Coding Challenge : Car Rental System

Objective

You are required to build a **Car Rental System** consisting of:

- A backend service using **FastAPI** with an **SQLite** database or any other database you are comfortable with.
- A **ReactJS** frontend that interacts with the API.
- A **Python SDK** (generated using OpenAPI Generator CLI).
- **Automation scripts** (PowerShell, Shell, or any other script you are comfortable with) to simplify setup and execution.

Your solution should be **fully functional**, adhere to **OpenAPI standards**, and demonstrate **best practices** in backend, frontend, database, and SDK development.

Please leverage any means available on the internet, such as **LLMs, open-source projects, or any other resources**, to enhance your solution. Using your **imagination to add additional functionality** is a plus.

📌 Tasks & Requirements

1. Backend Development (FastAPI & Database)

Implement a FastAPI service with the following endpoints:

- **POST** `/cars/` → Add a new car to the system.
- **GET** `/cars/` → Retrieve all available cars.
- **GET** `/cars/{car_id}` → Retrieve details of a specific car.
- **POST** `/cars/{car_id}/rent` → Rent a car for a specified period.
- **DELETE** `/rentals/{rental_id}` → Cancel an active rental.

Requirements:

- Use **SQLite** or any other database you are comfortable with.
- Ensure the API follows **OpenAPI standards** (**Swagger UI docs can be accessible**).
- Implement **error handling** (e.g., `404` for non-existent cars, `400` for invalid rental requests).
- Write **unit tests** for the backend.

Trick Logic in Backend (Hidden Complexity)

Each car can only be rented **if available**:

- A car **cannot be rented twice for overlapping dates**.
- **Cancellations** should free up the car for others to rent.
- If **all cars are rented**, the system should reject new rental requests.

📌 Example: ✅ **Car A is available** → Can be rented. ❌ If a user tries to rent **Car A when it's already rented for the same dates**, return an error. ✅ If a **rental is canceled**, the car becomes available again for new bookings.

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2. Database (SQLite or Other Database)

Create two database tables:

```
CREATE TABLE cars (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
```

```
    make TEXT NOT NULL,
    model TEXT NOT NULL,
    year INTEGER NOT NULL,
    daily_rate REAL NOT NULL CHECK (daily_rate > 0),
    available BOOLEAN NOT NULL DEFAULT 1
);

CREATE TABLE rentals (
    id INTEGER PRIMARY KEY AUTOINCREMENT,
    car_id INTEGER NOT NULL,
    user_name TEXT NOT NULL,
    start_date TIMESTAMP NOT NULL,
    end_date TIMESTAMP NOT NULL,
    rental_date TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (car_id) REFERENCES cars(id) ON DELETE CASCADE
);

```

- Provide a **sample SQL file** (`seed_data.sql`) to populate initial test data.

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3. Frontend Client (ReactJS)

Develop a **ReactJS-based frontend**.

Use **Axios** for making API calls.

The frontend should allow users to:

✅ View all available cars (**displaying make, model, year, and rental price**). ✅ Rent a car (**select car, enter user details, specify rental period**). ✅ Cancel a rental (**enter rental ID to cancel a booking**).

Requirements:

- The frontend should interact **only via API calls** (no direct database access).
- **Style is not a priority**, but **functionality must work correctly**.

📌 **Bonus:**

- Implement **real-time updates for car availability**.

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4. Platform SDK (Generated via OpenAPI Generator CLI)

Instead of manually writing an SDK, you must **generate** a **Python SDK** using the **OpenAPI Generator CLI**.

Instructions to Generate SDK

1. **Install OpenAPI Generator CLI:**

```
npm install -g @openapitools/openapi-generator-cli

```

2. **Run the following command to generate the SDK:**

```
openapi-generator-cli generate -i http://localhost:8000/openapi.json -g python -o car_rental_sdk

```

Modify and Test the SDK:

- After generation, **modify the SDK** if needed.

- Write a **sample script** to **test SDK functionalities**.

📌 **Hint:**

- Ensure your **FastAPI server is running** before running the generator.
- The OpenAPI spec will be available at `http://localhost:8000/openapi.json`.

Expected SDK Usage (After Generation & Testing):

```
from car_rental_sdk.api.cars_api import CarsApi
from car_rental_sdk import ApiClient

client = ApiClient()
cars_api = CarsApi(client)

# Retrieve all available cars
cars = cars_api.get_cars()
print(cars)

```

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5. Development Setup Script

Create an automation script (PowerShell, Shell, or any other script you are comfortable with) that:

✅ **Sets up a virtual environment**. ✅ **Installs Python dependencies** (`requirements.txt`). ✅ **Initializes the database** (**applies migrations**). ✅ **Installs ReactJS dependencies**.

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6. Execution Script

Create an automation script (PowerShell, Shell, or any other script you are comfortable with) to start the full application.

✅ **Start the FastAPI backend**. ✅ **Start the React frontend**.

🎯 Evaluation Criteria

✅ **Code Quality:** Well-structured, clean, and modular code. ✅ **Correct API Implementation:** API should work correctly and follow OpenAPI standards. ✅ **Proper Error Handling:** Handles bad inputs and errors gracefully. ✅ **Platform SDK Generation:** SDK must be generated correctly using OpenAPI Generator CLI. ✅ **Frontend Integration:** The ReactJS frontend should correctly communicate with the backend. ✅ **Automation Scripts:** Setup and execution scripts should work as expected. ✅ **Unit Tests:** Backend should include test cases. ✅ **Documentation:** Include a README with installation and execution steps. ✅ **Backend Trick Logic:** Ensure candidates correctly implement rental validation and car availability logic.

📦 Deliverables

By the end of the task, you should submit the following:

- ✅ **Backend (FastAPI) source code**
- ✅ **Database schema & migration files**
- ✅ **ReactJS frontend code**
- ✅ **Python SDK** (generated via OpenAPI Generator CLI)
- ✅ **Setup & Execution Scripts** (PowerShell, Shell, or any other script)
- ✅ **Unit tests for backend**
- ✅ **README explaining how to set up and run the project**

Good luck! 🚀