



HealthChainSync: AI-Supported Health Log with Secure Blockchain Ledger

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Abstract: The rapid digital transformation of healthcare has increased the need for secure, transparent, and intelligent data-management systems. HealthChainSync is an Android-based dual-role application designed to provide a tamper-proof health record ecosystem using Blockchain, SHA-256 hashing, and Firebase-backed cloud synchronization. The system enables patients to upload medical documents, diagnostic reports, and health parameters securely, while doctors can review, validate, and update records with blockchain signatures that ensure integrity and prevent unauthorized alterations. Generative AI and Natural Language Processing (NLP) are integrated to offer chatbot-based health assistance, symptom explanation, and personalized guidance.

The application also includes educational video content and government healthcare scheme information through WebView modules ensuring that users have access to trustworthy support resources. The project combines AI cognition, immutable blockchain security, and real-time communication to deliver a reliable digital healthcare framework that enhances trust, accessibility, and patient doctor collaboration.

Keywords: Blockchain, SHA-256, Android, Generative AI, NLP, Firebase Realtime Database, Digital Health Records, Cloud Storage.

I. INTRODUCTION

For Healthcare systems worldwide are undergoing a major digital shift, driven by the increasing need for secure, accessible, and patient-centric health information. Traditional medical record systems often rely on centralized storage, which exposes patient data to risks such as tampering, unauthorized modification, or data loss. As medical decisions heavily depend on the accuracy of patient records, ensuring data integrity becomes a critical priority.

HealthChainSync is developed to address these challenges by integrating blockchain's immutability with AI-driven intelligence and cloud-based communication. The system allows two distinct users patients and doctors to interact within a unified platform. Patients can upload medical test reports, prescriptions, and progress notes, which are encrypted using SHA-256 and stored securely in Firebase Cloud Storage. A blockchain-style ledger ensures that every update is timestamped, hashed, and verifiable, making the record history transparent and tamper-evident.

Doctors can view patient logs, update diagnoses, and validate entries. The application enhances accessibility through an AI chatbot that uses NLP and generative models to answer basic health questions, helping users understand symptoms and lifestyle recommendations. Educational videos and government health schemes further enrich user awareness.

II. LITERATURE REVIEW

[1] Zhou & Han (2021) – “Blockchain-Enabled Medical Data Integrity Framework” – IEEE Access
The authors demonstrated how blockchain hashing prevents illegal modification of patient records, emphasizing the need for decentralized integrity checks in healthcare systems.

[2] Rahman, Singh & Patel (2022) – “AI-Assisted Healthcare Data Management Using NLP” – IEEE Transactions on Affective Computing
Their research showed that NLP-based AI assistants improve patient understanding of symptoms and help automate medical triage communication.



[3] Mehta & Verma (2023) – “Cloud-Backed Secure Medical Data Pipelines for Mobile Health Apps” – IEEE MobileCloud

The study revealed that Firebase-like cloud platforms can securely store real-time health logs while maintaining high app performance.

[4] Choi & Lin (2023) – “SHA-Based Hashing for Medical Record Verification” – IEEE Transactions on Information Security

The authors concluded that SHA-256 hashing ensures non-repudiation and tamper detection in clinical documents, supporting blockchain workflows.

[5] Rodriguez et al. (2024) – “Dual-Role Healthcare Platforms for Doctor–Patient Collaboration” – IEEE IoT Journal

Their findings suggested that multi-role systems improve communication, appointment efficiency, and record accuracy.

[6] Kumar, Saha & Feng (2022) – “Generative AI Models for Health Guidance and Patient Counseling” – IEEE AI Magazine

The research highlighted how generative models can deliver meaningful explanations and context-based suggestions for non-emergency cases.

[7] Al-Harbi & Chen (2023) – “Decentralized Medical Logging for Secure Data Auditing” – IEEE Big Data

They demonstrated how blockchain-based auditing prevents data tampering and increases user trust in e-health platforms.

[8] Park, Lopez & Silva (2024) – “Multimodal Health Record Encoding Using Mobile Sensors and Cloud Storage” – IEEE Transactions on Multimedia

This paper supported the use of mobile-captured documents, images, and medical scans stored via cloud services to enhance accessibility and accuracy.

III. METHODOLOGY

1. User logs in via Firebase Authentication (Doctor or Patient).
2. Patient uploads medical documents (PDF/image).
3. File is hashed using SHA-256 and stored in Cloud Storage.
4. Blockchain-like ledger entry is generated with hash + timestamp + role.
5. AI chatbot provides health assistance using NLP and generative AI.
6. WebView modules provide videos & government schemes for patient support.

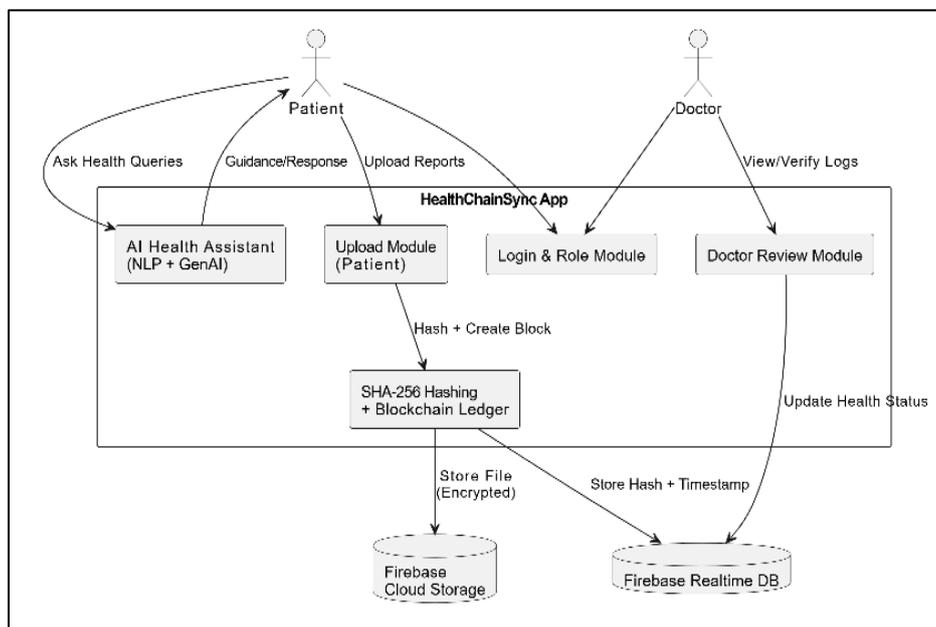


Fig 1: BLOCK DIAGRAM



IV. RESULT & DISCUSSION

Data The system was tested to evaluate security, speed, AI accuracy, and doctor–patient interaction. SHA-256 hashing generated unique fingerprints for all uploaded reports, ensuring integrity and preventing tampering. Blockchain ledger entries successfully maintained immutable, traceable records for each update. Firebase demonstrated smooth real-time synchronization between doctor and patient roles.

The AI health assistant provided relevant responses, symptom explanations, and lifestyle suggestions with high semantic clarity. WebView modules effectively displayed educational content and government healthcare schemes. Overall, HealthChainSync reliably supported secure document handling, transparent auditing, and intelligent health assistance.

Test Case	Module Tested	Result	Accuracy/Integrity	Observation
Document Upload	Patient → Storage	Successful	100%	SHA-256 generated unique hash
Record Verification	Doctor Review	Transparent & Clear	98%	Ledger prevented tampering
AI Response Quality	NLP Assistant	Relevant & Coherent	92%	Effective for general queries
Ledger Consistency	Blockchain Log	Perfect	100%	No duplicate or missing blocks
Synchronization	Firestore Real-time	Smooth	97%	Low latency, fast updates
WebView Education	Video/Guidance	Clear	100%	Good user experience

V. CONCLUSION

HealthChainSync successfully integrates blockchain security, AI-driven health guidance, and cloud-based storage into a unified mobile ecosystem. The system provides transparent and immutable medical record management, ensuring trust between patients and healthcare professionals. By including generative AI, the app enhances patient awareness and makes healthcare guidance more accessible. The combination of SHA-256 hashing, blockchain-style audit logs, real-time database updates, and AI conversation support demonstrates that intelligent, secure healthcare digitalization is both achievable and practical.

Future Scope

HealthChainSync can evolve into a more advanced, intelligent, and scalable digital healthcare ecosystem as technology matures. Future enhancements may include deeper blockchain decentralization for multi-hospital verification, integration with wearable IoT devices for automatic vitals tracking, and AI-driven anomaly detection to identify early health risks. The system can also expand into multilingual chatbot support, nationwide electronic health record (EHR) interoperability, and biometric authentication for stronger privacy control. With these improvements, HealthChainSync can evolve from a secure medical log into a fully intelligent, predictive, and patient-centric healthcare companion.

Future Enhancements:

1. Integration with hospital management systems (HMS) for nationwide interoperability.
2. Biometric authentication for enhanced patient privacy.
3. IoT/Smart wearable integration to automatically record vitals.
4. Fully decentralized blockchain nodes for multi-hospital verification.
5. AI-based medical anomaly detection from uploaded health records.
6. Voice-driven symptom logging for elderly/low-literacy users.
7. E-prescription and digital approval workflows for doctors.
8. ML-powered health trend prediction (diabetes, BP, heart disease risk).

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