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Design And Development Of Blockchain Influenced Eco System

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Abstract: A lack of prompt information on sensitive health data may have adverse health consequences. It is also essential that patients access and control their health information to play a more active role in their healthcare. The aim of this research is to integrate a common platform for patient, hospital, laboratories na medical shops by taking advantage of blockchain technology. The name of the said software suite is Medical Easy ness (Med Ease). The aim of the said software suite is to share a patients data securely with hospitals and doctors. The blockchain-influenced software suite was developed to ease security and simplicity with hospitals, medicals, pathologists, and most importantly, patients. The data generated through this software package can be utilised for further research in the field of healthcare. With the blockchain, data security will be improved, and it will be passed around to all relevant components with maximum security. The healthcare industry also benefits from this in data creation and maintenance for research purposes, such as disease transmission, weather impact, and disease prevalence.

Keywords: Blockchain. Data security. Electronic Health Records. Healthcare.

Introduction:

The healthcare industry is considered traditional, making it difficult to measure because of the challenges presented by a constantly changing environment and a resistance to new practices. The current global concern with healthcare (e.g. privacy, quality of care, information security) is evidenced by the recent spotlight it has received. Due to its use of encryption technology, blockchain has become a popular tool to fix issues with the current flow of information. It could help in the short term by improving health service delivery and care quality [16]. The typical approach to interoperability in healthcare has been to make data transfer between various hospital systems more fluid. While it is the norm for health data exchange to be patient-driven, recent emphasis has been placed on patient-mediated interoperability. Patients expect their data to be interoperable, but patient-centred interoperability introduces additional challenges, requirements, and security and privacy issues that must be addressed for data sharing to be successful [5]. New solutions have emerged alongside the recent advances in the healthcare field, including the emergence of blockchain technology [17]. The healthcare industry is one of the leading markets for blockchain applications. However, technology adoption in the healthcare industry is slow, which was mentioned in the document concerned with the health system's conceptual issues. The security and privacy measures for blockchain in healthcare applications must be rigorous enough to meet the standards of the Health Insurance Portability and Accountability Act of 1996.

A large amount of research has been dedicated to applying blockchain technology in the healthcare industry in recent years [6].

The ability to create a highly secure, publicly accessible database for information can bolster transparency and accountability. Blockchain technology allows each computer on a network to have a complete copy of the ledger of transactions. One of the best blockchain applications is in applications where lightweight digital footprints are a requirement, as in those cases, transparency and immutability benefit the users. Blockchain technology has enormous potential in the healthcare sector, particularly when it comes to identity verification, supply chain management, and dynamic consent and permission settings for data sharing and access. Records of health transactions, such as purchasing and shipping in supply chains for medical equipment and pharmaceuticals, and tracking permission and

access of personnel to facilities, medical records, or other health data, may need to be kept in a transparent and unalterable manner [14].

The internet has finally achieved complete decentralization thanks to blockchain. The blockchain was built with the main principle that third-party trust is unnecessary. Any service can be constructed using a transparent, decentralized, and secure model on top of the blockchain. So, users have complete control and autonomy over their data and can feel confident in its reliability. Blockchain provides extensive history and verifiability of data for the whole clinical trial documentation. It helps with traceability, and it avoids any of potential post-clinical trial reconstruction. It also allows for the clinical trial to be more securely automated by using Smart Contracts. The technology allows for data parameters, security, and distribution control, all for single patients or clinical trial stakeholders[2]. Blockchain is a secure, decentralized ledger for online records that has the potential to manage electronic health records better while also providing an interoperability pathway that could improve health outcomes. Blockchain is an information and transaction management tool that uses timestamped blocks, cryptology, and decentralized architecture. Although the primary use of blockchain technology is support for cryptocurrency, like Bitcoin, it is not yet used in other applications

Literature Review:

Mukherjee and Pradhan noted that Blockchain technology has become popular and increasingly well-regarded. Combining cryptographic principles with decentralization, immutability, and transparency has revolutionized the peer-to-peer information exchange. Blockchain is named after its distinctive characteristic of being a distributed ledger with each block secured and bound to the subsequent blocks by cryptographic hash functions, forming a chain of blocks. This section begins with a brief history of this quick development. It then explains the basic terminologies, their types, the structure of a partnership, and the various consensus models known to the public [13]. Khan et al. discovered a delayed uptake of blockchain technology, together with its applications' and users' diversity, reveals how difficult it is to implement it successfully. Academics and business people alike are looking for solutions to maximize the potential of this new technology, where two blockchains can talk to each other. Several solutions for interoperability have come forward as a result. Researchers have interviewed different types of blockchain users to learn more about the strengths and nuances of these methods.

However, previous surveys have concentrated on the architectural aspects of the interoperability solutions and neglected the most valuable aspect of blockchain adaptability, smart contracts [7].

Sharma et al. recommends Due to its automatic assignment, immutability, security, and transparency, the distributed ledger technology known as blockchain has gotten a lot of attention in recent years. On the other hand, the Internet of Things (IoT) is an environment with interconnected computing devices and unique identifiers that transmit data across a network with no human-human or human-computer interaction. The use of IoT resources allows other systems to be more efficient and attain full functionality. IoT and blockchain may revolutionize various industries. Implementing these tools could help increase data processing speed, lower costs, boost security, and streamline the supply chain [18].

Ellul, in their research, dissects and investigate a statement in an attempt to ascertain whether or not the blockchain is dead. They research a wide range of information, including financials, investments, company registries, data, community engagement, projects, source code repositories, academic research, and programmes. Each of the metrics they've shown indicates that the respective measures are doing well, and they've concluded that the collective statement "Blockchain is dead" is inaccurate. The most clearly conveyed in this work is that success occurs when people come together as a community rather than working separately [4].

The study conducted by Yadav shows that blockchain is a Bitcoin technology that has seen numerous applications in the finance, trade, telecommunication, and manufacturing sectors. This technological advancement was introduced in 2008. The Satoshi Naskamoto pseudonym, which a group of prominent individuals employed, gave birth to this idea. A virtual currency known as Bitcoin has developed to serve as a viable alternative to other forms of currency, such as the dollar. The term "blockchain" has a meaning beyond its designation of "a chain of blocks." The definitions of the words "block" and "chain" both have to do with the public recording of digital information (the "block") and how that information is arranged (the "chain") [20].

Blockchain:

While the technology can certainly be complicated, its core concept is quite straightforward. Blockchain is a database of a specific type. In order to comprehend blockchain, it's helpful first to understand the nature of a database. Electronic storage of

information is done in a database on a computer system. To facilitate finding and discarding, databases use table formatting to hold data. Spreadsheets are made for people to store and access their limited information.

In contrast, a database is meant to hold far more information to access, search, and manipulate. Large databases contain data on powerful computers which act as servers. To access the database simultaneously, these servers are sometimes constructed using hundreds or thousands of computers. While anyone may use spreadsheets and databases, they are often run by an organization and controlled by an appointed individual with full autonomy over how it functions and the data it contains. A block in a blockchain network contains four attributes: information, the current block's hash (identification number), the previous block's hash, and the timestamp. Blockchain technology has various design types, including public (no permission needed), private (permissioned), and hybrid (combination) blockchains [1].

Blockchain in Healthcare

The blockchain's decentralized, open, and permissionless characteristics may provide a unique healthcare solution. A wider range of uses for the technology makes it more appealing to healthcare providers, including to those using wearable devices and those involved in medical research. For the healthcare industry, blockchain's greatest impact will likely be in data management. Health care organizations and healthcare workers are employing several strategies and tools to share patient health information. Healthcare remains one of the most popular research areas in recent decades, and it continues to develop innovative and more dependable ways to help the healthcare and community industries. To show that records are authentic, it is essential to have data provenance. The healthcare sector's key issues are being addressed through the use of blockchain technology, which is being used in various settings. However, additional research is needed to focus this technology on implementing real-time applications [21]. Thanks to blockchain technology, the patient should be placed at the centre of the health system with improved security, privacy, and data interoperability. Electronic health records (EHRs) would be far more efficient and secure under this technology, becoming a model for health information exchange (HIE). Since blockchain is decentralized, data is not stored in a central location.

The time saved and the data not being able to be changed or deleted is another benefit [12].

The actual value of interoperability may be unlocked with a blockchain-powered health information exchange. Eliminating or reducing intermediaries is possible with blockchain-based systems. The possibility of blockchain in the health care ecosystem has broad implications for health care stakeholders. Leveraging this technology can integrate fragmented systems, allowing for an increased ability to gain insights and measure the value of care. The nation's blockchain network for electronic medical records may deliver long-term advantages to both patients and the healthcare system [15].

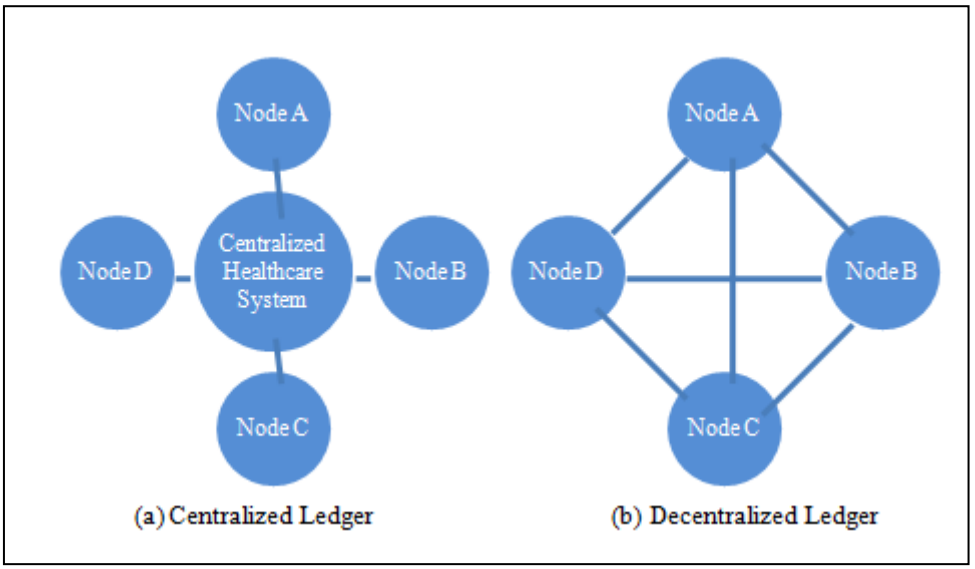

Fig. 1: Working of Centralized and decentralized healthcare system

Storage Structure of Blockchain

One key difference between the structure of a traditional database and a blockchain is the arrangement of the data. A blockchain collects information in sets called blocks, which are grouped. Blocks can store data and chain together to form a "blockchain" when they're filled. The newly created block will be filled with any new information and then be added

to the chain. A database uses tables to organize its data, whereas a blockchain uses chunks (blocks) connected to store information. By making all blockchains data storage systems but not all data storage systems blockchains, it was ensured. Because this system works on a decentralized network, it makes an irreversible timeline of data on its own. A filled block becomes part of this timeline and is set in stone. The exact timestamp of each block is noted as it is added to the chain [19].

Blockchain Features

Some distinctive features help blockchain technology make an impact:

a) **Decentralized:** Blockchains cannot be controlled by a single person or group due to their decentralized nature. The distributed ledger is with everyone in the network, but no one person can modify it independently. The exceptional capability of blockchain offers transparency and security to the users while also increasing their power.

b) **P2P network:** Blockchain makes it easy for two parties to interact without the need for a third party, thanks to its peer-to-peer model. Transactions are stored in an identical, decentralized ledger and can be approved with a machine consensus. For instance, you can send money to someone in another country all by yourself within a few seconds using blockchain. And in any case, any additional fees or interruptions will not be subtracted from the transfer.

c) **Immutable:** The unchanging nature of a blockchain's data is the inability to alter anything written to the blockchain. An example of immutability would be using email. Once you hit send on an email addressed to multiple people, it's impossible to retract. You will have to ask everyone to delete your email to get around this issue, which is very time-consuming. The way immutability functions is like this. The data is immutable once it has been processed. If you alter the data in one block in the blockchain, you will have to change the entire block because each block contains the previous block's hash. One hash change will result in all subsequent hashes being affected. Changing all the hashes is difficult because it requires a huge amount of computational power. Because of its imperviousness to alteration or hacker attacks, the data in a blockchain is never in danger of being altered.

d) **Tamper-Proof:** It's much easier to identify if data has been tampered with if a blockchain has immutability as a property. Even a minor change in a single block can be detected and quickly dealt with, as blockchains are considered tamper-proof. Hashes and blocks are the two ways to detect tampering. The previously mentioned uniqueness of each hash function, as it pertains to each block, was previously discussed. You can think of it as a block's fingerprint. Any alteration in the data will necessitate a modification of the hash function. A hacker would have to change the hash of all the subsequent blocks to alter the first block's hash, which is difficult to do.

e) **More rapid resolution:** Old banking systems are slow and cumbersome. The transaction can take days to process after the settlement has been finalized. Additionally, it is easily tainted. Due to its quicker settlement times, blockchain is preferred over traditional banking methods. In this way, the user can transfer money faster, and that saves a great deal of time overall. People who want to have a better life and job go to another country, often leaving their families behind. However, it takes a great deal of time to send money to their families abroad, which could mean death in times of need.

f) **Decentralized systems:** Public ledgers generally give access to all the details about a transaction and those involved. There is nowhere to conceal it now. Although private or federated blockchains have their special considerations. Despite this, there are still some instances where many people can easily see what is happening in the ledger. All the other system users manage the network ledger. By dividing up the computing work among the various computers, the final results will be better. It's why blockchain experts consider this to be a key feature. Better efficiencies will be a consistent result since this ledger system can overcome traditional methods.

g) **Minting:** We can address the issue of manipulation by using blockchain. If you travel to the west and ask if they trust technology, they will say yes, but not as much as they trust companies like Google, Facebook, or their banks. However, in the rest of the world, those organizations are not as trusted. There's no need to focus on locations; they're nice but secondary.

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Types of Blockchains

Even though blockchain has grown in popularity and complexity since its creation, the primary classifications are public and private blockchains.
Before we dig into the differences between public and private blockchains, let's make sure we understand their similarities.

- Public and private blockchain have decentralized peer-to-peer networks.
- The members of the network have a copy of the shared ledger on their devices.
- To avoid malicious attacks, the network follows the rules for immutability and security of the ledger.
- Now that we have found similar elements in both blockchains, let's study them in detail and look at their differences.

i. **Public Blockchain:** A public blockchain is permissionless and thus accessible to everyone. Anyone with internet access can download and use it. Also, people can trace the blockchain's entire history, and they can make transactions with it. Mining rewards and ledger immutability are often incentivized in public blockchains. The Bitcoin Blockchain is an excellent example of a public blockchain. Since public blockchains allow global communities to exchange information securely and openly, they offer numerous benefits. However, there are obvious drawbacks, such as a blockchain being vulnerable if the rules are not enforced to a large extent. The regulations established and put into practice at the outset have little leeway for modification later on..

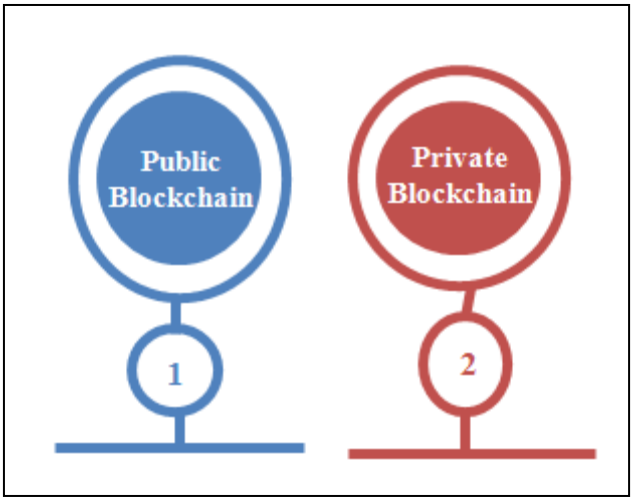

Fig. 2: Types of blockchain

ii.Private Blockchain: A private blockchain is one that is used only by trusted parties. The owners control the overall management of the network. Furthermore, private blockchain rules can be changed based on permissions, exposure, membership, and authorization. Either running alone or in conjunction with other blockchains, private blockchains are able to function independently. Enterprises and organizations are more commonly in the habit of using these things. Because of this, participants in private blockchains must have a higher level of trust in one another.

Blockchain for managing medical and pharmaceutical supply chains

Managing product supply chains is the most widespread use of blockchain in business today. The health sector is adopting blockchains to manage medication, medical supply, blood product, and medical device supply chains. Examples of how blockchain can be used in this space include:

a) Validation of a unique product identifier is easier and faster.

b) Tracing: enterprises can utilize a distributed ledger to track movements of items as they move from the manufacturer to the consumer.

c) Product authentication: helps private and public entities identify products suspected of being counterfeit, unapproved, or dangerous.

d) The system is also set up to quickly respond to any incidents and inform regulators of non-compliance or possible criminal activity incidents.
e) Additionally, other relevant product and transaction details, including licencing [14].

Consensus

The success of every blockchain depends on the algorithm. The design of the architecture is clever, and its core is built around consensus algorithms. Blockchain systems all need a method of deciding what is correct. The simple version is that the consensus is a method of making decisions for the network's nodes. The nodes here can quickly and easily reach an agreement. For a system to function correctly, a consensus among millions of nodes validating a transaction is vital. It's kind of like a voting system, where the winning side is determined by majority rule, and the minority is obliged to go along with it..

Consensus Algorithms in Blockchain

We recognize that blockchain provides users with immutability, privacy, security, and transparency through a distributed, decentralized network. Every transaction in the blockchain is seen as entirely secure and verified, even though there is no central authority. The consensus protocol is crucial to any Blockchain network and is what allows the shared ledger to exist.

To achieve consensus, a shared agreement on the current state of the distributed ledger is agreed upon by all network peers. Consensus algorithms thus foster trust and reliability in the Blockchain network, which is necessary for the proper operation of a distributed computing environment. In other words, the consensus protocol guarantees that each new block added to the blockchain contains only the single, agreed-upon truth that all the nodes have come to accept. The blockchain's consensus protocol sets out specific goals such as achieving an agreement, working together, collaborating, having equal rights for each node, and making participation in the consensus process mandatory for each node. As such, a consensus algorithm attempts to discover a collective consensus that benefits the entire network.

i. **Proof of Work (PoW):** This algorithm determines which miner will generate the next block. Bitcoin employs this PoW algorithm. This algorithm's underlying objective is to resolve a challenging mathematical puzzle and provide a solution with little effort. Solving this puzzle is computationally demanding, so the node who solves it first gets to mine the next block. Proof of work (PoW) is a system in which computing power is needed to deter spam email and denial of service attacks. Hashes, long strings of numbers that are proof of work, are how users detect tampering in practice. Use a hash function on a specific set of data (e.g., SHA-256), and it will always generate the same hash. Even a tiny alteration to any part of the original data can result in a totally different hash. Regardless of the size of the original data set, a certain function generates a hash of the same length. Hashes are single-use functions; you can use them to verify data matches the original, but you can't use them to reconstruct the original data.

ii. **Proof of Stake (PoS):** One of the most common alternatives to PoW is **Proof of Stake**. Ethereum has moved from proof-of-work to proof-of-stake consensus. Instead of investing in expensive hardware to solve a complex puzzle, participants in this consensus protocol commit their coins as a stake to get their hands on coins from the system. The validators will then all begin validating the blocks. To certify blocks, validators will place a bet on one that they think can be added to the chain if they discover one that meets their standards. Those who put their money in the bets will see their stake increase based on the blocks added to the blockchain. Following a period, a new block is generated by a validator with a stake in the network. PoS thus incentivizes validators to reach an agreement with an incentive mechanism.

iii. **Proof of Burn (PoB): Proof of Burn (**PoB) incentivizes validators to send coins to an address from which they are irretrievable, instead of investing in expensive hardware equipment. Validators can mine the system, in accordance with a random selection process, by committing coins to an unreachable address. Validity of acceptance is what they receive in return for their short-term loss. Using the native currency of the Blockchain application or bitcoin may depend on how the PoB is implemented. The better their chances of being selected to mine the next block, the more coins they burn. However, PoB, the protocol it's

competing with, is still wasting resources unnecessarily. Mining power is also suspect because some people are more than willing to burn money.

iv. **Proof of Capacity:** Validity in Proof of Capacity depends on the inauguration of hard drive space, not on the purchase of expensive hardware or the wasting of coins. Hard drive space is a key factor in how likely a validator is to be selected to mine the next block and receive the block reward..

v. **Proof of Elapsed Time:** PoET is a fair protocol for selecting miners to run the next block, using only fair methods. A permission blockchain is where permission is required to access the network, and it is used there. Every user is to pause at random intervals, according to this description. The individual who finishes waiting the designated period gets a chance to add a new block to the ledger. In addition to Proof of Work, Proof of Activity, Proof of Weight, Proof of Importance, and Leased Proof of Stake are other consensus algorithms developed. Blockchain networks can't function without the consensus algorithms to verify every transaction is committed, so it's essential to make wise choices when selecting one to suit the business network's needs.

Blockchain Towards Healthcare

While there is sure to be disagreement between people on opposite sides of the political spectrum regarding solutions for the ailing US health care system, few would debate that the sector is in poor shape right now. Reforming the health care system will certainly be a long and drawn-out process, with involvement from multiple players in the business, scientific, and political spheres. The industry's problems have been heatedly debated, but technological advances have helped in several small but essential ways despite the controversies. New software allows providers to send and store records in a safer and faster way, for example. In contrast, it's not a secret that various parts of the health care industry are stuck in outmoded technologies and practices. Pagers and fax machines are the first things that come to mind. Medical imaging devices running on unsupported operating systems was discovered to be the norm, which meant organizations were vulnerable to cyberattacks. 1 This can not only drain the healthcare industry of funds, but it can also jeopardize the well-being of patients. In light of these problems, there are new indications

that the health care sector may be in a position to make use of blockchain technology. This technology has gained widespread use in the cryptocurrency world but has not yet entered the mainstream business world. Blockchain will enable the secure, immediate and tamper-proof transfer of medical records, no matter the location or medical facility. Doing this would free up health facility resources for better patient care and research instead of administration.

Revolutionize Health Care using Blockchain Technology

Regardless of the cryptocurrency market is a massive bubble, the technology that supports it may still be around for the long haul. Healthcare, as an industry, maybe on the verge of being upended by technology like blockchain. Some of the key advantages of distributed ledgers and smart contracts are inherent to the industry in which they are employed. One can look forward to the features of encryption, shared data, connectivity, and consistent, stable service. While delivering the industry to its current state, healthcare infrastructure has been expensive, out of date, and fragile in the eyes of many analysts[11]. Proponents claim that legacy systems, which are forced to perform under increased data loads and strict industry regulations, have failed to improve patient care. Deloitte argues that "blockchain technology can reshape healthcare, putting the patient at the centre of the healthcare ecosystem and boosting security, privacy, and interoperability of health data."

Benefits of blockchain in healthcare

Blockchains in healthcare can be envisaged in the following areas:

For Hospitals

a) A prominent feature of blockchain that will be useful in healthcare is the absence of a central administrator. Indeed, a database is still something physical because it's made up of bits and bytes. Storing the database's contents in the physical memory of a single system puts it at risk of being corrupted by anyone who has access to that system. The necessity of a central administrator will be obviated with clever cryptography.
b) Everything the users do is within their control.

c) Medical records are often private and require quick access to data, which blockchain can deliver while maintaining privacy. Blockchain provides secure access, scalability, and data privacy in a single step.
d) Blockchain can collect inpatient, ambulatory, and wearable data to enable longitudinal patient records, with disease registries, lab results, and treatments in one place-allowing provider to deliver better care [13].
e) Instead of just using the primary key, blockchains create a hash for the entire database. An individual would search for the address, and a multitude of lessons and keys are available, but they all lead to a single patient ID.
f) Blockchain works on a validation-based exchange so that the claims can be automatically verified. There would also be less cheating and incorrect results because there is no central authority.

g) It becomes easy to Manage electronic medical record (EMR) data.

For Patient

a) The patient gets access to the information securely
b) It also Reduces data dependencies
c) Patients don't need to provide the same information repeatedly, even if they change the hospital for doctors.
d) The patient can view various hospitals and related products
e) All the medical history is available with the patient
f) It reduces the time of sharing background details

For Pharmacist

a) With each passing day, customers are getting more intelligent. Their demands as a customer are getting more and more. With increased scrutinization, it is up to the pharmaceutical companies to take better economic and clinical steps to provide services that meet customer expectations in poor and rich countries.

b) One of the biggest challenges of the pharma industry is to maintain the supply chain. The pharma supply chain is complex and risky. Supply chain management can become easy to maintain. A blockchain solution can make a substantive difference to the pharmaceutical supply chain. At every stage of the process, barcodes would be scanned and recorded onto a blockchain ledger system which, in turn, records and creates an audit trail of the drug journey.
c) Blockchain pharmacy can go to a new kind of infrastructure if the companies start to adopt it.
d) Blockchain can modernize the pharma industry as it introduces three essential elements: privacy, transparency, and traceability.
e) Blockchain is equally helpful for adding governance and compliance with the supply chain. It is possible because of the blockchain's essential features, including immutability, distributed nature, and transparency.
f) Blockchain can help with the patient-centric approach and help pharmaceutical companies track the patients through the blockchain.
g) Drugs can be verified, and authenticity can be ensured.

For physician

a) Some devices can be used on sharing basis, which helps to reduce device duplication
b) Information will be shared with patients, medicals and pathologists securely.
c) It decreases data dependencies
d) All the data available with the system is open data. So each access provides trusted data.
e) A physician can access the patient's history, so it reduces the time taken to collect historical data.

Working Model

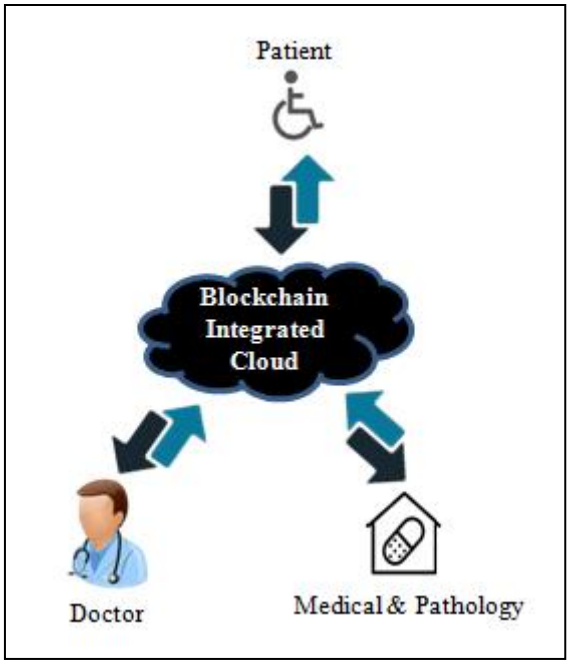

Fig. 3: Data transportation with the help of blockchain

The developed software package is divided into four modules

a. Patient
b. Doctor/Hospital
c. Medical
d. Pathology

Steps followed by patient

Step 1: Create an account to the Med Ease System
Step 2: Login and identify the hospital or doctor
Step 3: Book an appointment
Step 4: Visit hospital/doctor to get treatment
Step 5: Share the history or generate new metadata
Step 6: Visit pathology if recommended by a doctor
Step 7: Download or collect report and prescription
Step 8: Collect medicines offered by medical
Step 9: Repeat Step 3 to Step 8 if required

Steps followed by Hospital/Doctor:
Step 1: Create an account to the Med Ease System using hospitals and doctors

details
Step 2: Log in with the individual or hospitals credentials and add a list of allied medical and pathologies
Step 3: View list of patients
Step 4: View history of individual patients if available
Step 5: Diagnose the patient and create metadata for the patient
Step 6: Share the prescription with the patient and medical/pathology if required
Step 7: Repeat Step 2 to Step 6 for every session

Steps followed by Medical:
Step 1: Create an account to the Med Ease System using medical details
Step 2: Log in with the individual credentials and add a list of allied hospitals/doctors
Step 3: View a list of patients and select each patient to view prescriptions separately
Step 4: Prepare an order as per the prescription and generate a bill. The patient may pay a bill using online mode
Step 5: Deliver order to the patient if demanded
Step 6: Repeat Step 2 to Step 5 for every session

Steps followed by Pathology:
Step 1: Create an account to the Med Ease System using pathology details
Step 2: Log in with the individual credentials and add a list of hospitals/doctors
Step 3: View request generated by doctors/hospitals
Step 4: Deal with the patient regarding further process
Step 5: Generate a report to create metadata for the patient and
share it with the doctor and patient.
Step 6: Repeat Step 2 to Step 5 for every session

The Med Ease Ecosystem

To give patients control of their medical records, we can put them in charge of compiling their records' single, most complete version, which they can then share with every medical network they use. The patient records system is fragmented and compartmentalized, causing inefficiencies and inaccuracies throughout the healthcare system. Med Ease uses blockchain technology to securely store medical records to facilitate an innovative, collaborative approach to healthcare. By creating a short-term portal, patients can make their data more secure and protect their privacy by granting and revoking access to their electronic health records (EHRs). Med Ease is a member-run organization that provides customers with answers on how to take care of their loved ones from birth to death [8]. Med Ease uses blockchain technology to simplify healthcare decisions and minimize the burdens created by regulation, privacy protection, and competing interests. Med Ease operates a healthcare-specific network-as-a-service to ensure patient data privacy when transporting it. The Med Ease system stores no data; it is both a network and a protocol for configuring data layers while monitoring the source and destination of information in real-time. Med Ease ensures that healthcare data remains protected and available for sharing only with the people who are authorized to access it. The Med Ease blockchain creates immutable and independently verifiable publication protocols that run on a decentralized platform. It keeps digital proofs safe without revealing private data or requiring a trusted third party [9].

Med Ease's distributed ledger architecture lets related entries be linked in a chain to save storage space and make it easier to retrieve data. Any kind of data can be entered, but private information is not supported. Information entered by users is first hashed and then stored in the form of entry blocks. The actual data is then saved in distributed hash tables and distributed peer-to-peer. Each Med Ease blockchain directory block is protected and further safeguarded by anchor entries written into Bitcoin. One option for obtaining third-party security is to connect to other public blockchains [10].
A peer-to-peer network of federated servers governs the public Med Ease blockchain. The servers' membership is based on performance and community support. Entry requests are accepted for a fixed fee, based on the length of the chain and the size of the entry. The Med Ease protocol is open source, so anyone can set up a dev and prod node on a private network.

Opportunities of Blockchain in Healthcare

Numerous articles and reports have been written about the ways blockchain can be used in the healthcare sector. However, we believe that blockchain offers several opportunities in existing use cases.

i. **Supply Chains**: While various industries are already using blockchain to enhance supply chain integrity and traceability, the rest is just beginning to explore the potential. Because new drugs are pricey, counterfeiters find pharmaceuticals appealing. Even though Europe has a QR code-based anti-counterfeiting system, it has some faults. Blockchain could provide a further layer of integrity to ensure the product's integrity is solid.

ii. **Drug Verification**: This is a case of cross-sectoral blockchains being used in the pharmaceutical industry, for example, to confirm the authenticity of drugs at the point of dispensing. Even though blockchain is already in use for supply chain security in the industry and its suppliers, there are few examples of its use at the caregiver level. Despite that, critical data, such as the authenticity of a drug, its expiration date, and any special requirements for handling the product, such as organizing a product recall, is essential and is suitable for patient safety.

iii. **Reimbursement**: With patients, payers, and healthcare providers exchanging data more efficiently, it would be easier to verify insurance coverage. The consistent, automatic contract execution environment made possible by blockchains is created by establishing trusted relationships between all participants and storing transactions and contracts on a shared ledger. It could cut administration costs significantly.

iv. **Control The Access**: on the use of Electronic Health Records that are shared. Intelligent contracts will define and enforce access rules to EHR content, while

blockchain will reference EHR data. To guarantee that only authorized people have access to the EHR data, this will be implemented. The blockchain also keeps an irreversible record of all the data's transactions. All of these are critical to the administration of population health management and research.

v. **Clinical Trials**: Clinical trials present unique opportunities. The implementation of blockchain technology can help make clinical trials more reliable by keeping track of every stage of the trial and timestamping it (trial protocol, patient enrolment, data collection, trial monitoring and data management and analysis). Because it would minimize the number of data manipulation accusations and reporting errors, this would reduce waste [3].

Conclusion

Blockchain technology has become a vital piece of software development. Because it is of the utmost importance to landscape knowledge to develop a better understanding of design practises, To assist in making informed clinical decisions, healthcare professionals and patients need to have combined secure data exchange technologies to exchange and disseminate information. Blockchain-based technologies, their applications, and their value for healthcare industries were among our research subjects, as described in this paper. Cloud-based EHRs could be managed through a blockchain to ensure secure access. Blockchains help boost data interoperability while also providing data privacy and security. It includes built-in honesty and follows the law of the letter. An improvement in interoperability would help improve health outcomes. Blockchain influed software suite MedEase will provide the advantages of blockchain to share the patients data securely.

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