International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Enhancing Security and Efficiency Through Role-Based Access Control in Modern Systems

Lavanya K N[1], Janakiraman S[2]

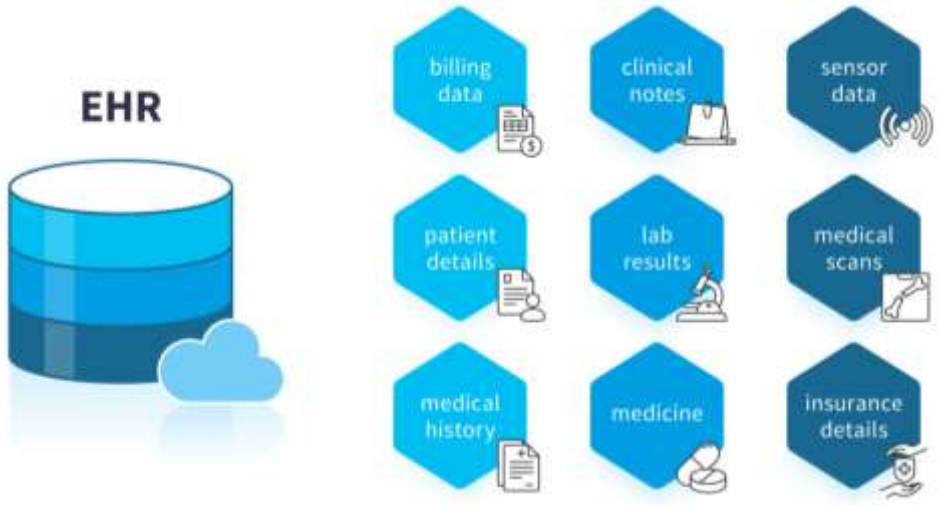
[1]Student-II MCA, Master of Computer Applications, Er. Perumal Manimekalai College of Engineering, Hosur.
[2]Assistant Professor, Master of Computer Applications, Er. Perumal Manimekalai College of Engineering, Hosur.

Abstract
Ensuring that sensitive data is secure and accessible at all times is very important, especially in healthcare systems. In this research, HealthChain is proposed, a secure system that uses RBAC, combines ABE with blockchain technology and helps manage electronic health records (EHRs) by decentralization. Defining people's roles as static and lacking strong audit controls are problems with conventional access control models that make them inefficient and easy to exploit. To address the issues above, HealthChain uses dynamic access control which ensures access is given according to who uses the system and what they are doing right now. Because of blockchain, logging remains unalterable, contracts are managed automatically by smarts and cloud services make it possible to enhance data handling. According to comparisons, using this hybrid strategy supports stronger data privacy, better operations and compliance with laws such as HIPAA and GDPR.

Keywords: Role-Based Access Control, Blockchain, Attribute-Based Encryption, HealthChain, Electronic Health Records

1. Introduction

The healthcare and many other sectors need access control systems to be secure, efficient and flexible, given how sensitive healthcare data is. Private patient information is held in EHRs and must be kept secure from those who are not cleared to view it, while at the same time being accessible by necessary healthcare personnel. DAC and MAC, traditional ways of access control, are not well-suited for environments that change and involve people cooperating. RBAC solves the problem by giving access according to the user's role. It describes Health Chain, a hybrid system that uses RBAC, block chain and ABE to improve security and the way EHR access is managed.



2. Literature Review

Researchers have developed many ideas for safe sharing of data. VigilRx offered a prescription management system that uses blockchain for openness and easy working with other systems. DSAS introduced a framework for searchable encryption that lets you look for data by the attributes you need. MedChain used blockchain to keep records safe, but it did not offer the right tools for controlling access. We have extended these methods by including RBAC, BP-ABE and smart contracts to create an access system that is both safe and flexible in many healthcare environments.

3. System Overview

Health Chain features cloud storage, a block chain record, smart contract automation and attribute-aware key management. Roles are given to users (for example, doctor, nurse, patient, etc.) and ABE trees are used to set their access rules. A user can only get access to data when their attributes conform to the policy rules. As a result, roles play less of a part, since access checks are done automatically with proof through cryptography and smart contracts.

4. Existing System Limitations

Normally, the policies and role management are set manually and do not adjust automatically, so they may be inaccurate and have limits on growth. Because of this lack of control such programs typically provide more privileges than required, making security gaps possible. Centralized audit trails make them vulnerable to anyone who wants to change them. Unlike existing ones, our system tackles this by providing support for decentralized logs, policy enforcement done automatically and making access choices based on attributes.

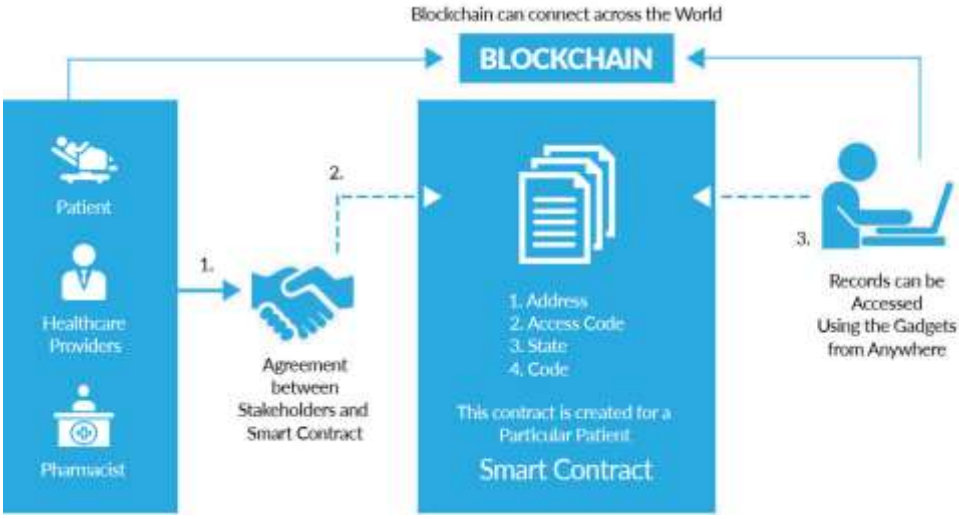
5. Proposed System: HealthChain

Data in HealthChain are protected with BP-ABE so that the access structures are included in the ciphertext. The data, user details and access rules are all recorded on a consortium blockchain by the system. Smart contracts handle the functions of signing up, distributing keys, logging use and cancelling keys. Patients are able to set who can see their information and under what terms. Only when both sides' blockchain credentials meet the policy requirements can data be securely and auditably exchanged.

6. System Modules

The architecture includes:

1. Health Chain Cloud – stores medical data securely and deals with secure search requests.
2. Keys are issued by the Key Generation Centre after confirming the attributes of the user.
3. Patient Portal is where you can add and control data upload and access policies.
4. Doctor/nurse tools allow users to send data security requests and access decrypted information.
5. Smart Contracts – ensure access policies are automatically followed and keep a logged record on the block chain.



7. Algorithm Summary

BP-ABE involves four primary operations:

- **Setup:** Initializes the system parameters and generates the master key.
- **KeyGen:** Issues private keys to users based on their attribute set.
- **Encrypt:** Encrypts data with an access tree policy. Only users whose attributes satisfy the tree can decrypt.
- **Decrypt:** Uses user attributes and keys to recover the original data if policy conditions are met.

8. Results & Discussion

It has been observed in simulations that HealthChain keeps data secure and lets users access only what they are allowed to, quickly. Each action on the blockchain is recorded which ensures accountability and smart contracts control policies without relying on servers. Performance tests proved that many users can be added and response times remain fast for real-time access of health information.

9. Conclusion

By teaming up RBAC, ABE and blockchain, HealthChain helps protect and streamline the use of electronic health records. With it, sensitive medical data is shared securely and patients maintain control while matching regulatory rules. Future work includes extending this model to multi-cloud architectures and integrating biometric authentication.

References

1. Alixandra Taylor, Austin Kugler, "VigilRx: A Scalable and Interoperable Prescription Management System Using Blockchain", IEEE Access, 2022, 10, 3156015.
2. Linlin Xue, "DSAS: A Secure Data Sharing and Authorized Searchable Framework for e-Healthcare System", IEEE Access, 2022, 10, 3153120.
3. Xiaoqing Li et al., "MedChain: Efficient Healthcare Data Sharing via Blockchain", Future Generation Computer Systems, 2021, 124, 230–245.