Project 1 (P1) - CS460 Spring 2026

Multistory Parking Structure Management

In this project, students will design and implement a *Multistory Parking Structure Management* System that simulates how vehicles are admitted, parked, and exited in a structured parking facility. The system simulates a software-controlled process that manages vehicle flow, parking availability, and system constraints across multiple parking floors.

You are allowed to be creative with the requirements to a certain extent, like how cars are tracked (optional), or how capacity is tracked (mandatory). The key is to have consistent state management of capacity vs cars entering based on the requirements.

System Description

The Parking Structure Management System is responsible for:

- Tracking parking availability across multiple levels
- Maintaining consistent system state under capacity constraints
- Displaying real-time parking availability information
- Controlling vehicle entry and exit through gates (optional)
- Modeling payment of the use of the parking structure (optional)

Parking Structure

- The structure consists of multiple parking floors (or zones)
- Each floor has a fixed number of parking spots
- Each parking spot is assumed to be equipped with a binary sensor that reports if the spot is free or occupied. The state of the spot is indicated with a light on the ceiling, aligned with the spot; it turns green if the spot is free, it tirns red if the spot is occupied.

The system must maintain **accurate** counts of available parking spots at both the floor level and the overall structure. It could be more challenging than it seems if we take into account the cars in transit.

Entry Behavior

When a vehicle arrives at the entry gate:

1. The system determines whether the structure has available parking capacity. This is displayed in a big screen at the entrance. (Decision: will there be more than one entrance and more than one exit? Simpler to have only one of each.)
2. If space is available, the entry gate opens and the vehicle is admitted.
3. The system updates internal state to reflect that a vehicle has entered the parking structure.

Parking Behavior

After entering the garage:

- Drivers may choose any floor with available parking, **or**
- The system may guide or assign drivers to specific floors (Or any other options)

If you choose to track cars in transit, there are some options, i.e.

- Immediate confirmation of parking, **or**
- A temporary **"pending" or "in-transit"** state before parking is confirmed

Parking is considered complete when the system detects that a parking spot has become occupied.

Availability Display

The system includes a display that shows parking availability for each floor.

Exit Behavior

When a vehicle attempts to exit the parking structure

The system verifies that exit conditions are satisfied and:

1. The exit gate opens if permitted (optional)
2. The system updates floor-level and overall structure availability

If you have taken the payment option, you may choose whether exit validation is

- Automatic, or
- Based on additional constraints such as time limits or ticket validation

State Modeling Expectations

You may model and document several system states listed below, the first two are mandatory.

- Floor states (e.g., available, full, closed)
- Parking structure capacity states
- Gate states (e.g., open, closed, unavailable) (optional)
- Vehicle states (e.g., admitted, in transit, parked, exiting) (tracking is optional)

Design Flexibility

You are given the flexibility to decide:

- Whether drivers choose parking floors or are assigned one
- How vehicles are tracked while inside the parking structure
- Whether a “pending” or “in-transit” state is modeled
- Whether to enforce time-based parking constraints
- How strictly exit conditions are validated