encrypted and de-identified, circulated access to the whole informational index has the risk for potential of haggling or re-identification.

Secondly, the speed and scalability of the Blockchain distributed system. Since the existing system is distributed it requires to access entire ledger and those blocks of information needs to be stored in every client node within the system.

Considering expenses, this platform holds significantly large volume of ledges information still can't seem to be demonstrated underway conditions. The consolidated uses for equipment, usage, and tool should be evaluated to decide if an arrival on venture for this innovation can be figured it out. Such boundaries make a contention that while Blockchain has the capacity to give straightforwardness and credibility to information exchanges, quickly progressing current healthcare IT systems to blockchain based innovation might be troublesome.

VII. ADVANTAGES OF BLOCKCHAIN APPLYING IN HEALTHCARE

1. End-to-end traceability of drugs and other health products:

The utilization of a healthcare blockchain based arrangement will empower streamlined capability of development and partners through which medications or drugs travel in the production network. The improved visibility encourages the streamlining of streams of merchandise and an effective stock administration system.

2. Reduced losses identified with duplicating:

A blockchain application can empower away from of wellbeing item's excursion from producer to patients with the digitized exchanges. Along these lines, it would get conceivable to inspect helpless focuses in the production network and diminish the odds of fakes and the expenses related with it.

3. Transparency to improve responsibility:

The accepting and delivery of wellbeing items all through the store network can be followed. Additionally, it is conceivable to follow the entertainers or partners associated with the chain of shipment.

In the event that any issue emerges during the stock of medications or meds, blockchain can empower to recognize the last partner by which the item gone through.

4. Efficient review the executives:

Utilizing blockchain in the pharmaceutical store network can permit the recognizable proof of careful areas of medications. Considering updated information concerned authorities can operate imports of drugs and medical equipments.

CONCLUSION

The Blockchain has become a tending technology. Distributed data management is best way to store biometric / healthcare data compared to the traditional data storing method. Mainly medical sector need original data for clinical procedures. And Since the blockchain provide safe, and secured environment and it is the trustable technology. Now a day applications of blockchain are serving extremely well in health care sector.

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