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CardioShield AI: A Smart Blockchain-Enabled System for Early Heart Disease Detection and Secure Telemedicine

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Abstract:

The artificial intelligence and blockchain-powered intelligent healthcare system is designed to improve the quality of early detection of heart diseases, improve the safety of medical records, and allow remote access to healthcare. The model is based on a decision tree classifier to examine the health parameters of the patients and predict cardiovascular risk. A blockchain-inspired ledger secures the prediction output through SHA-256 hashing and chaining, providing tamper-evident medical record storage. The presence of a combined telemedicine unit will allow patients and doctors to communicate with each other remotely via report access and consultations. The experimental results demonstrate the model's satisfaction and the system's suitability for use in a multi-user environment. The system proposed is more secure, transparent, and accessible than the traditional healthcare platforms.

Index Terms-

Smart Healthcare, Artificial Intelligence, Blockchain, Heart Disease Prediction, Decision Tree, Telemedicine, Secure Medical Records.

INTRODUCTION:

Most of the developing areas have healthcare systems that are characterized by delays in diagnosing conditions, poor records and access to specialist care. Most hospital management systems are based on centralized databases, which can be hacked, coerced or hit by a single point of failure. Besides, Heart disease is one of the leading causes of mortality in the world, and it is therefore important to have a quick diagnosis. There is a good potential in predictive analytics of healthcare using Artificial Intelligence (AI). Machine learning models are made to examine the characteristics of the patients, including age, cholesterol level, blood pressure and the type of chest pains, to predict the risk of disease. Nevertheless, prediction will not be sufficient when medical records lack security and verifiability. The cryptographic hashing and distributed records offer blockchain technology immutability and transparency. This project will result in an integrated smart health care ecosystem by combining AI-based prediction, blockchain-style secure storage, and telemedicine functionality.

LITERATURE SURVEY

Several studies use machine learning models, including logistic regression, Support Vector Machines, and Decision Trees, on data related to heart disease, like the UCI Cleveland data. The techniques are moderately predictive but, in most cases, may not be able to take into consideration medical record security. Healthcare blockchain applications are aimed at protected storage and decentralized access

control. Nonetheless, the majority of blockchain systems are achieved without AI-powered analytics. Telemedicine systems increase accessibility, although they mostly depend on central storage systems. The gap in the research is the integration of AI-based predictive analytics, a blockchain-ensured integrity of medical records, and an Internet-based telemedicine platform into a single architecture.

SYSTEM ARCHITECTURE

The system follows a three-layer architecture.

A. Presentation Layer

It was built in React.js and TypeScript and offers patient, doctor, and administrator role-based dashboards.

B. Application Layer

Functioning on Flask back-end API controls of AI prediction processing, authentication, ledger hash creation, and telemedicine processes.

C. Data Layer

Patient information and prediction history are stored in PostgreSQL. A table of ledger is of the blockchain fashion, where the hash of the data is made using SHA-256, which builds a secure hash chain to maintain the data integrity.

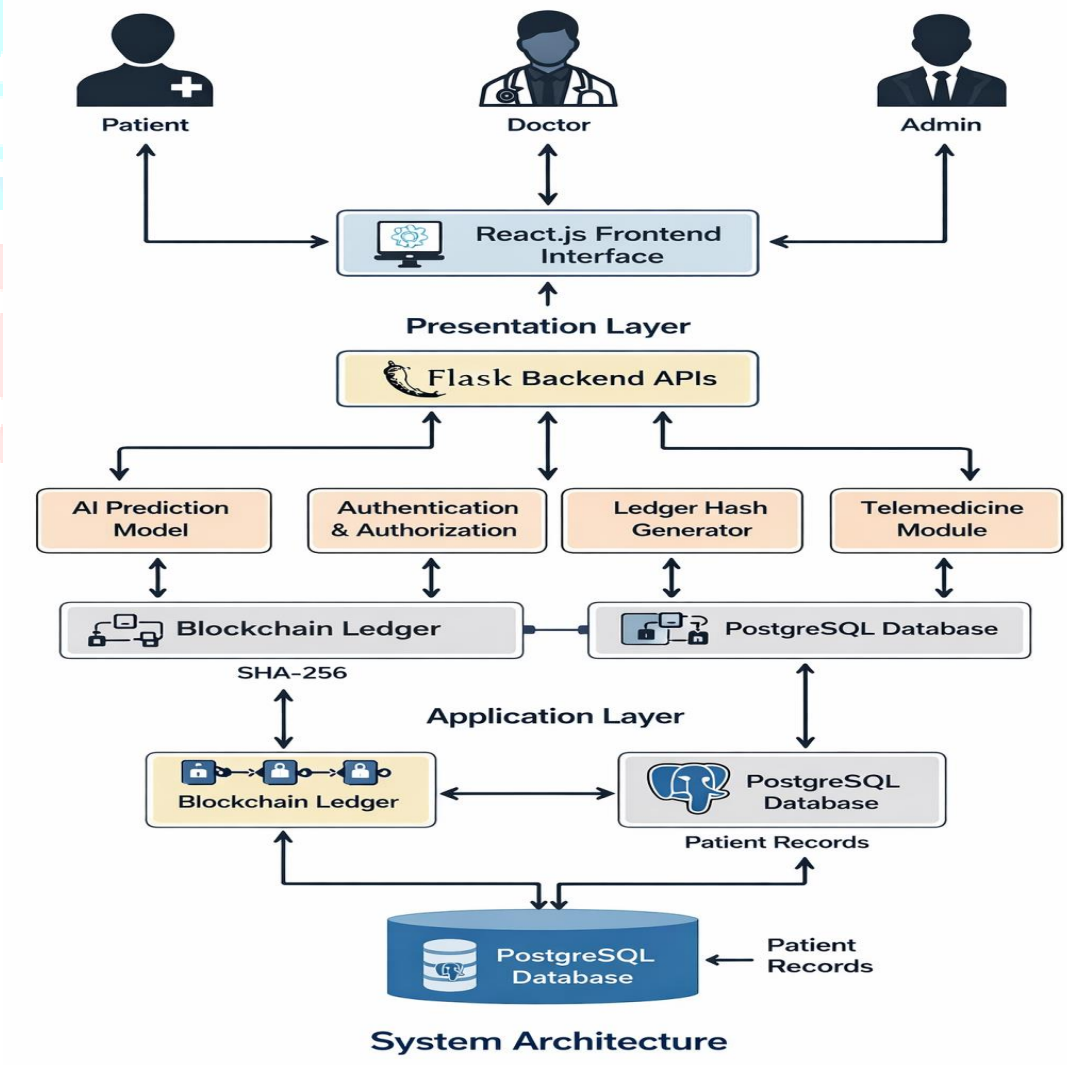


Fig. 1. Three-level system execution of clinical input to secure blockchain-based storage data flow

METHODOLOGY

A. Dataset and Preprocessing

The UCI Cleveland Heart Disease dataset is the dataset that will be used. Data preprocessing consists of managing the missing values, feature encoding, normalisation, and an 80:20 train-test split.

B. Decision Tree Model

Scikit-learn is used to train a Decision Tree classifier. As the splitting criterion, the Gini index is added. The model is trained to learn decision rules that will be used to classify the patients as either disease or no-disease cases.

C. Blockchain Ledger Mechanism

After prediction:

1) Report details are concatenated.
2) SHA-256 hash is generated.
3) The previous hash is appended.
4) Ledger entry is stored in the database.
5) This guarantees tamper-evident record storage.

D. Telemedicine Workflow

The patients can review reports, download QR codes, and consult. Doctors are able to retrieve reports on the patient, check their integrity by comparing hashes, and add clinical notes.

IMPLEMENTATION

A. Technologies Used

The implementation uses Python with Flask for REST APIs, React.js for the dynamic frontend, PostgreSQL for persistent storage, Scikit-learn for machine learning, and SHA-256 cryptographic hashing for security.

B. Algorithm Steps

The workflow begins with loading and preprocessing the dataset. The Decision Tree model is trained and deployed. Upon receiving patient input, the system predicts disease risk, generates a SHA-256 hash linked to the previous record, stores the ledger entry, and displays the result with QR verification.

RESULTS AND PERFORMANCE ANALYSIS

A. Performance Metrics

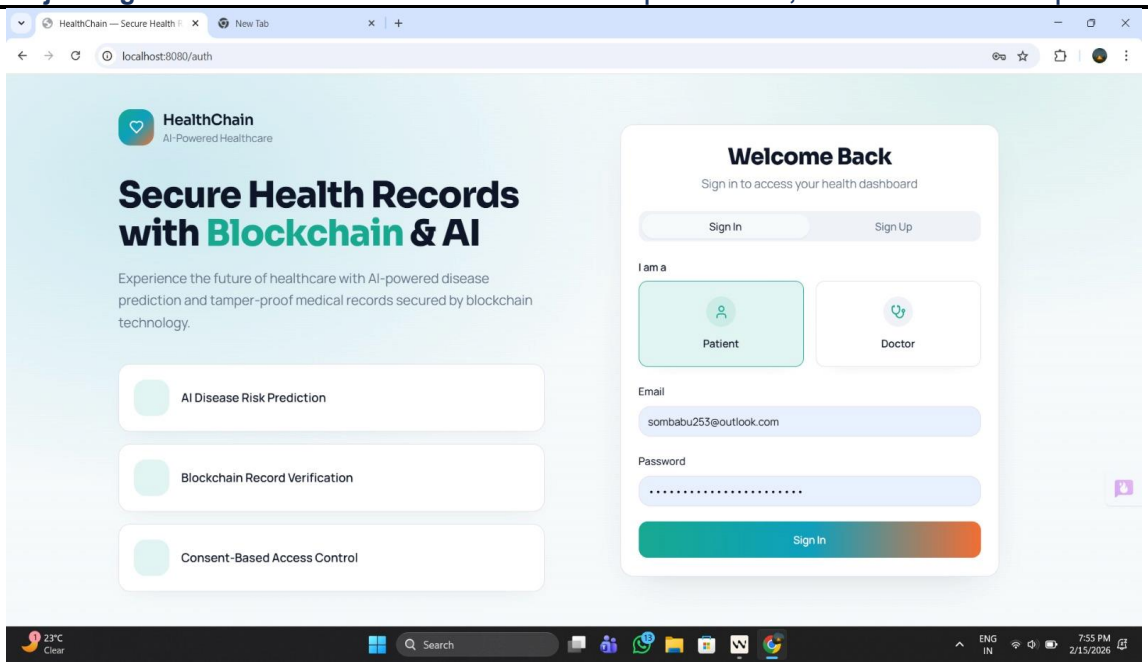
The Decision Tree model achieved acceptable accuracy, precision, recall, and F1-score on the test dataset.

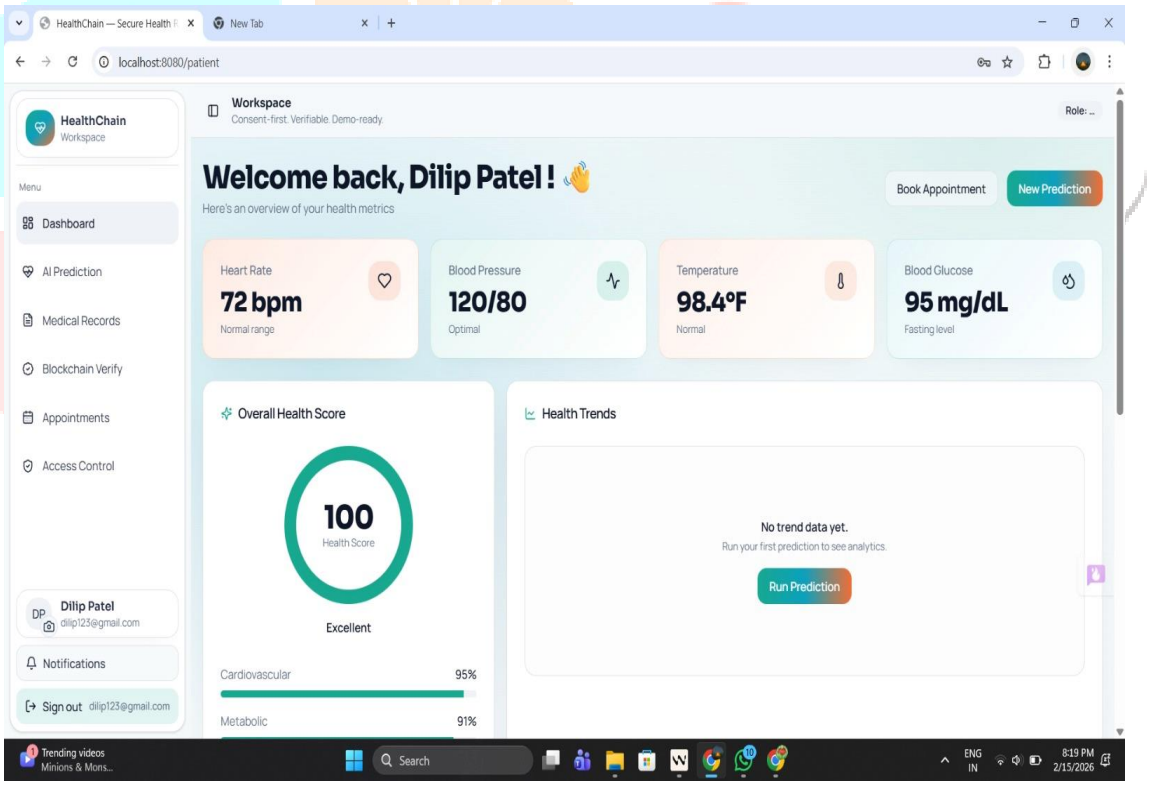
B. Confusion Matrix Analysis

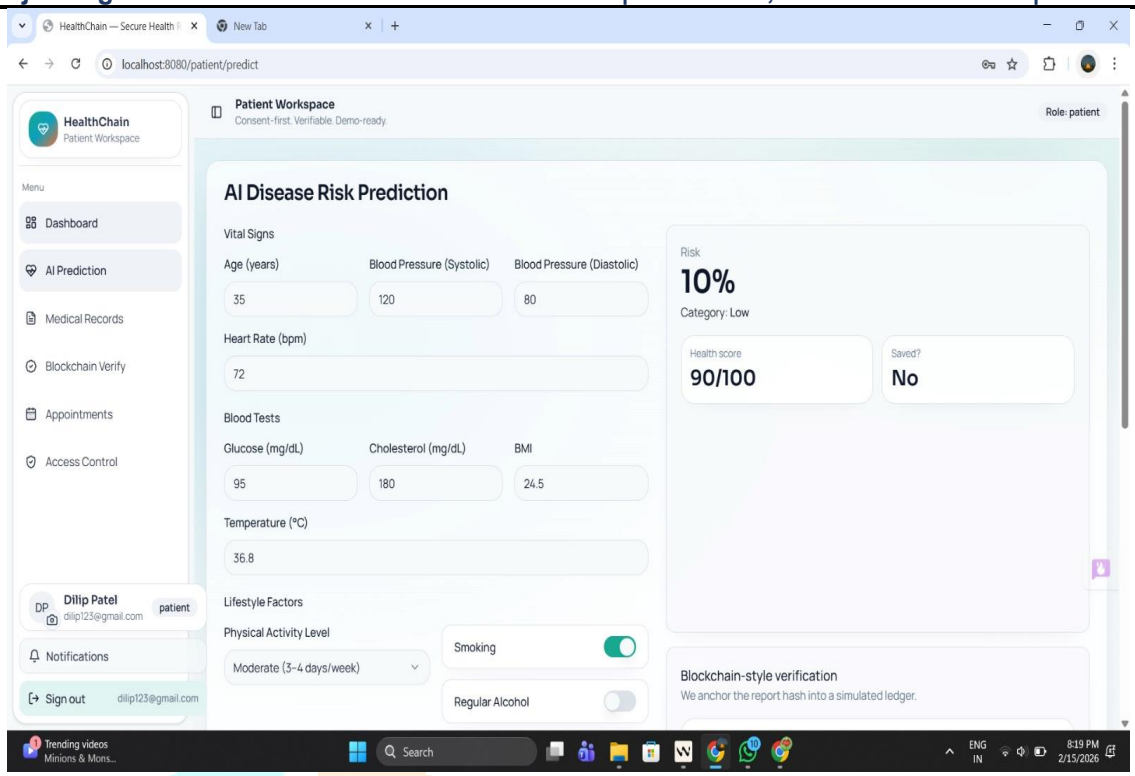
The confusion matrix indicates that the results are correctly classified in positive and negative cases. A prototype healthcare system can tolerate false positives and false negatives.

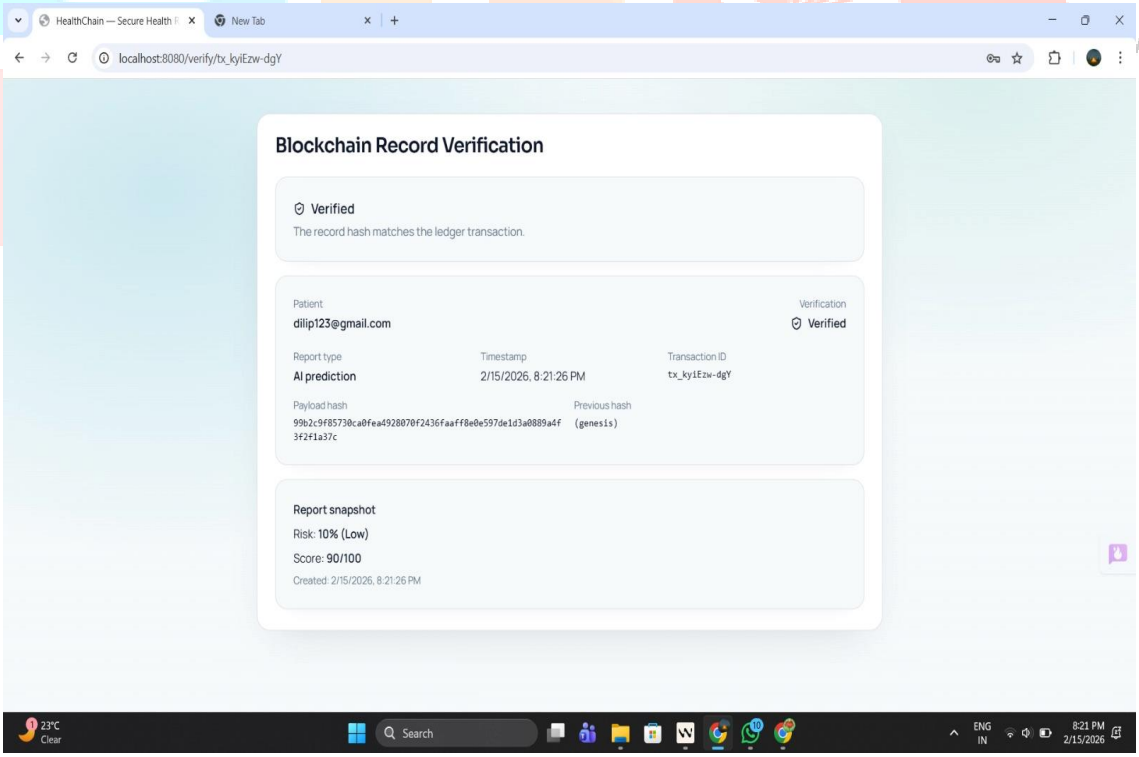
C. System Performance

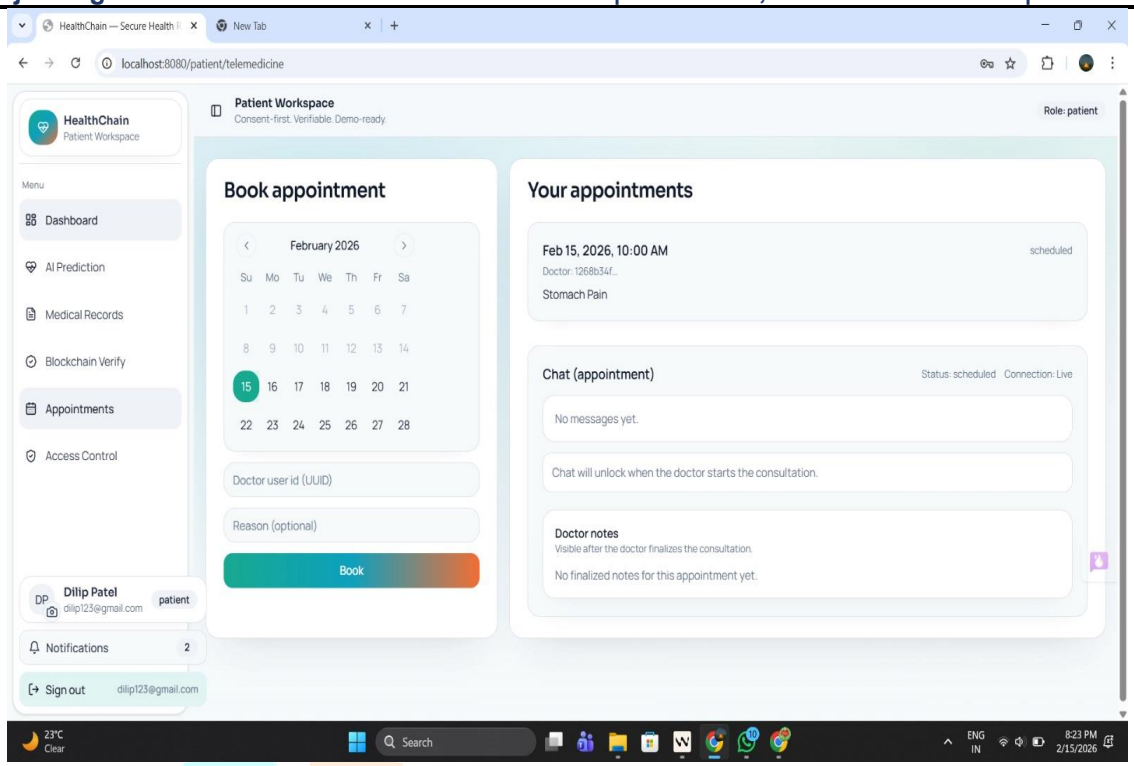
They had system benchmarks of an average prediction and ledger generation time of less than 2 seconds and less than 1 seconds respectively. The system was stable when tested under the conditions of multiple users.


HealthChain
AI-Powered Healthcare
Secure Health Records with Blockchain & AI
Experience the future of healthcare with AI-powered disease prediction and tamper-proof medical records secured by blockchain technology.
AI Disease Risk Prediction
Blockchain Record Verification
Consent-Based Access Control
Welcome Back
Sign in to access your health dashboard
Sign In
Sign Up
I am a
Patient
Doctor
Email
sombabu253@outlook.com
Password
Sign In


HealthChain
Workspace
Menu
Dashboard
AI Prediction
Medical Records
Blockchain Verify
Appointments
Access Control
Dilip Patel
dilip123@gmail.com
Notifications
Sign out
Workspace
Consent-first. Verifiable. Demo-ready.
Welcome back, Dilip Patel !
Here's an overview of your health metrics
Book Appointment
New Prediction
Heart Rate
72 bpm
Normal range
Blood Pressure
120/80
Optimal
Temperature
98.4°F
Normal
Blood Glucose
95 mg/dL
Fasting level
Overall Health Score
100
Health Score
Excellent
Cardiovascular 95%
Metabolic 91%
Health Trends
No trend data yet.
Run your first prediction to see analytics.
Run Prediction


HealthChain — Secure Health
New Tab
localhost:8080/patient/predict
HealthChain
Patient Workspace
Patient Workspace
Consent-first. Verifiable. Demo-ready.
Role: patient
Menu
Dashboard
AI Prediction
Medical Records
Blockchain Verify
Appointments
Access Control
Dilip Patel
dilip123@gmail.com
patient
Notifications
Sign out
dilip123@gmail.com
AI Disease Risk Prediction
Vital Signs
Age (years)
35
Blood Pressure (Systolic)
120
Blood Pressure (Diastolic)
80
Heart Rate (bpm)
72
Blood Tests
Glucose (mg/dL)
95
Cholesterol (mg/dL)
180
BMI
24.5
Temperature (°C)
36.8
Lifestyle Factors
Physical Activity Level
Moderate (3-4 days/week)
Smoking
Regular Alcohol
Risk
10%
Category: Low
Health score
90/100
Saved?
No
Blockchain-style verification
We anchor the report hash into a simulated ledger.
Search
ENG
IN
8:19 PM
2/15/2026


HealthChain — Secure Health
New Tab
localhost:8080/verify/tx_kyiEzw-dgY
Blockchain Record Verification
Verified
The record hash matches the ledger transaction.
Patient
dilip123@gmail.com
Verification
Verified
Report type
AI prediction
Timestamp
2/15/2026, 8:21:26 PM
Transaction ID
tx_kyiEzw-dgY
Payload hash
99b2c9f85730ca0fea4928070f2436faaff8e0e597de1d3a0889a4f3f2f1a37c
Previous hash
(genesis)
Report snapshot
Risk: 10% (Low)
Score: 90/100
Created: 2/15/2026, 8:21:26 PM
23°C
Clear
Search
ENG
IN
8:21 PM
2/15/2026



COMPARATIVE ANALYSIS

This section compares the proposed Smart Healthcare System with traditional healthcare systems in terms of prediction capability, data security, verification mechanism, accessibility, and transparency.

COMPARISON OF EXISTING AND PROPOSED SYSTEMS

Feature	Existing	Proposed
Prediction	Basic ML	Decision Tree
Data Security	Central DB	Hash-chained Ledger
Verification	Limited	QR-based
Accessibility	Physical Visits	Telemedicine
Transparency	Low	Ledger Tracking

FUTURE SCOPE

Among the future enhancements, it is proposed to use larger datasets and deep learning models, full permissioned blockchain integration, live video consultation, and hospital management system integration.

CONCLUSION

Smart Healthcare System is an effective implementation of AI-based prediction of heart diseases and blockchain-style management of medical records. The classifier named Decision Tree is useful for early diagnosis; a hash-chained ledger helps to ensure tamper-evident storage. Telemedicine is more accessible and offers a safe, transparent alternative to traditional platforms.

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