EV Charging and Billing System

hymate Tech Task

April 30, 2025

Design a simplified backend script that schedules electric vehicle (EV) charging for a small residential building and computes session costs based on charging duration and electricity prices.

Scenario

- You manage 5 EVs and 3 charging ports for a shared parking area.

- Each EV may have a charging request on certain days to reach a target state of charge (SoC) by a specific hour.

- Charging is allowed only when the car is available at the station, and each port can charge one car at a time.

Requirements

1. Charging Logic

   - Schedule charging sessions based on:
     * Port availability
     * Car's max charging rate
     * Arrival SoC and capacity
     * Desired SoC at a specific time
   - Distribute charging sessions across available ports fairly.

2. Billing

   - For each session, compute:
     * **Energy Charged = (target SoC − initial SoC) × capacity**
     * **Cost** $= \sum_{t=h_0}^{H}$ **energy charged**$_t$ × **price**$_t$ where t represents each hour
     * Assume 95% efficiency (i.e., real energy = energy / 0.95)

3. Output

- Charging schedule (hours and power)
- Final SoC
- Total Cost

You will Receive

- `cars.json` — list of 5 cars with capacity, max rate, efficiency

- `availability.csv` — car × hour matrix (1 = available, 0 = not)

- `requirements.json` — {`car`:{`day`:{`hour`:`target_soc`}}}

- `prices.csv` - hourly electricity price in €/kWh (for 7 days)

Assumptions

- Charging step = 1 hour

- Each port can charge only one car per hour

- Ignore battery degradation

- No need for authentication or user interface

Deliverables

- Python script or notebook

- Charging schedule per car

- Cost summary table

- Readme (explain structure, assumptions, and how to run)