**ELECTRONIC HEALTH RECORDS INFORMATION SYSTEM: A HEALTHCARE SOLUTION.**

1. **Introduction to Electronic Health Records (EHR)**

An Electronic copy of patient’s paper chart is called Electronic Health Records (EHR). EHRs are patient-centered, real-time records that give authorized users quick, secure access to health information. EHRs can store a range of data, including personal demographics, medical history, prescriptions, immunization status, laboratory test results, allergies, and radiological images. Healthcare professionals may get a thorough and current picture of a patient’s health thanks to these digital records, which are made to be shared across various healthcare settings.

**The Importance of EHR in Healthcare**

Electronic health records are crucial because they can increase the effectiveness, quality, and security of healthcare delivery. Paper-based records, which can be prone to mistakes, misplacements, and lack of accessibility, are replaced with electronic health record (EHR) systems. Medical practitioners can do the following with EHRs:

Electronic Health Records (EHRs) provide a digital of patient health data that help doctors and nurses providers to access a comprehensive record of a patient’s medical history, diagnoses, treatments, medications, allergies, and laboratory results. This digital format significantly reduces the issues associated with traditional paper-based records, such as illegible handwriting or misplaced files, ensuring that information is more accurate, accessible, and up to date. Their importance lies in their ability to enhance the quality, safety, and efficiency of healthcare delivery.

One of the key benefits of EHRs is their role in improving patient safety. By providing real-time access to a patient’s health information, EHR systems enable healthcare providers to make better-informed decisions. For example, if a doctor is prescribing medication, the system can alert them to potential drug interactions or allergies that may be harmful to the patient. This proactive approach helps prevent adverse events, thus improving patient outcomes. Additionally, EHRs can reduce the occurrence of medical errors that result from incomplete or outdated information, as they integrate data from different sources and provide a more holistic view of the patient’s health.

Another critical advantage of EHRs is their ability to facilitate better coordination of care. In today’s healthcare environment, many patients see multiple specialists or are referred to different healthcare providers. With EHRs, these providers can seamlessly share patient information, which reduces communication barriers and helps ensure that everyone involved in a patient’s care is working with the same, accurate data. This continuity of care leads to improved treatment plans, fewer redundant tests, and better overall management of chronic conditions. For patients, this means fewer delays in treatment, fewer duplicated tests, and a more cohesive care experience.

**The usage of electronic health records**

The usage of Electronic Health Records (EHRs) is pivotal in modern healthcare, serving a variety of functions that enhance both clinical and administrative processes. EHRs are utilized by healthcare providers to store and manage patient information electronically, ensuring that data is readily available whenever and wherever needed. This comprehensive record includes a patient's medical history, diagnoses, medications, immunization dates, allergies, lab results, and radiology images, among other critical health information.

Clinically, EHRs are used to support patient care through accurate and timely documentation. Healthcare providers rely on EHR systems to enter patient data during or after consultations, enabling real-time updates that ensure the patient's health record is always current. This feature helps in tracking patient progress over time and provides a complete view of the patient's health status, which is essential for making informed decisions. EHRs also assist in the coordination of care by making it easier to share information among different providers and specialists, reducing the chances of miscommunication or information gaps.

EHRs are also employed in the automation of routine tasks. For instance, they can generate alerts and reminders for preventive measures like vaccinations, screenings, or follow-up visits, ensuring that patients receive timely care. These alerts are instrumental in chronic disease management, helping providers monitor conditions such as diabetes or hypertension more effectively.

In terms of administrative usage, EHRs make things easier for doctors and hospitals by handling billing and paperwork automatically, which helps avoid mistakes and speeds things up. They also help keep track of important information, making it easier to see how well things are going and plan better for the future. EHRs let patients check their health information online, helping them stay involved and follow their treatment plans more closely.

EHR systems also play a crucial role in patient engagement. Many EHRs offer patient portals, which allow individuals to access their health information online. Patients can view test results, schedule appointments, request prescription refills, and communicate with their healthcare providers through these portals. This access empowers patients to participate more actively in their own care, fostering better health literacy and adherence to treatment plans.

**Development of Electronic Health Records**

The development of Electronic Health Records (EHRs) has been a transformative journey in healthcare, evolving from simple digital versions of paper records to complex systems that integrate a wide range of medical and administrative functions. Initially, EHRs were created to replace paper charts, offering a more organized and accessible way to store patient information. Early versions were basic, primarily used for storing demographic data and basic clinical notes.

As technology advanced, EHR systems became more sophisticated, incorporating features such as medication management, lab result tracking, and appointment scheduling. The introduction of networked systems allowed for better communication and information sharing between different healthcare providers, enhancing the coordination of care. Over time, EHRs began to include decision support tools, which help healthcare professionals by providing reminders, alerts, and clinical guidelines based on the latest medical research.

Government initiatives and regulations, such as the Health Information Technology for Economic and Clinical Health (HITECH) Act, played a significant role in promoting the adoption and development of EHR systems. These policies encouraged healthcare providers to transition to digital records by offering financial incentives and setting standards for meaningful use, which ensured that EHRs were used in ways that improved patient care.

Modern EHRs now offer comprehensive solutions that integrate clinical, administrative, and financial data. They support interoperability, allowing different systems to work together seamlessly, and often include features for telehealth, patient engagement through portals, and data analytics for improving healthcare outcomes. The development of EHRs continues to focus on enhancing usability, security, and patient-centred care, making them a cornerstone of modern healthcare infrastructure.

1. **WEBSITE DESIGN AND TECHNICAL ARCHITECTURE**

**A diagram of a software system

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**Overview:** The design of the EHR information system has an aim for simplicity, usability, and efficiency, especially from the perspective of a doctor who needs to access and manage patient data.

* **Navigation Menu:** The website has a clean, intuitive navigation menu at the top, allowing doctors to easily access essential features like: About, Services, Contact, Login and Register. This page is called the home page or landing page.

A screenshot of a computer

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* **Registration & Login:** Both forms are straightforward which is used by a new user or an old user for accessing the dashboard. The require fields such as: Username, Email and Password.

A screenshot of a login form

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Login page

A screenshot of a login form

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Registration Page

**Tools Used in this Project**

**Backend: Programming Language, API framework and External Libraries**

* Python was used for server-side programming, including handling user authentication, CRUD operations, and connection with the database and frontend.
* Flask as an API framework was used in this project to set up routes for pages like login, register and dashboard page. It was also used to handle HTTP requests (GET, POST).
* External libraries were also used to provide a structured logic and communication between the client (frontend), database and server (backend).

**Databases: Relational Database**

* MYSQL was used in this project for storing doctors and patients’ information (e.g. Username, email, password etc.). It provides robust querying and relationships (e.g. linking doctors to their patients).
* MYSQL connector as an external library was used to connect the flask application to MYSQL database.
* It was also used to execute queries to create tables, insert, update, and delete records (CRUD Functions)

**Frontend:**

* HTML was used to create pages such as home, login, register, and CRUD functionality page.
* CSS was used to make the application visually appealing for user interface.
* Bootstrap was used to quickly style forms, buttons, tables, icons and navigation menus.

FRONTEND: HTML 5, CSS 3, Bootstrap 5

DATABASES: MYSQL

BACKEND: Python, flask, external libraries

1. **EHR Information System**

**A screenshot of a medical form

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**A screenshot of a computer

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**Description of the Snapshots**

**Dashboard Snapshot:**

The first snapshot displays the Dashboard of the EHR Information System. This page is accessible to the doctor after logging in. It includes the following elements:

* **Header:** The system is branded as "RubiMed," and a "Logout" button is available for the user to exit the session securely.
* **Table of Patients:** A list of patients is displayed in a table format, with columns for:
  + ID: Unique identifier for each patient.
  + First Name: Patient's first name.
  + Last Name: Patient's last name.
  + Date of Birth: Patient's date of birth.
  + Gender: Patient's gender.
  + Contact Info: Patient's contact email.
  + Actions: Buttons to "View EHR," "Edit," and "Delete" the patient's record.

**EHR Detail Snapshot:**

The second snapshot shows the EHR Detail View for a specific patient. It contains:

* **Patient Details:** Including the patient's ID, first name, last name, and date of birth.
* **EHR Records:** A table listing detailed EHR data with columns for:
  + ID: Record identifier.
  + Diagnosis: Patient's medical diagnosis.
  + Medications: Prescribed medications.
  + Vital Signs: Key vital signs recorded.
  + Immunization Status: Immunization details.
  + Medical History: Any relevant medical history.
  + Test Results: Results of any tests conducted.
  + Date: Date when the record was created.
  + Actions: Buttons to "Edit" or "Delete" the record.

**How to Use the System**

1. **Registration**: New doctors can register by providing their username, password, and email. The system stores this data securely, hashing passwords for security.
2. **Login:** Doctors log in using their email and password. If credentials are correct, they are directed to the dashboard.
3. **Dashboard:** After logging in, doctors can manage their patients from the dashboard:
   * **Add New Patient:** Click on "Add New Patient" to enter new patient details.
   * **View Patient's EHR:** Select "View EHR" to access the patient's health records.
   * **Edit Patient:** Use the "Edit" button to modify patient details.
   * **Delete Patient:** Remove a patient's record by clicking "Delete."
4. **EHR Management:**
   * **View EHR:** Clicking on "View EHR" shows all health records for the selected patient.
   * **Add EHR Record**: Add new health records using the "Add New Record" button. Input diagnosis, medications, vital signs, and other health-related details.
   * **Edit EHR Record:** Modify existing records with updated information by clicking the "Edit" button.
   * **Delete EHR Record:** Remove a record by selecting "Delete."
5. **Forgot Password:** If a doctor forgets their password, they can request a password reset link via email. They will receive a link to set a new password securely.
6. **Logout:** Doctors can log out at any time by clicking the "Logout" button, which clears their session and redirects them to the login page.

**Functions of the System**

* User Authentication: Ensures that only authorized doctors can access the system.
* Patient Management: Allows doctors to add, view, edit, and delete patient information.
* EHR Management: Facilitates the recording and updating of patients' medical information, including diagnoses, medications, and test results.
* Security Features: Includes hashed passwords, session management, and secure token-based password reset functionality.
* Data Storage: Utilizes a MySQL database to store doctors' credentials, patient data, and EHR records.

This system simplifies the management of patient records, making it easier for healthcare professionals to access and update information efficiently while maintaining data security.

1. **Evaluation of the EHR information system**

**A screenshot of a survey

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link: [https://forms.gle/vK43Wsn4mUMVQg3B7](https://forms.gle/vK43Wsn4mUMVQg3B7%20)

To evaluate the usability and effectiveness of the EHR Information System, a survey was conducted with participants representing potential users of the system. The primary objective of the survey was together feedback on the system’s usability, functionality, design, and overall performance.

The survey included linear scale questions and participants were asked to rate their experiences using the system. The feedback was crucial identifying strengths and areas for improvement, ensuring the system meets the need of its user effectively.

**How to Calculate SUS score.**

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How I calculated the SUS score, the steps are as follows.

* 1. Collect Responses (Users response to 10 questions)
  2. Scores Normalization (odd: response – 1, even: 5 – response)
  3. Calculate the total Score
  4. Calculate the SUS score (multiplying by 2.5)

SUS score = (∑ adjusted scores \* 2.5)

* 1. Calculate the average SUS score for multiple users.

I had (num) responses below is the calculation.

1. **Conclusion**

In this report, I have detailed the development of an EHR Information System designed to streamline patient data management for healthcare providers. The system includes essential features like secure login, patient record management, and data storage, all aimed at improving efficiency and accuracy in healthcare settings.

Developing this project alone allowed me to gain a deeper understanding of both frontend and backend development, as well as database management. This project highlights the potential of technology to enhance healthcare operations, providing a foundation for future improvements and scalability.

In summary, this EHR system demonstrates how digital solutions can contribute to better healthcare management and patient care.