Smart Parking System

As a part of our course in Relational Database Management Systems (RDBMS), I developed this project titled **Smart Parking System**. This system is designed to manage user registrations, parking lot and slot allocations, bookings, and payments in a structured and reliable relational database using MySQL.

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Project Description

The **Smart Parking System** is a backend database solution built to manage the operations of a parking facility digitally. It supports real-time tracking of available slots, allows users to book/reserve parking, and logs the associated payment transactions. The goal is to minimize manual effort and errors while maximizing slot utilization and user convenience.

Basic Structure

The system is based on a relational model and consists of the following major entities:

- Users
- Parking Lots

- Parking Slots
- Bookings
- Payments

Each table is connected through foreign keys and maintains data integrity via constraints.

Functional Requirements

- Allow users to register and manage their vehicle details
- Define multiple parking lots with unique locations and slot counts
- Keep track of available and occupied parking slots
- Allow users to book parking slots and record booking times
- Handle and record payments for each booking

ER Diagram and Constraints

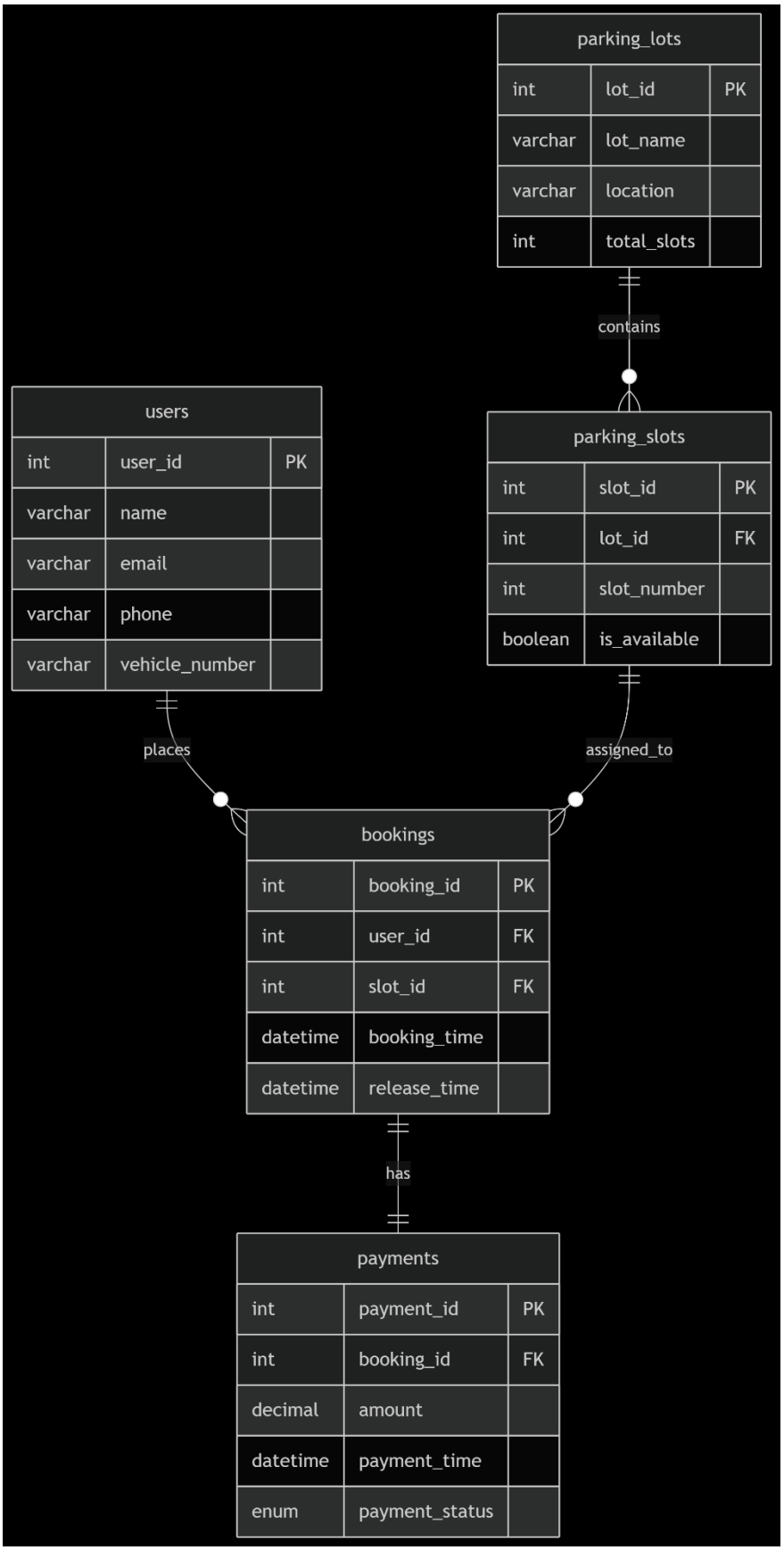
Entities:

- **Users** (user_id, name, email, phone, vehicle_number)
- **Parking Lots** (lot_id, lot_name, location, total_slots)
- **Parking Slots** (slot_id, lot_id, slot_number, is_available)
- **Bookings** (booking_id, user_id, slot_id, booking_time, release_time)
- **Payments** (payment_id, booking_id, amount, payment_time, payment_status)

Relationships:

- A User can make multiple Bookings
- Each Booking reserves one Parking Slot
- Each Booking is associated with one Payment
- Each Parking Slot belongs to one Parking Lot

Er Diagram:


parking_lots
int lot_id PK
varchar lot_name
varchar location
int total_slots
contains
users
int user_id PK
varchar name
varchar email
varchar phone
varchar vehicle_number
parking_slots
int slot_id PK
int lot_id FK
int slot_number
boolean is_available
places
assigned_to
bookings
int booking_id PK
int user_id FK
int slot_id FK
datetime booking_time
datetime release_time
has
payments
int payment_id PK
int booking_id FK
decimal amount
datetime payment_time
enum payment_status

Relational Database Schema

The MySQL schema is designed with normalization and data integrity in mind. Key constraints include primary keys, foreign keys with cascading deletions, and business rules using CHECK constraints.

Implementation

Creating Tables

- users: Stores user and vehicle details
- parking_lots: Details of each parking location
- parking_slots: Slot-level information linked to lots
- bookings: Records each reservation with timestamps
- payments: Stores transaction data linked to bookings

Inserting Data

Sample data was inserted to test functionality:

- Three users were added with unique vehicle numbers
- Three parking lots and five slots were initialized
- Three bookings were made and associated payments recorded
- One booking was released and slot availability restored

Pre-requisites

- **MySQL** installed (preferably version 8.0+ for full CHECK constraint support)
- Basic SQL knowledge
- A database client like MySQL Workbench or phpMyAdmin

Sample Queries for Verification

booking_id	user_id	slot_id	booking_time	release_time
1	1	1	2025-05-15 20:34:57	2025-05-15 23:23:43
2	2	2	2025-05-15 21:53:45	2025-05-15 22:30:40
3	3	3	2025-05-15 12:57:16	2025-05-15 14:54:21

booking_id	user_id	slot_id	booking_time	release_time
1	1	5	2025-05-15 00:11:35	2025-05-15 00:19:00
2	1	1	2025-05-15 21:40:53	2025-05-15 23:12:00

slot_id	lot_id	slot_number	is_available
6	1	101	1
7	3	102	1
8	1	103	1
9	5	104	1
10	2	105	1
NULL	NULL	NULL	NULL

user_id	name	email	phone	vehicle_number
1	John Doe	john@example.com	9876543210	DL01AB1234
5	Alice Smith	alice@example.com	9876543211	MH12XY4567
6	Rahul Verma	rahul@example.com	9123456789	KA01CD7890
NULL	NULL	NULL	NULL	NULL

lot_id	lot_name	location	total_slots
1	Lot A	Downtown Area	50
2	Lot A	Downtown Area	50
3	Lot B	Airport Road	80
4	Lot B	Airport Road	80
5	Lot C	Mall Basement	100
NULL	NULL	NULL	NULL