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EE/CSE 371 Lab 1 Report: Parking Lot Occupancy Counter

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**Design Procedure**

For this Parking Lot Occupancy Counter system, we first decided to create a block diagram of the overall system according to the lab specifications. By creating a block diagram (Fig. 1), we were able to see how the modules were connected and what inputs and outputs were required for each, allowing us to split up the lab work effectively.

**A diagram of a car wiring

Description automatically generated**

***Figure 1:*** *Block diagram of overall Parking Lot Occupancy system.*

The most important feature of the car detection module is its ability to detect two specific sequences from the outer and inner photosensors used to track cars entering and exiting the parking lot. An equally important feature of this module is its ability to disregard all other sequences from the photosensors, such as the sequence for pedestrians passing through. If an entering or exiting sequence is identified, the car detection module needs to signal that a car has either entered or exited the parking lot, or else the signals need to remain unaffected.

We used a Moore machine to design the car detection module. Although Moore machines react slower to inputs than Mealy machines, the Parking Lot Occupancy system is assumed to be a slow system in which the inputs are not changing rapidly. Additionally, Moore machines are much easier to design, which was advantageous when trying to design an FSM that can track two sequences while ignoring all others. Fig. 2 shows that 8 states were required to enable the Moore machine to track the enter and exit sequences, as well as restart the sequence tracking when any inputs did not match so that the enter and exit signals remained unaffected.

**A diagram of a diagram

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***Figure 2:*** *Moore machine state diagram of the car detection system.*

The most important features of the car counter module are its ability to accurately display the current number of cars in the parking lot on the seven-segment HEX displays in response to the enter and exit signals, and display when the lot is either empty or full. When the lot reaches maximum capacity (16 cars), the car counter module needs to display “FULL,” and when the lot is empty (0 cars), it needs to display “CLEAR0.”

[more details about HOW and WHY you designed the car counter module the way you did]

[insert FSM or helpful code for car counter if you have it]

[insert figure description]

The parking lot occupancy module simply connects the car detection and car counter modules together and connects their inputs and outputs to the off-board input switch signals and on-board seven-segment HEX displays. The DE1\_SoC Top-Entity module is responsible for using the V\_GPIO expansion header to physically wire the switches (inner sensor, outer sensor, and reset) to their corresponding LEDs and inputs of the parking lot occupancy module.

[insert snip of DE1\_SoC module and parking lot occupancy module?]

**Results**

Our completed design of the Parking Lot Occupancy system meets the requirements of Lab 1. Whenever a car enters the parking lot, the counter is increased by 1. Similarly, when a car leaves the parking lot, the counter is decreased by 1. The counter is always within the range of 0-16, with “CLEAR0” and “FULL” displayed for 0 cars and 16 cars, respectively. The Parking Lot Occupancy system does not

**DE1\_SOC**

**Flow Summary**

**Experience Report**