Healthcare Data access by Using of   Blockchain backed framework

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Introduction

Blockchain technology's distributed and decentralised architecture enables safe and secure transactions. Since a few years ago, this technology has advanced to a wide range of practical applications in the fields of finance, energy, security, and identity management. Researchers are excited about the application of its features in the healthcare sector, notably for data management and access, such as decentralised storage and authentication. Given the various blockchain frameworks (public, private), a ivate blockchain instance demanding the identification of all participants would be perfect in the case of medical records. Using a permissioned Hyperledger like the one Swiss hospitals use to combat medical fraud scandals [1] is studied in case studies concern- ing Blockchain for health care management [2][4] support the general researcher consensus that Blockchain is indeed a great candidate for healthcare record management over traditional DBMS.

   A blockchain deployment would effectively enable the creation of a single means for record creation and storage. Not to mention the fact that inherent blockchain characteris- tics effectively meet all of the demands that the modern healthcare industry requires in terms of data storage- Security, Interoperability, Data sharing, and access.[3] This work describes the creation of a blockchain-based patient health record creation and retrieval framework[1] that will overhaul current systems in place at the same time meeting standards put in place for ensuring health data security and integrity.

• Provides an opportunity to create a global health data sharing framework for medical institutions promoting better research and advancements in medical science.

•Non-identifying or anonymized patient data can be released to pharmacy and insurance companies for research and product marketing purposes. Payment for data access can be used to create an incentive program for patients.

•Enables the patient to have access to a wider range of medical facilities. Wherever the patient goes, the healthcare provider can always access their medical history by connecting to the blockchain instance.

•All the above-mentioned advantages and more can be developed knowing that data onthe blockchain is safe against intentional tampering or accidental errors and loss.

There are several hurdles in creating a new system from the ground up.

•Currently existing medical records although in disarray, would be inconvenient to com- pletely replace them in a short period.[5] Moreover, it is difficult to connect legacy systems with those based on blockchain.[2]

•The current lack of laws and regulations for blockchain use can often impede the cre-ation of newer methods of harvesting blockchain technology especially for sensitive data such as patient information.

•Lack of knowledge among the general public about blockchain may make them skepti-cal in agreeing to participate in their medical data being on the blockchain rather thantraditional databases.

•All regions and situations may not necessarily benefit from blockchain-based recordsdepending on their structure and working. For example, a single data writer does not need a blockchain deployment. A DBMS can manage the same function effectively. A blockchain-based framework is useful only if there are multiple writers to the distributed ledger.[4]

Studies like [5] propose possible examples where a physician updates data and corre- sponding blocks get updated with new information. The network validating the transaction

subsequently generates a fresh block and pushes the modified information, making it accessible to anybody so inclined. This example was given in terms of doctor information, such as practicing location, credentials, and licensure, but it can be expanded to generate patient profiles and record their health information. [2] proposes a blockchain-based record management system for shar-ing the test results of a patient between different medical institutions.

Operational blockchain-based framework

The same medical tests do not need to be repeated for a patient moving between facilities, as is common at the moment.

Figure 1 shows an example of an operational blockchain-based framework mainly divided into two, those that create the data and those that will access it.
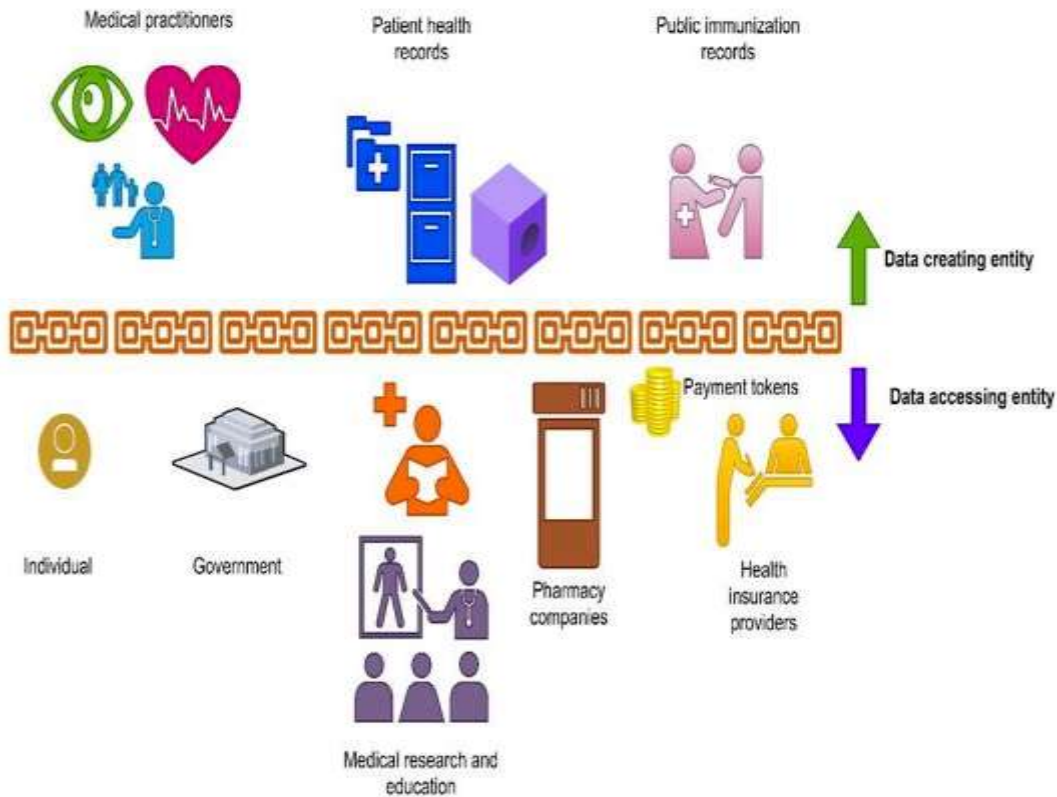
Figure 1. A blockchain-based Healthcare record and data creation and access framework

Medical practitioners and health care providers can create and update records on the blockchain. Depending on the consensus protocol for the blockchain, data can be validated by peers. Some popular consensus protocols are proof-of-work, proof-of-stake, proof-of activity, and proof-of importance.[4][6]

Accelerated research is being conducted in energy and computing power-intensive proto-cols, leading to them being replaced by lightweight blockchain operations such as the one in [7] using Practical Byzantine Fault Tolerance (PBFT) consensus protocol.[8]

Once the validated data is pushed to a block, it can be seen on the blockchain. Thus,wherever a patient

goes, their medical records accompany them. This of course depends
on the scale of the blockchain deployed and whether the new organization is a part of the deployed blockchain or not. However, interconnecting established medical record blockchain frameworks [3] such as an Ethereum based shared network infrastructure, where uses have real-time access to medical data, and MeDShare [9] which is a "*medical data sharing and storage framework in a trustless environment*", can be entirely possible.

When patient medical data is concerned, the legislation mandates a variety of laws to protect patient privacy. As a result of this, the patient data on the blockchain can be assigned identifier values instead of names, thus preserving identity. Patient data can be accessed only through a secure series of numbers or phrases, known only to the individual. This phrase can be used to unlock patient data and match it with patient profiles if and when needed. Upgrades to the framework can also allow the encryption of certain sections allowing increased security for any medical research and insight data.[4][6]

Third-party access to medical records can be allowed in a controlled manner, enabling efficient and secure data sharing at the same time generating income to offset blockchain maintenance costs as well as encourage people to consent to their public profile to be created on the blockchain. For example, agencies to which medical data is valuable and needed such as health insurance providers and big pharma can request access to generic non-identifying patient data and in return pay for it in the form of generated tokens on the blockchain. These tokens can be then distributed to the patients that provide the data as an incentive. This will increase the potential onboarding of new users and continued increase in the amount of data available.

Medical records and data on such frameworks are essentially vast libraries of knowledge. Anonymized medical data can be provided to medical research and educational institutions for further development in medical sciences. Since every person has a personalized record on the distributed ledger, including events of life and death, governments can use it for procedures such as the census, potentially saving money and time resources that would normally be used in doing the same process via other methods.

Systemic reviews of Blockchain in healthcare such as [4] correctly conclude that blockchain use in healthcare is increasing at a steady rate with the possibility of more applications such as medical billing and establishing tracking chains for controlled medicines as well as ensuring safe disposal of bio-hazardous medical waste. There are still issues with blockchain scalability such as energy consumption, token volatil- ity and manipulation that make sectors such as the medical industry wary of adopting it com- pletely. However small-scale deployments of frameworks such as the one proposed in this study may provide enough insight and operational data to one day enable the creation of a global blockchain-supported medical data management system.

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