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# AROGYAM-A BLOCKCHAIN BASED HEALTH CARE PLATFORM

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Abstract— In today's rapidly evolving healthcare sector, the integration of new technologies and innovations brings increased risks related to medical data security, privacy, and data loss prevention. Blockchain, recognized as one of the most advanced technologies, offers robust protection for data integrity, availability, and confidentiality against various cyber threats. Through the implementation of smart contracts—programmable, self-executing protocols on the blockchain—a secure framework is developed to enhance data protection, safeguard patient privacy, ensure traceability, and provide patients with full control over their health records. The data-sharing mechanisms incorporated into Arogyam and other systems benefit from increased trust and traceability, making healthcare data management more secure and transparent.

**Keywords**: Blockchain, Cyber Security, Storage, Traceability, Arogyam

## INTRODUCTION

The word "arogyam" is a Sanskrit word that means "overall well-being" or "health". It is derived from the word "aroga" which means "absence of disease". The word "roga" comes from the Sanskrit root "ruk" which means "pain".

As Per the survey of Ministry of Healthcare[1-3], The healthcare system in India has consistently been underpaid.The Indian healthcare industry is increasing at an astonishing 22.9% every year. Its current value is over $100 billion, and it is predicted to increase to $ 280 billion by 2020[2]. In India, 75% of clinics, 60% of hospitals, and 80% of physicians are located in metropolitan areas, servicing just 28% of the population. In the meantime, 72% of the population lives in rural regions, where there is a chronic dearth of medical facilities. Many technological standards[4-7] have been proposed to safeguard this data as it is exchanged inside medical settings and outside. Despite the fact that security measures available, The resource-constrained IoT nodes cannot meet their high resource needs in terms of processing power and energy usage.

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Related Work and literature survey

In this section, we gave a study of different in-depth cutting-edge and classic blockchain-based RPM systems.Blockchain is being used in a variety of industries, including banking, finance, and healthcare. We concentrated on the Healthcare domain.

Sabri Barbaria et al. [7] highlight the increasing risks to patient privacy and medical data security. To counter these emerging cyber threats, healthcare organizations must prioritize strategies that prevent rapidly evolving cyberattacks. A key focus should be on enhancing patient rights and consent management through robust cybersecurity measures. Blockchain technology, recognized for its advanced capabilities, offers strong protection for data integrity, availability, and privacy against various cyber threats.

Yan Zhuang et al. [8] discuss the significant benefits of Health Information Exchange (HIE) in improving patient care, including enhanced treatment quality and faster coordinated care.This study addresses these issues by leveraging blockchain technology, known for its secure, tamper-proof distributed ledger. Additionally, a graphical user interface was developed to enhance user interaction with the blockchain system, supported by dual-layer security.

Abdullah Al Mamun et al. [9] highlight the risks associated with electronic health records (EHRs), which are commonly shared among healthcare stakeholders but are vulnerable to misuse, outages, privacy breaches, and security issues. This technology addresses EHR management challenges by providing a secure, decentralized platform for data exchange. A Review was conducted to analyze and evaluate studies that propose or implement blockchain-based EHR management systems.

Jigna Hathaliya et al. [10] This System allows healthcare providers to access real-time patient data remotely via wireless communication, reducing both the time and costs associated with in-person visits while ensuring high-quality care.

Filippos Pelekoudas Oikonomou et al. [11] emphasize the significant impact of IoT technology on healthcare. However, these systems face security challenges due to their high demands for processing power and energy, which traditional security methods cannot meet. To address this, the authors propose a blockchain-based security solution built on the Hyperledger Fabric platform. This decentralized and autonomous architecture strengthens the security of IoT-based health monitoring systems, mitigating the risks posed by conventional security methods.

Seyednima Khezr et al. [12] explore the transformative potential of blockchain technology across various sectors, including healthcare. Blockchain, with its decentralized structure and trust-preserving capabilities, has prompted researchers to explore innovative applications in diverse industries. The study provides a comprehensive review of blockchain's rapid evolution and its potential to revolutionize healthcare. The authors highlight key research challenges and emerging opportunities, emphasizing how blockchain's continued development could reshape the healthcare sector.

Abid Haleem et al. [13] discuss how blockchain technology is being leveraged to create innovative solutions across various sectors, including healthcare. Its ability to detect critical errors, including potentially life-threatening ones, enhances both the security and accuracy of medical data sharing. By adopting blockchain, healthcare institutions can improve data analysis

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and operational efficiency. Additionally, the study highlights 14 significant blockchain applications in healthcare, including its role in preventing clinical trial fraud and improving data management efficiency.

Rim Ben Fekih et al. [14] provide a comprehensive overview of blockchain's growing role in various industries, including finance, government, energy, and healthcare. Their paper focuses on the rapid evolution of blockchain in healthcare, exploring current use cases such as electronic medical data sharing, remote patient monitoring, and the pharmaceutical supply chain. The authors also identify the limitations of existing approaches and discuss unresolved research challenges. Finally, they outline areas for future research, emphasizing the potential for further advancements and innovation in blockchain-based healthcare solutions.

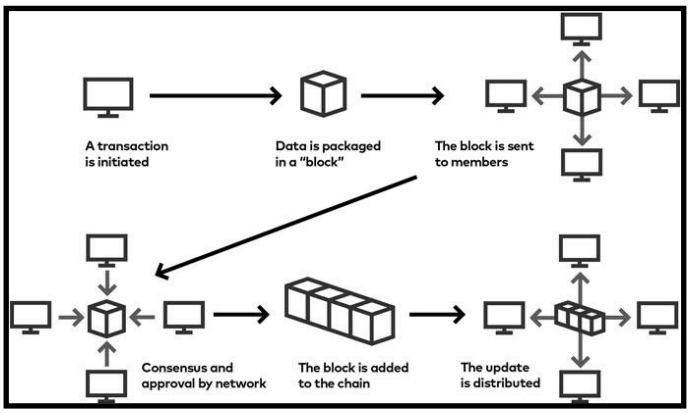


Fig 2.1: Describes the general working of blockchain system

2.1 **Open Blockchain :** Blockchain technology is designed to be resistant to data tampering. It functions as an open, decentralized ledger that efficiently, verifiably, and permanently records transactions between parties. Transactions are grouped into blocks, each of which is hashed and organized into a Merkle tree. Every block includes the cryptographic hash of the preceding block, creating a continuous chain that ensures the integrity of all previous blocks, starting from the genesis block. This structure enables a secure and transparent system where no central authority controls the data or transactions. Due to its benefits in secure remote data storage and generating audit trails, blockchain is widely used across various industries.

2.2 **Closed Blockchain:** A private blockchain operates within a closed network where only authorized individuals can access and participate. Administrators have the ability to modify transactions as needed. Unlike public blockchains, permissioned blockchains are managed by identifiable entities, often forming consortium blockchains. In these networks, a group of stakeholders from a particular industry collaborates to maintain and control the blockchain, ensuring secure and regulated access.

2.3 **Cryptography:** Blockchains utilize two primary types of cryptographic algorithms: asymmetric-key algorithms and hash functions. Hash functions ensure that all participants have a consistent view of the blockchain.

Proposed System

After doing the survey of existing systems [7]-[14] for storing and sharing of medical data we proposed "**Arogyam ".** In this system Patients can access their data using a private key,

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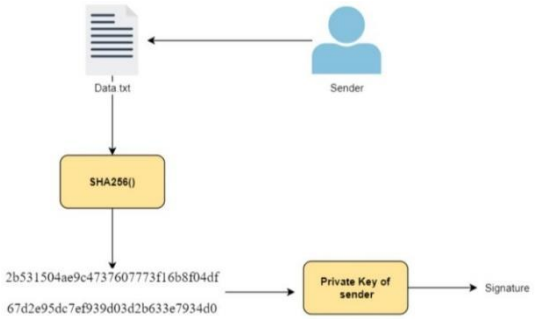
ensuring that even if the database is compromised, the data remains unreadable. Given the sensitive nature of healthcare data, it is essential to safeguard it from unauthorized access. Patients will have full control over who can view their medical records and what specific information they can access. Medical data can be transferred instantly, with all members of the distributed healthcare network having access to the same up-to-date patient records .Both patients and doctors can access lab data at any time and from anywhere, provided they have the necessary authentication.

Algorithm

The Algorithms used in the systems are as follows:

1. SHA 256 algorithm

SHA-256, a cryptographic hashing algorithm, is widely used in blockchain systems. It takes an input of varying length and generates a fixed 256-bit hash output. This algorithm is a key component in blockchains like Bitcoin, Bitcoin Cash, and Bitcoin SV.




SHA-256 is an ideal choice for blockchain due to its security and reliability. Some key features that make it particularly well-suited for this purpose include Preimage Resistance, In the case of Bitcoin's proof of work, this ensures that miners cannot predict the nonce by reversing the hash; instead, they must rely on brute force, ensuring the integrity of the process.

Modules

- **System Admin:** Admin will be responsible for getting the user logged in to the website and for creation of the key.
- **User/Patient:** User is going to login into the website by entering the correct credentials and he/she is responsible for creating the block which is used for storing and transacting the medical history.
- **Doctor:** The third person entity who is going to access the data stored in the block and can perform the operation of adding new data into the block.
- **Pathologist:** On the recommendation of the doctor, pathologists will perform the test(HBA1C, HIV,CBC, Ferritin) and add their reports to the block.
- **Radiologist:** On the recommendation of the doctor, Radiologist will perform the SCAN's (CT Scan, MRI's, XRays,2D Echo, Sonography, Cardiogram, etc ) and add their photocopies can be added in the system.

**VII. Applications of Blockchain In Healthcare**

"Blockchain technology has a wide range of uses across multiple industries, transforming conventional processes with its decentralized, secure, and transparent features. In the financial

sector, blockchain supports cryptocurrencies such as Bitcoin and Ethereum, enabling efficient peer-to-peer transactions without relying on intermediaries. It also facilitates smart contracts, which automate agreements and promote trust between participants. In supply chain management, blockchain enhances traceability by documenting every stage of a product's lifecycle, improving transparency and reducing fraud. The healthcare industry leverages blockchain to protect patient records, maintain data accuracy, and simplify the sharing of medical information among stakeholders. Blockchain is also revolutionizing voting systems by providing tamper-resistant digital ledgers that ensure transparency and minimize election fraud. Furthermore, it aids in protecting intellectual property, managing decentralized identities, and enabling renewable energy trading, demonstrating its capacity to innovate and disrupt traditional systems across various fields.

Conclusion

The main focus is on making healthcare industry decentralized, distributed, tampered proof. This Paper discusses the issues in healthcare and performs the study of various solutions to healthcare. Thereafter the requirements to develop a blockchain based healthcare system is discussed, various representations and details are discussed in the System Architecture, further advantages, limitations and applications of the proposed system are discussed.

RESULTS

A blockchain-driven healthcare system provides innovative solutions by improving security, transparency, and efficiency in managing medical data. It secures patient records through decentralized, tamper-resistant ledgers, minimizing risks of data breaches and unauthorized access. The system facilitates real-time sharing of medical information among healthcare providers, enabling better collaboration and enhancing patient care. Blockchain maintains data accuracy by verifying and time-stamping every transaction or update, creating a transparent and traceable record. Patients gain more control over their health information, allowing them to manage access to their data as needed. Additionally, blockchain supports medical research by enabling the secure sharing of anonymized data, promoting discoveries while safeguarding privacy. Administrative tasks, such as billing and insurance claims, are streamlined through automated smart contracts, reducing errors, fraud, and processing delays. Overall, this technology fosters trust, boosts efficiency, and drives innovation in the healthcare sector.

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