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A Review on: Blockchain for Healthcare

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Abstract: ***Healthcare is a data intensive domain where a huge amount of data is created, which is access and stored daily. Data captured in the paper format is hard to capture in system as well expensive to archive, and being available when required. These challenges may lead to health decisions not made with absolute information, due to missing information there is need for repeated tests or data being stored in a different hospital at a different state or country. This highlights the need of a secured system. The proposed system has the potential to use the Blockchain technology to protect healthcare data hosted within the cloud. Electronic Medical Records (EMRs) contain medical and clinical data related to a given patient and stored by the responsible healthcare provider by using the proposed system. The individual or hospital authority facilitates the retrieval and analysis of healthcare data. The proposed system is a web-based application where user can register and get their unique key. With the help of unique key patient can itself upload patient's data on cloud as well by giving permission to hospital authority they can also view patient's data. By connecting two or more hospital, hospitals can share their patient's data for further treatment. They can share patient's data only if patient has given the right when he/she wants to transfer their medical history to other doctor. Change in data will be reflected to all hospitals in network. For this web-based interface user only has to make use of their Aadhar card number for registration and login purpose, no need of having hospital membership.***
Keywords: Blockchain, (Health Information System) HIS, (Electronic Medical Record) EMR, Cloud Computing.

I. INTRODUCTION

There has been recent drift in utilizing blockchain in the provision of secure healthcare data management. Broadly speaking, blockchain is a technology able to build an open and distributed online database, which consists a list of blocks that are linked with each other. These blocks are distributed among multiple nodes of an infrastructure, and are not centrally stored.

A. Blockchain

A blockchain is a concept which is digitally used to store data. Data is acquired in blocks, so now we can imagine it as blocks which contains digital data[6]. As blocks are connected in chained form this makes the data immutable. When a block of data is chained to the other blocks, data present it can never be changed again. Data will be always available to anyone who wants to access it again, in exactly the same way it was once added to the blockchain. Thus, it's revolutionary, as it allows us to keep track records of everything, we can think of such as medical record, identities, property rights, money balances without risk that someone is tampering those records.

B. Consensus Protocol

In simpler terms, consensus is a dynamic way of reaching agreement in a group. While voting just settles for a majority rule without any thought for the feelings and well-being of the minority, a consensus on the other hand makes sure that an agreement is reached which could bene?t the entire group as a whole. From a more idealistic point-of-view, Consensus can be used by a group of people scattered around the world to create a more equal and fair society. Method by which consensus decision-making is achieved is called "Consensus Mechanism"

II. LITERATURE SURVEY

A. Implementation of Medical Information Exchange System Based on EHR Standard

S.H. Han of "Implementation of Medical Information Exchange System Based on EHR Standard" has proposed a system in that when a patient is transferred to another hospital, the patient needs to bring his/her own records and submits to the newly assigned doctors. In this study, the WebService technique was adopted to connect EMR systems of each hospital. In addition, the international standard of the clinical document architecture (CDA) R2 was used to enable nationwide transfer of medical records for the information exchange. We implemented the centralized EHR Registry Server which contains information to share. As a result, it enabled users to retrieve and distribute the CDA document from CDA Repository by patient's index. The EHR Registry Server is the centre to store and manage information on hospitals, patient's medical information and their consent to release of them medical records.

1) Advantages

a) Hard copy of the medical report is not necessary

b) International Standard of clinical document

2) Disadvantages

a) Single point of failure

B. Blockchain Technology Innovations

Jeff Daniels of "Blockchain Technology Innovations" has proposed a system it contains some affirm that it is the next big thing after the Internet. Blockchain is a novel technology enabling new forms of distributed software architectures, where components can find agreements on their shared states for decentralized transactional data sharing across a large network of untrusted participants, without relying on a central integration point that should be trusted by every component within the system. The blockchain data structure is a time stamped list of blocks, which records and aggregates data about transactions that have ever occurred within the blockchain network. A blockchain is an electronic ledger of digital records, events, or transactions that are cryptographically hashed, authenticated, and maintained through a distributed or share d network of participants using a group consensus protocol. Much like a checkbook is a ledger of one's personal financial transactions, with each entry indicating the details of a particular transaction (withdrawal or deposit, recipient and sender, amount, date, etc.), the block chain is a complete listing of all transactions, the need for third-party intermediaries in some transactions [3].

1) Advantages

a) Transparency: Get real-time insights into trades and transactions rather than just receiving reports in different formats at different times from different institutions.

b) Security: Digital signature and a cryptographic encryption are aimed at providing a steady system of information recording.

2) Disadvantages

a) Cost: Blockchain offers tremendous savings in transactions costs and time but the high initial capital costs could be a different.

b) Large Energy Consumption: The Bitcoin blockchain networks miners are attempting 450 thousand trillion solutions per second in efforts to validate transactions, using substantial amounts of computer power.

C. Providing HealthCare-as-a-Service in Cloud Computing

I.A.T. Hashem of "Providing HealthCare-as-a-Service in Cloud Computing" has proposed the use of cloud computing environment for big data analytics. Author's formulated a relationship between cloud computing, big data, and compared several big data cloud platforms with respect to storage, machine learning techniques for mining of data, and availability of resources on the cloud. Castiglione developed a SaaS-based cloud architecture that allows heterogeneous devices to interact among themselves to provide secure and efficient access to healthcare resources regardless of network capabilities used by the end users. Lin proposed an algorithm to schedule data transmission of medical sensors for E-Health Applications in Internet of Vehicles. All these aforementioned schemes can be exploited to help improve the efficiency of healthcare related services. In addition to these schemes, Cheng proposed a clinical decision support system based on association rule mining to help ICU physicians to perform real-time information mining in the intensive care scenarios Authors have selected key attributes in compressed data using Correlation-based Feature Subset (CFS) and used Expectation Maximization (EM) technique for automatically forming the clusters. The server calculated-rules upon receiving the compressed data and pass on these rules to the patient's mobile where the classification of abnormalities was performed. Using big data, Jiang designed a wearable sensor system which used Hidden Markov Model (HMM) to recognize the human behaviour using big data analytics for monitoring the health of elderly people.

1) Advantages

a) Doctor can input the symptoms of any new disease that breaks out and then finds only those persons who are likely to be get affected.

b) The data is stored on cloud; simultaneous queries can be run on it to achieve high throughput with reduced delay

2) Disadvantages

a) Work was limited to only detecting cardiovascular diseases from compressed ECG data of patient and cannot be used to predict other diseases

b) Moreover, this scheme may suffer from additional delay which is caused between transmitting the data and receiving the rules

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III.IMPLEMENTATION

A. Work Flow of System

Cloud computing has potential to support real-time data sharing regardless of geographical locations, to provide resource flexibility as required, and to handle big data to obtain useful vision from the analysis of big healthcare data for research and policy decision making. Due to this cloud computing is a potential solution. In Figure 1, helps us to understand how cloud is used to facilitate sharing of healthcare data among providers, providing a smooth and consistent way of exchanging and potentially certifying data between EHR and PHR, supporting each provider in managing their data, and providing a comprehensive view of healthcare records for each patient. Cloud computing can be used to interconnect PHR solutions and the different healthcare providers, used by the providers to deal with any rapid or periodic changes, and so on.

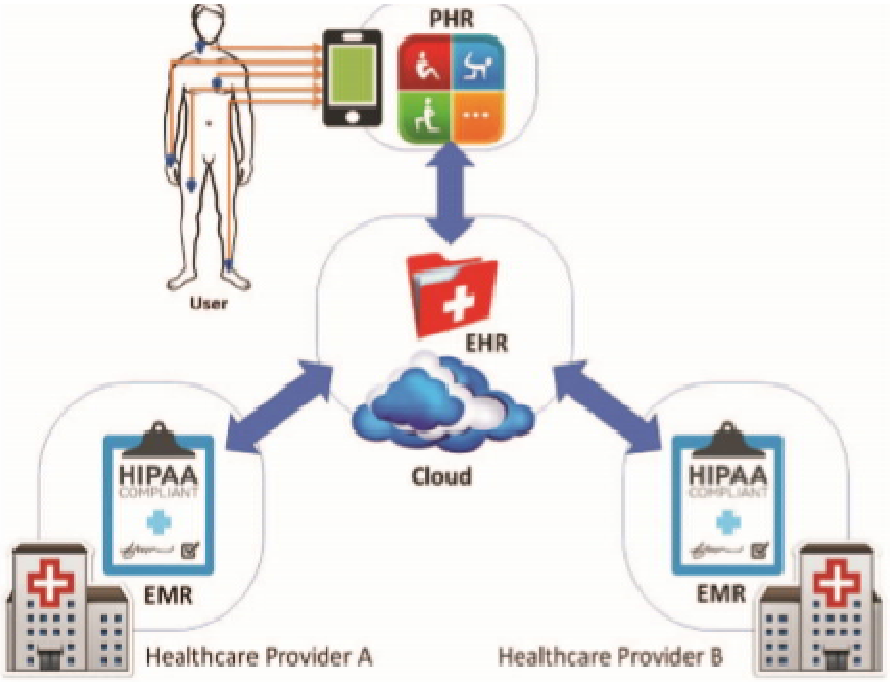

Figure 1: Cloud Based Ecosystem

Approaches include using cryptographic primitives, such as those based on public key infrastructure and public clouds to ensure data confidentiality and privacy. Data is encrypted before to outsourcing to the cloud, this limits the search ability of the data, in the sense that healthcare providers have to decrypt the data before performing searching on the decrypted data, resulting in increases in time and costs for the data retrieval and diagnosis. Access control models have also been used to regulate and limit access to the data, based on predefined access policies. Each block in blockchain contains a timestamp of its production, the hash of the previous block and the transaction data, and in our context, a patient's healthcare data and the healthcare provider information. Figure2 describes our conceptual blockchain-based ecosystem. Specifically, when new h healthcare data for a particular patient is created a new block is instantiated and distributed to all peers in the patient network. After a majority of the peers have approved the new block, the system will insert it in the chain. This allows us to achieve a global view of the patient's medical history in an efficient, verifiable, and permanent way. If the agreement is not reached, then a fork in the chain is created and the block is defined as an orphan and does not belong to the main chain. Once the block has been inserted into the chain, the data in any given block cannot be modified without modifying all subsequent blocks. In other words, modification can be easily detected. As block content is publicly accessible, healthcare data needs to be protected before the data being in the block.

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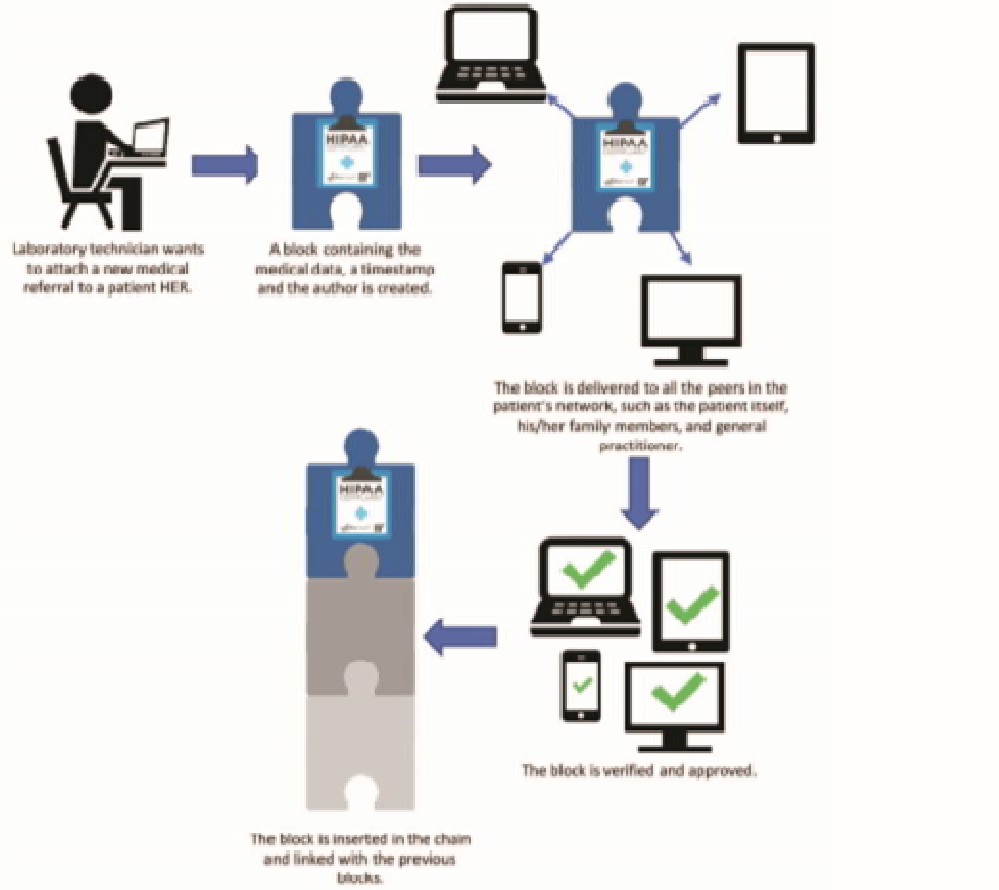

Figure 2: Conceptual Blockchain-based ecosystem

Conceptually, blockchain is secure by design that provides the capability to achieve decentralized consensus and consistency, and resilience to intentional or unintentional attacks. The method of adding new blocks to the chain is called mining, and the nodes that do the job of generating a new block are called a miner. The rate at which new blocks are included in the chain is defined by the developers of each Blockchain project. In the Bitcoin network a target of 10 minutes was established: that is, the difficulty is adjusted by all the complete nodes and miners so that, on average, every 10 minutes a new block is included in the chain. New miners are expected to join the network, and new, more powerful equipment is launched, so on average, the inclusion time of new blocks tends to decrease. Top re-vent new blocks from being included at intervals shorter than 10min, the difficulty is adjusted by increasing the number of bits for the collision. Thus, as it will be harder to find the new hash, the inclusion time of new blocks will adjust until it is close to the 10-minute target. Each mining node independently recalculates the new difficulty every 2016 new blocks by performing the following mathematical calculation:

NewDiff = OldDiff X (Time n Blocks / Time Target X n Blocks)

where,

NewDiff is the new difficulty calculated

OldDiff is the old difficulty in the Blockchain network.

IV. CONCLUSIONS

Patient needs to carry hardcopy of their report every time they visit a doctor. Patient can share a data. Data captured in the paper format is hard to capture in system as well expensive to archive, and being available when required. These challenges may lead to health decisions not made with absolute information, due to missing information there is need for repeated tests or data being stored in a different hospital at a different state or country. So to reduce the efforts and make convenient solution to patient system works in sufficient way.

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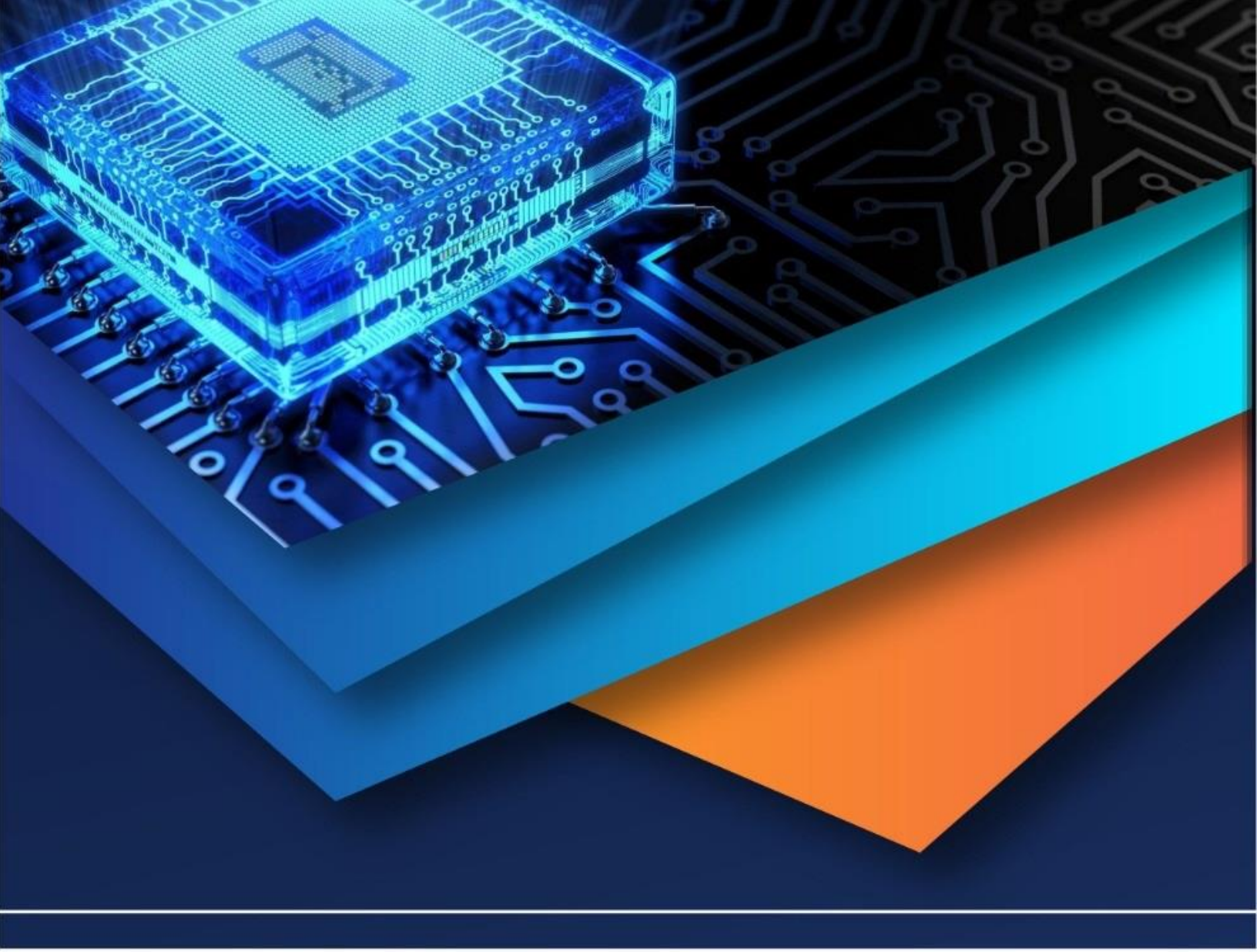

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