Unified Medical Ecosystem with Outbreak Surveillance

Project Members:

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Project Summary

Our Unified Medical Ecosystem aims to provide a hassle-free experience for patients to manage their healthcare journey, from booking appointments to tracking medical expenses, all in one place. For healthcare providers, it enhances their ability to provide seamless care through access to the complete history of a patient and manage their day-to-day operations efficiently. The platform also allows healthcare officials to monitor real-time Surveillance of diseases.

Description

The current healthcare system faces various challenges in delivering efficient care to patients. There is a lack of access to the patient's past health records, difficulties in booking and managing appointments, limited visibility into medical expenses, and a lack of real-time disease tracking for health officials to take preemptive actions. While systems do exist to address each of these individual challenges, there is a lack of a unified platform, resulting in fragmented data, poor interoperability between systems, and an increased burden of time-consuming administrative tasks.

Our Unified Platform will provide an easy-to-manage appointment scheduling process, allowing patients to schedule, reschedule, or cancel appointments. This feature will also display available slots for each healthcare provider in real-time, ensuring patients can choose their preferred ones. Additionally, the platform provides full CRUD (Create, Read, Update, Delete) operations for managing these appointment slots, allowing healthcare providers to efficiently update and modify their availability, ensuring better time management and a focus on patient care.

The platform also provides a unified way to track expenses from both patient's and hospital administrators' sides. Patients can access a clear, detailed view of their past and current bills, including itemized charges, making it easier to understand and manage healthcare costs. From the Administration's perspective, they can track revenue streams and insurance claims. This transparency will lead to better financial planning and management for patients and institutions.

A unique and advanced feature of the system will be real-time analysis and tracking of the diseases geographically. There would be an interactive visualization showing the disease-affected areas and intensity indicators based on up-to-date patient records. This visualization can be filtered based on gender, age, and location, allowing healthcare officials to understand the outbreak in detail. By offering these insights, the platform enables healthcare officials to take preemptive actions, allocate resources more effectively, and improve public health responses.

Usefulness

The Unified Medical Ecosystem serves three primary user groups: patients, healthcare providers, and healthcare officials, offering specific features tailored to their needs and improving the overall efficiency and transparency of healthcare management.

1. **Patients**
    - Patients can easily schedule and manage appointments with healthcare providers. They can book an appointment weeks before. They can also look up available healthcare providers and available time slots. This allows patients to plan their visits hassle-free.
    - Patients can track and view their past and current medical bills with itemized charges. This transparency will lead to better satisfaction and financial planning.
    - Patient records will be digitized, preventing patients from carrying bulk past patient records while visiting hospitals.
2. **Healthcare Provider**
    - The healthcare providers can view complete past patient records. This can be crucial information as healthcare providers do not have to depend on patients' words for medical history. This also enables the providers to take swift action in emergencies.

- The healthcare provider can also set up their working timeline, making it easy to manage their work time.
- The healthcare provider can also request lab records for patients, allowing the patients to not worry about scheduling and managing the lab appointments.

3. **Healthcare Officials And Administrators**
    - Healthcare officials can view real-time analyses and track outbreaks using interactive visualization. This enables the officials to take preemptive actions, allocate resources more effectively, and improve public health responses.
    - Healthcare officials can also monitor the expenses, enabling them to do strategic financial planning and management and improve overall financial health and efficiency.

Several healthcare management applications provide partial features that address appointment scheduling, patient record management, and disease monitoring.

- Cerner is used widely across many healthcare institutions to manage healthcare records.
- Zocdoc is used for appointment scheduling and monitoring
- World Health Organization provides disease-tracking surveillance tools for public health monitoring

These applications do perform the functionalities individually there is a **clear lack of a unified system that provides all these functionalities together**. Cerner, for instance, is not universally adopted across healthcare institutions, and many organizations do not share patient records, leading to fragmented data that hampers comprehensive care. Our platform solves this by allowing healthcare providers to view past patient records from other institutions, ensuring continuity of care regardless of where a patient has been treated. Additionally, the disease-tracking surveillance provided by the World Health Organization does not have real-time analysis. It is updated only if a certain geographical location has a lot of diseases reported of the same type. Due to this delayed update, the officials cannot take any preemptive decision to avoid the outbreak's spread at an early stage. In contrast, our platform offers real-time disease tracking, enabling officials to detect and respond to outbreaks early, improving public health responses and resource allocation.

Dataset Description

We plan to use two datasets.

1. Healthcare Dataset
    - This dataset comprises synthetic patient healthcare records.
    - The dataset is in CSV format.
    - It includes attributes such as patient demographics, medical conditions, admission details, and more.
    - Cardinality is 10000, and degree is 15
2. Hospital Patient Records Dataset
    - This dataset contains records of patients treated at a hospital, including demographic information, medical conditions, treatments administered, medical expenses incurred, and current health status.
    - The dataset is in CSV format.
    - Cardinality is 1000, and degree is 10

Both datasets contain synthetic patient records and do not contain real patient information or violate any privacy regulation. The records mimic the real patient records as closely as possible. We plan to merge the columns from both rows and in cases of missing fields, we plan to randomize data closer to reality.

Functionality Description

User Profile creation and login flows:

As this app would rely on the patient, doctor and hospital admin interacting with each other, a central login/sign-up flow is used to perform operations on user with the required permissions based on the user type (i.e. Patient, Doctor, Admin).

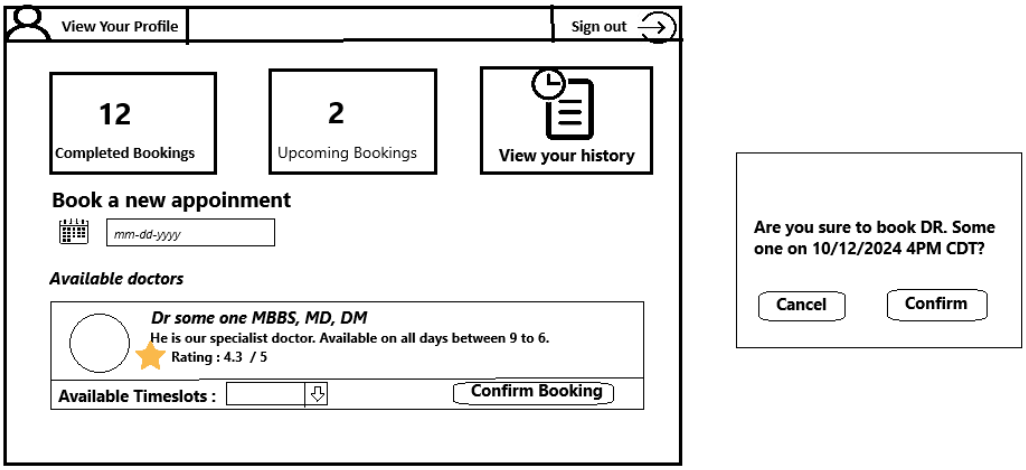
For any user a central login Id (email) and password (with constraints as per industry standard) would be created/updated and based on the user the login workflow will redirect to the respective pages as presented below.

Patient profile and appointment booking workflow

After logging in, patients can book new appointments based on their selected date. We will have a list of available doctors on that particular day and their available slots. Once they select, they can confirm their appointment by clicking the “confirm booking” button. We would have a prompt to confirm the details, such as the doctor’s name, booking data, and time.

In addition, they would also be able to look at their past and future appointments as well as their profile details to edit/update their personal data.

Under the history, they could look at past diagnostics and the prescriptions they received. Along with all these details, they would also be able to see the total cost of the appointment and the prescription and lab appointments they have.

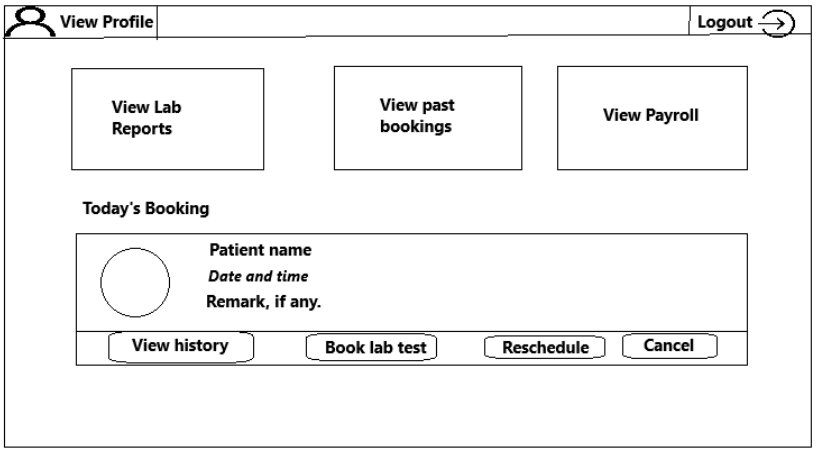


Doctor profile workflow

In terms of the doctor's view, they would be able to access the list of appointments that they have for that day, results from the lab that they requested for a patient, and past bookings.

They would also be able to edit the appointments that they have and book lab appointments for the patients.

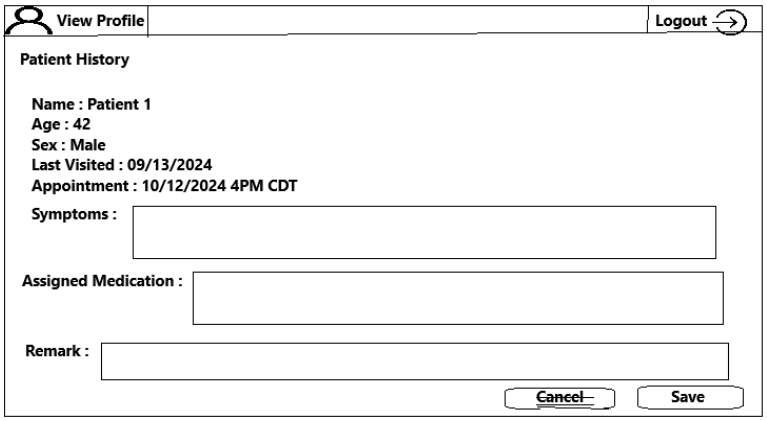
Apart from this, It also provides the functionality to allow users to view their current payroll system, with their compensation, bonuses and their billing history.



Diagnosis workflow

During a patient's diagnosis, the doctors would be able to look at the patient's detailed history of reports. They could enter the symptoms, medications prescribed, and the remarks the doctors may have during the visit. They would also be able to request lab appointments on behalf of the patient.

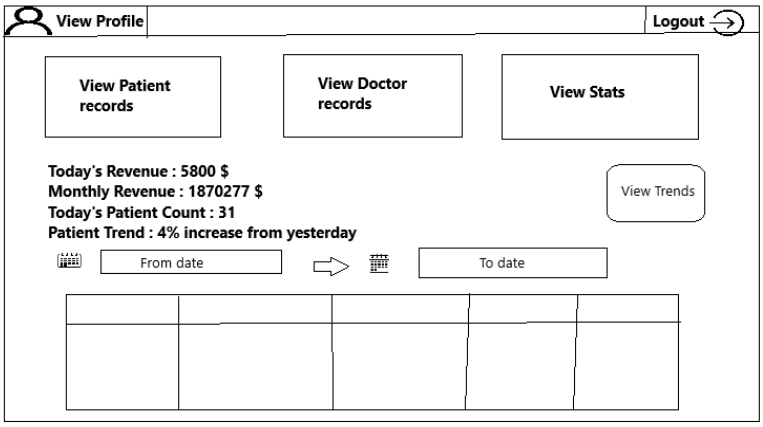
The symptoms and assigned medication will have the functionality to auto complete the symptoms with each input and provide the dialog to provide new symptoms/medication not present in the database as a new entry.



Administrators workflow

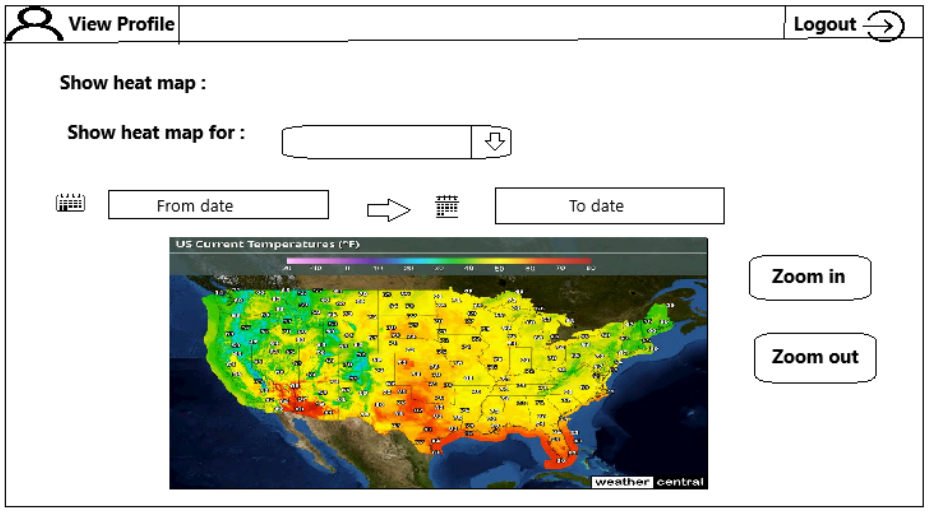
The administrators view would be a high-level overview of all the appointments for their hospital, including revenue, patients' records, and doctors' records, and filter those based on a date range.

They could also look at the trends and plan their resource allocation accordingly.



Health Officials view

After logging in, the health official and the administrators could access the trends and heat map of diseases prevalent in a particular geographical location. They would also have a set of filters that they could use, for example, date range, age, and gender.



Project work distribution

We divided the project work based on each individual's experience, expertise, and availability.

1. **Documentation and records**: Vishal R, Venkatesh P
    - This includes creating and maintaining project reports, documentation, and presentations.
2. **Database Design and advanced query creation:** Venkatesh P, Sabhari P
    - This includes creating and maintaining database design and diagrams (ER, UML), database creation and hosting, record creation, query/procedures/triggers/advanced database operations designs, creations, and optimizations.
3. **Frontend Development:** Sabhari P, Arunesh K
    - This includes working on the front-end (UI/UX) design, development and integration with the backend.
4. **Backend Development:** Vishal R, Arunesh K
    - This includes working on the backend design, development, performance optimization and integration with frontend