DOCSPOT: SEAMLESS APPOINTMENT BOOKING FOR HEALTH

A Project Report Submitted by:
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1) Project Overview

Healthcare management systems are essential for improving hospital operations and patient services. Traditional appointment booking methods are manual, time-consuming, and inefficient. With the advancement of web technologies, healthcare services can be digitized to enhance accessibility and efficiency. This project focuses on building an online healthcare appointment system using the MERN stack, enabling seamless interaction between patients, doctors, and administrators.

2) Project Overview

➢ **Purpose**

The purpose of this project is to develop a web-based healthcare appointment management system that allows patients to book appointments with doctors online. Traditional hospital appointment systems are manual and inefficient. This system digitizes the process to improve accessibility, efficiency, and management.

The main goal is to:

- Reduce manual workload
- Provide secure user authentication
- Enable doctor approval system
- Streamline appointment booking process

➢ **Features**

- User Registration and Login
- Doctor Registration with Professional Details
- Admin Approval System for Doctors
- Browse Approved Doctors
- Book Appointment
- View Appointment Status (Pending / Approved / Rejected)
- Role-Based Access Control (User / Doctor / Admin)
- Secure JWT Authentication
- Responsive UI Design

3) <u>Architecture</u>

The application follows a **three-tier architecture**:

Frontend → Backend → Database

- **Frontend Architecture (React.js)**
  - Developed using React.js with TypeScript
  - Uses Redux Toolkit for state management
  - Uses Material UI for UI components
  - Uses React Router for navigation
  - API calls handled using RTK Query / Axios
  - Protected routes implemented for role-based access

Component-Based Structure:

- Pages (Login, Register, Home, Appointments)
- Components (Navbar, Table, Cards, Forms)
- Redux store for managing global state

- **Backend Architecture (Node.js + Express.js)**
  - Developed using Node.js and Express.js
  - RESTful API structure
  - MVC architecture pattern
  - Controllers handle business logic
  - Routes define API endpoints
  - Middleware used for:
    - Authentication
    - Authorization
    - Error handling

Security:

- JWT Token Authentication
- Password hashing using bcrypt
- Role-based route protection

- **Database Architecture (MongoDB)**

MongoDB is used as a NoSQL database.

Collections:

Users Collection

- _id
- name
- email
- password (hashed)
- role (user / doctor / admin)

Doctors Collection

- userId (reference to user)
- fullName
- specialization
- experience
- feePerConsultation
- timings
- status (pending / approved / rejected)

Appointments Collection

- userId
- doctorId
- date
- time
- status

Mongoose is used to define schemas and models.

Flow:
User → Frontend → API → Backend → MongoDB → Response → Frontend

4) <u>Setup Instructions</u>

➢ **Prerequisites**

- Node.js (v16 or higher)
- MongoDB (Local or Atlas)
- npm
- Git

Installation Steps

- **Step 1: Clone Repository**

```
git clone <repository-url>
cd project-folder
```

- **Step 2: Backend Setup**

```
cd server
npm install
```

Create .env file:

```
PORT=5000
MONGO_URI=your_mongodb_connection_string
JWT_SECRET=your_secret_key
```

- **Step 3: Frontend Setup**

```
cd client
npm install
```

5) Folder Structure

- **Client (React Frontend)**

```
client/
├── src/
│   ├── components/
│   ├── pages/
│   ├── redux/
│   ├── hooks/
│   ├── utils/
│   ├── App.tsx
│   └── main.tsx
└── package.json
```

Explanation:

- components → Reusable UI components
- pages → Page-level components

- redux → State management
- utils → Helper functions

➢ **Server (Node.js Backend)**

```
server/
├── controllers/
├── models/
├── routes/
├── middleware/
├── config/
├── server.js
└── package.json
```

Explanation:

- controllers → Business logic
- models → Mongoose schemas
- routes → API routes
- middleware → Auth & error handling

6) <u>Running the Application</u>

➢ **Start Backend**

Inside server directory:

```
npm start
```

Server runs on:

http://localhost:5000

➢ **Start Frontend**

Inside client directory:

```
npm start
```

Frontend runs on:

http://localhost:3000

7) API Documentation

Authentication APIs

POST /api/users/register

Registers new user

Request:

```
{
  "name": "Swetha",
  "email": "swetha@gmail.com",
  "password": "123456"
}
```

Response:

```
{
  "message": "User registered successfully"
}
```

POST /api/users/login

Response:

```
{
  "token": "jwt_token",
  "role": "user"
}
```

Doctor APIs

POST /api/doctors/apply

Doctor registration

GET /api/doctors

Get all approved doctors

Appointment APIs

POST /api/appointments/book

Book appointment

GET /api/appointments/user

Get user appointments

8) <u>Authentication</u>

Authentication is implemented using **JWT (JSON Web Tokens)**.

Process:

1. User logs in
2. Server validates credentials
3. JWT token is generated
4. Token is stored in local storage
5. Token is sent in Authorization header
6. Middleware verifies token for protected routes

Authorization:

- Users can book appointments
- Doctors can manage appointments
- Admin can approve doctors

9) <u>User Interface</u>

The UI is built using:

- React.js
- Material UI
- Responsive design

Screens include:

- Login Page
- Registration Page
- Home Page
- Doctor Profile Page
- Appointment Page
- Admin Dashboard

10) Testing

Testing was performed manually.

Test Cases:

- User registration validation
- Login authentication check
- Doctor approval flow
- Appointment booking flow
- Role-based access testing

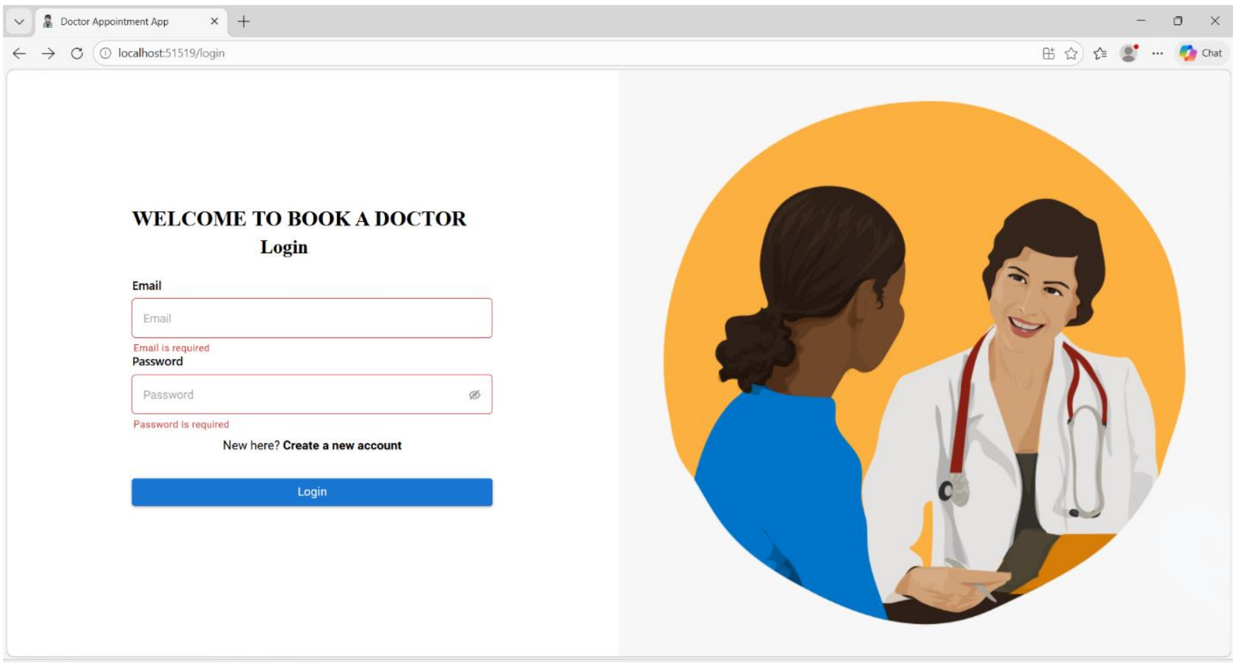
Error handling tested for:

- Invalid credentials
- Unauthorized access
- Invalid form inputs

11) Screenshots or Demo

Include:

- Login Page Screenshot
- Doctor Registration Screenshot
- Admin Approval Screenshot
- Booking Appointment Screenshot
- MongoDB Collections Screenshot



WELCOME TO BOOK A DOCTOR

Login

Email

Email

Email is required

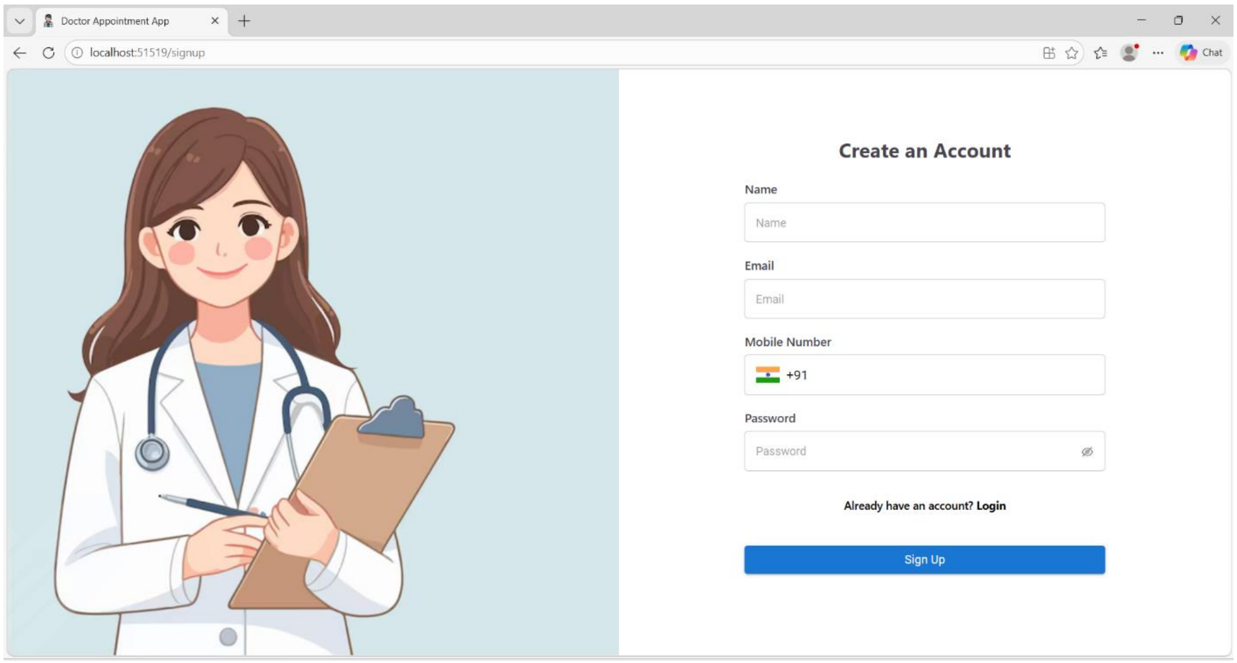
Password

Password

Password is required

New here? **Create a new account**

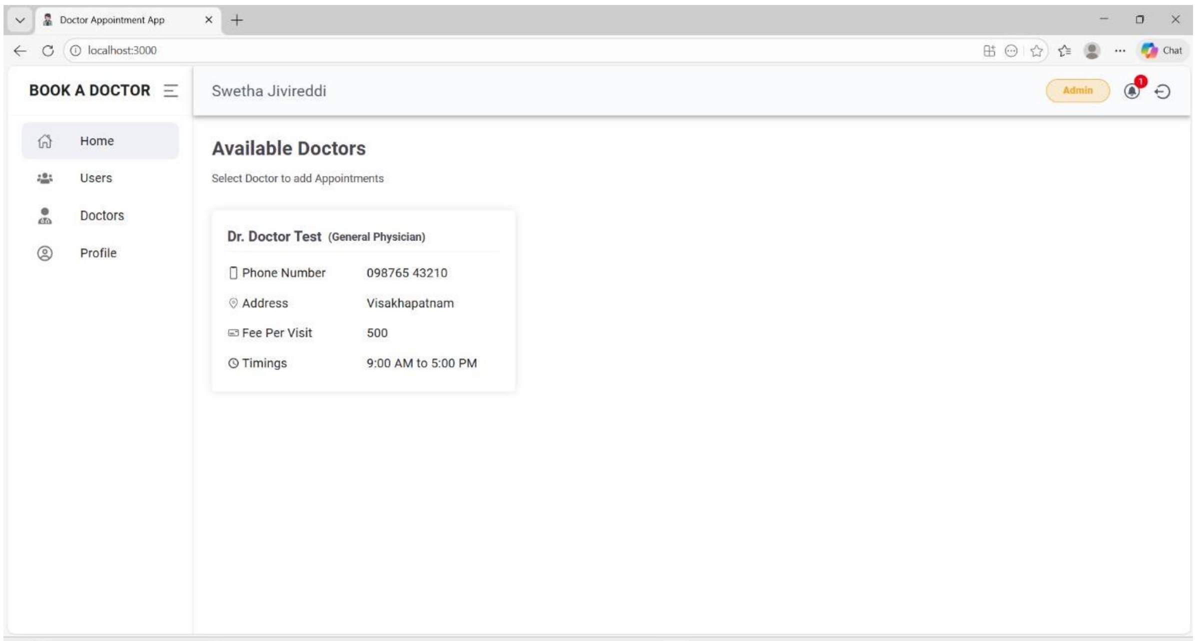
Login



Create an Account

Name	Name
Email	Email
Mobile Number	+91
Password	Password

Already have an account? **Login**

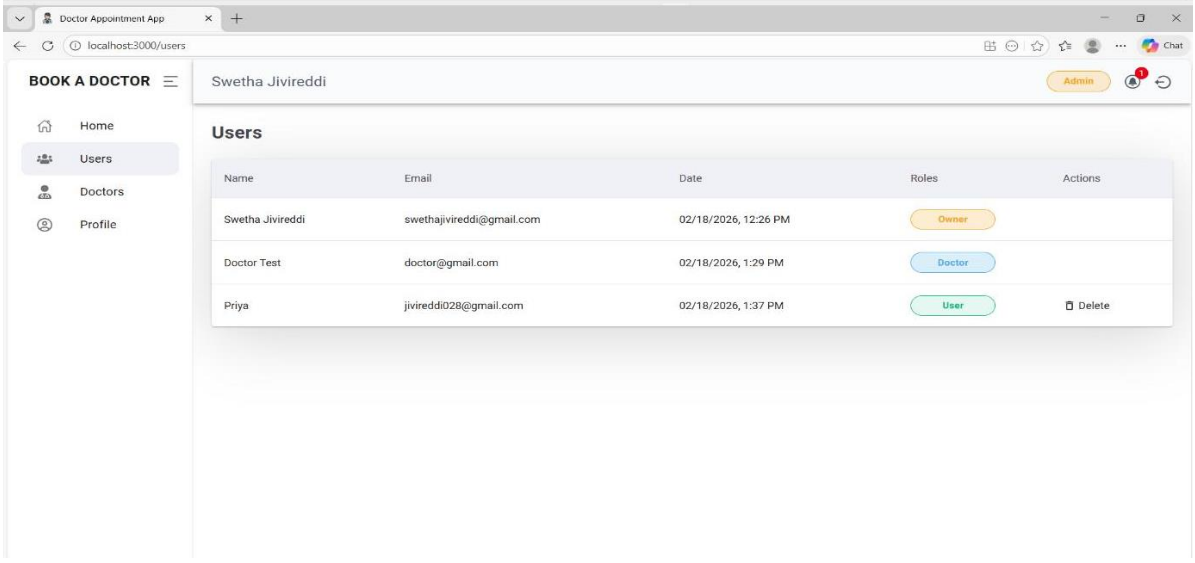


Available Doctors

Select Doctor to add Appointments

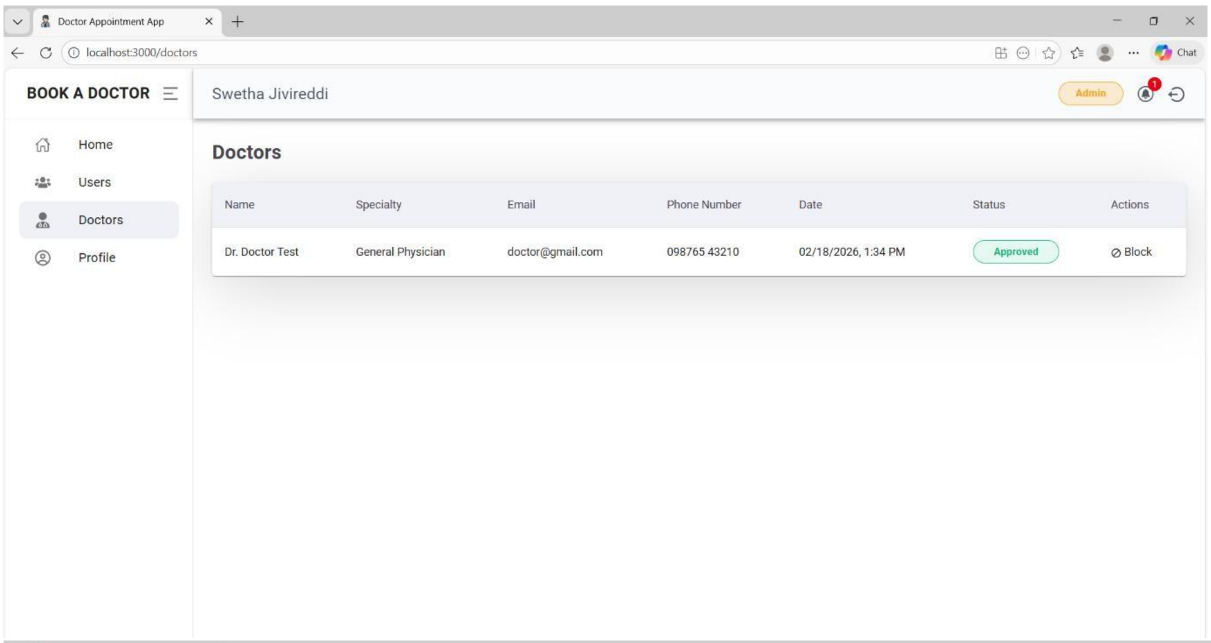
Dr. Doctor Test (General Physician)

Phone Number	098765 43210
Address	Visakhapatnam
Fee Per Visit	500
Timings	9:00 AM to 5:00 PM



Users

Name	Email	Date	Roles	Actions
Swetha Jivireddi	swethajivireddi@gmail.com	02/18/2026, 12:26 PM	Owner	
Doctor Test	doctor@gmail.com	02/18/2026, 1:29 PM	Doctor	
Priya	jivireddi028@gmail.com	02/18/2026, 1:37 PM	User	Delete


Doctor Appointment App

localhost:3000/doctors

BOOK A DOCTOR

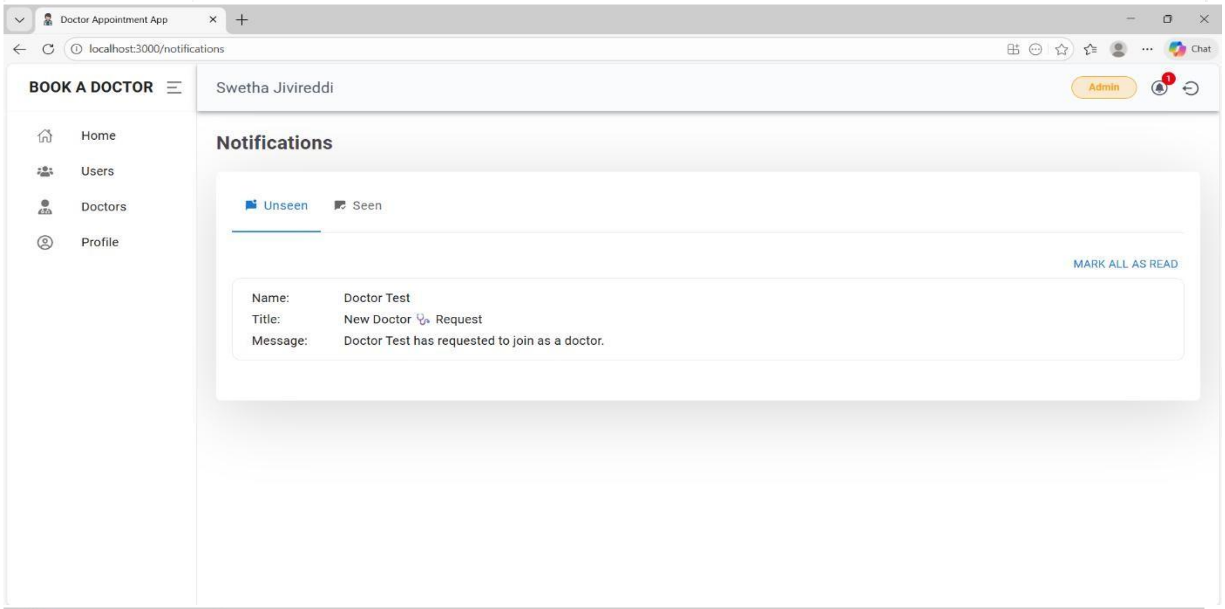
Swetha Jivireddi

Admin

Home
Users
Doctors
Profile

Doctors

Name	Specialty	Email	Phone Number	Date	Status	Actions
Dr. Doctor Test	General Physician	doctor@gmail.com	098765 43210	02/18/2026, 1:34 PM	Approved	⊘ Block


Doctor Appointment App

localhost:3000/notifications

BOOK A DOCTOR

Swetha Jivireddi

Admin

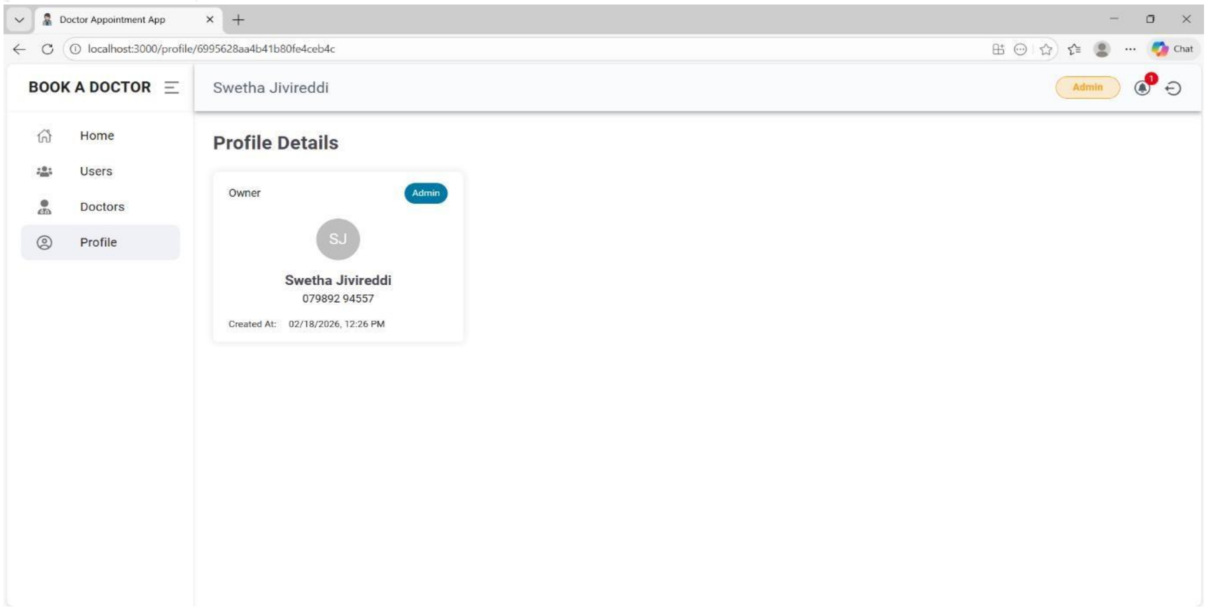
Home
Users
Doctors
Profile

Notifications

Unseen Seen

MARK ALL AS READ

Name:	Doctor Test
Title:	New Doctor Request
Message:	Doctor Test has requested to join as a doctor.


Doctor Appointment App

localhost:3000/profile/6995628aa4b41b80fe4ceb4c

BOOK A DOCTOR

Swetha Jivireddi

Admin

Home
Users
Doctors
Profile

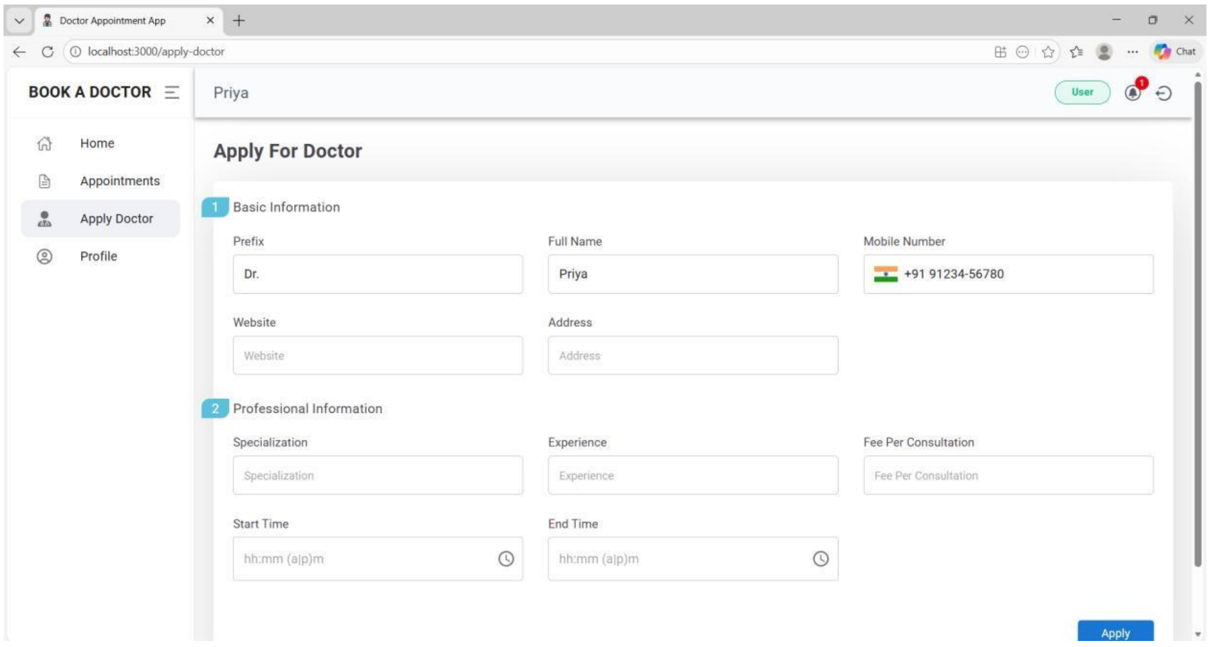
Profile Details

Owner Admin

SJ

Swetha Jivireddi
079892 94557

Created At: 02/18/2026, 12:26 PM


Doctor Appointment App

localhost:3000/apply-doctor

BOOK A DOCTOR

Priya

User

- Home
- Appointments
- Apply Doctor
- Profile

Apply For Doctor

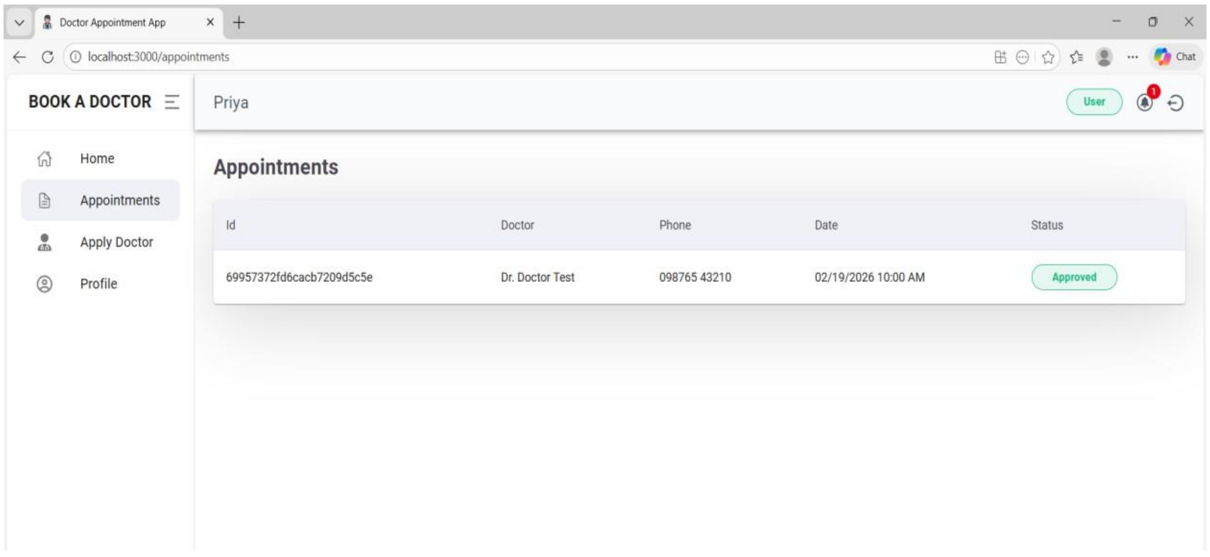
1 Basic Information

Prefix	Full Name	Mobile Number
Dr.	Priya	+91 91234-56780
Website	Address	
Website	Address	

2 Professional Information

Specialization	Experience	Fee Per Consultation
Specialization	Experience	Fee Per Consultation
Start Time	End Time	
hh:mm (a|p)m	hh:mm (a|p)m	

Apply


Doctor Appointment App

localhost:3000/appointments

BOOK A DOCTOR

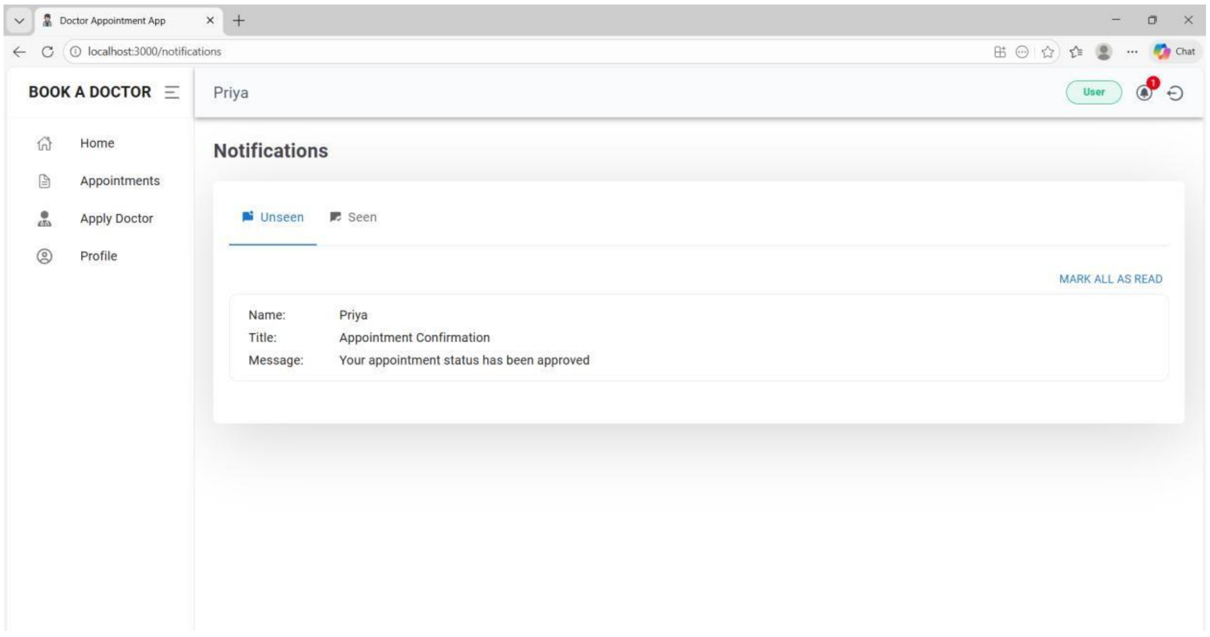
Priya

User

- Home
- Appointments
- Apply Doctor
- Profile

Appointments

Id	Doctor	Phone	Date	Status
69957372fd6cacb7209d5c5e	Dr. Doctor Test	098765 43210	02/19/2026 10:00 AM	Approved


Doctor Appointment App

localhost:3000/notifications

BOOK A DOCTOR

Priya

User

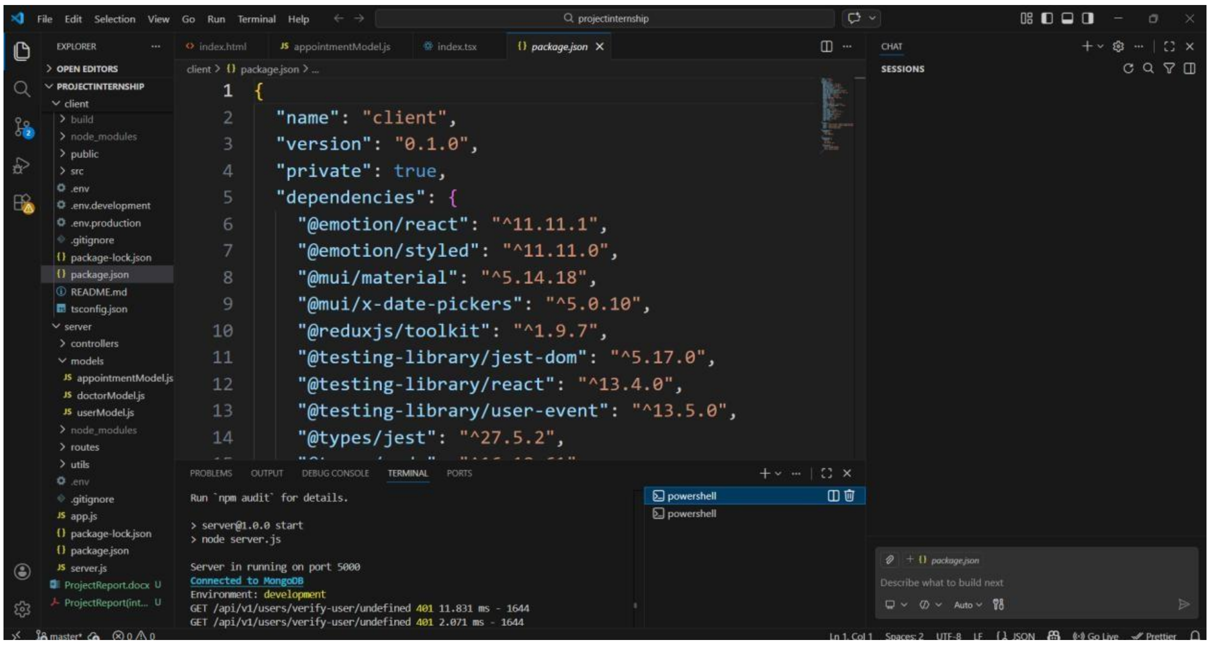
- Home
- Appointments
- Apply Doctor
- Profile

Notifications

Unseen Seen

MARK ALL AS READ

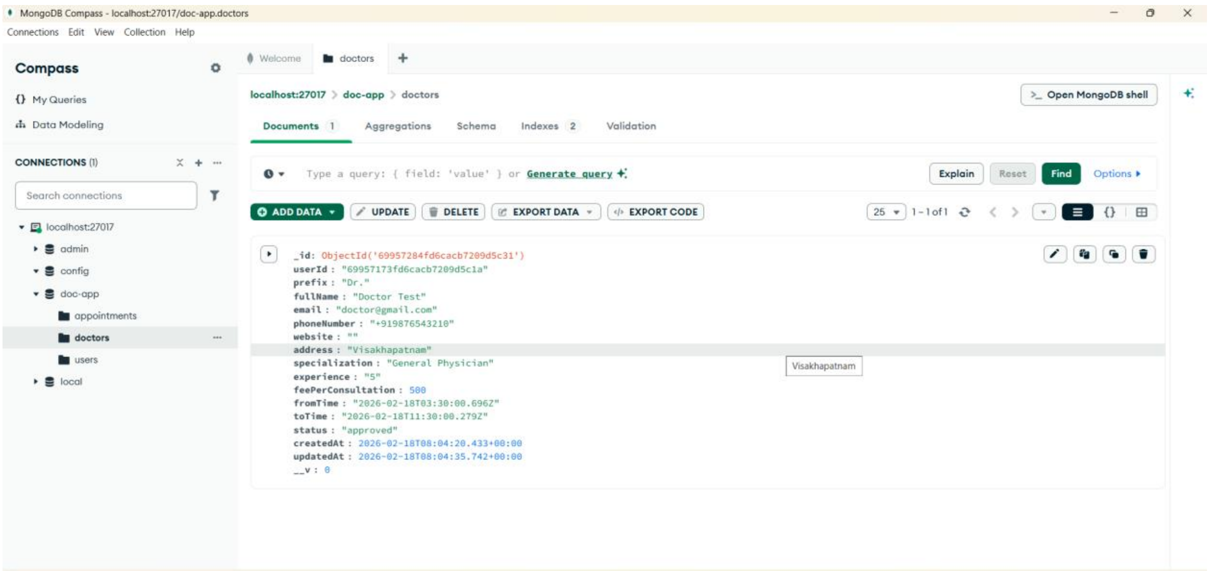
Name:	Priya
Title:	Appointment Confirmation
Message:	Your appointment status has been approved



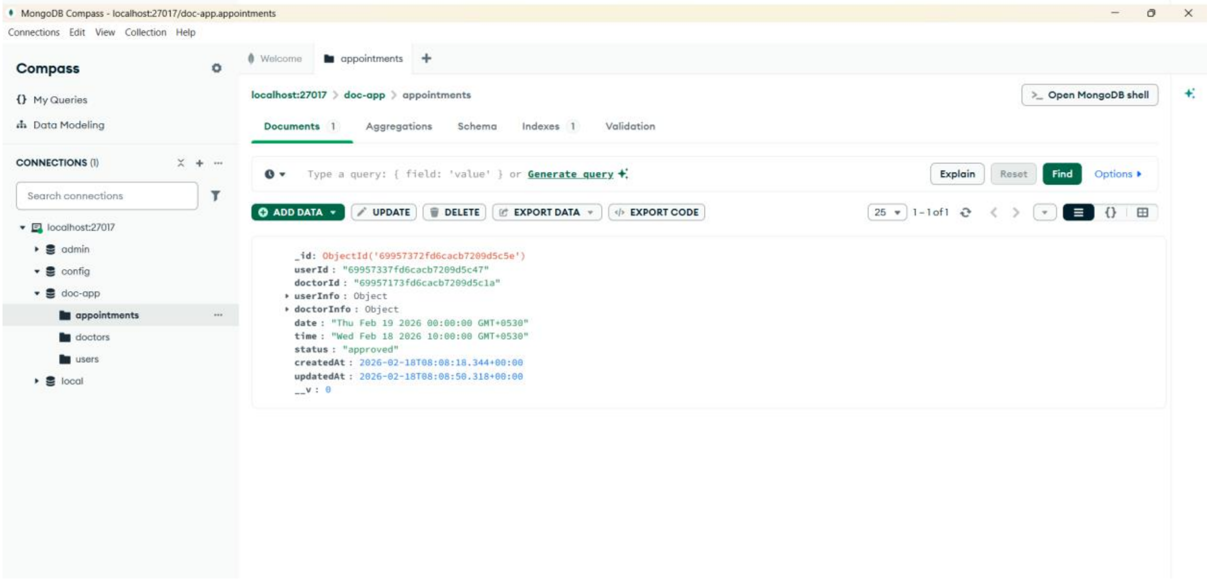
```json
{
  "name": "client",
  "version": "0.1.0",
  "private": true,
  "dependencies": {
    "@emotion/react": "^11.11.1",
    "@emotion/styled": "^11.11.0",
    "@mui/material": "^5.14.18",
    "@mui/x-date-pickers": "^5.0.10",
    "@reduxjs/toolkit": "^1.9.7",
    "@testing-library/jest-dom": "^5.17.0",
    "@testing-library/react": "^13.4.0",
    "@testing-library/user-event": "^13.5.0",
    "@types/jest": "^27.5.2",
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

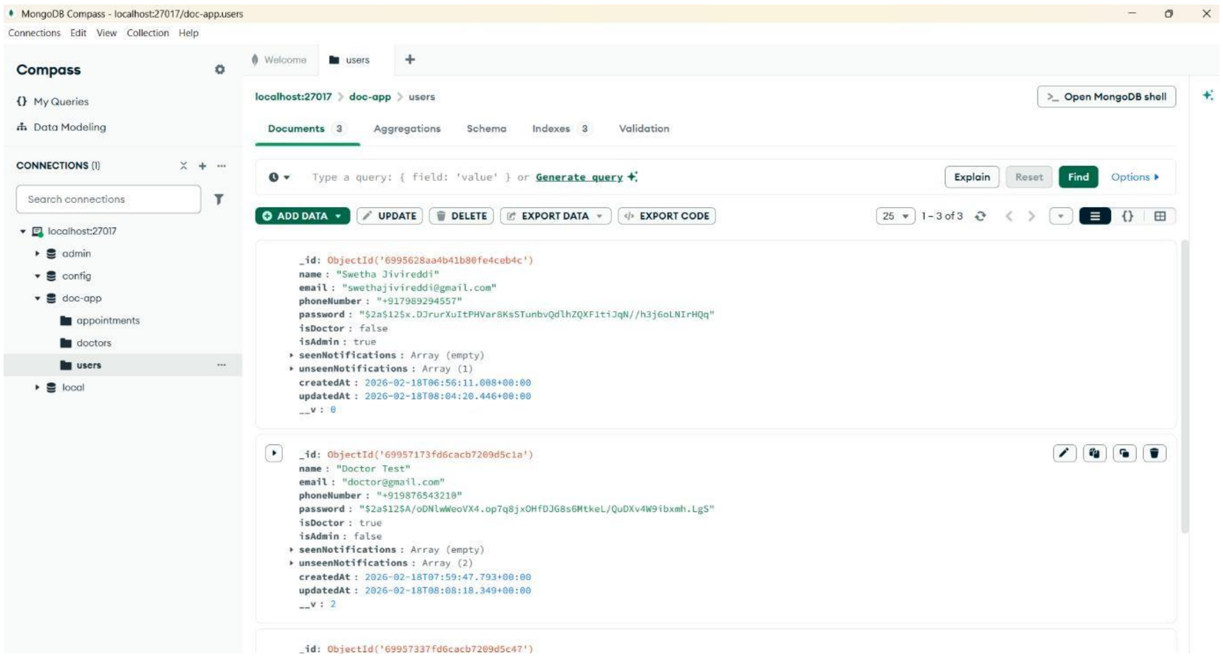
```
Run `npm audit` for details.

> server@1.0.0 start
> node server.js

Server in running on port 5000
Connected to MongoDB
Environment: development
GET /api/v1/users/verify-user/undefined 401 11.831 ms - 1644
GET /api/v1/users/verify-user/undefined 401 2.071 ms - 1644
```



```
_id: ObjectId('69957284fd6cacb7209d5c31')
userId : "69957173fd6cacb7209d5c1a"
prefix : "Dr."
fullName : "Doctor Test"
email : "doctor@gmail.com"
phoneNumber : "+919876543210"
website : ""
address : "Visakhapatnam"
specialization : "General Physician"
experience : "5"
feePerConsultation : 500
fromTime : "2026-02-18T03:30:00.696Z"
toTime : "2026-02-18T11:30:00.279Z"
status : "approved"
createdAt : 2026-02-18T08:04:20.433+00:00
updatedAt : 2026-02-18T08:04:35.742+00:00
__v : 0
```



```
_id: ObjectId('69957372fd6cacb7209d5c5e')
userId : "69957337fd6cacb7209d5c47"
doctorId : "69957173fd6cacb7209d5c1a"
▸ userInfo : Object
▸ doctorInfo : Object
date : "Thu Feb 19 2026 00:00:00 GMT+0530"
time : "Wed Feb 18 2026 10:00:00 GMT+0530"
status : "approved"
createdAt : 2026-02-18T08:08:18.344+00:00
updatedAt : 2026-02-18T08:08:50.318+00:00
__v : 0
```



```
_id: ObjectId('6995628aa4b41b80fe4ceb4c')
name : "Swetha Jivireddi"
email : "swethajivireddi@gmail.com"
phoneNumber : "+917989294557"
password : "$2a$12$x.DJrurXuItPHVar8KsSTunbvQdlhZQXF1tiJqN//h3j6oLNIrHQq"
isDoctor : false
isAdmin : true
seenNotifications : Array (empty)
unseenNotifications : Array (1)
createdAt : 2026-02-18T06:56:11.008+00:00
updatedAt : 2026-02-18T08:04:20.446+00:00
__v : 0

_id: ObjectId('69957173fd6cacb7209d5c1a')
name : "Doctor Test"
email : "doctor@gmail.com"
phoneNumber : "+919876543210"
password : "$2a$12$A/oDNlwWeoVX4.op7q8jxOHfDJG8s6MtkeL/QuDXv4W9ibxmh.LgS"
isDoctor : true
isAdmin : false
seenNotifications : Array (empty)
unseenNotifications : Array (2)
createdAt : 2026-02-18T07:59:47.793+00:00
updatedAt : 2026-02-18T08:08:18.349+00:00
__v : 2

_id: ObjectId('69957337fd6cacb7209d5c47')
```

12) Known Issues

- No payment integration
- No real-time notifications
- Basic UI design
- No email confirmation system

13) Future Enhancements

- Payment gateway integration
- Email and SMS notifications
- Video consultation
- AI-based doctor recommendation
- Mobile application development
- Dashboard analytics for admin

14) CONCLUSION

The Smart Healthcare Appointment & Management System successfully demonstrates the implementation of a full-stack web application using the MERN stack. The system enables secure authentication, role-based access control, and efficient appointment management. It simplifies healthcare appointment booking and reduces manual workload. This project enhanced my knowledge in frontend and backend development, database integration, authentication, and REST API implementation.