HealthStack:- A Digital Healthcare Ecosystem for Secure Health Data Management

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***Abstract*—The increasing demand for efficient healthcare services has emphasized the need for secure and centralized management of medical data. Traditional healthcare systems often rely on paper-based or fragmented digital records, resulting in inefficiencies, delayed diagnosis, and poor coordination among healthcare providers. This paper presents *HealthStack*, a digital healthcare ecosystem designed to provide secure, mobile-accessible, and centralized health data management. The system enables patients to store and access medical records, book doctor appointments, and share health information securely. HealthStack is implemented using an Android application developed in Java, a Node.js backend, and Supabase as the cloud platform for database management, authentication, and storage. Advanced security mechanisms including role-based access control, row-level security, SSL/TLS encryption, and two-factor authentication ensure data privacy and integrity. The proposed system enhances healthcare accessibility, improves doctor–patient coordination, and supports sustainable, paperless healthcare practices.**

***Index Terms*—Digital Healthcare, Electronic Health Records, Mobile Health, Supabase, Node.js, Two-Factor Authentication**

I. Introduction

Healthcare information management is a critical component of modern medical services. Accurate and timely access to patient data plays a vital role in diagnosis, treatment planning, and continuity of care. However, many healthcare institutions still maintain patient records in paper format or in isolated digital systems, making it difficult to retrieve complete medical histories when required. This lack of integration often results in repeated medical tests, delayed treatment, and increased operational costs.

With the rapid growth of mobile technologies and cloud computing, digital healthcare ecosystems have emerged as effective solutions to overcome these challenges. A unified digital platform can facilitate real-time access to patient information, improve communication among healthcare stakeholders, and enhance patient engagement. HealthStack is proposed as a comprehensive digital healthcare ecosystem that addresses these challenges through a secure, mobile-first approach.

II. Related Work

Several studies have explored the use of electronic health record (EHR) systems and mobile health applications to improve healthcare efficiency. Cloud-based healthcare platforms provide scalability and real-time data access but often lack strong security or integration features. Recent research highlights the importance of role-based access control, multi-factor authentication, and secure cloud storage in healthcare applications. HealthStack builds upon these concepts by integrating appointment booking, secure authentication, and centralized data management within a single ecosystem.

Fig. 1. Workflow of the HealthStack System

III. System Overview

HealthStack is designed as a patient-centric digital healthcare ecosystem. Patients can register, securely log in, upload and view medical records, and book appointments with doctors. Healthcare providers can access patient histories, update diagnoses, and manage appointments efficiently. Administrators monitor system operations and ensure data integrity.

IV. Methodology

The system follows a client–server architecture. The Android mobile application, developed using Java, serves as the client interface. The backend is implemented using Node.js and Express.js to handle business logic and API requests. Supabase is used as the cloud platform, providing PostgreSQL database services, authentication, storage, and row-level security. Two-factor authentication is enabled to enhance account security.

Requirement analysis was carried out to identify functional and non-functional requirements, focusing on secure health data management, appointment booking, and role-based access. Based on these requirements, the system architecture was designed to support multiple stakeholders, including patients, doctors, and administrators.

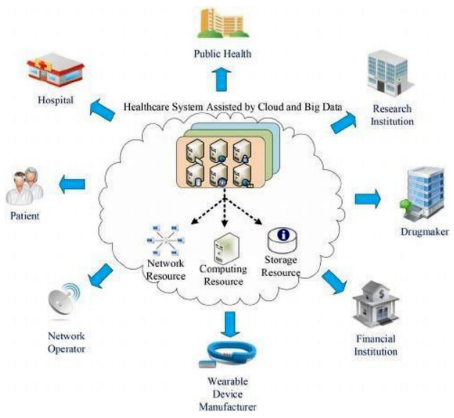

Fig. 2. Cloud-Based Digital Healthcare Ecosystem

V. Results and Discussion

The proposed system successfully demonstrates secure storage and retrieval of healthcare data through a mobile application. Appointment booking functionality reduces waiting times and improves scheduling efficiency. Security mechanisms ensure compliance with healthcare data privacy requirements. The system also reduces dependency on paper-based documentation, contributing to environmental sustainability.

VI. Future Work

Future enhancements of HealthStack include telemedicine integration, AI-based health analytics, wearable device data integration, and predictive health monitoring. These additions will further improve healthcare accessibility and personalized care.

VII. Conclusion

HealthStack demonstrates the effective integration of mobile applications, cloud infrastructure, and secure authentication mechanisms to address key challenges in healthcare data management. By providing centralized access to electronic health records and appointment booking, the system improves healthcare accessibility and coordination. The implementation of two-factor authentication and role-based access control ensures strong data security and user trust. Future work may include telemedicine integration, AI-based health analytics, and wearable device support, making HealthStack a scalable and extensible digital healthcare ecosystem.

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