

DBMS End Sem Project Report

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The Database:

The hospital management system utilizes a well-structured relational database designed to efficiently handle diverse operations ranging from patient care and diagnostics to staff authentication and room allocations. The schema emphasizes normalization, clarity, and extensibility.

Key Features and Strengths

- **Entity-Centric Organization:**
 - The database contains clearly defined entities such as Patient, Doctor, Appointment, Test, Treatment, Room, and Admit, each responsible for a specific domain in the hospital's workflow.
 - Patient-related data is modularly split into relevant tables like Allergy, MedicalHistory, and Diagnosis, reducing redundancy and supporting detailed medical profiling.
- **Strong Referential Integrity:**
 - Foreign key relationships are carefully designed, such as linking Appointment with Patient and Doctor, or Treatment and Test with Appointment. This ensures data consistency and simplifies queries that join multiple tables.
- **Role-Based Authentication:**
 - Separate authentication tables (AuthPatient and AuthStaff) offer controlled access with roles and login states, enhancing security and supporting different system user experiences (e.g., patients vs. doctors vs. admins).

- **Efficient Resource Management:**

- The Room and Admit tables allow for effective tracking of room availability and patient admissions, with fields for timestamps and status management.

- **Support for Medical Workflows:**

- Test and treatment modules are dynamically linked to predefined lists (TestsAvailable, TreatmentsAvailable), allowing easy updates and scalability.
- The inclusion of fields like Status, Result, and Timestamp in Test and Treatment tables enables precise tracking of medical procedures over time.

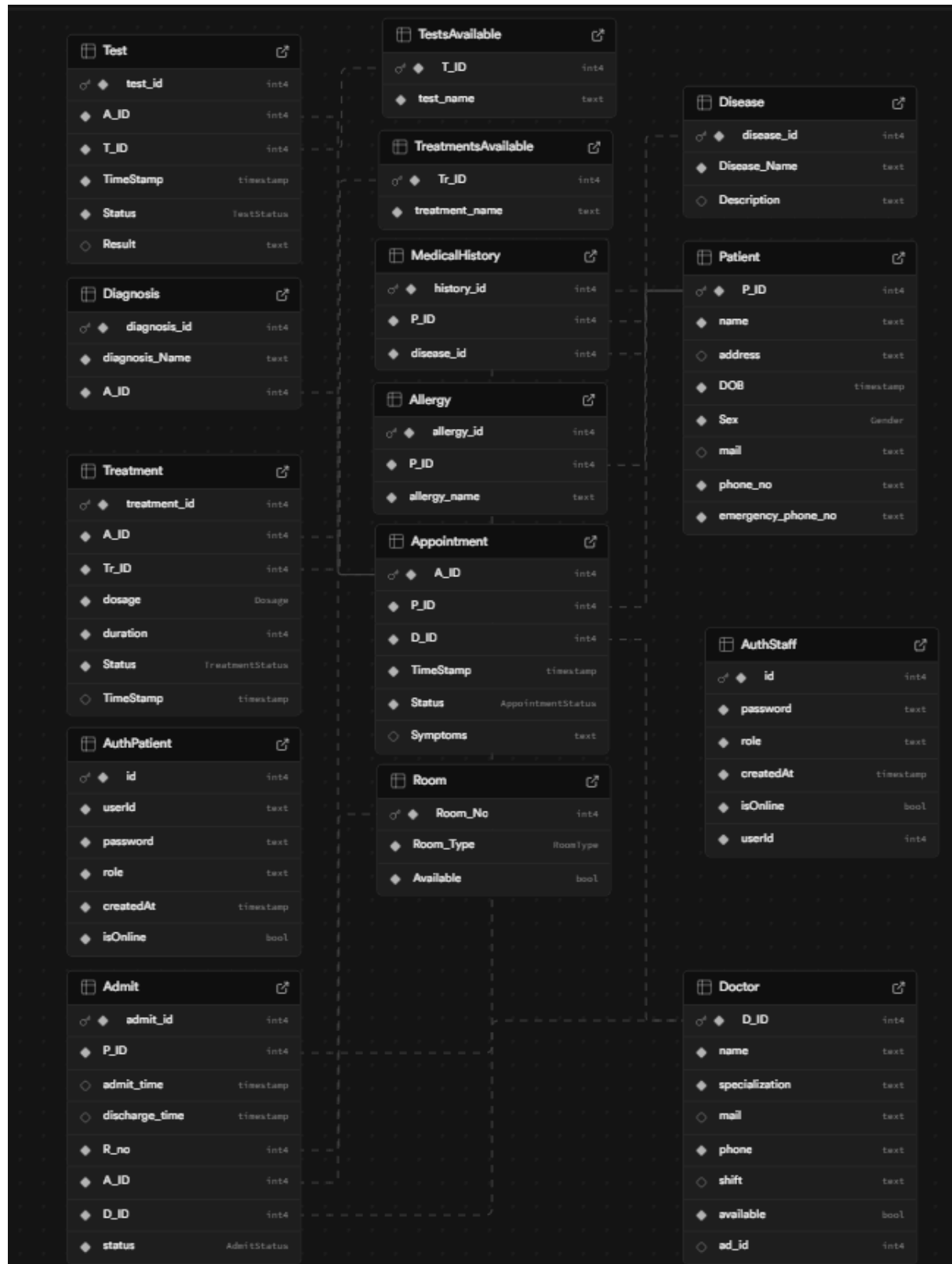
- **Scalability and Extensibility:**

- The schema is easily extendable—new departments, procedures, or user roles can be added without disrupting existing structure due to normalized design.
- Enum-like fields (e.g., Gender, TreatmentStatus, AppointmentStatus) provide clarity while allowing strict validation.

- **Well-Named Attributes:**

- The attributes are consistently and meaningfully named, improving readability and reducing the chance of misinterpretation during development or reporting.

Database Overview:



Technologies and Tools Used

Our hospital management system is built using a robust and modern tech stack, separated cleanly into frontend and backend components. The system ensures scalability, maintainability, and a smooth user experience.

Frontend

- **React:** Used as the core library for building responsive and component-based user interfaces.
- **TypeScript:** Adds static typing to JavaScript, improving code safety and developer experience.
- **Tailwind CSS:** A utility-first CSS framework that enables rapid UI development with consistent styling.
- **shadcn/ui:** A modern UI component library built on top of Tailwind CSS, used to design clean and accessible components.
- **Role-Based Component Structure:** Components are organized by user roles (e.g., front desk operator) to maintain clarity and separation of concerns.

Backend

- **Express.js:** A lightweight and flexible Node.js framework used to handle routing and REST API logic.
- **TypeScript:** Used throughout the backend for type safety and improved code maintainability.
- **Prisma ORM:** Acts as the bridge between the application and the PostgreSQL database, enabling type-safe database access and schema modeling.
- **PostgreSQL:** A powerful open-source relational database system used to store all hospital-related data, such as patients, appointments, tests, and treatments.

Tools and Utilities

- **Postman:** Used for testing and verifying RESTful API endpoints during development.
- **Supabase:** Employed for storing and managing assets like images or documents related to the system (e.g., medical records or reports), and optionally as an authentication layer for certain modules.

Workflow Overview: From Database to UI

1. User Interaction (Frontend – client)

A user (e.g., front desk operator) interacts with a React component (e.g., clicking “Schedule Test” or “View Treatments”), triggering a handler function.

2. API Call (Frontend → Backend)

The frontend uses the **native fetch API** to send a RESTful request (e.g., `fetch(' /api/appointments')`) to the backend server.

3. Routing Layer (Backend – server/src/routes)

The request is routed by Express to the appropriate **route handler**, which maps the endpoint to a controller function.

4. Controller Logic (Backend – server/src/controllers)

The controller processes the request, applies any business logic, and uses **Prisma ORM** to interact with the PostgreSQL database.

5. Database Interaction (Backend – prisma)

Prisma translates the queries into SQL and communicates with **PostgreSQL** to fetch or update the data as needed.

6. Response to Frontend

The controller sends a JSON response containing the requested data or operation result.

7. UI Rendering (Frontend – client/components/pages)

The frontend receives the response, updates React state, and re-renders the component to display the latest data using Tailwind CSS and shadcn/ui components.

HTTP Requests Used in our Project:

1. GET

The GET method is used to retrieve data from the server without making any modifications to the database. It is designed to be a read-only operation.

Purpose: Data retrieval

Data transmission: Parameters are typically passed via the URL (query string or path parameters)

Security: Should not be used for transmitting sensitive information, as the data is visible in the URL and may be stored in browser history

Use Case Example: Fetching patient records or viewing appointment details

2. POST

The POST method is used to create new resources on the server. It is also commonly used for user authentication, as it allows the transmission of data securely within the request body.

Purpose: Data creation and secure data submission

Data transmission: Sent via the request body in formats like JSON

Security: Suitable for transmitting sensitive information such as login credentials, as the data is not exposed in the URL

Use Case Example: Adding a new patient record to the database or logging in a staff member using credentials

3. PUT

The PUT method is used to update existing data on the server. It is generally intended for replacing the entire resource with the new data provided in the request.

Purpose: Full update of an existing resource

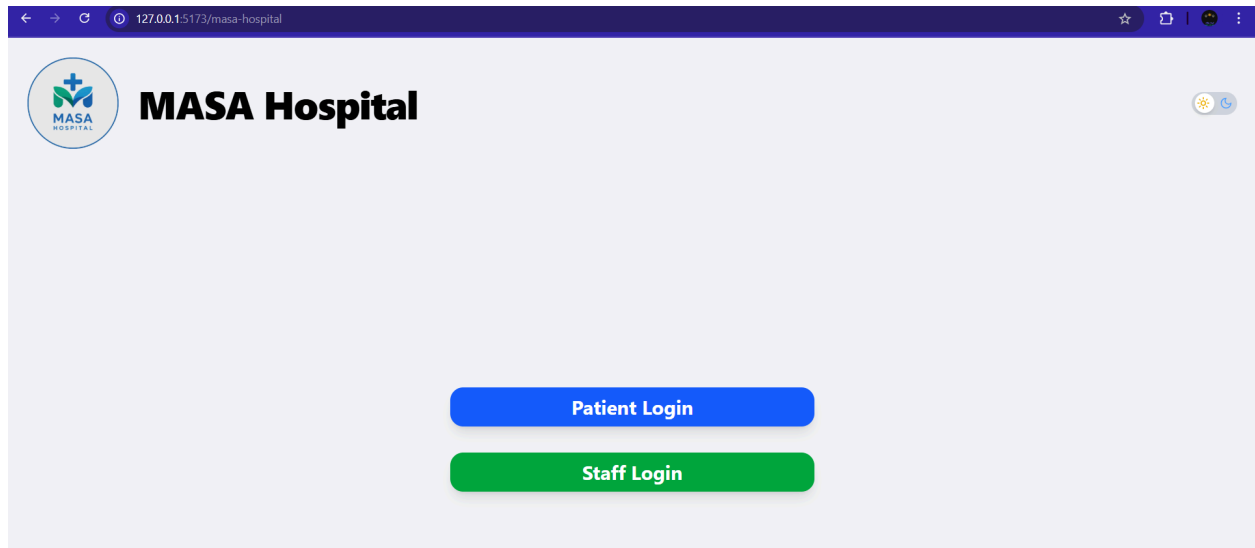
Data transmission: Sent via the request body, similar to POST

Requirement: The resource being updated (e.g., a specific patient by ID) must already exist

Use Case Example: Updating a patient's details, such as changing the diagnosis or age

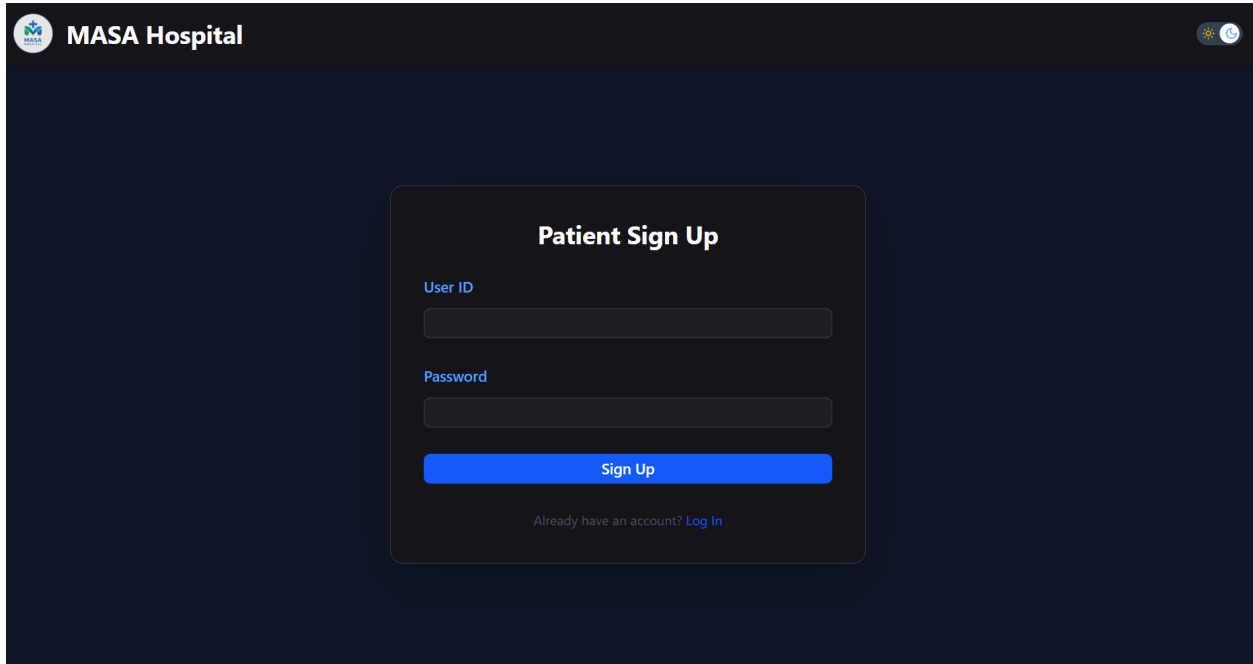
Page-by-Page overview of functionalities available

Masa-hospital: Home Page



- Allows patients to move to patient signup/login page
- Allows the staff to move to their login pages (staff includes doctors, front desk operators and data entry operators)

Patient Sign-up :



The image shows a web interface for MASA Hospital's Patient Sign Up. The header features the MASA Hospital logo and name on the left, and a sun/moon icon on the right. The main content area is dark blue. In the center, there is a white rounded rectangle containing the title "Patient Sign Up". Below the title are two input fields: "User ID" and "Password". A blue "Sign Up" button is positioned below the password field. At the bottom of the form, there is a link that says "Already have an account? Log In".

Patient Sign Up

User ID

Password

[Sign Up](#)

Already have an account? [Log In](#)

- Helps a new patient to sign-up and move to Sign-up form (where the data of a new patient is collected for the 1st time)
- Allows existing patient to move to Log In page

Patient Sign-up Form:

Complete Your Profile

Full Name

Kumar Snehal

Address

602 B, Spring Bloom Apartments, B G Shirke Road, Near Bharat Forge, Ghorpadi

Date of Birth

06-02-2005

Sex

Male

Email

22cs02009@iitbbs.ac.in

Phone Number

9420611217

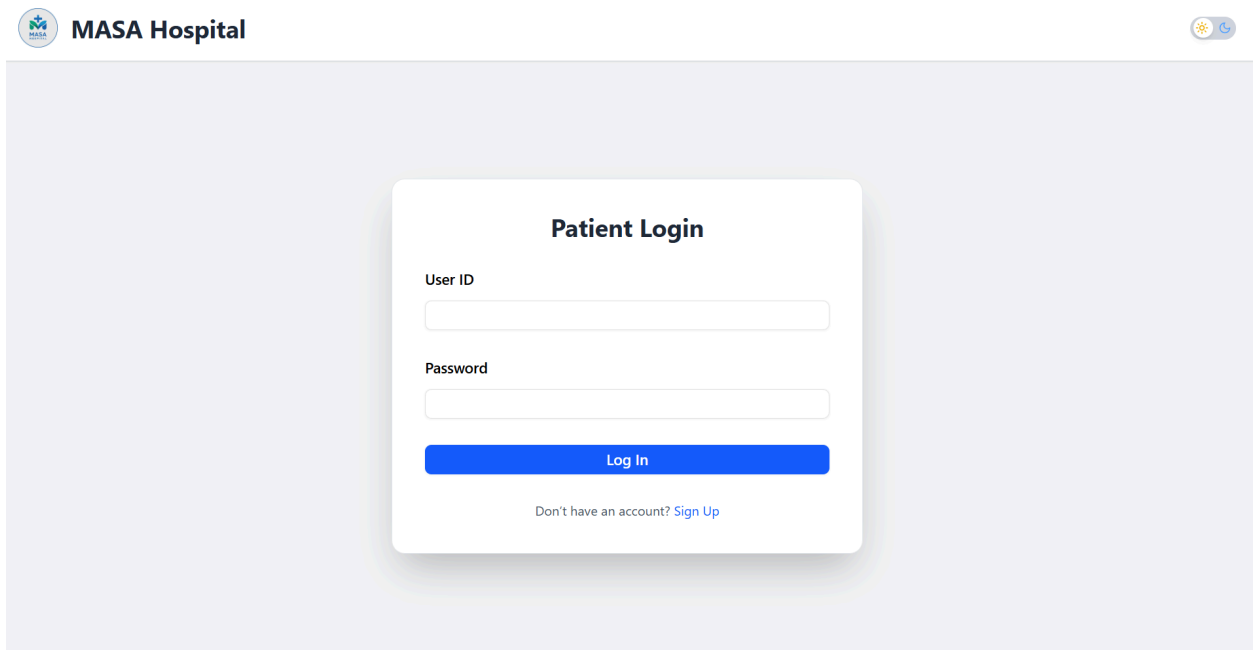
Emergency Phone Number

9867123576

Submit Info

- Allows a new patient to register their details to the hospital database
- Includes interactive calendar to select DOB in required format, ensuring no error.

Patient Login:



The image shows a web page for MASA Hospital. At the top left is the MASA Hospital logo, which consists of a blue circle with a white 'M' and the text 'MASA Hospital' next to it. At the top right is a small circular icon with a sun and a moon. The main content area is a light gray rectangle. In the center of this rectangle is a white rounded rectangle with a subtle shadow. Inside this white box, the title 'Patient Login' is centered at the top. Below the title, there are two input fields: the first is labeled 'User ID' and the second is labeled 'Password'. Both labels are in a small, dark font. Below the 'Password' field is a blue button with the text 'Log In' in white. At the bottom of the white box, there is a link that says 'Don't have an account? Sign Up'.

Patient Login

User ID

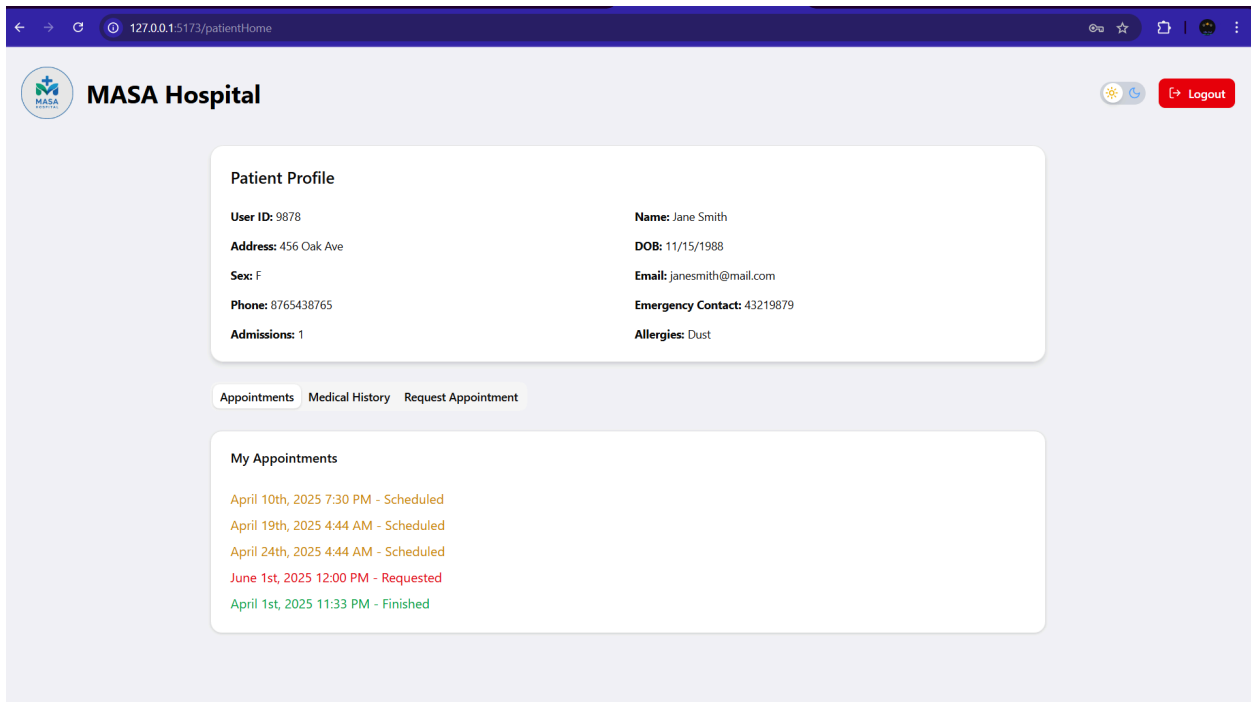
Password

Log In

Don't have an account? [Sign Up](#)

- Allows new users to move to Sign Up
- Navigates current users to their home-page after a successful login.

Patient Home Page:



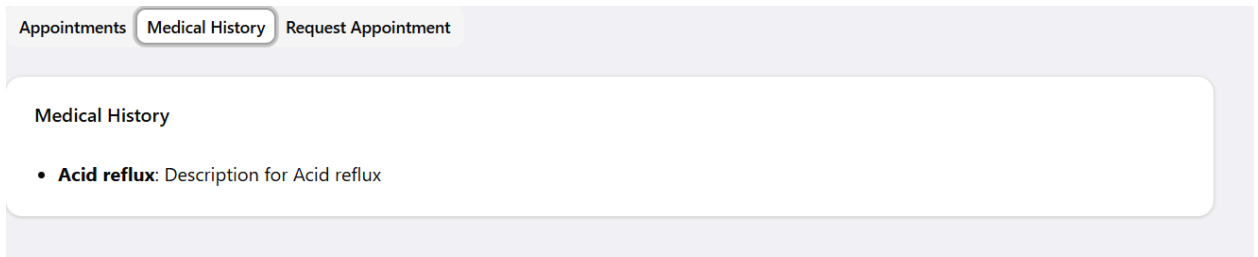
The screenshot shows the MASA Hospital Patient Home Page. The browser address bar displays "127.0.0.1:5173/patientHome". The page header includes the MASA Hospital logo and a "Logout" button. The main content area features a "Patient Profile" section with the following details:

Patient Profile	
User ID: 9878	Name: Jane Smith
Address: 456 Oak Ave	DOB: 11/15/1988
Sex: F	Email: janesmith@mail.com
Phone: 8765438765	Emergency Contact: 43219879
Admissions: 1	Allergies: Dust

Below the profile section are three tabs: "Appointments", "Medical History", and "Request Appointment". The "Appointments" tab is active, showing a list of "My Appointments":

- April 10th, 2025 7:30 PM - Scheduled
- April 19th, 2025 4:44 AM - Scheduled
- April 24th, 2025 4:44 AM - Scheduled
- June 1st, 2025 12:00 PM - Requested
- April 1st, 2025 11:33 PM - Finished

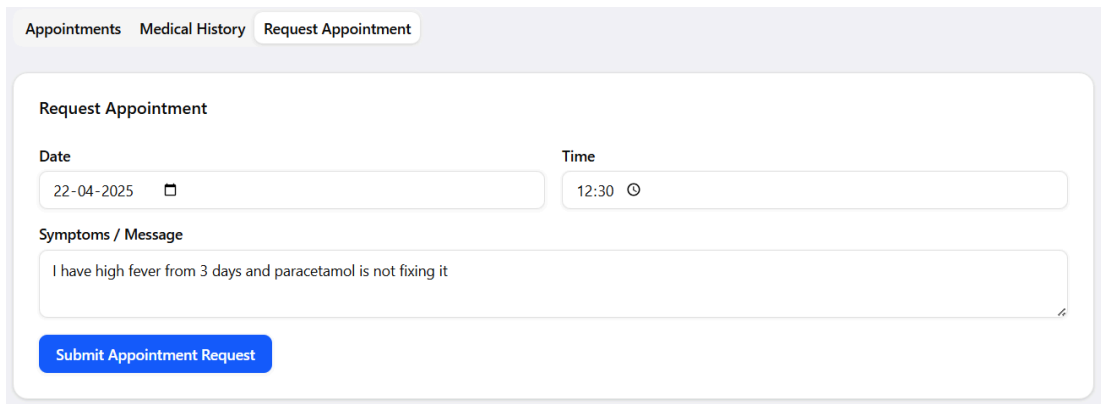
- Displays the general details of a patient (that the patient would have filled while filling in the Sign-up form)
- Shows the status and details of appointments
- Shows the medical history (if any) of the patient



This screenshot shows the "Medical History" section of the patient home page. The "Medical History" tab is active, and the section displays a single entry:

- **Acid reflux:** Description for Acid reflux

- Allows the patient to request a new appointment



This screenshot shows the "Request Appointment" form. The "Request Appointment" tab is active. The form includes the following fields:

- Date:** A text input field containing "22-04-2025" and a calendar icon.
- Time:** A text input field containing "12:30" and a clock icon.
- Symptoms / Message:** A text area containing the message "I have high fever from 3 days and paracetamol is not fixing it".
- Submit Appointment Request:** A blue button at the bottom of the form.

Staff Login:

Staff Login

User ID

9

Password

.....

Role

Data Entry Operator ▾

Doctor

Front Desk Operator

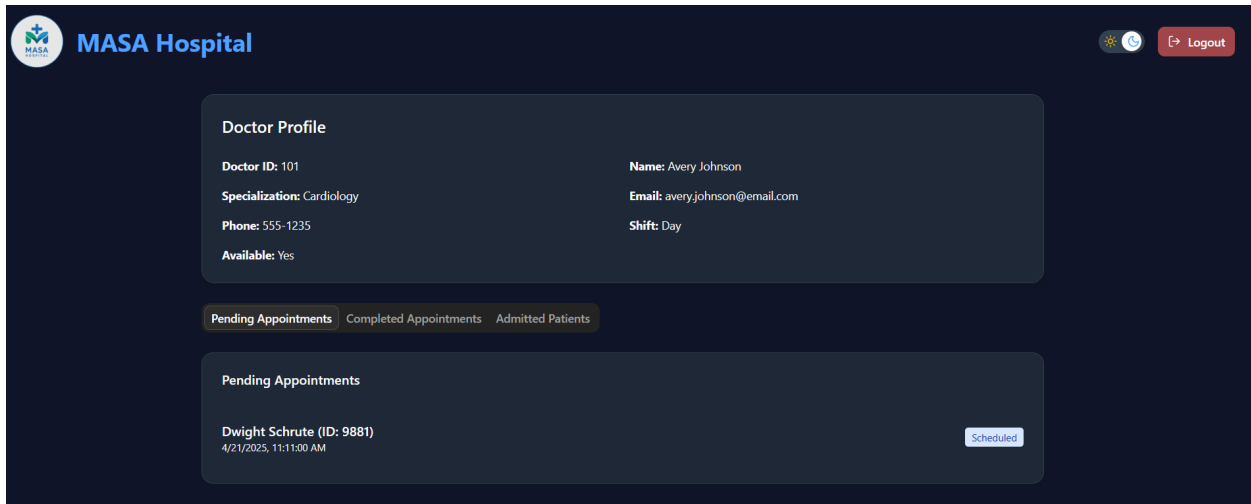
Data Entry Operator ✓

Database Administrator

Login

- Allows staff to select their particular roles
- Moves to their dashboard/homepage after successful login

Doctor Homepage:



The screenshot shows the MASA Hospital Doctor Homepage. At the top left is the MASA Hospital logo. To its right is the text "MASA Hospital". On the top right, there are icons for a sun, a moon, and a "Logout" button. Below the header, there is a "Doctor Profile" section. It contains two columns of information: Doctor ID: 101, Specialization: Cardiology, Phone: 555-1235, and Available: Yes on the left; and Name: Avery Johnson, Email: averyjohnson@email.com, and Shift: Day on the right. Below the profile section, there are three tabs: "Pending Appointments", "Completed Appointments", and "Admitted Patients". The "Pending Appointments" tab is selected. Below the tabs, there is a "Pending Appointments" section. It shows a patient named "Dwight Schrute (ID: 9881)" with the date and time "4/21/2025, 11:11:00 AM". To the right of this information is a "Scheduled" button.

MASA Hospital

Doctor Profile

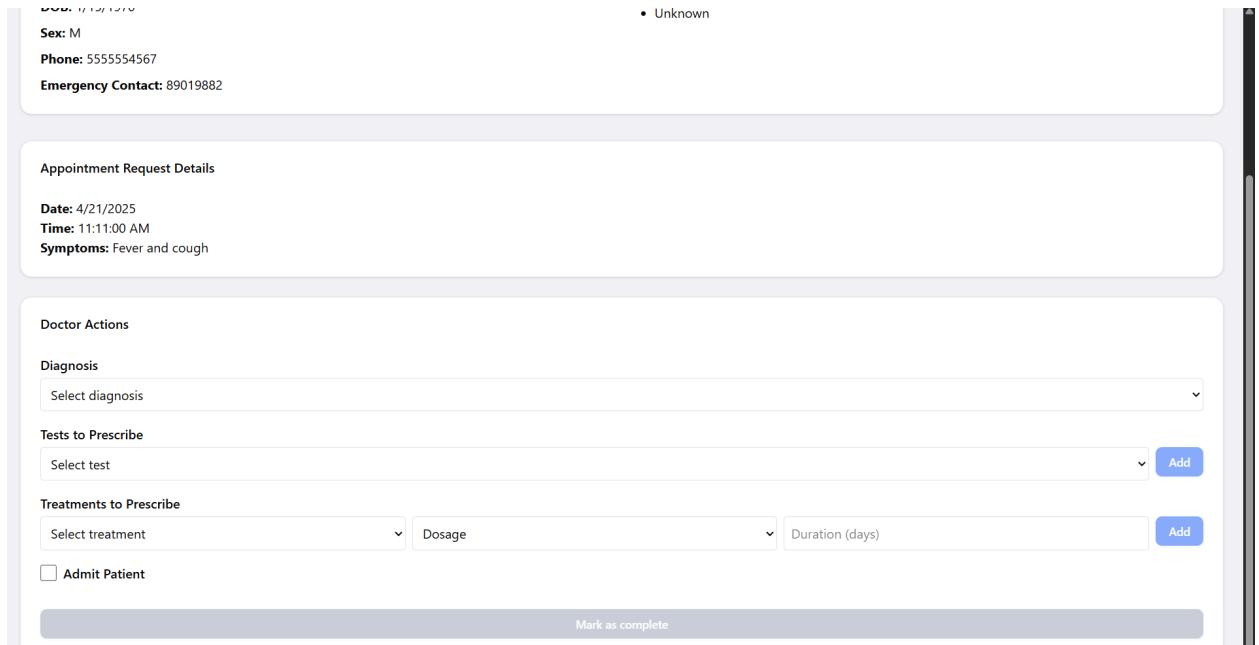
Doctor ID: 101 Name: Avery Johnson
Specialization: Cardiology Email: averyjohnson@email.com
Phone: 555-1235 Shift: Day
Available: Yes

Pending Appointments Completed Appointments Admitted Patients

Pending Appointments

Dwight Schrute (ID: 9881)
4/21/2025, 11:11:00 AM Scheduled

- Pending appointments: shows him the list of available appointments
- Clicking on that particular appointment allows him to see all details about that patient and also resolve the appointment (give a diagnosis/test/treatment/admit the patient)



The screenshot shows the "Appointment Request Details" form. It is divided into several sections. The top section contains patient information: Sex: M, Phone: 5555554567, and Emergency Contact: 89019882. Below this is the "Appointment Request Details" section, which includes Date: 4/21/2025, Time: 11:11:00 AM, and Symptoms: Fever and cough. The "Doctor Actions" section contains a "Diagnosis" dropdown menu with "Select diagnosis" as the placeholder. Below this is a "Tests to Prescribe" section with a "Select test" dropdown menu and an "Add" button. The "Treatments to Prescribe" section has a "Select treatment" dropdown menu, a "Dosage" dropdown menu, a "Duration (days)" text input field, and an "Add" button. At the bottom of the "Doctor Actions" section, there is a checkbox labeled "Admit Patient". At the very bottom of the form, there is a "Mark as complete" button.

Sex: M • Unknown

Phone: 5555554567
Emergency Contact: 89019882

Appointment Request Details

Date: 4/21/2025
Time: 11:11:00 AM
Symptoms: Fever and cough

Doctor Actions

Diagnosis
Select diagnosis

Tests to Prescribe
Select test Add

Treatments to Prescribe
Select treatment Dosage Duration (days) Add

☐ Admit Patient

Mark as complete


- Completed appointments: shows all completed appointments and everything that was performed on. prescribed to that patient (if clicked)

Pending Appointments Completed Appointments Admitted Patients

Completed Appointments

Pam Beesly (ID: 9880)
3/27/2025, 1:32:33 AM

Finished

 **MASA Hospital**🌞🌙 Logout

Patient Information

Name: Pam Beesly
Patient ID: 9880

Appointment Summary

Date: 3/27/2025
Time: 1:32:33 AM
Symptoms: Joint pain
Diagnosis: N/A
Doctor: Avery Johnson
Admit: No

Prescribed Tests & Results

MRI X-Ray Thyroid
Status: Completed
Result: No abnormality

Prescribed Treatments

Physical Therapy | Dosage: Morning & Afternoon | Duration: 9 days

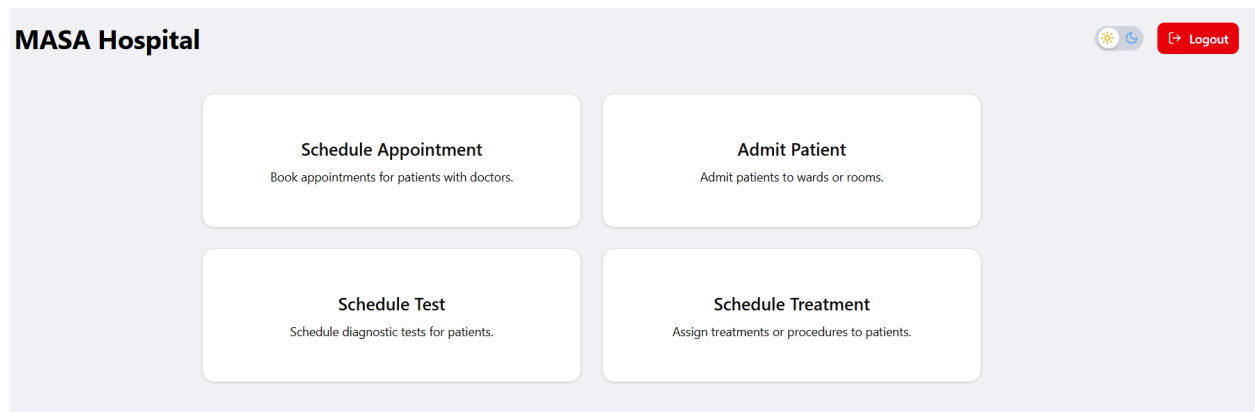
- Admitted patients: allows the doctor to view his admissions and put in a discharge request for any patient

Pending Appointments Completed Appointments Admitted Patients

Admitted Patients

No admitted patients.

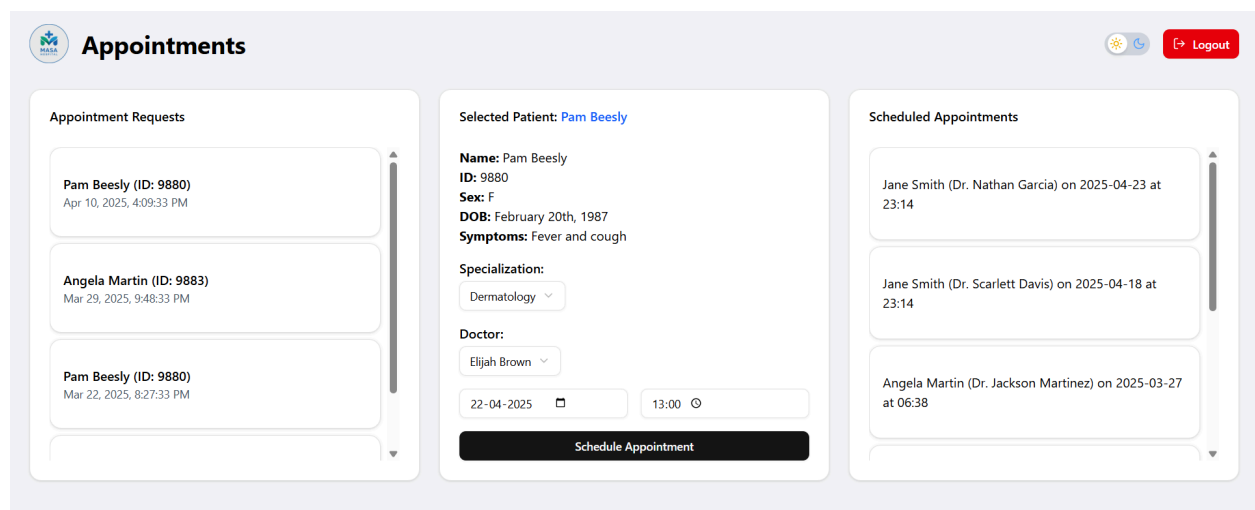
Front-desk Operator homepage:



- Move to scheduling appointments, admitting a patient, scheduling a test, scheduling a treatment

Scheduling appointments:

- Can see requested as well as scheduled appointments, can click on a requested appointment and schedule it as shown.



Admit Patient:

- Can see all patients seeking admission/discharge, and can allot a room (if available) and discharge patients

The screenshot shows a web browser window with the address bar displaying '127.0.0.1:5173/front-desk-admissions'. The interface is divided into two main sections at the top: 'Seeking Admission' and 'Discharge Requests'. The 'Seeking Admission' section contains a form for patient information: Name (Pam Beesly), ID (9880), Sex (F), DOB (February 20th, 1987), Reason (Fever and cough), and a 'Select Ward Type' dropdown menu currently set to 'General (1-20)'. The 'Discharge Requests' section shows 'No discharge requests.' Below these sections is a grid of 40 room tiles, arranged in 4 rows and 10 columns. The first two rows are labeled 'General' (General 1 to General 20). The third row is labeled 'ICU' (ICU 21 to ICU 30). The fourth row is labeled 'Maternity' (Maternity 31 to Maternity 40). Most tiles are green and indicate 'PID: None'. General 4 is highlighted in red and indicates 'PID: 9878'. All other tiles indicate 'PID: None'.


Schedule tests:

- All info about pending and scheduled tests and can schedule tests by selecting time and date

The screenshot shows a web browser window with the address bar displaying '127.0.0.1:5173/tests-scheduling'. The interface has a header with a logo, the title 'Tests Scheduling', and a 'Logout' button. The main content is divided into two panels: 'Requested Tests' and 'Pending Tests'. The 'Requested Tests' panel lists three tests: Jane Smith (Patient ID: 9878) — Blood Cultures, Pam Beesly (Patient ID: 9880) — Heart X-Ray, and Dwight Schrute (Patient ID: 9881) — ECG Vitamin. Below the list is a detailed form for the selected test (Blood Cultures): Test Name, Test ID (1), Patient Name (Jane Smith), Patient ID (9878), Sex (F), DOB (November 15th, 1988), Symptoms (I have fever), Appointment ID (2), and Appointment Time (April 19th, 2025 at 4:44 AM). At the bottom of this form are 'Select Date' and 'Select Time' dropdowns, currently showing '22-04-2025' and '14:00'. A blue 'Schedule Test' button is at the bottom of the panel. The 'Pending Tests' panel lists three tests: Angela Martin (Patient ID: 9883) — Heart Ultrasound (March 27th, 2025 at 12:08 PM, Abdominal pain), Angela Martin (Patient ID: 9883) — Culture CT Ultrasound (March 29th, 2025 at 9:48 PM, Fever and cough), and Pam Beesly (Patient ID: 9880) — Biopsy Hormone Culture (March 27th, 2025 at 6:55 PM, Headache).

Treatment scheduling :

- Similar to test scheduling page, shows all pending and scheduled ones and can schedule treatments

 **Treatment Scheduling** ⚙️ 🌙 ➡️ Logout

Requested Treatments

- Jane Smith (Patient ID: 9878) — Chemotherapy
- Jane Smith (Patient ID: 9878) — Surgery
- Angela Martin (Patient ID: 9883) — Targeted Therapy
- Dwight Schrute (Patient ID: 9881) — Photodynamic Therapy
- Pam Beesly (Patient ID: 9880) — Physical Therapy
- Jane Smith (Patient ID: 9878) — Blood Transfusion

Scheduled Treatments

- Jane Smith (Patient ID: 9878) — Radiation Therapy
May 2nd, 2025 at 4:00 PM
- Michael Scott (Patient ID: 9879) — Hormone Therapy
May 5th, 2025 at 2:15 PM
- Angela Martin (Patient ID: 9883) — Hyperthermia
May 9th, 2025 at 12:30 PM
- Jane Smith (Patient ID: 9878) — Dialysis
May 13th, 2025 at 6:00 PM


Schedule Treatment for Pam Beesly

Treatment: Physical Therapy
Patient ID: 9880
Sex: F
DOB: February 20th, 1987

Date **Time**

[Schedule Treatment](#)

Data Entry Operator:

 **Test Results Entry** ⚙️ 🌙 ➡️ Logout

Pending Tests

- Angela Martin (Patient ID: 9883) — Heart Ultrasound
Doctor: Jackson Martinez (ID: 107)
March 27th, 2025 at 12:30 PM
- Angela Martin (Patient ID: 9883) — Culture CT Ultrasound
Doctor: Scarlett Davis (ID: 104)
March 29th, 2025 at 10:00 PM
- Pam Beesly (Patient ID: 9880) — Biopsy Hormone Culture
Doctor: Nathan Garcia (ID: 105)
April 1st, 2025 at 4:20 AM

Enter Result

Test: Heart Ultrasound
Patient: Angela Martin (ID: 9883)
Doctor: Jackson Martinez (ID: 107)
Date: March 27th, 2025 at 12:30 PM

Result

[Save Result](#) [Cancel](#)

Completed Tests

- Jane Smith (Patient ID: 9878) — Biopsy CT
Doctor: Nathan Garcia (ID: 105)
April 21st, 2025 at 12:11 AM
Result: cat found in abdomen
- Michael Scott (Patient ID: 9879) — Biopsy Kidney
Doctor: Elijah Brown (ID: 103)
April 2nd, 2025 at 8:30 AM
Result: High cholesterol
- Jane Smith (Patient ID: 9878) — Urine Blood X-Ray
Doctor: Sofia Anderson (ID: 108)

- Can enter the result of a pending test, and can see all data of all completed tests

Database Administrator:

Can search for patients/ remove them/ add new ones, and a doctor can only be added by this ID

- Patients Tab:

The screenshot shows the 'Patients' tab of the 'Hospital Database Manager'. The left sidebar contains the 'MASA Hospital' logo, 'Hospital DB', and navigation links for 'Patients', 'Doctors', 'Tests Available', 'Appointments', and 'Home'. The main content area has a search bar labeled 'Search by ID or name' with 'Search', 'Reset', and 'Add Patient' buttons. Below is a table of patients with columns: ID, Name, Gender, Date of Birth, Phone, and Emergency Contact.

ID	Name	Gender	Date of Birth	Phone	Emergency Contact
9877	John Doe	Male	May 23, 1990	9876541234	56789878
9878	Jane Smith	Female	November 15, 1988	8765438765	43219879
9879	Michael Scott	Male	March 1, 1975	7654322345	67899880
9880	Pam Beesly	Female	February 20, 1987	6543213456	78909881
9881	Dwight Schrute	Male	January 15, 1970	5555554567	89019882
9882	Jim Halpert	Male	October 10, 1982	4444445678	90129883
9883	Angela Martin	Female	September 30, 1985	3333336789	01239884
9884	Kevin Malone	Male	July 7, 1978	2222227890	12349885
9885	Oscar Martinez	Male	December 12, 1983	1111118909	2345

- Doctor Tab:

The screenshot shows the 'Doctors' tab of the 'Hospital Database Manager'. The left sidebar is identical to the previous screenshot. The main content area has a search bar labeled 'Search by ID, name or specialization' with 'Search', 'Reset', and 'Add Doctor' buttons. Below is a table of doctors with columns: ID, Name, Specialization, Phone, and Status.

ID	Name	Specialization	Phone	Status
102	Harper Williams	Pediatrics	555-5678	Available
103	Elijah Brown	Dermatology	555-9012	Unavailable
104	Scarlett Davis	Orthopedics	555-3456	Available
105	Nathan Garcia	Neurology	555-7890	Available
106	Chloe Rodriguez	Oncology	555-2345	Available
107	Jackson Martinez	Emergency Medicine	555-6789	Available
108	Sofia Anderson	Gynecology	555-0123	Unavailable
101	Avery Johnson	Cardiology	555-1235	Available

- Can add a new test, for example the hospital procured a new equipment with which they can test new diseases

The screenshot displays the 'Hospital Database Manager' interface for 'MASA Hospital'. The left sidebar contains navigation links: 'Patients', 'Doctors', 'Tests Available' (highlighted with a right arrow), 'Appointments', and 'Home'. The main content area is titled 'Tests Available' and features a search bar with the placeholder 'Search by ID or name', a 'Search' button, a 'Reset' button, and an 'Add Test' button. Below the search bar is a table listing available tests.

ID	Test Name
2	Biopsy CT
4	Urine Blood X-Ray
5	Biopsy Kidney
6	Heart Ultrasound
7	Biopsy Hormone Culture
8	ECG Vitamin
9	Culture CT Ultrasound
10	MRI X-Ray Thyroid
11	Cholesterol Bone