Chapter 2
Building an IPFS and Blockchain-Based Decentralized Storage Model for Medical Imaging

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ABSTRACT

Currently, sharing and access of medical imaging is a significant element of present healthcare systems, but the existing infrastructure of medical image sharing depends on third-party approval. In this chapter, the authors have proposed a framework in order to provide a decentralized storage model for medical image sharing through IPFS and blockchain technology that remove the hurdle of third-party dependency. In the proposed model, the authors are sharing the imaging and communications in medicine (DICOM) medical images, which consist of various information related to disease, and hence, the framework can be utilized in the real-time application of the healthcare system. Moreover, the framework maintains the feature of immutability, privacy, and availability of information owing to the blockchain-based decentralized storage model. Furthermore, the authors have also discussed how the information can be accessed by the peers in the blockchain network with the help of consensus. To implement the framework, they have used the python ask and anaconda python.

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INTRODUCTION

The blockchain technology is gaining tremendous popularity for their feature of decentralization, immutability, privacy, and availability of data. The underlying technology was first implemented on the Bitcoin financial application in 2009 for asset transaction processing (Nakamoto, 2008). Moreover, the underlying technology is not limited to the financial sector as it is growing with the capabilities which demands by different organizations like medical supply chain, identity management, insurance policy, and other government agencies (R. Kumar, n.d.). Furthermore, the blockchain based storage system is currently straining the existing storage system owing to the feature of decentralization and immutability. The blockchain feature includes the peer-to-peer (P2P) structure in order to provide information sharing platform by using data privacy. Above all, the blockchain maintains the order of transaction record to provide the detailed history of transactions. The blockchain transaction gets recorded on the chain with the cryptographic hash and hence, any attempt of tempering data can be easily detected. The gaining popularity of blockchain technology is becoming the part of information storage including healthcare system, to provide the efficient storage of medical data. The underlying technology moving deeper to data-centric in order to address the breaches of centralized storage. However, the advent of blockchain technology is also facing the challenge to store and manage the large volume of data.

Currently the patients are visiting multiple healthcare providers (doctor) for the consultation or many be transfer from one hospital to another hospital. There must be a secured infrastructure which can ensure the details of patient record and their ailment details. There must be a timestamp with the history that can ensure about who has accessed the patient information at what time. The co-ordination becomes extremely difficult, especially when patients get transferred to other hospital, city, region, or country for the consultant may does not know in advance the about the hospital he/she is coming from and what types of diseases he/she is suffering from. This issue poses the demand of peer-to-peer storage where each peers can coordinate among themselves. Even the consent is provided by the hospital about the transfer of patient, the process is still time consuming, especially if data about patient is sent over the email. There must be an ecosystem which ensures the alliance during the transfer of medical data securely and efficiently(Vwhp, Rq, Iru, & Sulydwh, 2018)(Kim, Lee, Kwon, Kim, & Kim, 2018). To rely on centralized entity for the storage and maintenance of patient data and access control may lead to single point of failure and becomes bottleneck for the complete network(Conference & Systems, 2018). This issue demands for the representation of data in different format and fully trusted structure where information can be shared.