Health Record Management System – A Web-based Application

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Abstract

Storage of data and using that data in an effective manner are the major issues in the health management system. Security of health data and the use of this data in a proper way are very important. 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 aspect 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 involving the existing systems. The project focuses on developing a simple system where the doctor can upload the data of the patient in the system and can retrieve it when needed. The patient can view the same data from their end. Moreover, the patients can book the appointment with the doctor through the application. The final project consists of a website which attains all the features of a management system. Another focus of the project is to develop a web-based application with application rich UI and UX interfaces which is very accessible even for the new users of the technology. The system is also notable for its great user friendliness.

Keywords: Health record management, security, efficiency, web application

1. Introduction

Health Record Management System improves the accuracy, efficiency and quality of data recorded in a health record. This improves the quality of care by ensuring that medical information is always available to patients. A paperless environment comes with the introduction of electronic health records and eliminates many of the problems associated with maintaining paper health records. This maintains confidentiality and reduces medical errors

and costs. This system has certain advantages, especially in the areas of reduced medical errors, completeness of records, decision support, accurate billing and return on investment.

2. Related Work

Sheanaz et al., (2019) [1] recommended a system in their study that was primarily based on Hyperledger-fabric and Hyperledger-composer of blockchain technology. They named their technology the Emergency Access Control Management System abbreviated as EACMS. In the presented system, they used the smart contracts in the case of emergencies where patients have the rights for assigning a few restrictions for controlling the permissions of the PHR. Many testing criteria such as reaction time, privacy and security, accessibility were considered for the analysis of the proposed framework. Their analysis and experiments verified that their framework affords higher performance in comparison to the conventional system of emergency access.

Rajput et al., (2019) [2] described a patient-driven model for maintenance of records. It uses blockchain where smart contracts are designed for the storage of data. They came up with the idea that these smart contracts in the future can be activated for smooth data exchange. They concluded that this technology will have a very large scope in the coming time and many more researches will be carried upon on this.

Harshini et al., (2019) [3] provided a model built using block chain technology to support resistance to alteration primarily called data tampering. Privacy of the data is preserved by using cryptography and encryption techniques like proxy re-encryption. The peculiarity of the proposed model includes flexible access control, revocability of consent auditability and tamper resistance. The putted-up model has features like privacy and resistance to tampering. Therefore, the model is more suited for use in the primary healthcare systems.

Thwin et al., (2019) [4] discussed electronic medical records systems in which health care providers access data electronically. The electronic health records improve the exactness, proficiency, and standard of medical data. The electronic health record ensures all the above features and reduces medical errors as per the model discussed by Thwin and his team.

Latha et al., (2012) [5] discussed applications of the blockchain in the transformation of the electronic health system. The framework of blockchain technology is used to provide

storage by defining granular access rules for users. The advantages provided are scalability, security. Their aim of the HER system was to provide a solution to the problem faced by existing paper-based record management systems. The functionality of the system was electronic storage, patient appointment booking and cancellation, and billing and lab tests. The system was developed by using Ethereum.

Sanders et al., (2014) [6] have proposed an application that provides actual exchange and interaction of data amongst physicians and patients who are the key players in the health infrastructure. With the use of ontology and code level standards of the medical field that are accepted world-wide, the presented application provides a solution for the issues of interoperability between medical entities. The standard rules and relationships built on the base of medical knowledge provide rigidity for making better health care decisions, resulting in higher quality health care. The system also provides access to the remote area and monitoring of the patient, thus reducing the overall time as well as cost required for providing care.

Mahore et al., (2019) [7] discussed a system where users have ownership over their data and they have control over it regarding who will access what features of the data and so on. The system does this by separation of the susceptible and unsusceptible data of the patient. This data is shared effectively for the research purpose with the researchers without compromising the security of the data of the patient. The system uses the technology to share the data of the patient privately without revealing the private key of the patient called proxy re encryption. The Hyperledger fabric of blockchain is used for the implementation and execution of the proposed system. The high information security is guaranteed by the use of asymmetric cryptographic techniques and modified access control protocols.

Roehrs et al., (2019) [8] discussed the implementation of the Omni PHR architecture model that integrates distributed health records. The model measured the performance of the Omni PHR system. This was done by exposing the system over a load of thousand concurrent sessions that were transmitting data blocks continuously over a network that has 10 super peers. The prototype also evaluated the implementational approaches in correlation to replicating of health concerned blockchain solutions to encourage the amalgamation of patients' well-being data.

Yan et al., (2018) [9] described a system that is accessible by many at a time, where patient health related data are maintained by doctors, nurses, medical and other people of a

health organization. The system offers the health providers a primary responsibility of upkeeping of the blockchain that consists of formation, authentication and adding of new blocks to the existing data blocks. The heuristic architecture used in the design of this model is not dependent on any precise blockchain platforms, and any other similar multiple access electronic records systems can fit its different versions.

Mohammad Rehman et al., (2019) [10] described a blockchain based architecture tamper proof EHR system. The system recorded health related data in cloud storage. The invader can access the patient records such issues solved by this temper proof EHR system. The blockchain is an emerging technology that specializes in developing such temper proof data systems.

Gaganjeet Singh Reen et al., (2019) [11] presented EHR systems that are obtaining immense popularity across the world. The current EHR system has problems such as privacy and security. They proposed a solution related to this issue. Using the Ethereum blockchain it allows the hospital across the world to be connected to each other. They use asymmetric and symmetric cryptography keys to provide security to the storage and access the records. It provides complete access to patients for their records. They used IPFS for storage of records.

R. Amrita et al., (2018) [12] described a secured EHR system for secure databases containing records of patients. Many such systems have manual maintenance techniques and most of the database of the patient or many times others cannot access the history of the patient and it interrupts the process of taking care of the patient. This prototype provides an effective solution to all the above problems with less price, reduction in time and resources. This project protects the privacy of records from hackers, trojan horses etc.

Manohara Pai et al., (2021) [13] discussed about the public health facilities in the developing countries like India where the health systems are mainly divided into three levels namely Primary, Secondary and Tertiary Healthcare Systems. They discussed about the data problems that arise while developing the Healthcare Systems. They proposed a framework especially for Indian medical Systems as per Indian medical standards to promote the smooth workflow of data.

Usharani Chelladurai et al., (2022) [14] proposed a system namely immutable patient log creation using modified Merkle Tree data structure. The proposed system ensures the privacy and security of the data. The system is made using peer to peer blockchain network. The exchange of data becomes easy due to smart contracts.

Shadab Alam et al., (2021) [15] developed a system which worked efficiently during the Covid-19 pandemic situation. This paper analyses the use of the blockchain in efficient Covid-19 pandemic management with all the features of an EHR system.

All the papers mentioned above focuses on designing a safe, secure and an efficient system that is scalable and easily accessible. Many of these systems are designed using the blockchain technology concept called smart contracts. The main feature of these systems is the security of the data.

3. Proposed work

### 3.1 Overall System Architecture
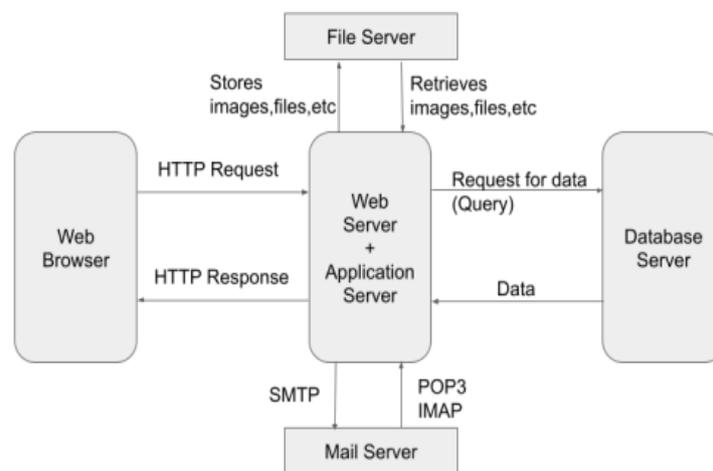
Figure 1. Architecture diagram of Health Record Management System

An overall architecture diagram of the system is a client-server-based architecture specifically server-side rendering architecture. Figure 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.

3.2 Server Internal Architecture

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.
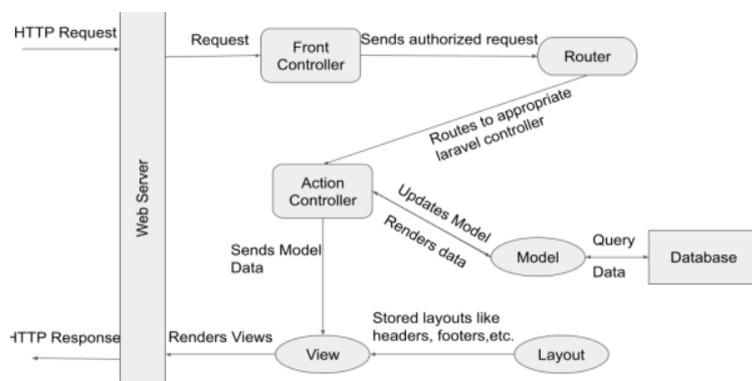
Figure 2. Internal architecture diagram of Web application server

3.3 Data Model
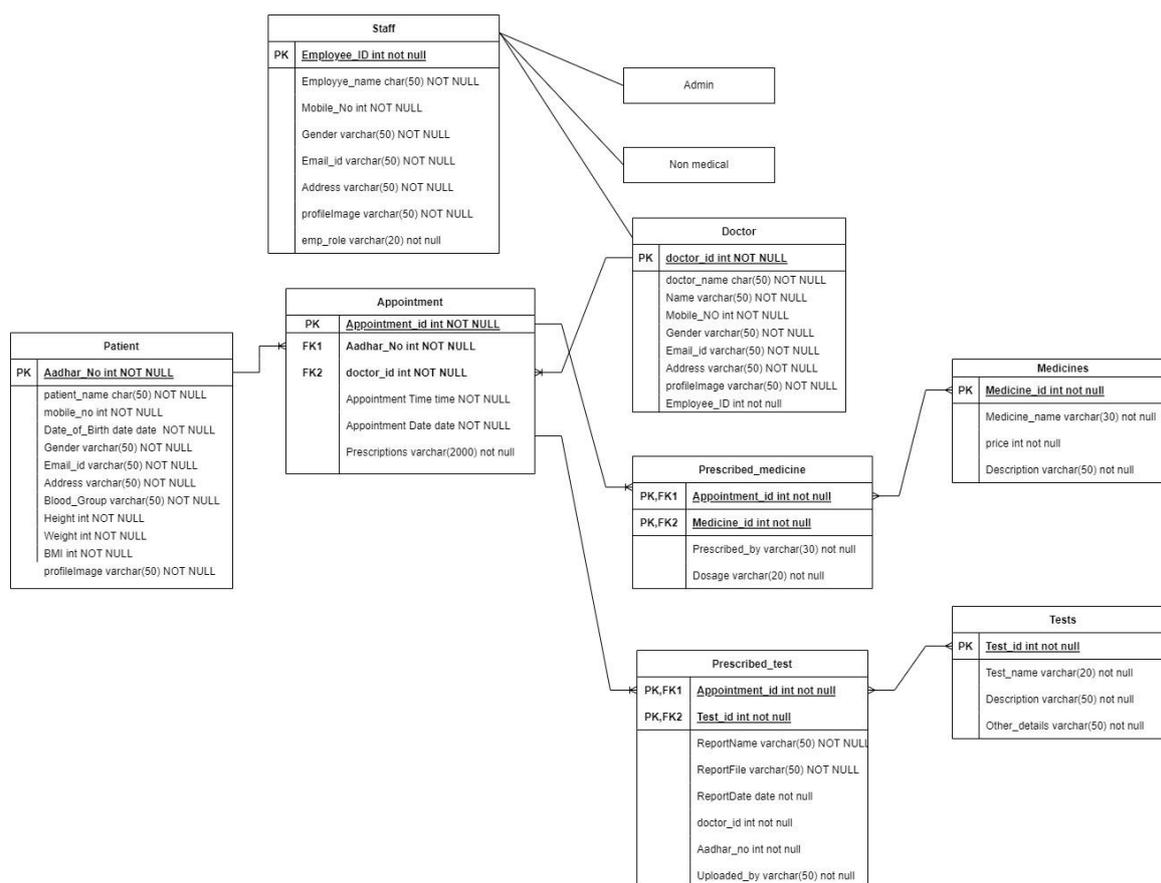
Figure 3. Data flow diagram

Figure 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.

3.4 Methodology

- **Technology Stack**
  1. Web Server-Apache
  2. Backend-PHP
  3. Database-MySQL
  4. Frontend-HTML, CSS, JavaScript
  5. Framework- Laravel
 6. Views and Template-Blade
  7. ORM-Eloquent

- **Hardware Details**
  1. Processor- i3 or above
  2. RAM-4 GB minimum
  3. Display-Super VGA with a resolution of 1024*768

The proposed application is a simple website designed to store, retrieve and update the health related data of the patients. The data will be accessible to the medical staffs of the hospital. The data of a particular patient will be accessible to even the other doctors via the patient login. This means that the scalability issues along with the security can easily be resolved based on the convenience of the patient.

4. Results and Discussions

The screenshots presented below are the outputs of our system.
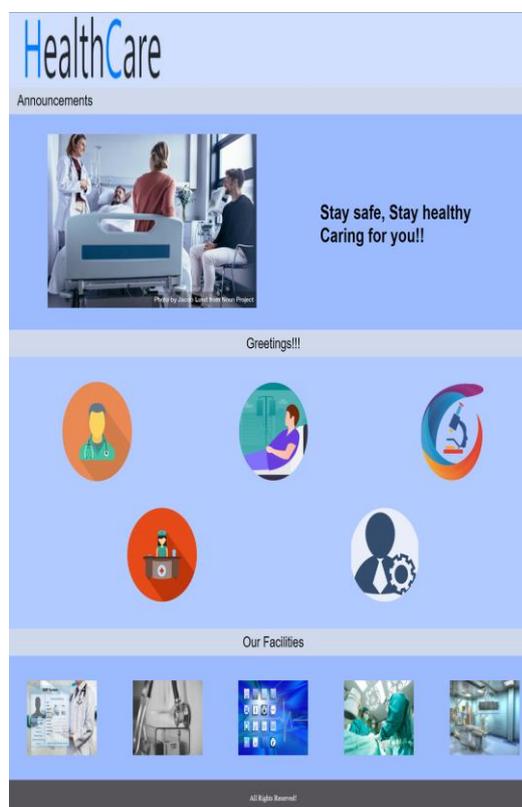
Figure 4. Homepage of Health Record Management System

The image in figure 4 represents the homepage of health record management system. It consists of the announcements and the facilities offered by the hospital. The 5 elliptical images are actually the logins for different roles namely in sequence as doctor, patient, pathology, reception staff and admin. Clicking on any one of the images will direct the user to the respective login page.

Figure 5. Login page for medical staffs

As discussed before figure 4 and 5 are the login page for the staffs of the hospital which includes doctor/nurses, pathology ward, reception staffs and the admin department.

Figure 6. View appointment page for doctors

The image in the figure 6 is the view appointment page for the doctor where the particular doctor will be able to visualize all his/her appointments for the day.

Figure 7. View test page for pathology unit

The image in figure 7 is visible from the view of the pathology side. The test that a patient book will be visible to the pathology lab on this age and the reports will be uploaded for the same here.
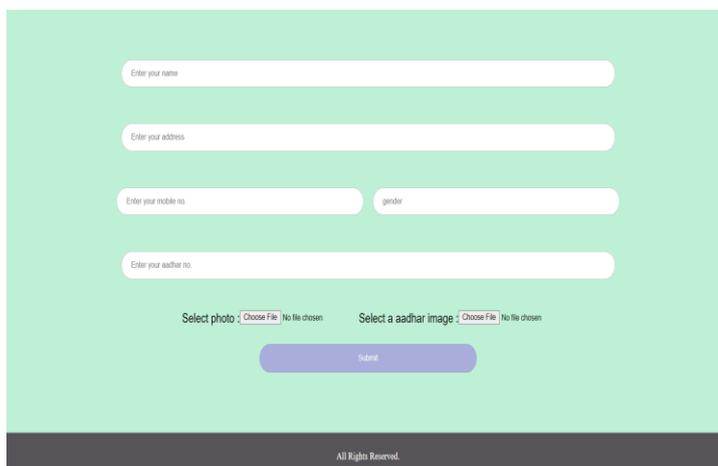

Figure 8. View report page for patients

The image in figure 8 is the view report page for patient where all the .pdf files of the patient's test reports will be available.

Figure 9. View profile page for doctors

The profile page for the doctor will consist of a profile image and some basic details of his/her as shown in figure 9.

Figure 10. Registration page for new patient

The registration page is the page where the new patient registration is done. Once the patient is registered, the login access is granted. This facility as in figure 10 is available at the reception itself.
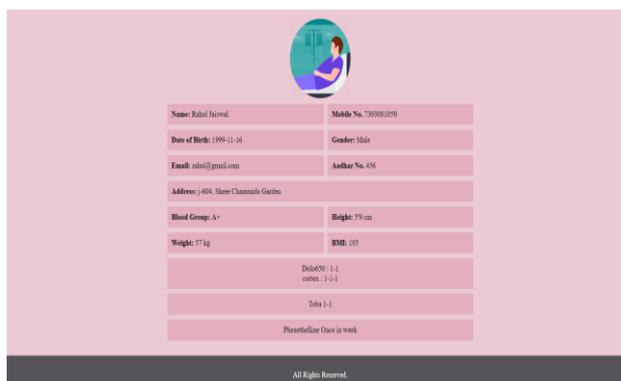
Figure 11. Patient profile page

The image in figure 11 shows the profile page of the patient where various medical data like medicines, reports and some additional prescriptions are available with recent ones appearing first.

5. Conclusion

A system that can keep track of all patient's data of the hospital has been implemented. It will allow the health providers, most probably the doctors and nurses to easily access the data they want, pertaining a given patient without spending an excessive amount of time searching it amongst different documents saved **with inside** the stores of the hospital. The system will ease retrieval of the patient's data if wished by the health service providers while not having to struggle with boxes in the store room. Therefore, handling the patient's data is simplified by this system. The manual system will get replaced by the brand-new proposed system which saves time, it's far more efficient and might work under all situations so long as there's power around and access of patients' data is therefore simplified.

The future scope for the above system consists of integrating the above system with the block chain to enhance the security features of the system. Extending the concepts, the system shall be integrated with the various AI algorithms based on the datasets to provide the effective predictions related to the health-related data.

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