System Design Documentation: Small Medical Clinic Software System

1. System Architecture

1.1 Overview

The system follows a three-tier architecture, designed for scalability, security, and usability:

- **Presentation Layer (Frontend):** Web-based UI using React.js (or similar framework) for staff, doctors, and patients.

- **Application Layer (Backend):** RESTful API built with Django or Node.js to handle business logic.

- **Data Layer (Database):** Centralized SQL database (e.g., PostgreSQL or MySQL) for structured data storage.

1.2 Architecture Diagram


Healthcare Web Application Architecture
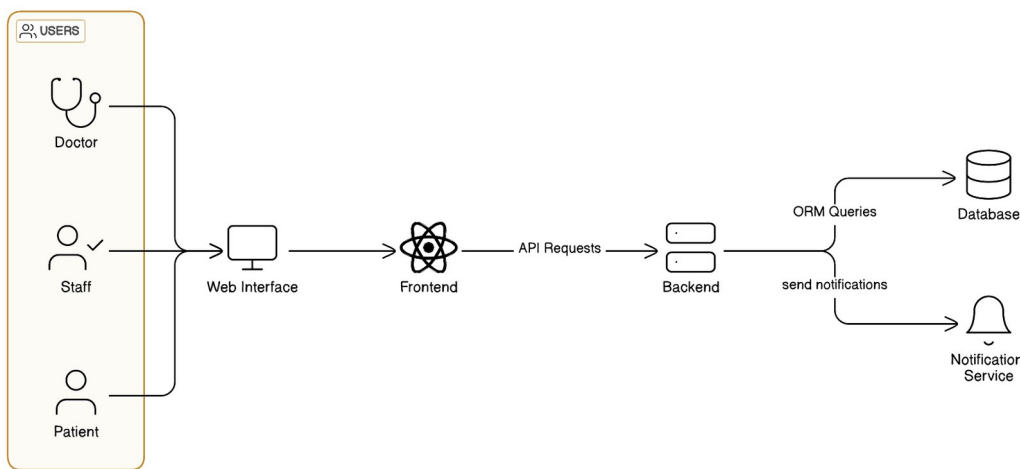
1.3 System Components

- **Authentication Module**: Role-based access (admin, doctor, nurse, receptionist, patient).

- **Scheduling Module**: Manages shift and appointment calendars.

- **EMR Module**: Handles secure storage and retrieval of medical records.

- **Notification Service**: Sends automated SMS/email reminders.

- **Analytics Module**: Generates reports on system usage, performance, and productivity.

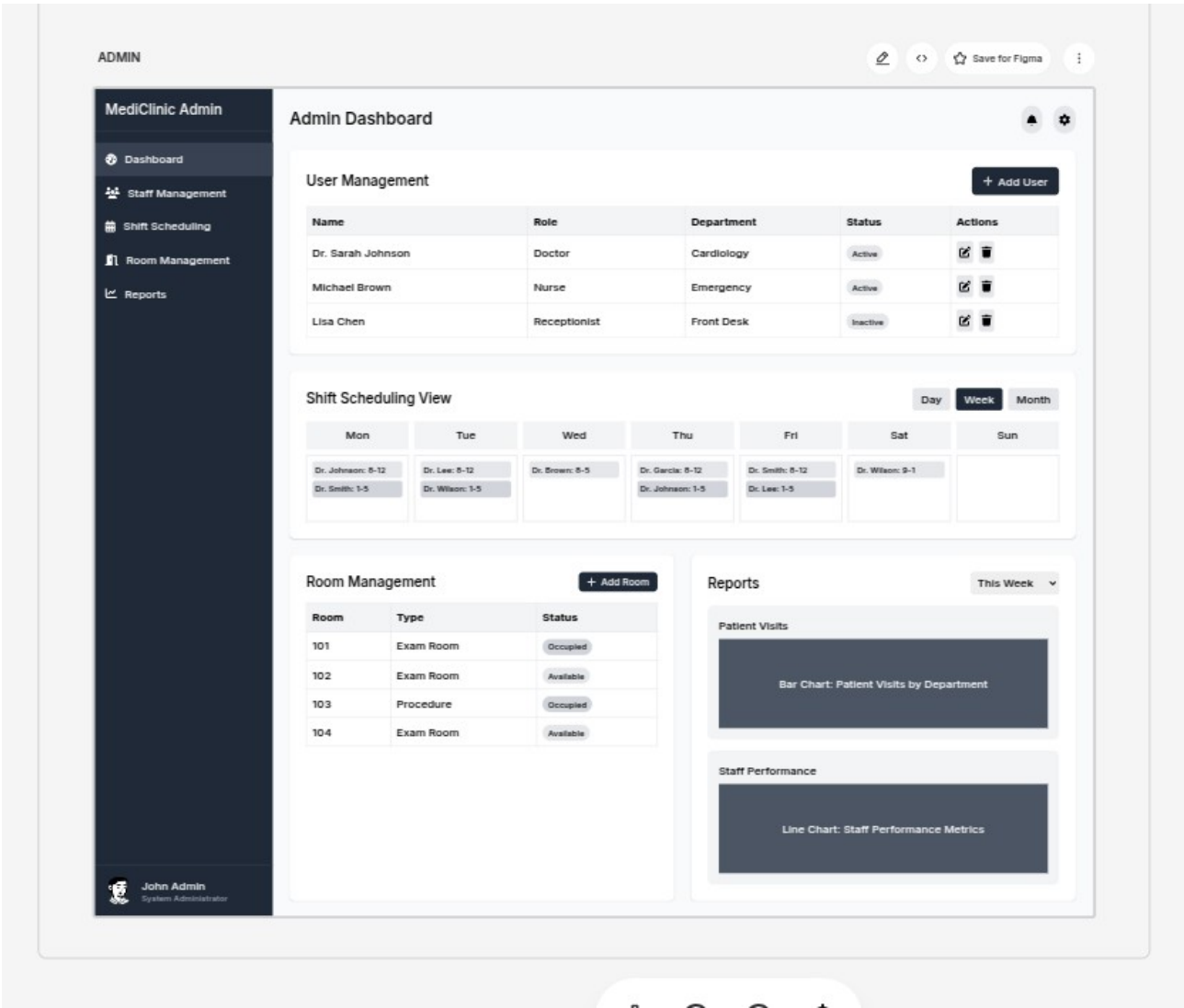# 2. Entity-Relationship Diagram (ERD)

Healthcare Facility Data Model
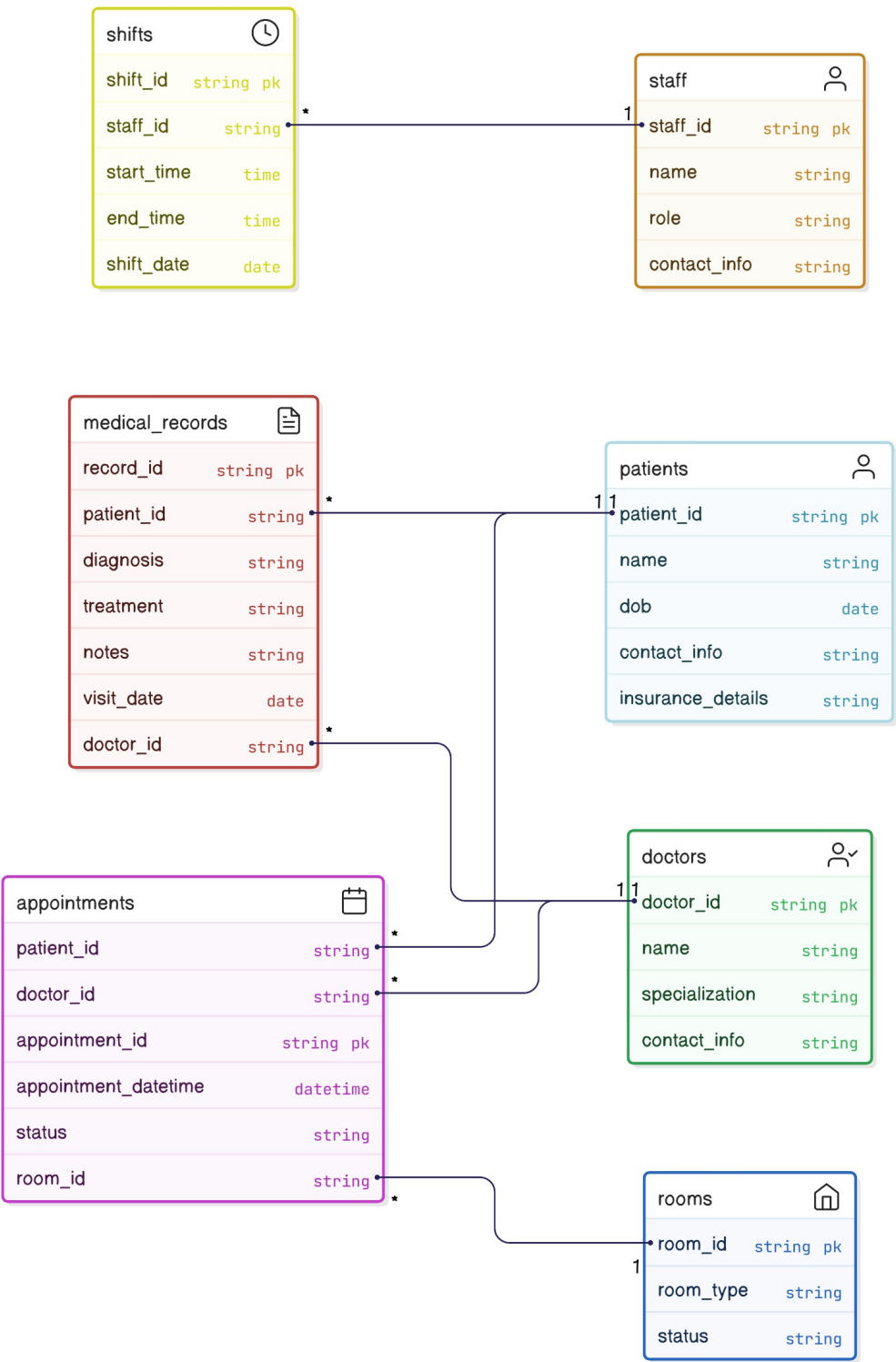
3. Interface Designs (UI Mockups)

3.1 Roles-Based Interface Design

Admin Dashboard

- User Management
- Shift Scheduling Panel
- Examination Room Management
- Reporting & Analytics

Doctor Interface

- View Schedule
- Access Patient Records
- Write Prescriptions

- Update EMR

MediClinic
Doctor Portal

- Dashboard
- Patients
- Appointments
- Prescriptions
- Reports

Welcome, Dr. Smith
Thursday, May 1, 2025

Dr. Jane Smith
Cardiologist

Daily Schedule View

Time	Patient Name	Reason	Status	Action
8:00 AM	John Doe	Annual Checkup	Checked In	⊙
9:30 AM	Sarah Johnson	Follow-up	In Progress	⊙
11:00 AM	Mike Wilson	Prescription Refill	Scheduled	⊙
1:30 PM	Emily Parker	Consultation	Scheduled	⊙
3:00 PM	Robert Brown	Lab Results Review	Scheduled	⊙

Patient Search

🔍 Search patients...

RECENT PATIENTS

Sarah Johnson
ID: #12345 • 42 yrs

John Doe
ID: #12346 • 58 yrs

Emily Parker
ID: #12347 • 35 yrs

EMR Access - Sarah Johnson

Sarah Johnson
DOB: 05/12/1983   Gender: Female
Phone: (555) 123-4567   Patient ID: #12345

Medical History
Allergies: Penicillin, Peanuts
Chronic Conditions: Hypertension, Type 2 Diabetes
Previous Surgeries: Appendectomy (2015)

Recent Visits

04/01/2025
Follow-up for Hypertension

03/15/2025
Annual Physical Examination

02/22/2025
Medication Review

[🗐 Full EMR] [🧪 Lab Results] [℞ Prescriptions]

Prescription Entry

Patient
Sarah Johnson
ID: #12345

Medication Name
Search medication...

Dosage
e.g. 10mg

Frequency
Once daily ⌄

Duration
e.g. 14   Days ⌄

Quantity
e.g. 30

Instructions for Patient
Special instructions...

Notes (not visible to patient)
Doctor's notes...

☐ Allow generic substitution

[🖶 Print] [✕ Cancel]

- Settings
- Logout

Receptionist Interface

- Register Patients
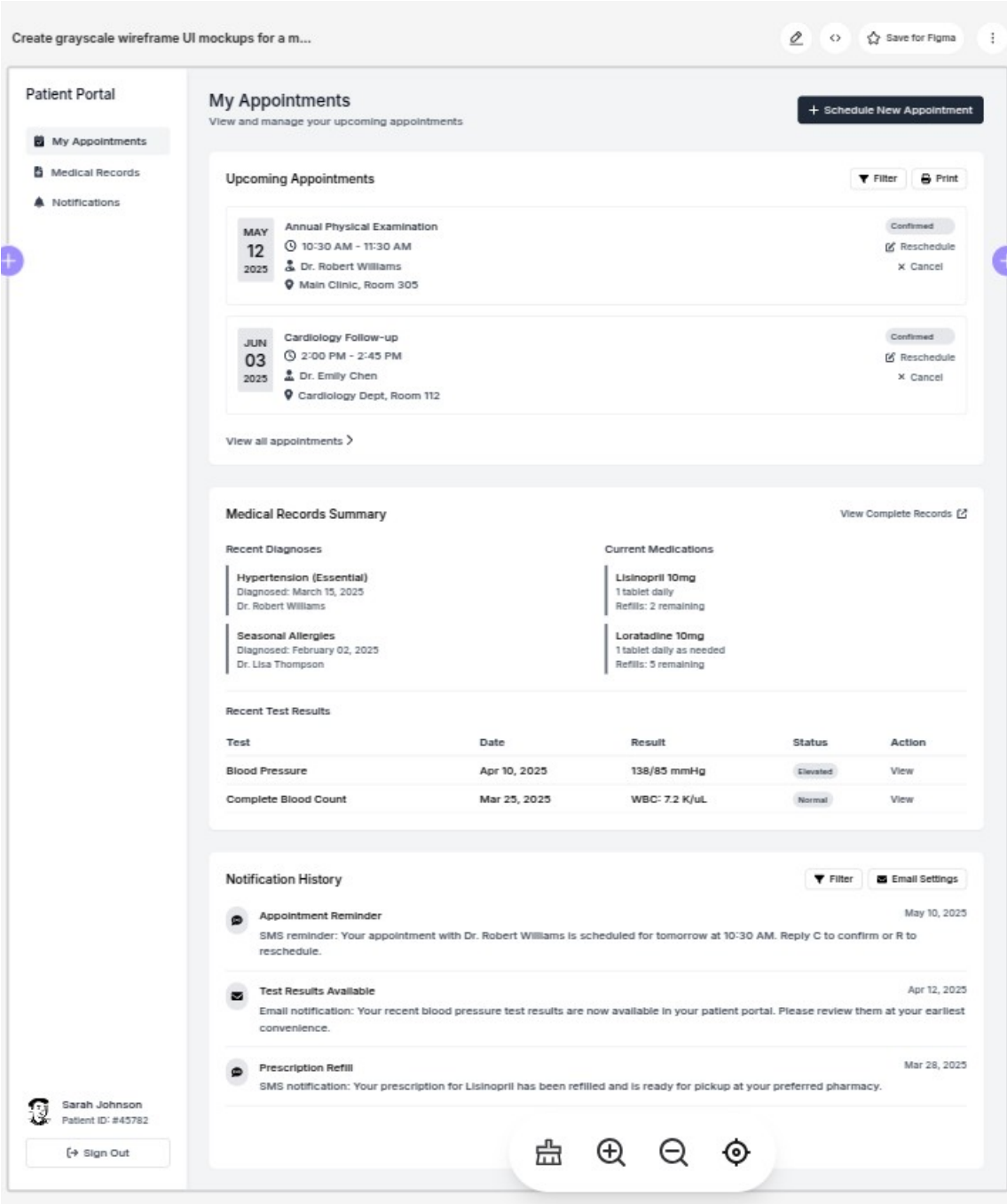- Manage Appointments
- Notify Patients of Schedule Changes

Patient Portal

- View Appointments

- Access Medical History

- Receive Notifications

4. Database Schema

```sql
CREATE TABLE Patient (
    patient_id SERIAL PRIMARY KEY,
    name VARCHAR(100),
    dob DATE,
    contact_info TEXT,
    insurance_details TEXT
);

CREATE TABLE Doctor (
    doctor_id SERIAL PRIMARY KEY,
    name VARCHAR(100),
    specialization VARCHAR(100),
    contact_info TEXT
);

CREATE TABLE Staff (
    staff_id SERIAL PRIMARY KEY,
    name VARCHAR(100),
    role VARCHAR(50),
    contact_info TEXT
);

CREATE TABLE Room (
    room_id SERIAL PRIMARY KEY,
    room_type VARCHAR(100),
    status VARCHAR(50)
);

CREATE TABLE Appointment (
    appointment_id SERIAL PRIMARY KEY,
    patient_id INT REFERENCES Patient(patient_id),
    doctor_id INT REFERENCES Doctor(doctor_id),
    room_id INT REFERENCES Room(room_id),
    appointment_datetime TIMESTAMP,
    status VARCHAR(50)
);

CREATE TABLE MedicalRecord (
    record_id SERIAL PRIMARY KEY,
    patient_id INT REFERENCES Patient(patient_id),
    doctor_id INT REFERENCES Doctor(doctor_id),
    diagnosis TEXT,
    treatment TEXT,
    notes TEXT,
    visit_date DATE
);

CREATE TABLE Shift (
    shift_id SERIAL PRIMARY KEY,
    staff_id INT REFERENCES Staff(staff_id),
    start_time TIME,
    end_time TIME,
    shift_date DATE
);
```

5. Summary

This system design aims to modernize a small clinic's operations by digitizing patient records, managing medical staff and appointments, and improving service delivery. The modular and scalable architecture supports easy enhancements and integrations, ensuring long-term sustainability and data security.