Hospital Management System

Backend – Spring Boot Microservices

The backend is developed using **Spring Boot** with a **microservices architecture**, ensuring scalability, modularity, and maintainability. Each hospital function—patients, doctors, appointments, billing, notifications, and auditing—is implemented as an independent microservice. These services communicate through **REST APIs** and **Kafka-based event-driven messaging**, enabling efficient and real-time data flow.

Core Microservices

Patient Service

- Manages patient registration, authentication, and profile management.
- Stores structured patient records in **MySQL**.
- Secured using **JWT/OAuth2** authentication mechanisms.

Doctor Service

- Handles doctor registration, authentication, and scheduling.
- Provides APIs for appointments, diagnoses, and prescriptions.
- Manages doctor availability and departmental mappings.

Appointment Service

- Supports booking, updating, and canceling appointments.
- Publishes and listens to **Kafka events** for real-time updates.
- Validates patient–doctor schedules before confirmation.

Billing Service

- Manages invoices, payments, and insurance claims.

- Provides detailed billing history and reporting.

- Ensures transactional integrity via **MySQL**.

Notification Service

- Sends SMS and email notifications for appointments, reminders, and billing.

- Uses **Kafka** for asynchronous event-driven communication.

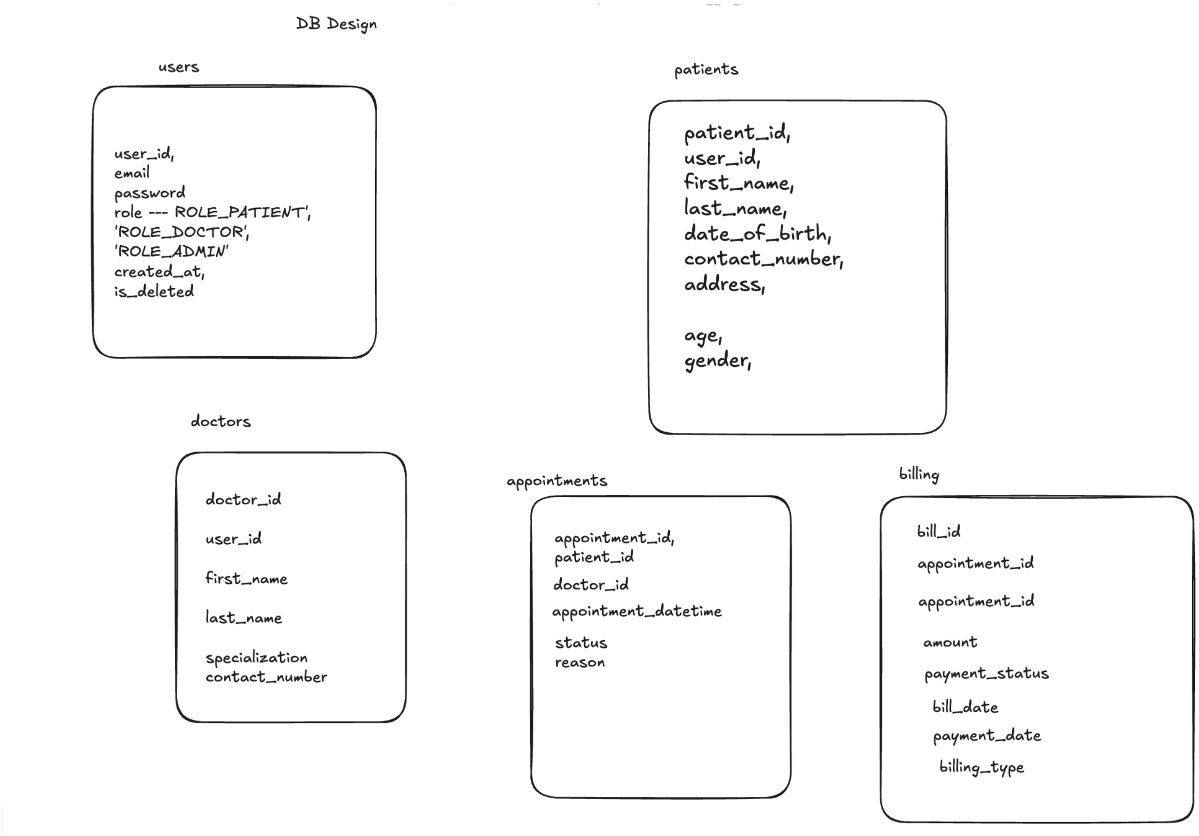
- Supports customizable notification templates.

Audit & Logs Service

- Tracks sensitive actions (e.g., diagnoses, billing transactions).

- Provides auditing for compliance and security monitoring.

Architecture



DB Design

users

user_id,
email
password
role --- ROLE_PATIENT',
'ROLE_DOCTOR',
'ROLE_ADMIN'
created_at,
is_deleted

patients

patient_id,
user_id,
first_name,
last_name,
date_of_birth,
contact_number,
address,

age,
gender,

doctors

doctor_id

user_id

first_name

last_name

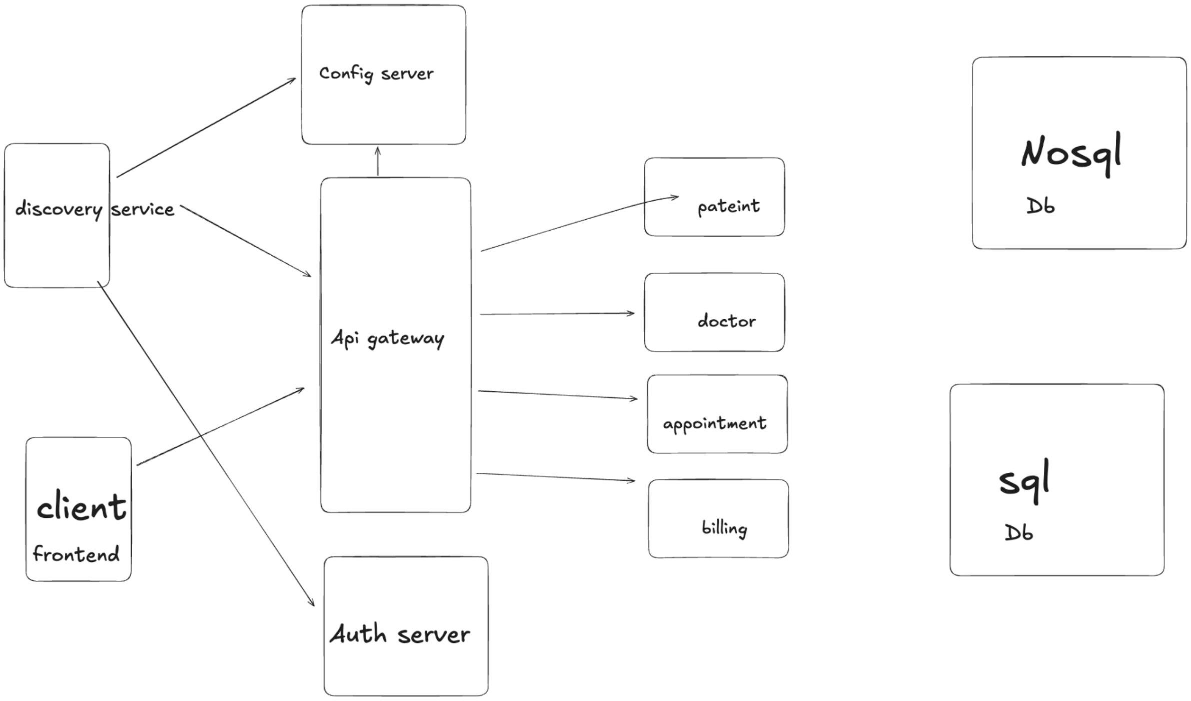
specialization
contact_number

appointments

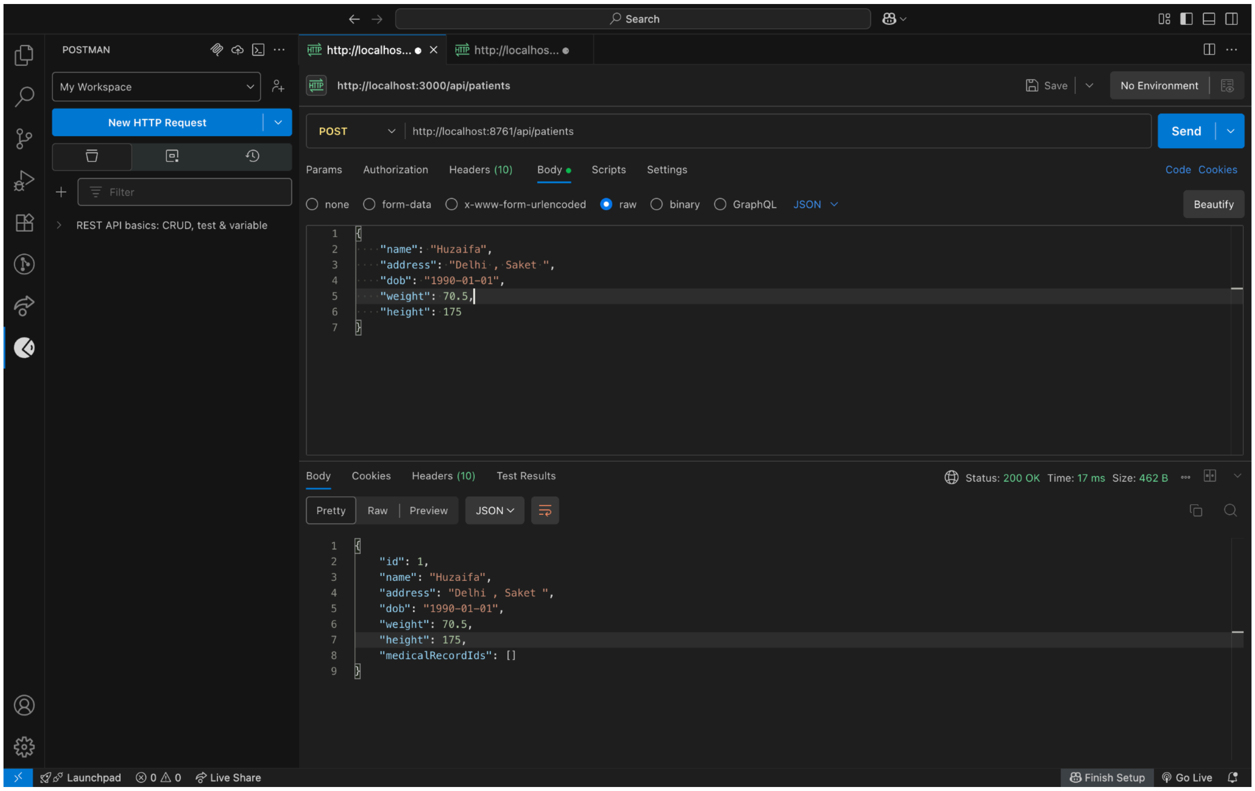
appointment_id,
patient_id
doctor_id
appointment_datetime
status
reason

billing

bill_id
appointment_id
appointment_id
amount
payment_status
bill_date
payment_date
billing_type



Signup Patient



http://localhost:3000/api/patients

POST http://localhost:8761/api/patients

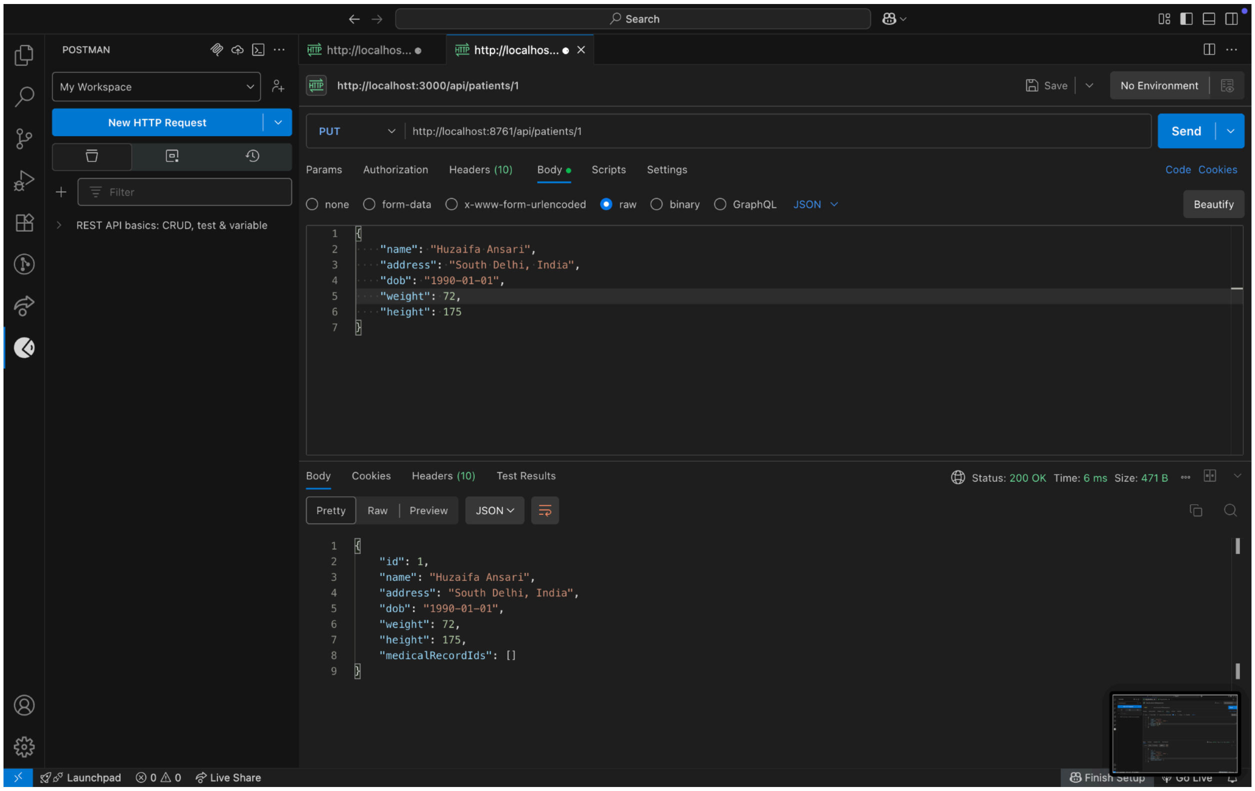
○ none ○ form-data ○ x-www-form-urlencoded ● raw ○ binary ○ GraphQL JSON

```
{
    "name": "Huzaifa",
    "address": "Delhi , Saket ",
    "dob": "1990-01-01",
    "weight": 70.5,
    "height": 175
}
```

Status: 200 OK Time: 17 ms Size: 462 B

```
{
    "id": 1,
    "name": "Huzaifa",
    "address": "Delhi , Saket ",
    "dob": "1990-01-01",
    "weight": 70.5,
    "height": 175,
    "medicalRecordIds": []
}
```

Update Patient



http://localhost:3000/api/patients/1

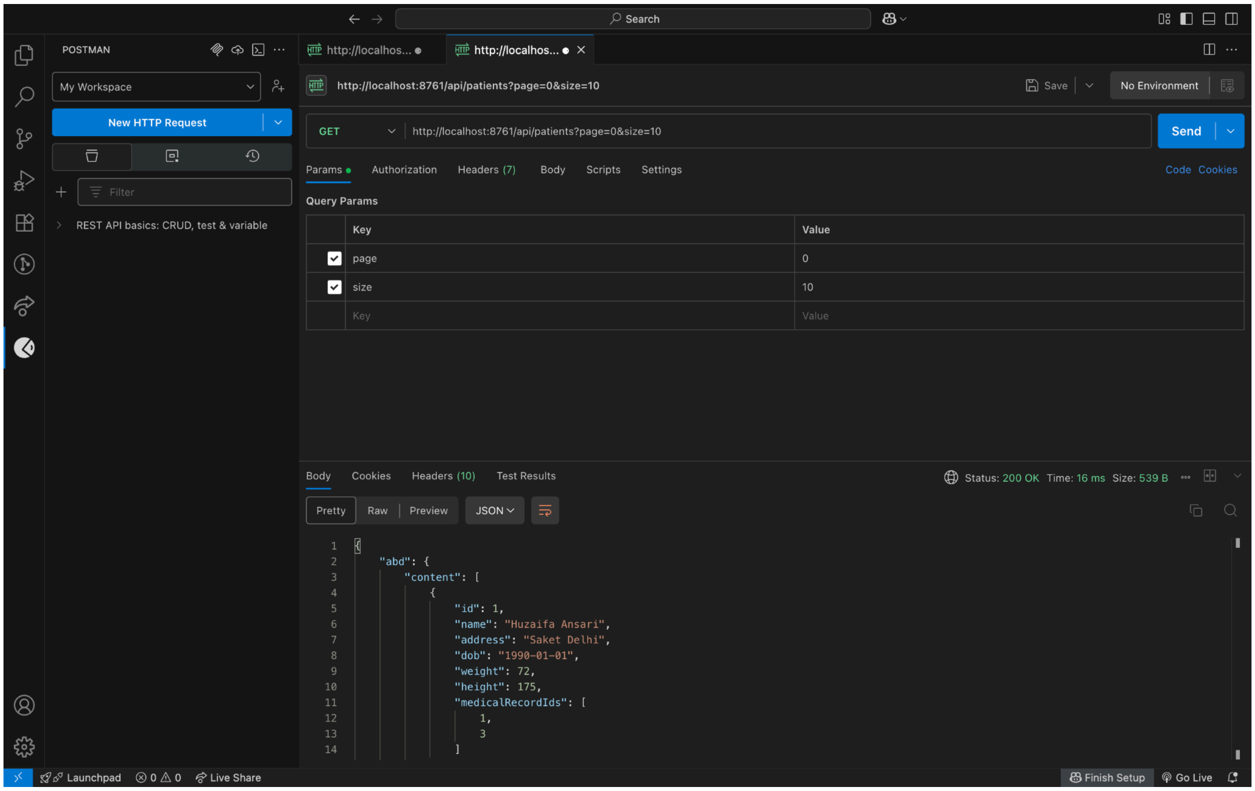
PUT http://localhost:8761/api/patients/1

```
{
    "name": "Huzaifa Ansari",
    "address": "South Delhi, India",
    "dob": "1990-01-01",
    "weight": 72,
    "height": 175
}
```

Status: 200 OK Time: 6 ms Size: 471 B

```
{
    "id": 1,
    "name": "Huzaifa Ansari",
    "address": "South Delhi, India",
    "dob": "1990-01-01",
    "weight": 72,
    "height": 175,
    "medicalRecordIds": []
}
```

Get Patient



http://localhost:8761/api/patients?page=0&size=10

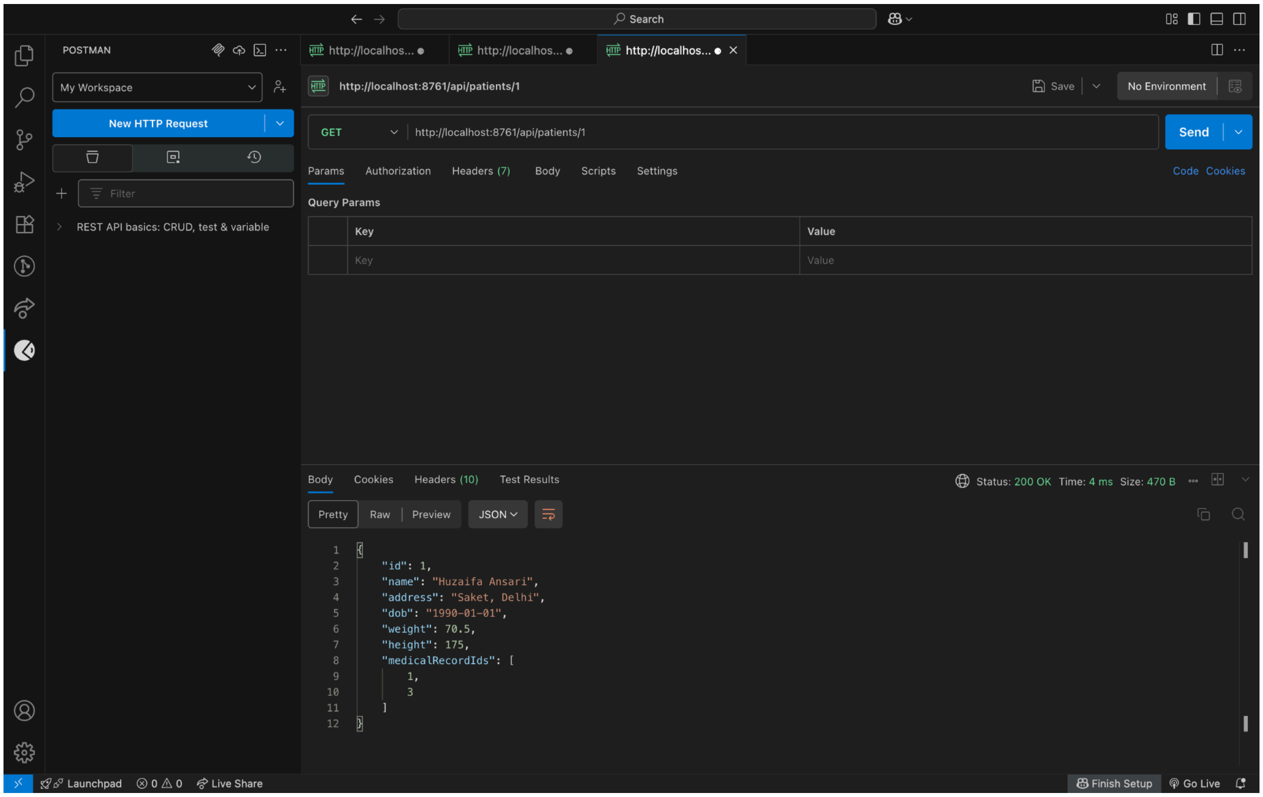
GET http://localhost:8761/api/patients?page=0&size=10

Query Params

	Key	Value
☑	page	0
☑	size	10
	Key	Value

Status: 200 OK Time: 16 ms Size: 539 B

```
{
    "abd": {
        "content": [
            {
                "id": 1,
                "name": "Huzaifa Ansari",
                "address": "Saket Delhi",
                "dob": "1990-01-01",
                "weight": 72,
                "height": 175,
                "medicalRecordIds": [
                    1,
                    3
                ]
```



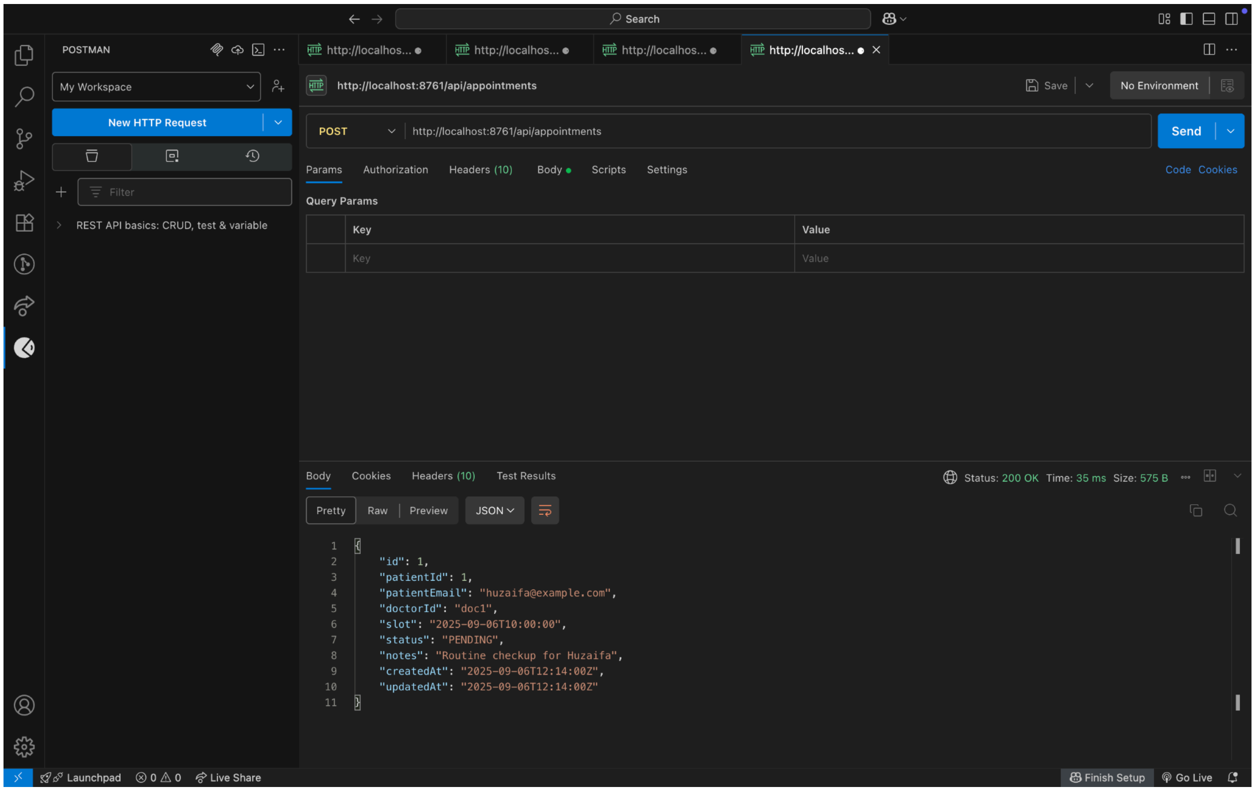
http://localhost:8761/api/patients/1

GET http://localhost:8761/api/patients/1

Status: 200 OK Time: 4 ms Size: 470 B

```
{
    "id": 1,
    "name": "Huzaifa Ansari",
    "address": "Saket, Delhi",
    "dob": "1990-01-01",
    "weight": 70.5,
    "height": 175,
    "medicalRecordIds": [
        1,
        3
    ]
}
```

Create Appointment

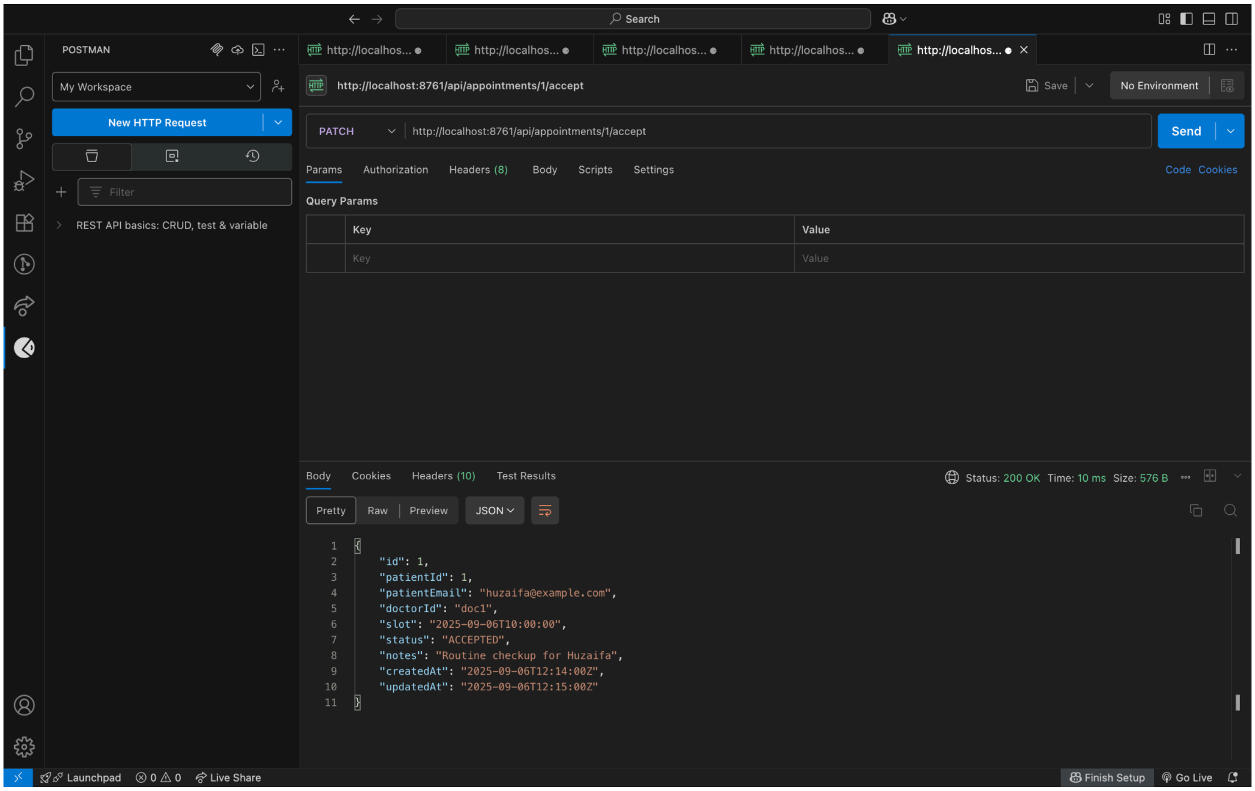


POST http://localhost:8761/api/appointments

Status: 200 OK Time: 35 ms Size: 575 B

```
{
    "id": 1,
    "patientId": 1,
    "patientEmail": "huzaifa@example.com",
    "doctorId": "doc1",
    "slot": "2025-09-06T10:00:00",
    "status": "PENDING",
    "notes": "Routine checkup for Huzaifa",
    "createdAt": "2025-09-06T12:14:00Z",
    "updatedAt": "2025-09-06T12:14:00Z"
}
```

Accept Appointment



http://localhost:8761/api/appointments/1/accept

PATCH http://localhost:8761/api/appointments/1/accept

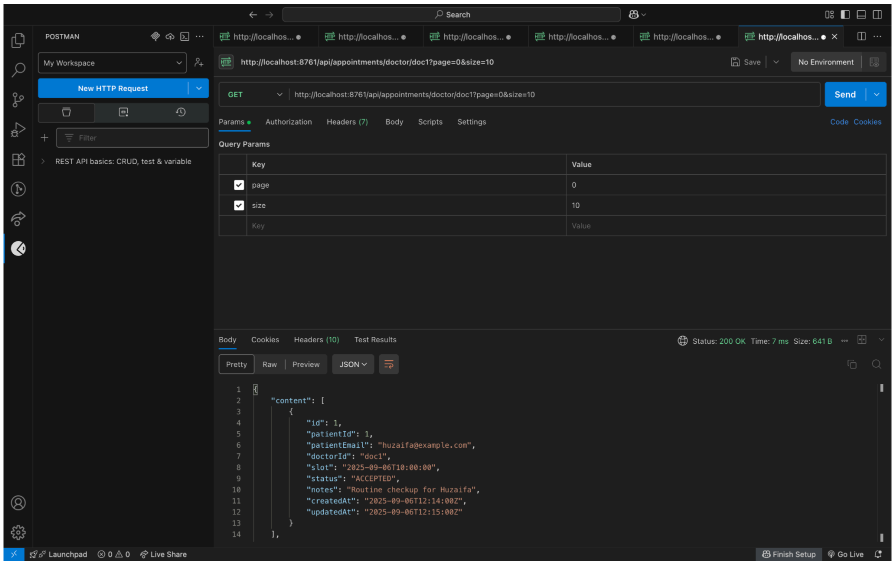
Query Params

Key	Value
Key	Value

Status: 200 OK Time: 10 ms Size: 576 B

```
{
    "id": 1,
    "patientId": 1,
    "patientEmail": "huzaifa@example.com",
    "doctorId": "doc1",
    "slot": "2025-09-06T10:00:00",
    "status": "ACCEPTED",
    "notes": "Routine checkup for Huzaifa",
    "createdAt": "2025-09-06T12:14:00Z",
    "updatedAt": "2025-09-06T12:15:00Z"
}
```

Get Appointments for Doctor



http://localhost:8761/api/appointments/doctor/doc1?page=0&size=10

GET http://localhost:8761/api/appointments/doctor/doc1?page=0&size=10

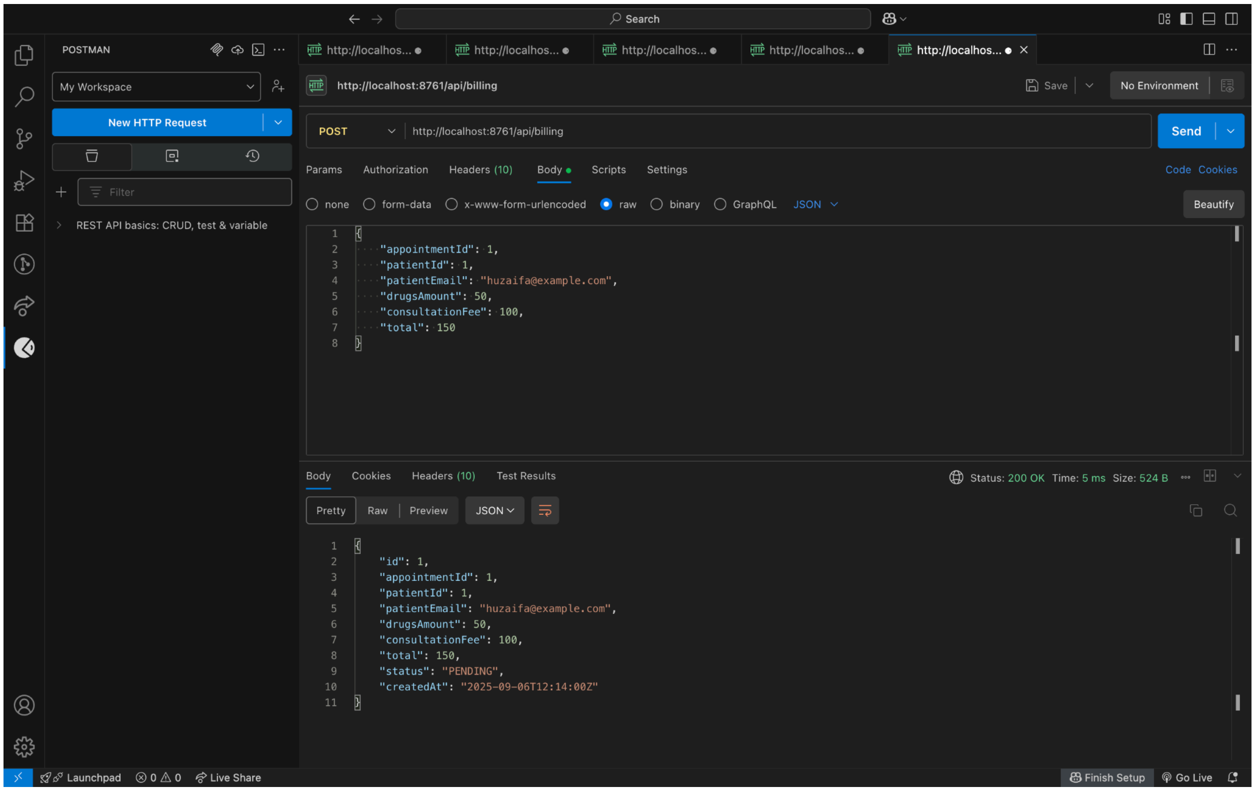
Query Params

	Key	Value
☑	page	0
☑	size	10
	Key	Value

Status: 200 OK Time: 7 ms Size: 641 B

```
{
    "content": [
        {
            "id": 1,
            "patientId": 1,
            "patientEmail": "huzaifa@example.com",
            "doctorId": "doc1",
            "slot": "2025-09-06T10:00:00",
            "status": "ACCEPTED",
            "notes": "Routine checkup for Huzaifa",
            "createdAt": "2025-09-06T12:14:00Z",
            "updatedAt": "2025-09-06T12:15:00Z"
        }
    ],
```

Create Bill



POST http://localhost:8761/api/billing

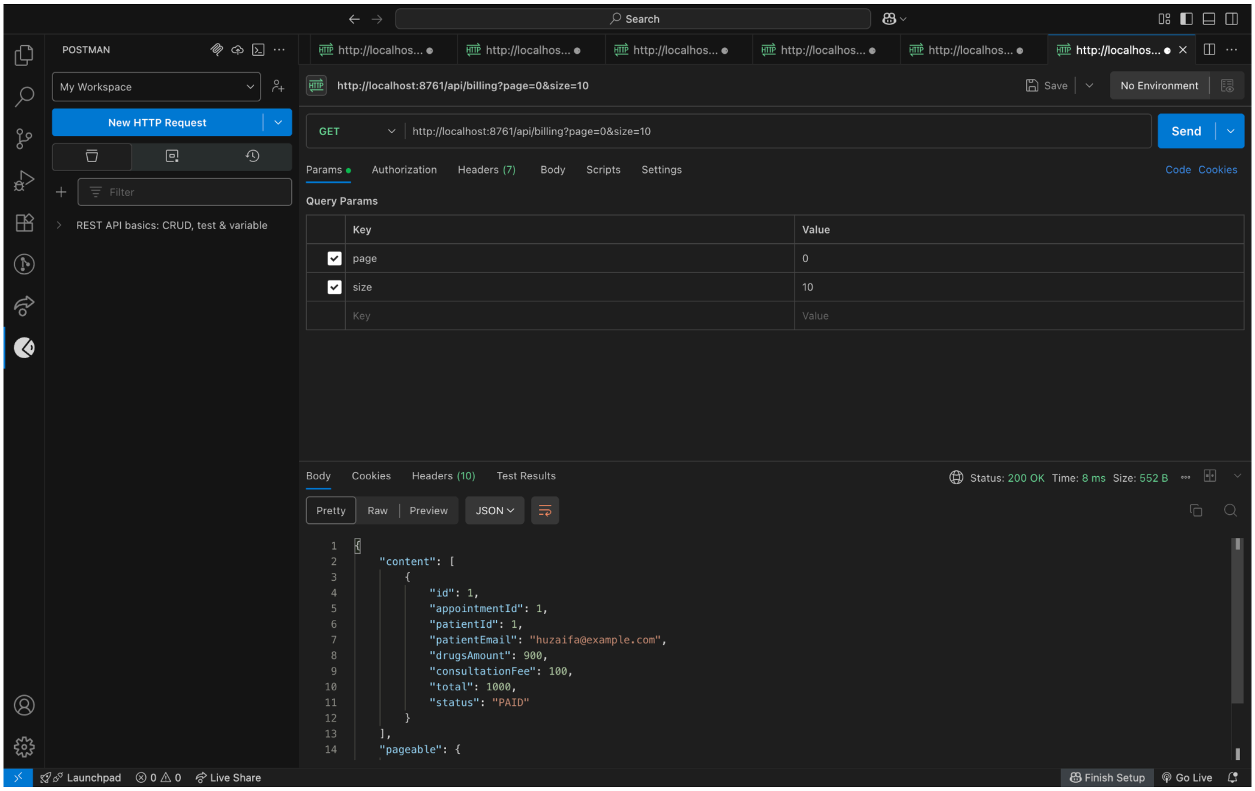
Body (raw, JSON):

```
{
    "appointmentId": 1,
    "patientId": 1,
    "patientEmail": "huzaifa@example.com",
    "drugsAmount": 50,
    "consultationFee": 100,
    "total": 150
}
```

Status: 200 OK Time: 5 ms Size: 524 B

```
{
    "id": 1,
    "appointmentId": 1,
    "patientId": 1,
    "patientEmail": "huzaifa@example.com",
    "drugsAmount": 50,
    "consultationFee": 100,
    "total": 150,
    "status": "PENDING",
    "createdAt": "2025-09-06T12:14:00Z"
}
```

List Bills



http://localhost:8761/api/billing?page=0&size=10

GET http://localhost:8761/api/billing?page=0&size=10

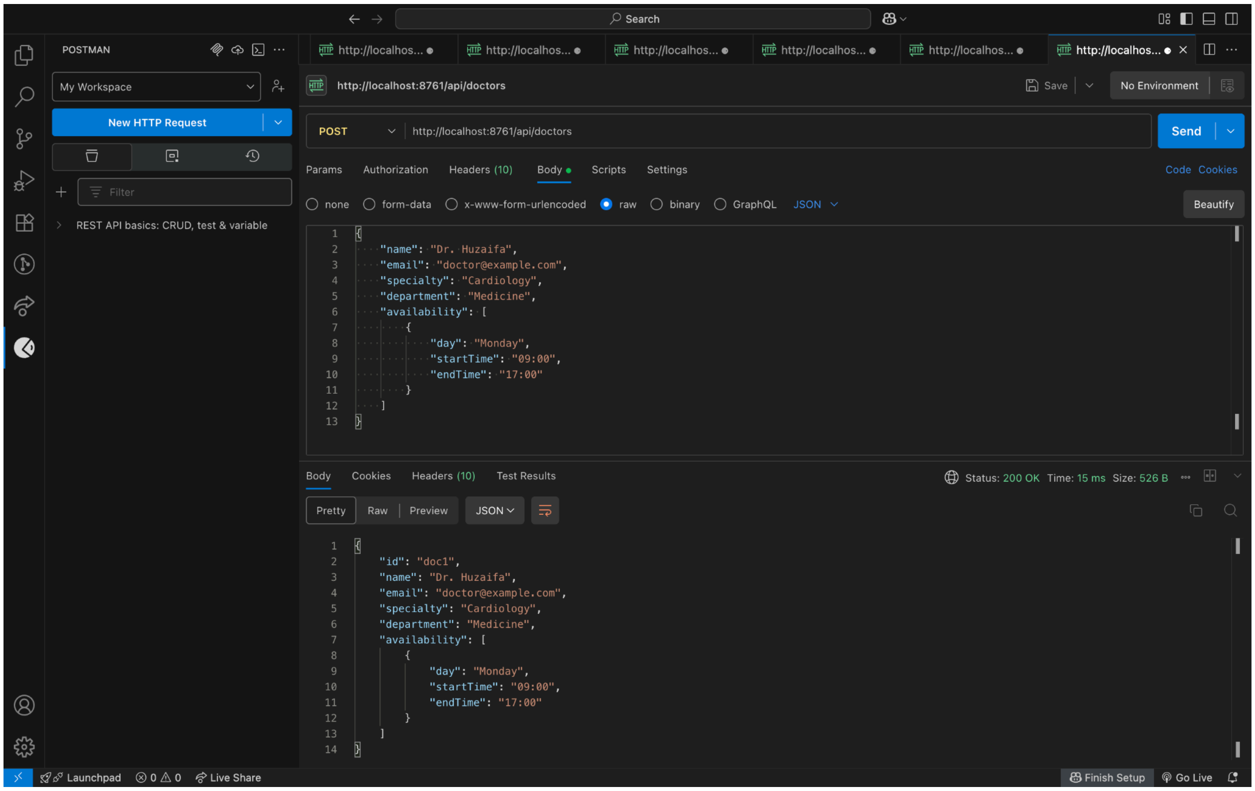
Query Params

	Key	Value
☑	page	0
☑	size	10
	Key	Value

Status: 200 OK Time: 8 ms Size: 552 B

```
{
    "content": [
        {
            "id": 1,
            "appointmentId": 1,
            "patientId": 1,
            "patientEmail": "huzaifa@example.com",
            "drugsAmount": 900,
            "consultationFee": 100,
            "total": 1000,
            "status": "PAID"
        }
    ],
    "pageable": {
```

Create Doctor



http://localhost:8761/api/doctors

POST http://localhost:8761/api/doctors

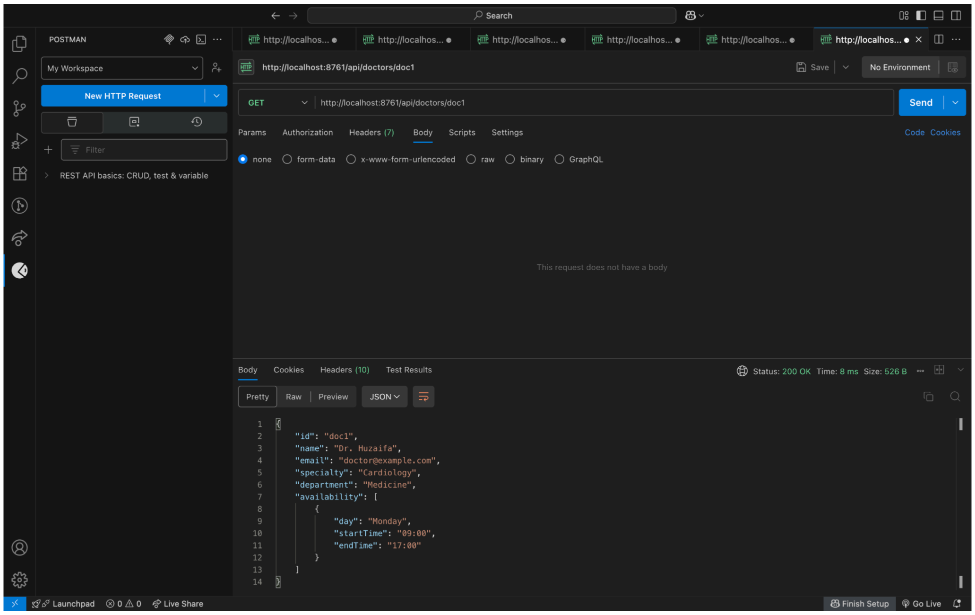
○ none ○ form-data ○ x-www-form-urlencoded ● raw ○ binary ○ GraphQL JSON

```
{
    "name": "Dr. Huzaifa",
    "email": "doctor@example.com",
    "specialty": "Cardiology",
    "department": "Medicine",
    "availability": [
        {
            "day": "Monday",
            "startTime": "09:00",
            "endTime": "17:00"
        }
    ]
}
```

Status: 200 OK Time: 15 ms Size: 526 B

```
{
    "id": "doc1",
    "name": "Dr. Huzaifa",
    "email": "doctor@example.com",
    "specialty": "Cardiology",
    "department": "Medicine",
    "availability": [
        {
            "day": "Monday",
            "startTime": "09:00",
            "endTime": "17:00"
        }
    ]
}
```

Get Doctor



http://localhost:8761/api/doctors/doc1

GET http://localhost:8761/api/doctors/doc1

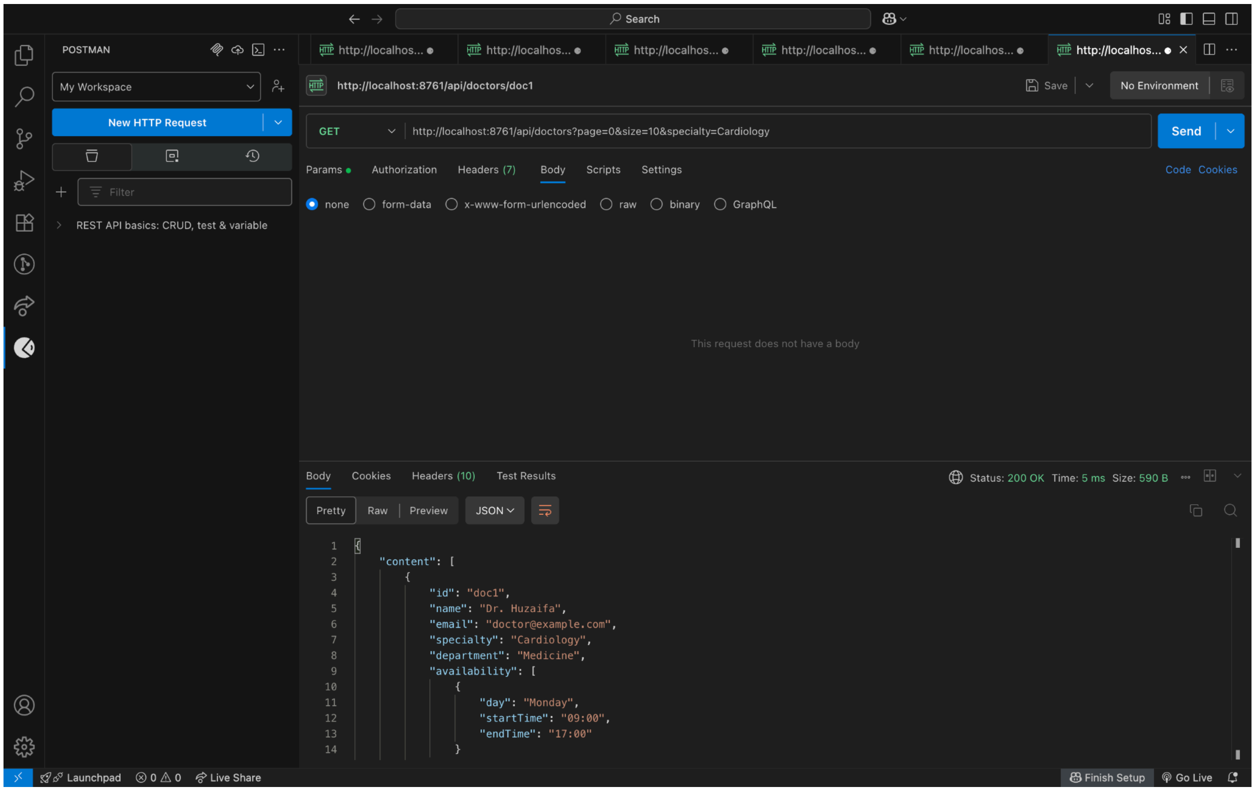
● none ○ form-data ○ x-www-form-urlencoded ○ raw ○ binary ○ GraphQL

This request does not have a body

Status: 200 OK Time: 8 ms Size: 526 B

```
{
    "id": "doc1",
    "name": "Dr. Huzaifa",
    "email": "doctor@example.com",
    "specialty": "Cardiology",
    "department": "Medicine",
    "availability": [
        {
            "day": "Monday",
            "startTime": "09:00",
            "endTime": "17:00"
        }
    ]
}
```

Get All Doctors



http://localhost:8761/api/doctors/doc1

GET http://localhost:8761/api/doctors?page=0&size=10&specialty=Cardiology

Body: ● none ○ form-data ○ x-www-form-urlencoded ○ raw ○ binary ○ GraphQL

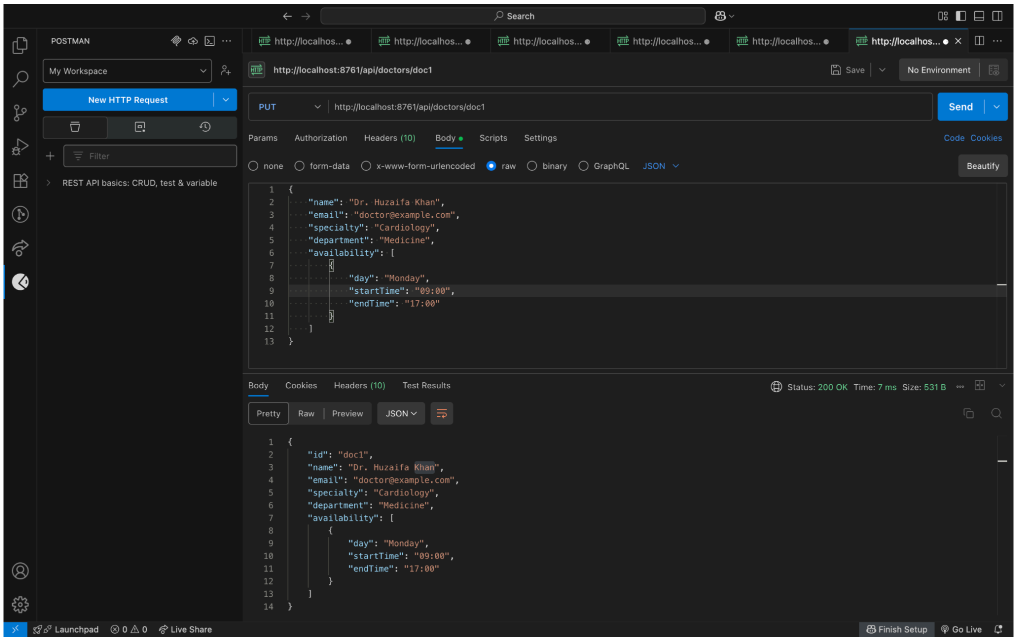
This request does not have a body

Body | Cookies | Headers (10) | Test Results — Status: 200 OK Time: 5 ms Size: 590 B

JSON

```
{
    "content": [
        {
            "id": "doc1",
            "name": "Dr. Huzaifa",
            "email": "doctor@example.com",
            "specialty": "Cardiology",
            "department": "Medicine",
            "availability": [
                {
                    "day": "Monday",
                    "startTime": "09:00",
                    "endTime": "17:00"
                }
```

Update Doctor



http://localhost:8761/api/doctors/doc1

PUT http://localhost:8761/api/doctors/doc1

Body: ○ none ○ form-data ○ x-www-form-urlencoded ● raw ○ binary ○ GraphQL JSON

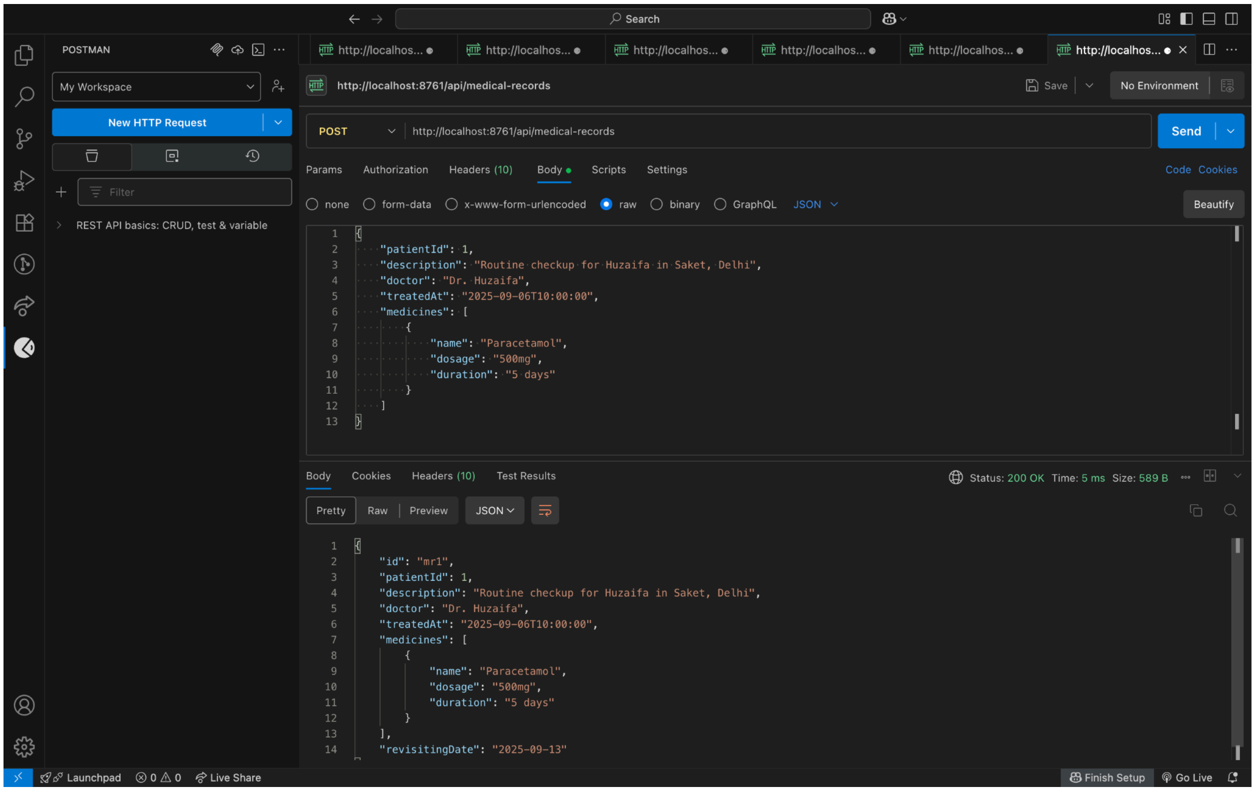
```
{
    "name": "Dr. Huzaifa Khan",
    "email": "doctor@example.com",
    "specialty": "Cardiology",
    "department": "Medicine",
    "availability": [
        {
            "day": "Monday",
            "startTime": "09:00",
            "endTime": "17:00"
        }
    ]
}
```

Body | Cookies | Headers (10) | Test Results — Status: 200 OK Time: 7 ms Size: 531 B

JSON

```
{
    "id": "doc1",
    "name": "Dr. Huzaifa Khan",
    "email": "doctor@example.com",
    "specialty": "Cardiology",
    "department": "Medicine",
    "availability": [
        {
            "day": "Monday",
            "startTime": "09:00",
            "endTime": "17:00"
        }
    ]
}
```

Create Medical Record



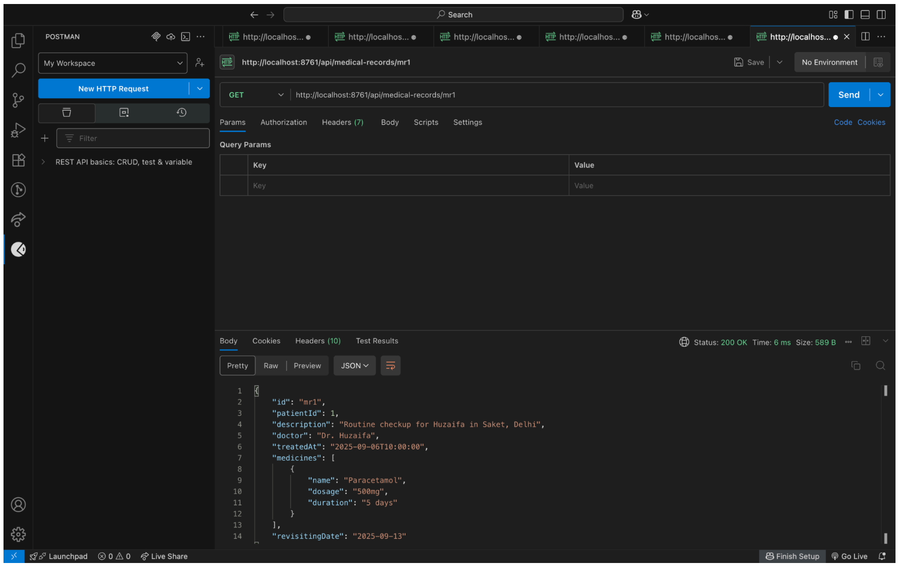
POST http://localhost:8761/api/medical-records

```
{
    "patientId": 1,
    "description": "Routine checkup for Huzaifa in Saket, Delhi",
    "doctor": "Dr. Huzaifa",
    "treatedAt": "2025-09-06T10:00:00",
    "medicines": [
        {
            "name": "Paracetamol",
            "dosage": "500mg",
            "duration": "5 days"
        }
    ]
}
```

Status: 200 OK Time: 5 ms Size: 589 B

```
{
    "id": "mr1",
    "patientId": 1,
    "description": "Routine checkup for Huzaifa in Saket, Delhi",
    "doctor": "Dr. Huzaifa",
    "treatedAt": "2025-09-06T10:00:00",
    "medicines": [
        {
            "name": "Paracetamol",
            "dosage": "500mg",
            "duration": "5 days"
        }
    ],
    "revisitingDate": "2025-09-13"
```

Get Medical Record

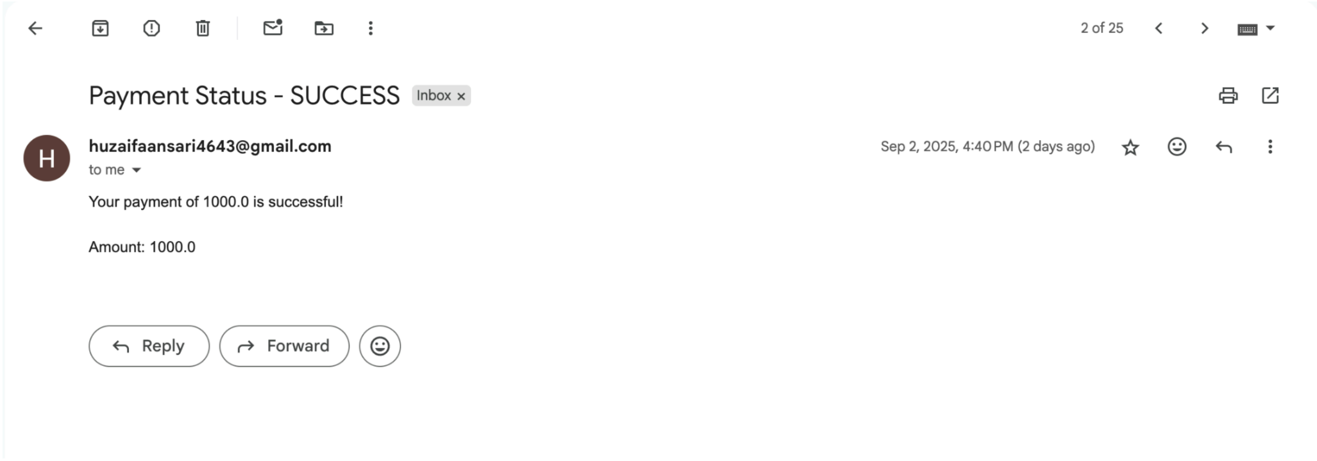


GET http://localhost:8761/api/medical-records/mr1

Status: 200 OK Time: 6 ms Size: 589 B

```
{
    "id": "mr1",
    "patientId": 1,
    "description": "Routine checkup for Huzaifa in Saket, Delhi",
    "doctor": "Dr. Huzaifa",
    "treatedAt": "2025-09-06T10:00:00",
    "medicines": [
        {
            "name": "Paracetamol",
            "dosage": "500mg",
            "duration": "5 days"
        }
    ],
    "revisitingDate": "2025-09-13"
```

Email Notification (Using KAFKA)



Payment Status - SUCCESS

huzaifaansari4643@gmail.com
to me

Sep 2, 2025, 4:40 PM (2 days ago)

Your payment of 1000.0 is successful!

Amount: 1000.0