**DSD Project : Smart Parking System**

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1-The Idea:

The idea of this project is that we created a smart parking that keeps count of the number of cars inside the parking in any given time as well as being equipped with a fire detection system.

**2-The Sensors used**

* 2 infra-red motors used to close the gate after the car has passed safely
* 2 servo motors used to open the parking gate
* 2 buttons on the FPGA to activate the servo motors
* 1 MQ2 smoke sensor to trigger the fire alarm if any smoke is detected
* 1 sound buzzer used as a siren if any smoke is detected using the MQ2
* 2 LED lights, 1 green and 1 red, the red one indicates a full parking (15 cars) and the green one indicates that there are empty spots
* 2 bread boards to help with the connections

**3- The Implementation:**

* First of all we used 2 built in clocks in the FPGA which runs at a frequency of 10MHz the first is Assigned to PIN\_N5 and the second PIN\_N14.

1. First button built in the FPGA assigned to PIN\_B8 this button opens the entrance gate to the parking
2. First servo motor: this motor is connected to the 3.3V for VCC and Assigned to PIN\_V10 for PWM This motor takes a signal from the first button to open and from the first infra-red sensor to close.
3. First infra-red sensor: connected to the 3.3V for VCC and assigned to PIN\_AA8, this sensor detects cars that have passed by the entrance gate and increments the counter after detection
4. Second button: built in the FPGA and assigned to PIN\_A7, this activates the exit gate allowing for cars to leave
5. Second servo motor: this motor is connected to 3.3V for VCC and assigned to PIN\_AA7 for PWM this motor takes input from the second button and the second infra-red sensor to open and close the gate accordingly
6. Second infra-red sensor: this sensor is connected to 3.3V for VCC and assigned to PIN\_AA6, this sensor closes the second servo and decrements the number of cars by 1
7. MQ2 smoke sensor: connected to 5V for VCC and assigned to PIN\_AB2, this sensor sends a signal to the sound buzzer if any smoke is detected
8. Sound buzzer: a siren which turns on whenever a signal from the smoke detector is sent, Assigned to PIN\_AA2 for input VCC
9. Red LED: assigned to PIN\_AB3 ,turns on whenever the parking is full.
10. Green LED: assigned to PIN\_Y3, turns on whenever the parking has any empty spaces.
11. 7 Segment display: displays the counter using PINS(PIN\_C14,PIN\_E15,PIN\_C15,PIN\_C16,PIN\_E16,PIN\_D17,PIN\_C17,PIN-C18,PIN\_D18,PIN\_E18,PIN\_B16,PIN\_A17,PIN\_A18,PIN\_B17).

**The results:**

For testing this project we set the maximum amount of cars to 15, and began to enter cars and take them out at random to test the correctness of the counter, also testing the edge cases(parking is full and then trying to add more cars or an empty parking where we try to remove more cars from it).

As well as lighting a flame to test the fire detection sensor and the siren.