Blockchain-based Secure Storage System for Medical Image Data

A large number of patient images are generated every day in medical applications such as ultrasound, Computer Tomography scans, X-Ray, and so on. Medical data is related to patient privacy and personal rights. Thus, the security and privacy of medical images become an important issue. In order to comply with the regulations of the Personal Data Protection Act, medical images need to be protected under a secure method. Therefore, we proposed a secure storage method for chest X- Ray images from Kaggle based on blockchain technology. We developed a smart contract to control role-based access permissions and authenticate medical images. We performed a cryptographic operation on the X-Ray image after each medical examination and stored the image fingerprint in the blockchain. Artificial intelligence was used to identify pneumonia-related diseases. We compared the required X-Ray retrieval time with the conventional PACS systems. The experimental results showed that the overhead of the proposed scheme using blockchain was only about 5 %.

**Existing Systems:**

Centralized storage: Medical images are stored on servers controlled by healthcare institutions, raising concerns about data breaches and security vulnerabilities.

Cloud storage: Offers scalability and accessibility but still raises privacy concerns due to reliance on third-party providers.

Federated learning: Enables collaborative analysis of medical images without sharing the data itself, improving privacy but requiring significant infrastructure and collaboration.

**Disadvantages of Existing Systems:**

Vulnerability to data breaches and unauthorized access: Centralized storage and cloud solutions are susceptible to cyberattacks and data breaches, compromising patient privacy.

Lack of transparency and control: Patients have limited control over their medical data and often lack transparency into how it is used.

Limited interoperability: Different healthcare institutions often use incompatible systems, making it difficult to share medical images for diagnosis and treatment.

**Proposed Systems:**

Blockchain-based storage: Utilizes the decentralized and secure nature of blockchain technology to store medical image data, offering significant advantages in terms of security, privacy, and interoperability.

**Advantages of Proposed Systems:**

Enhanced security: Blockchain's distributed ledger technology provides a tamper-proof and immutable record of data, preventing unauthorized modifications and protecting against data breaches.

Improved patient privacy: Patients retain control over their data and can choose who has access, ensuring greater privacy and preventing unauthorized data use.

Increased interoperability: Blockchain-based systems offer standardized data formats and protocols, facilitating seamless data exchange between different healthcare institutions and platforms.

Transparency and trust: Patients can track their data's journey and understand how it is being used, fostering trust and transparency in the healthcare system.

**Algorithms used in proposed systems:**

Cryptographic hashing: Ensures data integrity and verifies the authenticity of medical images.

Digital signatures: Guarantee the authenticity of uploaded data and ensure non-repudiation.

Smart contracts: Automate specific tasks related to data access and sharing, improving efficiency and reducing administrative overhead.

Consensus algorithms: Ensure data consistency and prevent unauthorized modifications across the blockchain network.

Challenges of Proposed Systems:

Scalability: Storing large medical images directly on the blockchain can be computationally expensive and limit scalability.

Privacy concerns: While blockchain offers security benefits, ensuring patient privacy requires additional measures like data encryption and access control mechanisms.

Regulation and compliance: Navigating complex healthcare regulations and ensuring compliance with data privacy laws requires careful consideration.

Technical expertise: Implementing and maintaining blockchain-based systems requires specialized technical expertise and resources.

**SYSTEM SPECIFICATION:**

**HARDWARE REQUIREMENTS:**

* **System :** Intel i7
* **Hard Disk :** 1 TB.
* **Monitor** : 14’ Colour Monitor.
* **Mouse :** Optical Mouse.
* **Ram :** 8GB.

**SOFTWARE REQUIREMENTS:**

* **Operating system :** Windows 10.
* **Coding Language :** Python.
* **Front-End :** Html. CSS
* **Designing :** Html,css,javascript.
* **Data Base :** SQLite.

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