

Final Project

Fall 2023

Parking management system

Description

You are about to design a parking management system by using PS2 Keyboard, an LCD, 7-segments and LEDs.

The parking system will be installed in a two-level parking lot. Each floor will have a sensor to monitor the number of parked cars.

Each floor can accommodate up to five vehicles, with a total of ten parking spots. Two spots are reserved for two special IDs that are kept free if the ID holder didn't use the parking.

The parking can be accessed by 14 other IDs, with a total of 16 IDs having the right to park, including the two special IDs.

The parking is considered full when the eight spots that are not reserved are fully occupied. The parking works on the principle of first come, first served, meaning that when the parking is full, no new car can enter even if the parking ID is correct. The only exception is when the special ID is entered since it has its own reserved spot.

The parking has an entrance and an exit gate, each having a security guard. Every guard has an admin ID that gives them the ability to override the gate operation by keeping it open or closed. They can also block a car from accessing the parking.

Functional description

The parking system has a switch on the board that is used to indicate the desired parking level. Level 0 is designated by 0, and level 1 is designated by 1. Each ID should have the following notation: "20230XX," which is a decimal representation of the ID value. The "X" should be replaced with the desired value.

The number of available spots on each level of the parking will be displayed on a seven-segment display, along with the total number of available spots. Three seven-segment displays will be used in total.

A red led will turn on when the system is on, another red led is used to indicate a wrong ID and a green led will be used to indicate a valid ID.

The two reserved spots are located on level 0 of the parking. When the counter of the available spots reaches a value of 2 and no reserved spot is occupied, level 0 is considered full.

To enter the parking, the user simply has to enter their ID. To exit the parking, the Esc key should be pressed before entering the ID. An ID that has not been entered cannot exit the parking. The parking system cannot accept the same ID twice. If an ID is used to enter the parking and then used a second time without exiting, it will not be accepted.

A timeout of 2s should be used between each key press.

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Behavioral description

The System should have the following behavior:

1. When turned on a red led is turned on to indicate the power status, and the LCD should display:

Enter Your LCD_STATE = 0
ID to Park

2. The user will have to use the keyboard to enter the ID.
 - a. If the user entered a valid ID, a green led will turn on and the LCD will show:

ACCESS GRANTED LCD_STATE = 1
ID: 20230XX

The system checks the switch value to decrement the corresponding counter. If the level chosen is already full, the car is placed in the other level automatically.

Then, the system returns to the initial state after 3s.

- b. If the user entered a wrong ID, a red led should be turned on and the LCD should display:

ACCESS DENIED
Try Again

If no input is received within 5s, the system returns to the initial state.

3. If the “Esc” key is pressed the LCD should display:

Enter Your
ID to Exit

4. The security guard can enter the administrator mode exclusively form the initial state by pressing the CTRL+A keys simultaneously followed by one of the two Admin IDs.

A green and red LEDs will start to blink every 0.25s, and the LCD should display:

Administrator
Mode

After 2s of entering the administrator mode, the display will show:

- 1- *Open the Gate*
- 2- *Restrict access*

- I. If the user presses 1, the LCD should display:

Gate is Open

- II. If the user presses 2, the LCD should display:

Enter ID to
Restrict

If the operation succeeded, the LCD should display:

ID: 20230XX
Is restricted

The system exits the administration mode if the user presses CTRL+A or inactive for 5s.

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Requirements

- You should implement the described system using VHDL or Verilog. Simulate your design and show your results.

Submissions

- A report clearly explaining all your design in detail; it should include Diagrams and state machines. For simplicity do not include your code in the report you can attach the (.v or .vhd) files in a folder with the report.
- A presentation on the due date. You should be prepared for any question regarding your design.
- A demonstration on the board.

Due Date

Final Assessment Period.

Good Luck