Health Record Management System

Dr. Varsha Bodade

Department of Information Technology,

Terna Engineering College, Nerul

Navi Mumbai, India

Anuj Ashok Jaiswal

Department of Information Technology,

Terna Engineering College, Nerul

Navi Mumbai, India

Akhilesh Kumar Ashok Kumar Mishra

Department of Information Technology,

Terna Engineering College, Nerul

Navi Mumbai, India

Lokesh Tukaram Chaudhari

Department of Information Technology,

Terna Engineering College, Nerul

Navi Mumbai, India

Abstract— Storage of data and using that data in an effective manner is the major issue in the health management system. Security of this data and use of this data in a proper way is very necessary. This project of Health Record Management System is a web application-based project designed for the hospital to manage and use the data of their patients effectively. The main purpose and the function of the project is to provide a system where the data can be stored and retrieved easily. The web application is designed from the scratch without any idea of evolving the existing system. The project focuses on developing a simple system where the doctor would be able to insert the data of the patient in the system and retrieve it from there. The patient could be able to see the same data on their end. They can book the appointment from the doctor. And finally, an admin to monitor the access of the system. The final project consists of a website which attains all the features of a management system. Another focus of the project is developing a web-based application with application rich UI and UX interfaces which are very easy to use for even the new users of the technology. The system is also designed for its greater user friendliness.

Keyword- Health record management, Security, Web application, effectively

1. Introduction

Health Record Management System improves the accuracy, efficiency and quality of data recorded in a health record. It improves the quality of care as a result of having health information immediately available at all times for patient care. A paperless environment will come with the introduction of an electronic health record and eliminate many of the problems in maintaining paper health records. It maintains privacy and confidentiality, reduces medical errors and costs. There are quite benefits with this system, especially in the areas of medical error reduction, compliance completeness of records, decision support, accurate billing, and even returns on investment.

2. Literature Review

The authors in [1] propose an emergency access control management system (EACMS) based on permissioned blockchain hyperledger fabric and hyperledger composer. In the proposed system, there are some rules using the smart contracts for emergency conditions and time duration for the emergency access PHR data items that patients can assign some limitations for controlling the PHR permissions. We analyzed the performance of our proposed framework by implementing it through the hyperledger composer based on the response time, privacy, security,
and accessibility. The experiments confirm that our framework provides better efficiency compared with the traditional emergency access system.

The authors in [2] highlight the patient-driven model of record maintenance using Blockchain technology where smart contracts can be incorporated in future days making it more potential in data exchange. Finding its huge scope, hoping that more research will be carried out and practically implemented.

The authors in [3] proposed a model built using the blockchain technology to support a tamper resistance feature. Proxy re-encryption and other cryptographic techniques are employed to preserve privacy. Features of the proposed model include fine grained and flexible access control, revocability of consent, auditability, and tamper resistance. A detailed security analysis shows that the proposed model is provably secure for privacy and tamper resistance. The performance analysis shows that the proposed model achieves a better overall performance compared with the existing approach in the literature. Thus, the proposed model is more suitable for the PHR system usage.

The authors in [4] discussed an Electronic Health Record System where data is accessed electronically by healthcare providers. Electronic health record improves the accuracy, efficiency, quality of healthcare and data recorded. EHR maintains privacy, confidentiality and reduces medical errors.
The authors in [5] discuss how blockchain technology can be used to transform the electronic health system. They present a framework that can be used to implement blockchain technology in the healthcare system. They provide secure storage of electronic records by defining granular access rules for users of the proposed framework. The framework provides the EHR system with the advantages of having scalable, security and integral blockchain-based solutions. Their aim of HER system was to solve the problem faced by paper-based healthcare records. The functionality of the system was electronic storage, patient appointment management, billing and accounts and lab tests. The system was developed by using Ethereum.

The authors in [6] analyze the impact of an EHR OR management system in ophthalmology or other surgical fields. The key findings were that (1) there was overall worsening in intraoperative documentation time following implementation of an EHR OR management system, which eventually improved to near–paper baseline levels for most procedure categories and (2) surgical volume and overall OR staffing requirements did not change significantly after implementation, although an increase in circulating nurses persisted through the study in cataract procedures.

The authors in [7] proposed an application that assures interactive and real time data exchange between the main actors of the medical system. Using ontology and widely accepted medical coding standards the proposed solution solves the interoperability issues between medical entities. Rules and relations embedded in the medical knowledge base offer support for a better medical decisions and in these ways assure higher quality for medical services. Also, the system assures remote access and patient's monitoring reducing time and cost needed for medical assistance.

The authors in [8] discuss a system where users have ownership and control over their data without compromising security. The system enables this by separating sensitive and non-sensitive data of a patient which helps in sharing healthcare data effectively with researchers without revealing the patient's privacy. The model successfully uses proxy re-encryption technique to share a patient's sensitive data without revealing the patient's private key. Based on the constraints related to the health care context, the decision of the hyperledger fabric blockchain implementation for the execution of the proposed model. The combination of customized access control protocol and asymmetric cryptography guarantee high information security.

The authors in [9] presented the prototype implementation and evaluation of the OmniPHR architecture model that integrates distributed health records using blockchain technology and the openEHR interoperability standard. Omni PHR prototype comprises a novel blockchain-based design that optimizes health data replication across computing nodes. We evaluated the performance of the Omni PHR the OmniPHR prototype by subjecting it to loads of thousands of concurrent sessions transmitting data block data blocks on a network of 10 super peers. We also evaluated implementation strategies related to the replication of health-oriented blockchain solutions to promote the unification of patient health data

The authors in [10] consider the system as essentially a multiple access system, where records are individually maintained by health providers, and let providers take primary responsibilities of maintenance of the blockchain, including creation, verification and appending of new blocks. Smart contracts are utilized in this design, and can be further developed with preferences, e.g., particular items in records can also be added to the blockchain for tracking. This heuristic architecture is independent of any specific blockchain platforms, and its variations can potentially fit other similar multiple access electronic records systems.

Table 2.1 gives the brief description of all the literature papers discussed above.

Title	Method	Feature	Technology used	Advantage
[1] Using blockchain for electronic health records. *IEEE Access* 7 (2019): 147782-147795.	They propose an emergency access control management system by using blockchain hyperledger fabric & composer. In which they defined some rules using smart contracts.	Grant a specific access control for managing, tracing, participating health care data.	Blockchain hyperledger fabric & blockchain hyperledger composer.	Data privacy, Data security, Data accessibility
[2] EACMS: Emergency access control management system for personal health records based on blockchain. *IEEE Access* 7 (2019): 84304-84317.	The paper represents a patient driven model of record maintenance based on blockchain technology. In which smart contracts can be included in future days.	It records the collection of clinical data related to the patient's mental & physical health.	Blockchain, cryptographic Hash.	Only authorized users can access data, Data security, immutability of data.
[3] Health record management through blockchain technology. In *2019 3rd International Conference on Trends in Electronics and Informatics (ICOEI)*, pp. 1411-1415. IEEE, 2019.	The proposed model used a private blockchain, cloud storage and some cryptographic mechanisms & also included a proxy re-encryption hashing and digital signature to provide privacy.	Allow the data manager to manage & share the data of his or her to selected individuals.	Blockchain, cloud storage, Cryptography.	Cryptographic technique used to preserve privacy, flexible access control.
[4] Blockchain-based access control model to preserve privacy for personal health record systems. *Security and Communication Networks* 2019 (2019).	Electronic health record is a comprehensive record of patient health care history in digital format. It is an electronic set of patient records which contain information of patient medical history, laboratory data & other important medical reports.	Improve accuracy, efficiency & quality of health care & data recorded in the system.	Blockchain	Error reduction, completeness of record, decision support.
[5] Electronic health record." *International Journal of Engineering* 1, no. 10 (2012): 25-27.	In this paper they discuss how blockchain technology is used in the Health Record System. They proposed a framework of combination of secure	Improve security, Provide tamper-proof platform for storing health related information.	Blockchain Technology.	Data security, More data transparency,

	record storage with access rules for records.			
[6] Using blockchain for electronic health records. *IEEE Access* 7 (2019): 147782-147795.	To examine the research on the effect of an EHR OR control machine in ophthalmology or different surgical fields. The key findings have been that there has been overall worsening in intraoperative documentation time following implementation of an EHR OR control machine, which subsequently advanced to near–paper baseline stages for most process classes	Improve interoperability,	Blockchain	Saves time, reduces the paperwork
[7] "Impact of an electronic health record operating room management system in ophthalmology on documentation time, surgical volume, and staffing." *JAMA ophthalmology* 132, no. 5 (2014): 586-592.	The application assures interactive and real time data exchange between the main actors of the medical system. Using ontology and widely accepted medical coding standards the proposed solution solves the interoperability issues between medical entities.	Automatic Data transfer, Remote Access	Blockchain	Data Security, Data Privacy, User Friendly
[8] "Secure and Privacy Focused Electronic Health Record Management System using Permissioned Blockchain." In *2019 IEEE Conference on Information and Communication Technology*, pp. 1-6. IEEE, 2019.	Users should have ownership and control over their data without compromising security. The system enables this by separating sensitive and non-sensitive data of a patient which helps in sharing healthcare data effectively with researchers without revealing the patient's privacy. The model successfully uses proxy re-encryption technique to share a patient's sensitive data without revealing the patient's private key.	Proxy re-encryption technique for sensitive medical information sharing.	Blockchain hyperledger fabric,	High data Security, Customized access control and asymmetric cryptography, Data privacy, Interoperability.

[9] "Analyzing the performance of a blockchain-based personal health record implementation." *Journal of biomedical informatics* 92 (2019): 103140.	This article presented the prototype implementation and evaluation of PHR model that integrates distributed health records using blockchain technology and the openEHR interoperability standard.	Data Replication, More Flexible	Blockchain, Chord Algorithm	Data Security, Data Privacy
[10] "A design of blockchain-based architecture for the security of electronic health record (EHR) systems." pp. 261-265. IEEE, 2018.	Considering the system is essentially a multiple access system, and records are individually maintained by health providers, we let providers take primary responsibilities of maintenance of the blockchain, including creation, verification and appending of new blocks.	Improve interoperability, Prevent tampering and malicious misuse	Blockchain	Data secure, Flexible Access control.

Table 2.1: Brief description of Literature Survey

3. Proposed System

Overall System Architecture:

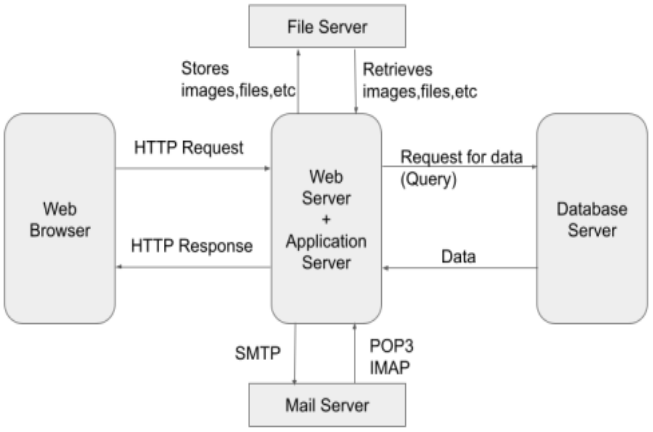

Figure 3.1: Architecture of Health Record Management System

The overall architecture of the system is a client-server based architecture specifically server-side rendering architecture. Figure 3.1 shows the overall architecture of the system. The user triggers a http request to the web application server and in turn gets the response from the web server. The web server is connected to the database server to communicate with the database, to the file server to store and retrieve images and other files and to the mail server to perform email operations.

The internal architecture of the web application is based on the architecture of the Laravel framework. Figure 3.2 shows the internal architecture of the web application server. The request made by the user is the http request. This request is handled by the web server and the request is sent over to the front controller. The front controller sends the authorized request to the router which sends the request to the desired MVC controller and the data obtained is given to the view. The view renders the request to the server.

Server Internal Architecture:

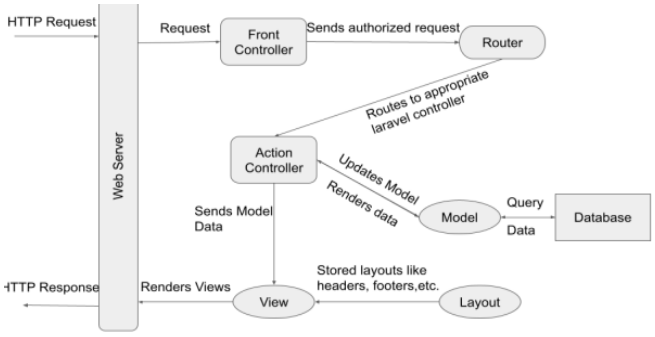

Figure 3.2: Internal architecture of Web application server

Data Model:

Figure 3.3 represents a data flow diagram i.e., E R diagram of a Health Record Management System. The main primary entity is the staff and patients. The staff is generalized into Doctor, Admin and Non- Medical Staff. The primary key for the Staff is their employee_id whereas for the doctors it is doctor _id which is an integer. The other attributes included are the name, phone number, qualifications, profile image, gender, address and the role of the employee as doctor, non-medical staff and the admin.The patient database table has the primary key attribute as aadhar number with other attributes. The patient database table is connected to the appointment table. The appointment table is connected to the patient table with a one-to-many relationship with many towards the patient. The appointment table is connected to the doctor table with a one-to-many relationship towards appointment.

The medicine table is actually the collection of the medicines from which the medicines need to be prescribed. Similarly, the test table consists of the test name and their basic details. The patient books the appointment whose details get stored in the appointment table. The appointment table is connected to the prescribed_test table and prescribed_medicine to ensure the test and medicine assigned to the patient by a specific doctor.

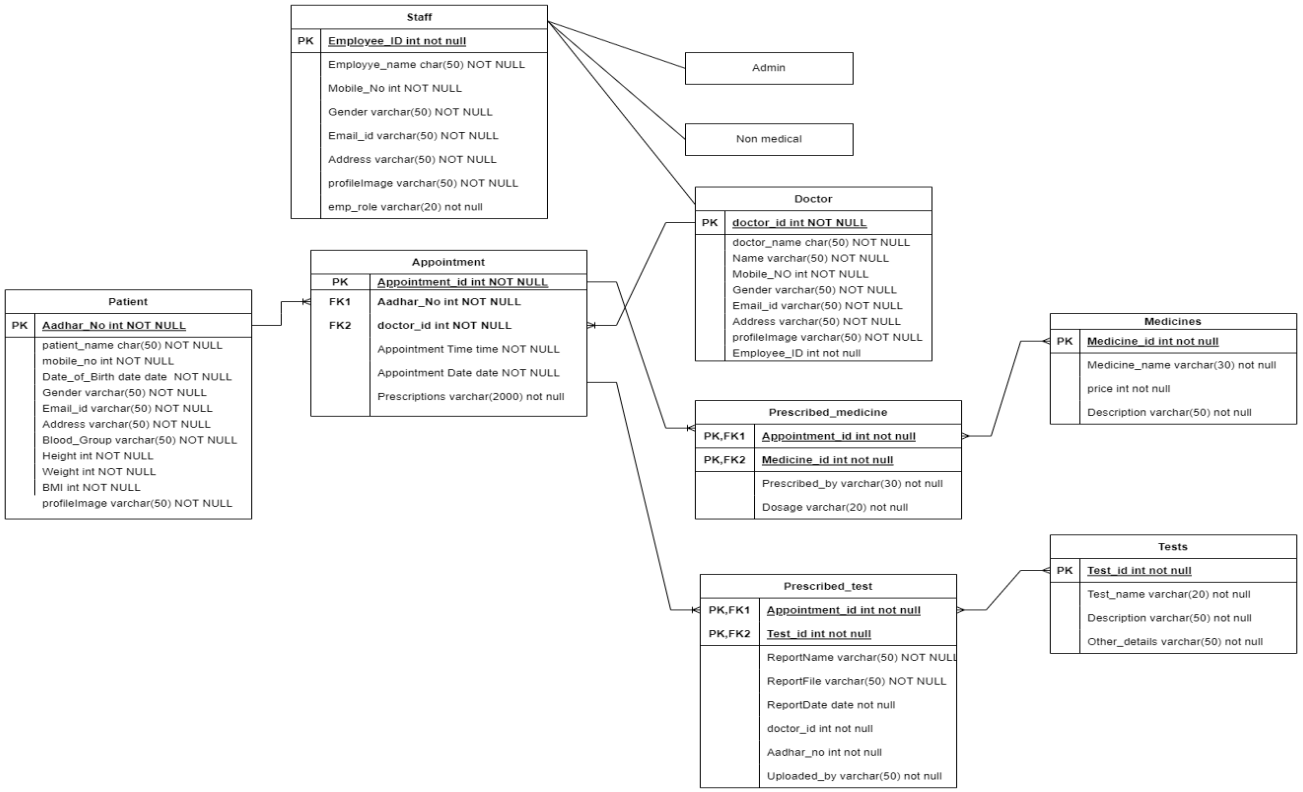

Figure 3.3 : Data flow diagram

4. Methodology

- **Technology Stack**
  Web Server-Apache
  Backend-PHP
  Database-MySQL
  Frontend-HTML, CSS, JavaScript
  Framework- Laravel
  Views and Template-Blade
  ORM-Eloquent
- **Hardware Details**
  Processor- i3 or above
  RAM-4 GB minimum
  Display-Super VGA with a resolution of 1024*768

5.Result

Figure 5.1 : Homepage of Health Record Management System

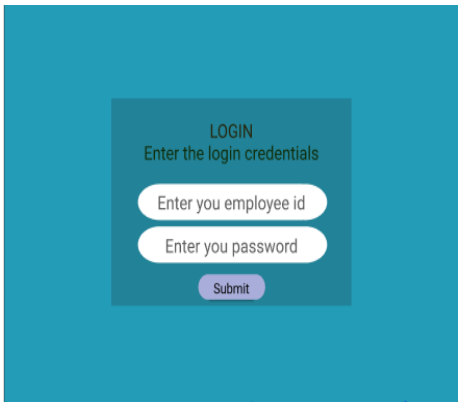

Figure 5.2: Login page for medical staffs

Figure 5.3 : View appointment page for doctor

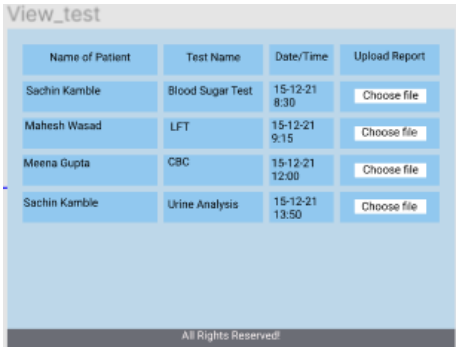

Figure 5.4 : View report page for pathology unit

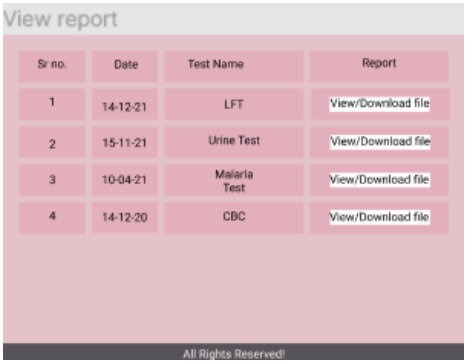

Figure 5.5 : View report page for patient

Figure 5.6 : View profilepage for doctor

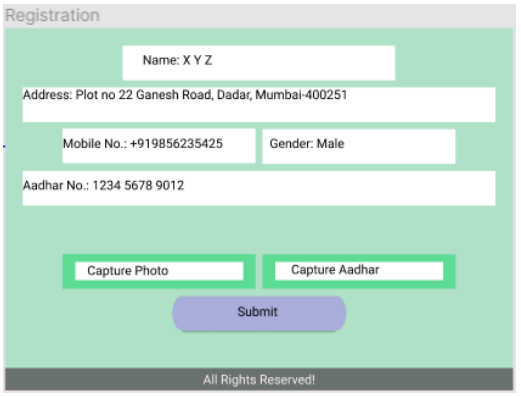

Figure 5.7 : Registration page of the new patient

Figure 5.8 : Patient profile page

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