

## App Dev-II Project Report

### 1. Student Details

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**About Me:** I enjoy building structured, scalable web applications and exploring backend automation.

My interests lie in Flask-based systems, UI frameworks, and cloud-style workflows.

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### 2. Project Details

#### Project Title: Vehicle Parking Management App – V2

##### Problem Statement:

To develop a multi-user parking management system that handles parking lots, parking spots, and reservation of 4-wheeler slots. The app must support an admin role with full control over lots/spots and normal users who can book, release, and view their parking history.

##### Approach:

The system is developed using Flask for backend APIs and Vue.js for frontend UI. The backend follows a modular controller-based architecture, integrated with Redis caching and Celery for scheduled/background jobs. Users can register, book the first available spot, release it, and view charts and reports. Admin can manage lots, spots, users, and view dashboards.

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### 3. AI/LLM Declaration

I used **ChatGPT (GPT-5.1)** only for **solving specific errors** during development and for minor improvements in documentation wording.

The extent of AI usage is approximately **8–10%**

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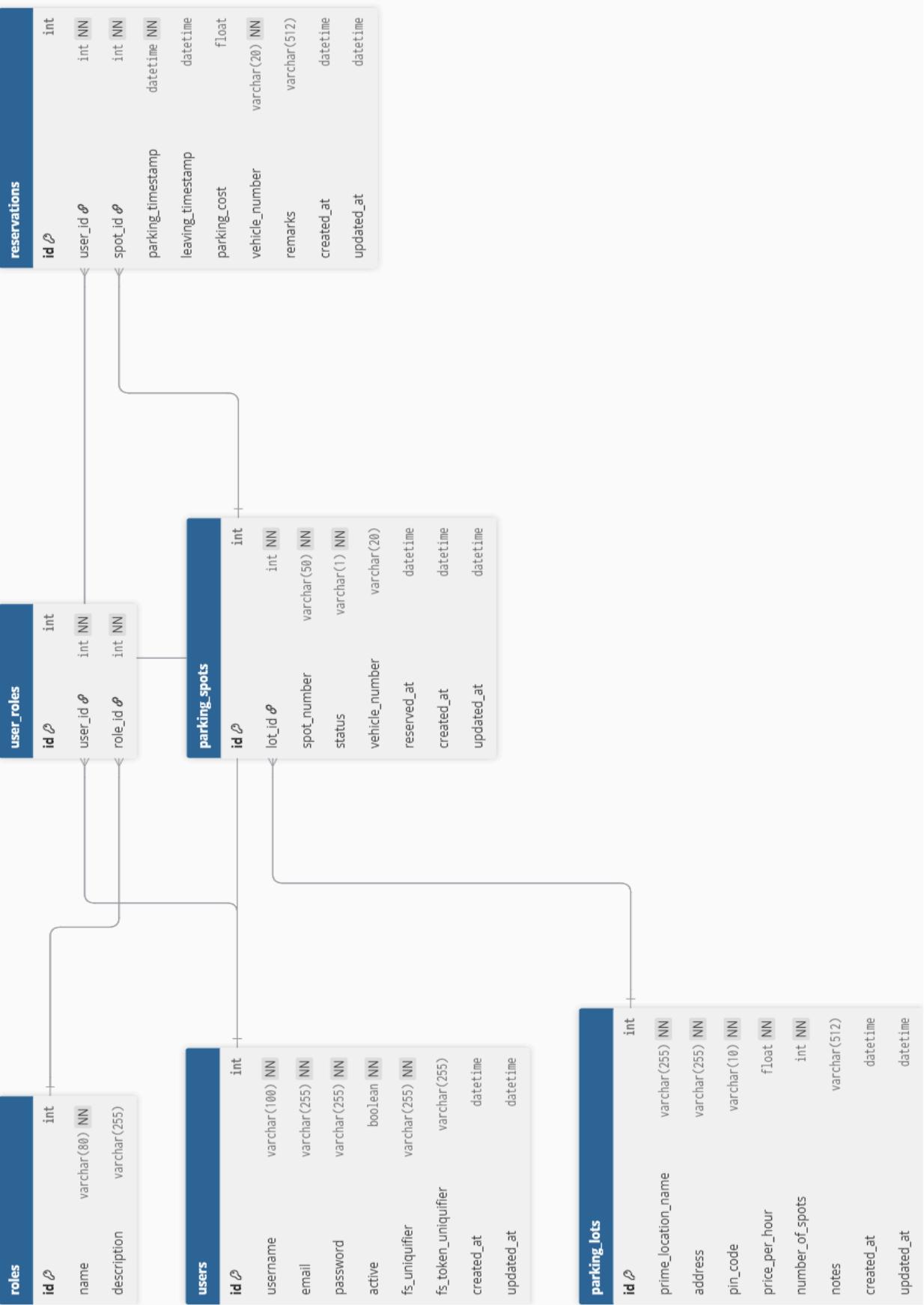
### 4. Technologies & Frameworks Used

Technology / Library	Purpose
Flask	-Backend API framework
SQLite	-Lightweight local database for storing data
Vue.js (CLI)	-Frontend UI framework
Bootstrap 5	-Styling and responsive layout
SQLAlchemy	-ORM for database modeling
Redis	-Caching and Celery backend (broker & result backend)
Celery	-Background/scheduled task execution (daily reminders, monthly reports, CSV exports)
<u>Chart.js</u>	-Rendering admin and user charts
Flask-JWT / Flask-Login	-Authentication and role handling
MailHog	-Local SMTP server to catch and view all emails sent via send_email (daily reminders & monthly reports)

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### 5. Database Schema / ER Diagram

The application uses a relational database with the following main tables:



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## 6. API Resource Endpoints

The Vehicle Parking App provides RESTful APIs to manage users, parking lots, spots, and bookings. Endpoints were implemented for **user registration and login**, **admin dashboard and role management**, **booking/reservation of parking spots**, **releasing spots**, and **fetching user/admin-specific chart data**. Additional APIs were created for **exporting CSV reports** and **retrieving parking spot and lot details**. The APIs were built using **Flask-RESTful**, with **Redis caching** for frequently accessed data and **Celery** for asynchronous and scheduled tasks such as daily reminders and monthly reports. All endpoints, request/response details, and parameters are defined in the submitted api.yaml file.

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## 7. Architecture and Features (optional)

### Backend

The backend is built with Flask and organized as follows: `app.py` as the entry point, `model.py` for SQLAlchemy models, `cntrlrs/` for API controllers, `tasks/` for Celery jobs, `cache.py` for Redis caching, `celery_app.py` for task configuration, and `mail.py` for email utilities.

### Frontend

The frontend uses Vue.js with a component-based structure. `views/` contains Admin and User pages, `components/` holds reusable UI elements, `api/axios.js` manages API calls, and `stores/` manages state with Pinia.

### Features

- **Admin:** Manage parking lots, auto-generate spots, view users, dashboard with charts, monitor spot status.
- **User:** Register/Login, reserve/release spots, view booking history, personalized dashboard.
- **Background Tasks:** Celery + Redis for daily reminders, monthly HTML reports via email, and async CSV export.
- **Other:** Caching with expiry for frequently accessed APIs, full frontend & backend validation, responsive UI with Bootstrap.

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## 8. Video Presentation

### Video Link:

[https://drive.google.com/file/d/1RsdwPmNyIFrD50-V\\_ZLD3GjZN8fZpif4/view?usp=sharing](https://drive.google.com/file/d/1RsdwPmNyIFrD50-V_ZLD3GjZN8fZpif4/view?usp=sharing)