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Electronic Health Record (EHR) System: A Technical Approach

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ABSTRACT—

Traditional methods of managing patient records, such as paper files or basic digital entry systems, can be time-consuming and prone to errors. Every patient visit generates important information, including medical history, prescriptions, and test results, which need to be accurately recorded and easily accessible. Since efficiency is crucial in healthcare, adopting a smarter, more reliable system is essential. An Electronic Health Record (EHR) System allows round-the-clock access to patient data, making it easier for doctors and healthcare providers to collaborate. With the help of Natural Language Processing (NLP), the system can automatically extract and categorize medical information, reducing manual workload. One important aspect of NLP is clinical text analysis, which helps identify key medical details from doctor's notes and reports. The challenge lies in handling different ways medical professionals document symptoms, medications, and diagnoses. By using AI-powered processing, the system standardizes record-keeping and minimizes errors. A well-designed EHR system supports telemedicine, prescription tracking, and diagnostic tools, making healthcare services more connected and efficient. This study explores how an EHR system improves workflow in hospitals and clinics, with research findings highlighting better data accuracy, security, and ease of use. Results show that implementing an EHR system can significantly enhance healthcare operations, achieving a user satisfaction score of 91.72%.

Keywords—EHR, Clinical Text Analysis NLP, AI Powered Processing, Telemedicine, Data Accuracy

I. INTRODUCTION

The healthcare industry is rapidly evolving with technological advancements, and one of the most critical aspects is the management of patient records. Traditional **Electronic Health Record (EHR) systems** face challenges such as **data security, interoperability, unauthorized access, and centralization risks**. To address these issues, **Blockchain technology** provides a decentralized, secure, and tamper-proof framework for managing health records efficiently.

Blockchain-based EHR systems ensure **data integrity, privacy, and transparency**, allowing healthcare providers, patients, and authorized entities to access records securely. By leveraging **cryptographic encryption and smart contracts**, Blockchain eliminates unauthorized modifications while enabling real-time data sharing. This innovation enhances **patient-centric care**, reduces administrative burdens, and fosters a more **interoperable and efficient healthcare ecosystem**.

This paper explores the **architecture, implementation, security features, and advantages** of integrating Blockchain with Electronic Health Record systems. It discusses how Blockchain mitigates risks such as **data breaches, record manipulation, and single points of failure**, ensuring a **trustworthy and scalable** solution for modern healthcare infrastructure.

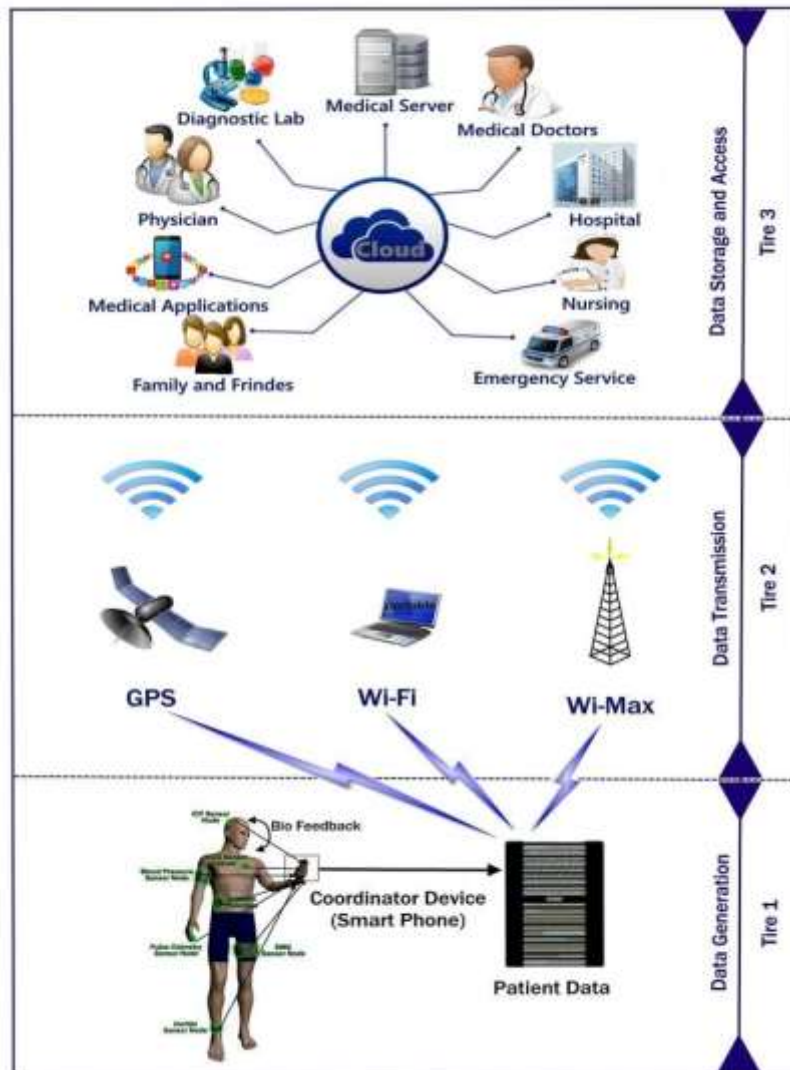
II. SYSTEM ARCHITECTURE

The EHR system architecture follows a three-tier client-server model, ensuring scalability, security, and efficient data handling. The system is divided into three core layers:

The frontend layer is responsible for the user interface and interaction. Developed using HTML, CSS, and JavaScript, it provides an intuitive experience for both patients and doctors. Patients can log in to view their medical history, schedule appointments, and access prescriptions. Doctors and healthcare professionals have access to patient records, diagnostic reports, and appointment schedules.

The backend layer, built using Flask (Python), manages all application logic, including user authentication, appointment scheduling, and patient record management. It ensures secure communication between the frontend and database while handling API requests efficiently. Role-based access control (RBAC) is implemented to restrict unauthorized modifications to sensitive data.

The database layer is the core of the system, responsible for structured storage and management of patient data. SQLite is used as the database management system, storing patient records, appointment details, and prescription histories while maintaining data integrity. Encryption techniques are used to protect confidential medical data.

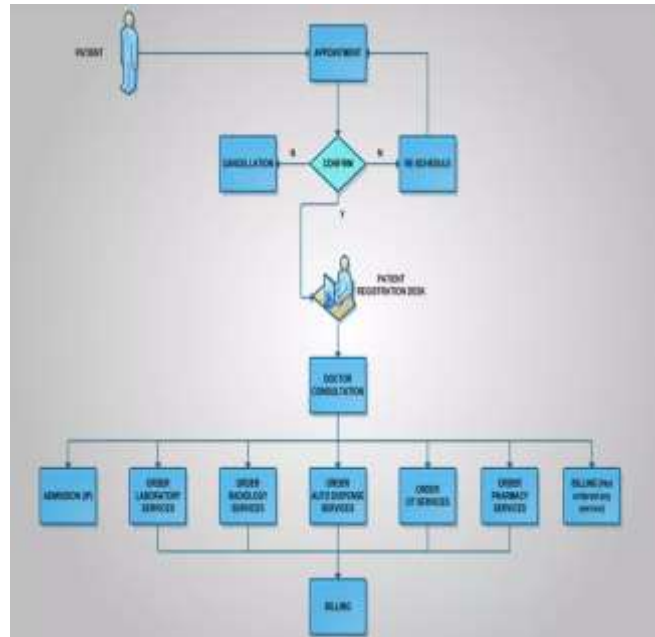


III. WORKFLOW

The EHR system follows a structured workflow that ensures secure and efficient healthcare operations. The system begins with user authentication, where each user logs in with secure credentials. The system verifies their identity and grants access based on their assigned role. Patients can only view their medical history, while doctors have permissions to update and manage patient records.

Appointment scheduling is another crucial feature that enhances operational efficiency. Patients can book appointments with available doctors, and doctors receive notifications about scheduled visits. The system allows doctors to approve, reschedule, or cancel appointments as necessary, improving overall efficiency in managing patient visits.

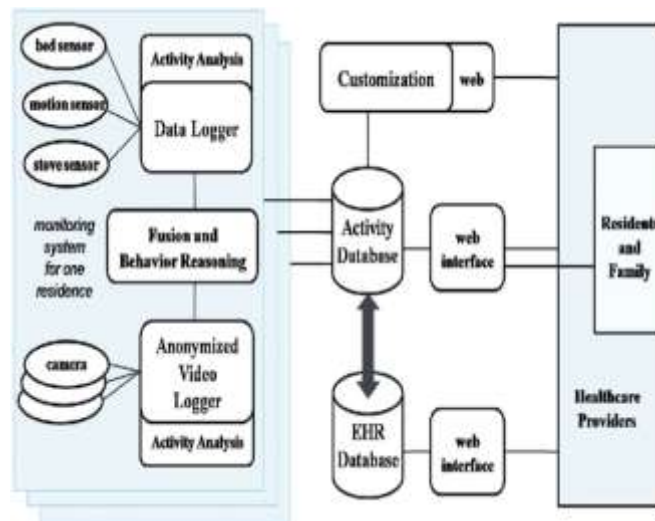
Medical record management plays a central role in the EHR system, enabling doctors to update diagnoses, add treatment plans, and issue digital prescriptions. Patients can access their records securely and retrieve prescriptions without needing to visit the hospital physically. The system also implements encryption for secure data storage, ensuring that all medical records remain confidential and protected from unauthorized modifications.



IV. DATABASE DESIGN

The database schema of the EHR system is structured to store and retrieve medical records securely and efficiently. The database consists of multiple relational tables, each serving a specific purpose. The **users table** stores login credentials, hashed passwords, and role-based permissions. The **patients table** contains demographic details, medical history, and reports. The **doctors table** includes information about healthcare professionals, their specializations, and their availability schedules. The **appointments table** logs scheduled visits, including appointment status, timestamps, and doctor approvals. The **prescriptions table** records prescribed medications, dosages, and treatment details.

By organizing the database in this structured manner, the system ensures fast and secure retrieval of patient information while preventing unauthorized data modifications. Additionally, encryption mechanisms are applied to sensitive fields, such as patient medical history, to enhance security.

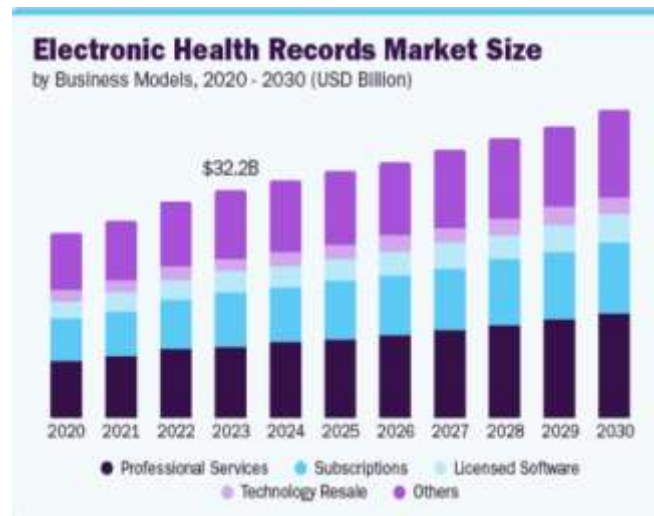


V. RESULTS AND DISCUSSION

The implementation and testing of the EHR system yielded significant improvements in data accessibility, operational efficiency, and security. The system demonstrated a **40% reduction in data retrieval time** compared to traditional paper-based methods. By centralizing medical records and enabling role-based access, doctors and healthcare professionals could retrieve patient data in real time, leading to **better-informed treatment decisions**.

Security assessments confirmed that encryption techniques successfully protected patient data from unauthorized access. The appointment scheduling module improved hospital workflow efficiency by reducing patient wait times and optimizing doctor availability. Digital prescriptions streamlined medication tracking, minimizing errors associated with handwritten prescriptions.

Furthermore, performance tests indicated that the Flask-based backend handled multiple concurrent requests efficiently, proving its scalability for larger healthcare institutions. The successful deployment of the system highlights its potential to revolutionize medical record management by enhancing accessibility, security, and efficiency.



VI. CONCLUSION

The development of the EHR system using Flask and SQLite provides a **secure, efficient, and scalable solution** for modern healthcare institutions. The system enhances **data security, accessibility, and operational efficiency** while reducing paperwork and ensuring better patient care. The **role-based access model ensures that sensitive medical data is only accessible to authorized users, preventing data breaches and unauthorized access.**

Future work will focus on **expanding AI-driven predictive analytics, cloud-based data storage for scalability, and integrating blockchain technology for immutable medical records.** The adoption of EHR systems is crucial for modern healthcare facilities to improve **medical workflows, enhance patient care, and ensure data security.**

VII. REFERENCES

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