Author

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I completed my BSc in Statistics from Aligarh Muslim University. I am currently a standalone BS student. I am deeply interested in Responsible AI Research and plan to do research and publish a paper in this field by next year.

Description

This project implements a multi-user web application that allows administrators to manage 4-wheeler parking lots and users to reserve parking spots. The admin can create parking lots with multiple parking spots and monitor usage, while users can register, book the first available spot, and release it after use.

Technologies used

Flask: A Backend framework for routing, request handling, and business logic.

SQLite: Lightweight relational database for persistent data storage.

Jinja2: Flask's templating engine for dynamic rendering of HTML content.

HTML5, **CSS3**, **Bootstrap**: For structuring and styling the frontend to ensure responsiveness and a clean UI.

Flask Extensions:

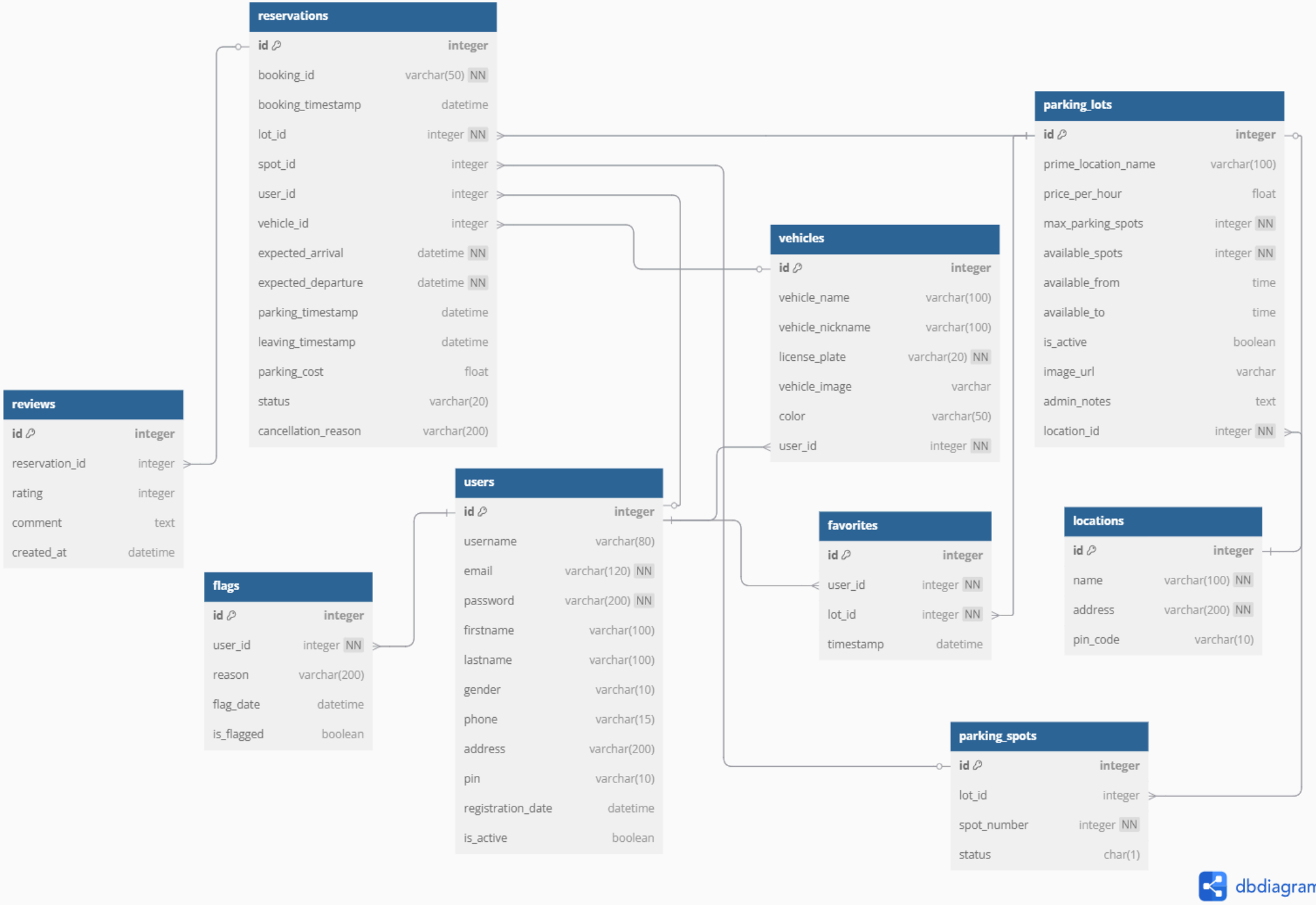
- **flask_login**: To handle user session management.
- **flask_sqlalchemy**: ORM for database model definition and interaction.
- **Werkzeug Security**: Password hashing for secure user data.

Chart.js: For rendering user/admin dashboards with visual parking usage summaries.

datetime: Manage booking and parking time.

DB Schema Design

Entities and Relationship Diagram:


reservations
id integer
booking_id varchar(50) NN
booking_timestamp datetime
lot_id integer NN
spot_id integer
user_id integer
vehicle_id integer
expected_arrival datetime NN
expected_departure datetime NN
parking_timestamp datetime
leaving_timestamp datetime
parking_cost float
status varchar(20)
cancellation_reason varchar(200)
parking_lots
id integer
prime_location_name varchar(100)
price_per_hour float
max_parking_spots integer NN
available_spots integer NN
available_from time
available_to time
is_active boolean
image_url varchar
admin_notes text
location_id integer NN
vehicles
id integer
vehicle_name varchar(100)
vehicle_nickname varchar(100)
license_plate varchar(20) NN
vehicle_image varchar
color varchar(50)
user_id integer NN
reviews
id integer
reservation_id integer
rating integer
comment text
created_at datetime
users
id integer
username varchar(80)
email varchar(120) NN
password varchar(200) NN
firstname varchar(100)
lastname varchar(100)
gender varchar(10)
phone varchar(15)
address varchar(200)
pin varchar(10)
registration_date datetime
is_active boolean
favorites
id integer
user_id integer NN
lot_id integer NN
timestamp datetime
locations
id integer
name varchar(100) NN
address varchar(200) NN
pin_code varchar(10)
flags
id integer
user_id integer NN
reason varchar(200)
flag_date datetime
is_flagged boolean
parking_spots
id integer
lot_id integer
spot_number integer NN
status char(1)
dbdiagram

Entities and Relationships:

- **User** (id, username, email, password, firstname, lastname, gender, phone, address, pin, registration_date, is_active)
    - One-to-Many with **Vehicle**
    - One-to-Many with **Favorite**
    - One-to-Many with **Reservation**
    - One-to-Many with **Flag**
    - **Purpose:** User to register with personal details and manage multiple Vehicles, mark multiple Favorite parking lots, make multiple Reservations, and may be Flagged multiple times for misconduct.

- **Vehicle** (id, vehicle_name, license_plate, color, user_id)
    - One-to-Many with **Reservation**
    - **Purpose**: Each **Vehicle** to have multiple Reservations.

- **Location** (id, name, address, pin_code)
    - One-to-Many with **ParkingLot**
    - **Purpose**: Location to host multiple **ParkingLots**.

- **ParkingLot** (id, prime_location_name, price_per_hour, max_parking_spots, available_spots, available_from, available_to, is_active, location_id, latitude, longitude, image_url, admin_notes)
    - One-to-Many with **ParkingSpot**
    - One-to-Many with **Reservation**
    - One-to-Many with **Favorite**
    - **Purpose:** Each **ParkingLot** to have multiple **ParkingSpots** and many Reservations.

- **ParkingSpot** (id, lot_id, spot_number, status)
    - One-to-Many with **Reservation**
    - **Purpose**: A parking spot to have multiple reservations.

- **Reservation** (id, booking_id, booking_timestamp, lot_id, spot_id, user_id, vehicle_id, expected_arrival, expected_departure, parking_timestamp, leaving_timestamp, parking_cost, status, cancellation_reason)
    - One-to-One with **Review**
    - **Purpose:** Each Reservation to receive one Review.

API Design

- **User Registration & Login APIs**: Authentication endpoints.
- **Parking Lot APIs**: CRUD operations for Parking Lots (create, update, delete, list).
- **Parking Spot APIs**: APIs to check and update spot status.
- **Reservation APIs**: APIs for booking and vacating parking spots.

APIs return JSON responses wherever used. Swagger YAML documentation separately submitted.

Architecture and Features

```
park_ease_21f3002068
├── app.py
├── config.py
├── utils.py
├── instance
│   └── parkease.db
├── model.py
├── Project Report.pdf
├── README.md
├── requirements.txt
├── routes
│   ├── admin_routes.py
│   ├── __init__.py
│   └── user_routes.py
├── static
│   ├── icon
│   ├── image
│   ├── scripts
│   ├── style
│   └── uploads
└── templates
    ├── admin
    ├── index.html
    ├── partials
    └── user
```

- **app.py** - Main application entry point.
- **/templates** - All HTML templates (Admin dashboard, User dashboard, Login/Register, Lot management, Spot management).
- **/static** - Static files (CSS, Bootstrap assets, JS).
- **/model.py** - All SQLAlchemy ORM models (User, ParkingLot, ParkingSpot, Reservation).
- **/routes.py** - All application routes (User, Admin, CRUD operations, booking/reserving).
- **/config.py** - Database and environment configurations.

Features Implemented

- **Authentication**
  - **Admin login** with hardcoded credentials.
  - User **registration** and **login**.
  - **Passwords hashed** securely using Werkzeug.

- **Admin Features**
  - **View** all parking lots.
  - **Create** new parking lots with admin assigned number of spots.
  - **Edit/Delete** parking lots.
  - **Delete** parking spots.
  - **View** all parking spots.
  - **View** registered users and their parking reservations.
  - **View** summary charts

- **User Features**
  - **View** available parking lots.
  - **Reserve** the first available spot in the selected lot.
  - **View** and **manage** current parking status.
  - **Release** parking spot and **generate** parking cost based on duration.
  - **View** parking history and **summary charts**.

- **Additional features**
  - **Display flash messages on top-right corner of the screen.**
  - **Admin**
    - **Flag/Unflag** users.
    - **Flagged** user will be unable to login to their dashboard.
    - **Delete user**.

        - Create **multiple parking lots** for a location.
        - **Print out** parked-out parking reservation details of a users
    - **User**
        - Profile completion bar.
        - **Flagged user will be unable to login to their dashboard.**
        - **Cancel** parking reservations with statuses **'Pending'** and **'Confirmed'**.
        - Reservation status **'Rejected'** in cases of no-show.
        - **Re-book** a parking lot reservation with status **'Cancelled**/**Rejected'** or '**Parked Out'**.
        - **Favorite/Save** a parking lot.
        - Add **multiple vehicles** to their profile
        - **Print out** parked-out parking reservation details.
        - **Delete** their account

Video

DriveLink:
https://drive.google.com/file/d/1PNSmYSB8zykQxnyztq75t_j98t2MALwi/view?usp=sharing

YTLink (in case the drive link takes a longer loading time):
https://youtu.be/Ly-Wm7Tt9Ck