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APPLICATION OF ELECTRONIC HEALTH RECORD SYSTEM

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Abstract - Health record system is a critical aspect of efficient healthcare delivery. Traditional paper-based systems have long been the norm, but they suffer from various limitations such as inefficiency, inaccuracy, and lack of accessibility. This research paper aims to explore the development and implementation of an application for Health record system as a solution to these challenges. The objective is to investigate the key features and functionalities of such an application and analyse its potential benefits and impact on healthcare organizations. The paper begins by highlighting the importance of Health record system in healthcare settings and the need for a more efficient and effective system. It examines the drawbacks of paper-based systems and emphasizes the advantages of adopting an application-based approach. The research focuses on key features and functionalities that can enhance data entry, storage, retrieval, and sharing of health records. Additionally, it explores aspects such as data security, privacy protection, integration with other healthcare systems, and user-friendly interfaces. Implementation and adoption considerations are discussed, including potential challenges related to interoperability, data migration, and staff training. Successful case studies are presented to illustrate the outcomes and benefits achieved by organizations that have implemented similar systems. The potential impact on healthcare providers, patients, and the overall healthcare system is analysed, considering improved patient care, cost savings, and streamlined workflows. Additionally, any limitations or drawbacks of the application are addressed, along with suggestions for mitigating them. The paper concludes by discussing future directions and advancements in Health record system systems, such as electronic health records (EHRs), telemedicine integration, and the utilization of artificial intelligence. It summarizes the key findings and emphasizes the significance of an application for Health record system in enhancing healthcare delivery. Overall, this research aims to provide insights into the development, implementation, and benefits of an application for Health record system. By exploring the potential of this technology, healthcare organizations can make informed decisions to improve their record management processes and ultimately enhance patient care and outcomes.

***Key Words*:** Health record system, Electronic health records (EHR), Paper-based systems, Data migration, Benefits Patient care

1.INTRODUCTION

In today's digital age, the management of health records plays a crucial role in providing efficient and effective healthcare services. With the advancements in technology, there is a growing need for applications that can securely store, retrieve, and share health records. This project aims to develop a Health record system backend system that will serve as the foundation for creating a user-friendly and secure front-end application.

The main objective of this project is to create a REST engine and API that allows developers to build a front-end interface for the Health record system application. The focus is on developing a robust and secure API that supports authentication and authorization features, ensuring that only authorized users can access the health records.

Electronic devices have become an integral part of our lives, offering convenient ways for users to access healthcare data and services. Therefore, the project aims to develop a application that provides physicians with access to their patients' health records through a community, regional, or state Health Information Exchange (HIE). This will enable healthcare providers to access crucial patient information on-the-go, improving the quality and efficiency of care.

The system architecture will be designed to address security and privacy concerns associated with Health record system. Measures will be implemented to ensure that the sensitive patient data is protected and only accessible by authorized individuals. The REST API operations will be carefully crafted to provide seamless integration and efficient communication between the front-end application and the backend system.

Throughout the project, a range of techniques and technologies will be utilized. For the front-end development, JavaScript, and Android (Java) will be employed to create an intuitive and user-friendly interface. The back-end development will involve Database Management Systems (DBMS), specifically using MYSQL, and Python programming language. Single Sign-On (SSO) will be implemented for authentication and authorization purposes, enhancing the security of the system.

The application itself will include essential components such as data security measures to safeguard patient information, a portal for doctors to access and manage health records, and a patient portal that enables individuals to view their own health records and interact with healthcare providers.

Overall, this project aims to create a comprehensive and secure Health record system by developing a REST API integrated with a application. By leveraging the latest technologies and techniques, the project seeks to enhance the accessibility, efficiency, and security of healthcare data management, ultimately improving the quality of healthcare services provided to patients.

2. LITERATURE REVIEW:

I.) In the medical field, the accurate recording and management of patient data and medical history play a vital role in ensuring quality healthcare services. Medical record data serves as a reference for health checks, a source of authentic evidence for diagnoses, and a record of the medical services received by patients. However, several factors can affect the analysis and management of medical data, leading to potential drawbacks in the healthcare system. [Khan, M.M. et al. (2021)].

II.) According to various sources, the lack and mismanagement of information, both in electronic systems and physical documents, have been identified as factors that impact medical analysis. These factors can result in incomplete or inaccurate patient records, leading to challenges in diagnosing and treating patients effectively. Some of the reported issues include the lack of symptoms in the patient registry, inappropriate conclusions drawn from available information, history or incomplete exams, inadequate information systems, and cognitive errors when gathering relevant information. [D. K. Jain et. al. (2015)].

III.) To address these challenges and improve the healthcare system, several approaches and technologies have been explored in the literature. One such approach is the development of smart healthcare systems that focus on providing information and services that are timely, comfortable, and efficient for patients. These systems leverage smart health information models to create a patient-centric experience and ensure that healthcare services can be accessed by anyone, anytime, and anywhere. [Pahwa Monica et. al. (2013)].

3. SYSTEM'S ARCHITECTURE / DESIGN:

The proposed system architecture for the Health record system application consists of a application with data security measures, a doctor's portal, a patient's portal, and a backend infrastructure to store and manage the medical records. The system follows a REST API approach for communication and data retrieval.

3.1. Application:

The mobile application serves as the front-end interface for both doctors and patients to access and interact with the Health record system. It provides features such as viewing patient demographic information, medical history, allergies, immunization records, and family history. The application ensures data security by not storing any patient, login, or password data on the device. Instead, users authenticate themselves through a login and password, which are sent to the server via an API. Upon successful authentication, the server sends back a security token for subsequent requests.

3.2. Data Security:

To comply with HIPAA security regulations and minimize security risks, the system avoids storing sensitive patient information on the mobile device. Access to health records is granted only after successful authentication. The server-side implementation ensures that only authorized users (physicians) with patient consent can access the data. The system utilizes SSL for secure communication and issues security tokens to maintain session authentication.

3.3. Backend Infrastructure:

The backend infrastructure includes databases and server-side components responsible for storing and managing the health records. The architecture aims to be easily integrated and scalable as more data types are added. The system leverages REST API architecture, which offers lightweight, extensible, and scalable features. This architecture separates concerns and allows all resources to be accessed using the HTTP protocol.

3.4. Rest API:

The system adopts a REST API approach for communication between the mobile application and the backend server. The REST API dynamically generates unique URLs to represent patient demographic information and health records. The API supports HTTP requests and responses using JSON as the data format, providing better performance compared to XML. The server-side implementation utilizes the JBOSS JAX-RS Rest Easy library, which simplifies resource mapping using Java annotations. The Java Spring framework is used for integration with backend data sources and services.

3.4.1 API Design and Development:

The API design follows the principles of REST and utilizes JBOSS JAX-RS Rest Easy library for building the API endpoints. JSON is used as the data format for request and response payloads, and GZIP compression is applied for better performance. The integration with backend data sources and services is achieved using the Java Spring framework. The development process follows an agile/SCRUM methodology with iterative and incremental development sprints.

3.4.2 API Operation:

The API supports various operations for accessing health records. GET requests are predominantly used for retrieving patient information, lab results, and other health data. For authentication and certain operations involving sensitive patient information, a POST method is utilized, with the sensitive data passed in the request body as a JSON object over an SSL connection.

3.4.3 Health Record API Operation:

The API endpoints are designed to retrieve patient data based on user and patient IDs. Authentication is performed using a POST request to obtain a security token. GET requests retrieve patient profiles and lab results specific to a patient.

3.4.4 Workflow:

The system follows a workflow that involves the database as the backend storage, the API for handling requests and responses, and the mobile application as the user interface. The application connects to the backend through the API, ensuring secure access to patient health records. By implementing this system architecture, the Health record system application can provide secure access to patient information, enable efficient data retrieval for doctors and patients, and ensure compliance with data protection regulations

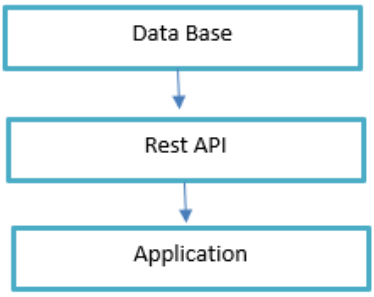

Figure 1 Facilities required for proposed work.

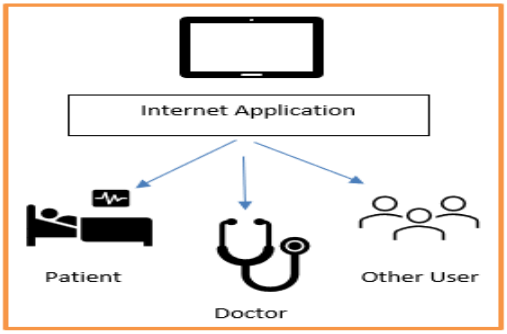

Figure 2 System representation Design

4. RESULTS:

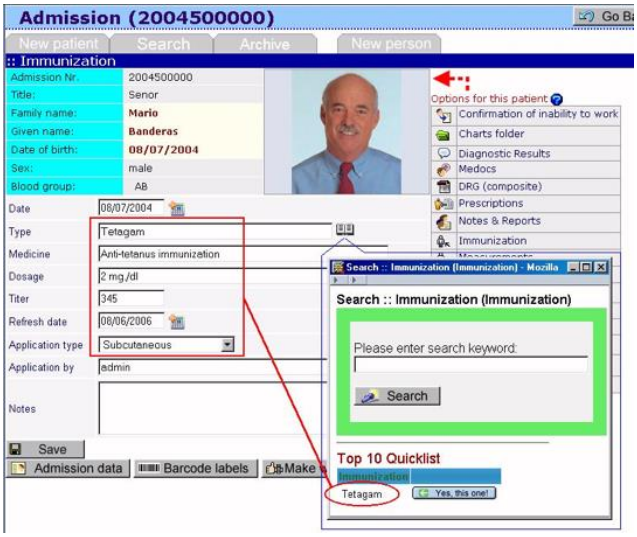

Figure 3 screenshot of User profile

4.1 Technology Characteristics

Technology Characteristics	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Comfortable using Computers	10	85	3	2	-
Comfortable using EHRs	5	77	13	5	-
Training provided on using EHR	8	69	21	2	-
Additional training on EHR if provided	10	72	15	3	-
EHR helps in reducing errors in health records	13	62	20	5	-
Overall happy with EHR implementation	10	67	20	3	-
Ease of using EHR on handheld devices	3	74	18	5	-
Prefer to use EHR from home	15	31	49	5	-

Table 1

The above table shows the response of 39 respondents who are using EHR at their respective hospitals. The table clearly shows that majority of the respondents are comfortable using computers and EHRs. Majority are happy with the training provided on how to use the EHR system and would prefer additional training on the same. Majority of them found EHRs help in reducing errors in maintaining health records. About 77% of respondents are happy with the implementation of EHR and about 77% of them feel that it is easier to enter the details of health records on handheld devices. Only about 46% of respondents preferred to use EHR from home for any reference and the rest 54% were either neutral or not ready to use EHRs from home for any reference or calls.

4.2 Use and Usability:

The responses of the respondents on use and usability of EHR were analyzed and found the following results.

Usability and Usefulness of EHR	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Easy documentation while seeing patients	10	77	13	-	-
Enables machine to locate appropriate format	10	80	10	-	-
Easy navigation to explore various features embedded in it	8	77	15	-	-
Able to effectively use various modules	3	64	28	5	-
Able to electronically review patient's ancillary and diagnostic test results	10	74	13	3	-
All information needed to assess a patient's condition is available	3	63	21	13	-
Able to quickly search, select and enter patient's medication	5	58	26	11	-

Able to electronically prescribe patient's medication with ease	5	55	29	8	3
Provides useful tools for disease management	8	47	13	32	-
Helps in faster insurance processing	19	57	19	5	-

Table 2

The above in table were found from a total of 39 respondents using EHR. Some respondents did not respond to use of EHR to assess patients and recommend medication as they were clinical staff and had never prescribed medication to any patients. Almost 85% and more of the respondents were at ease using EHRs and found it easy to search patient records electronically and prescribe medication easily. About 15-25% of the respondents were neutral about the use and usability of EHRs. A larger number, close to 33% did not comment or did not find EHR providing useful tools for disease management. 11-13% of the respondents were unable to search the records quickly and find information to treat the patients quickly.

4.3 Pattern of documentation using EHR

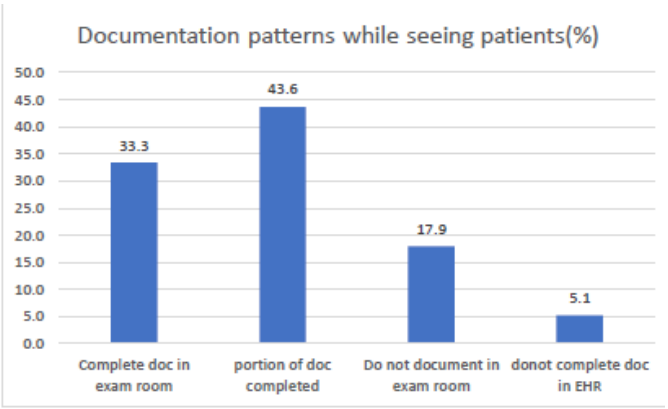

Figure 5 - Documentation Pattern

The above figure shows the documentation pattern by respondents while seeing patients.

4.4 Technical Support:

Technical Support	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Hardware and network support for EHR available	5	67	23	3	2
The hardware and network supporting EHR were reliable in terms of speed	46	33	21	-	-
The devices used to access EHR enabled efficient work flow	5	56	26	13	-
IT support at the organization very responsive	82	18	-	-	-
The organization has right number of IT resources to support in using EHR	-	49	20	31	-
Can easily get help from IT team when having a problem using EHR	3	85	8	2	2
The technical team in organization considers enhancement requests when submitted	5	77	10	3	5

Table 3

The IT/Systems department plays a very important role in every hospital. In public hospitals all the sanctions to procure the required computers and network equipment has to be sanctioned by the Government. There are also people hired on contract basis to help respondents use EHR and also enter the data into EHR from the handwritten records. There is a need to procure the computers with proper hardware and network them with good connectivity to the server so that the patient records can be accessed and stored with high speed. The respondents experience regarding this is as shown in the table above.

4.5 Respondents not using EHR:
130 of the total respondents were not using electronic health record system and still followed the manual record system. Analysis of the data collected from them is as follows:
At these hospitals where EHR was either not implemented or was still not fully functional, computers were used for registration of patients and hence all demographics of patients were found online.
4.5.1 Convenience to investigate old information of patients stored manually:
All respondents found it convenient to investigate old information of patients stored manually.
59% of the respondents maintained diagnostic reports on computers and the rest 41% of them maintained the records only in hard copy format.
4.5.2 Preference to view patient reports:
It was found that only 85% of the respondents preferred to view the reports only in hard copy format and 15% of the respondents preferred to view it on computers.
4.6 Documentation patterns while seeing patients:

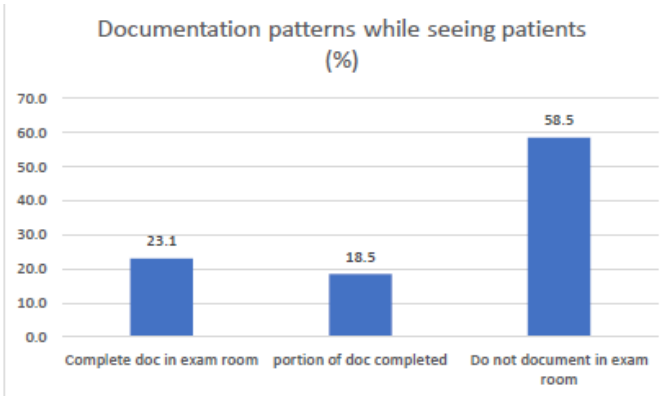

Figure 6 – Documentation patterns while seeing patients.
The above figure shows the documentation patterns of respondents while seeing patients.

4.7 Preference to use Electronic Health Record System
96% of the respondents agreed that they prefer to use EHR and only 4% were neutral of their opinion.
4.8 Specific reasons for not implementing EHR
About 15% of the respondents felt lack of approval from authorities as a reason for not implementing EHR, 80% felt the software not user friendly and hence the reluctance to use it and 5% felt lack of funds as a reason for not implementing EHR.

5. CONCLUSION

Our project focuses on developing a backend system in the form of a REST API for electronic health record management. By providing a standardized interface, the API enables seamless communication between different applications and allows frontend developers to create user-friendly interfaces.
The key advantage of using a REST API over SOAP is its extensibility, scalability, lightweight nature, and ease of debugging. These characteristics make it a suitable choice for our project, ensuring efficient and flexible communication between the various components of the system.
The overall outcome of our project is to enhance the healthcare experience for both healthcare providers and patients. By implementing electronic health records, healthcare providers will have access to complete and accurate patient information, enabling improved diagnosis and reducing the risk of medical errors. The convenience of accessing records electronically benefits both patients and doctors, promoting better accessibility and streamlined workflows.
One of the core aspects of our application is to prioritize data security and privacy. We ensure that sensitive health information is protected, complying with privacy regulations to maintain the confidentiality of patient data. By addressing data security concerns, our application establishes trust and contributes to the overall integrity of the electronic health management system.
In the modern healthcare system, our mobile application has the potential to provide significant benefits to doctors, hospitals, and patients alike. Accurate and easily accessible medical records are crucial for hospital operations and informed decision-making. With its user-friendly interface, our application improves overall outcomes by promoting efficiency, privacy, and improved patient care.
It Will aims to revolutionize the healthcare industry by leveraging technology to enhance electronic health record management. Through proper storage, easy accessibility, and a focus on data security, our mobile application contributes to efficient healthcare experiences and high-quality care delivery.

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