Electronic Computer Systems

FPGA car parking system

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Introduction

FPGA car parking system

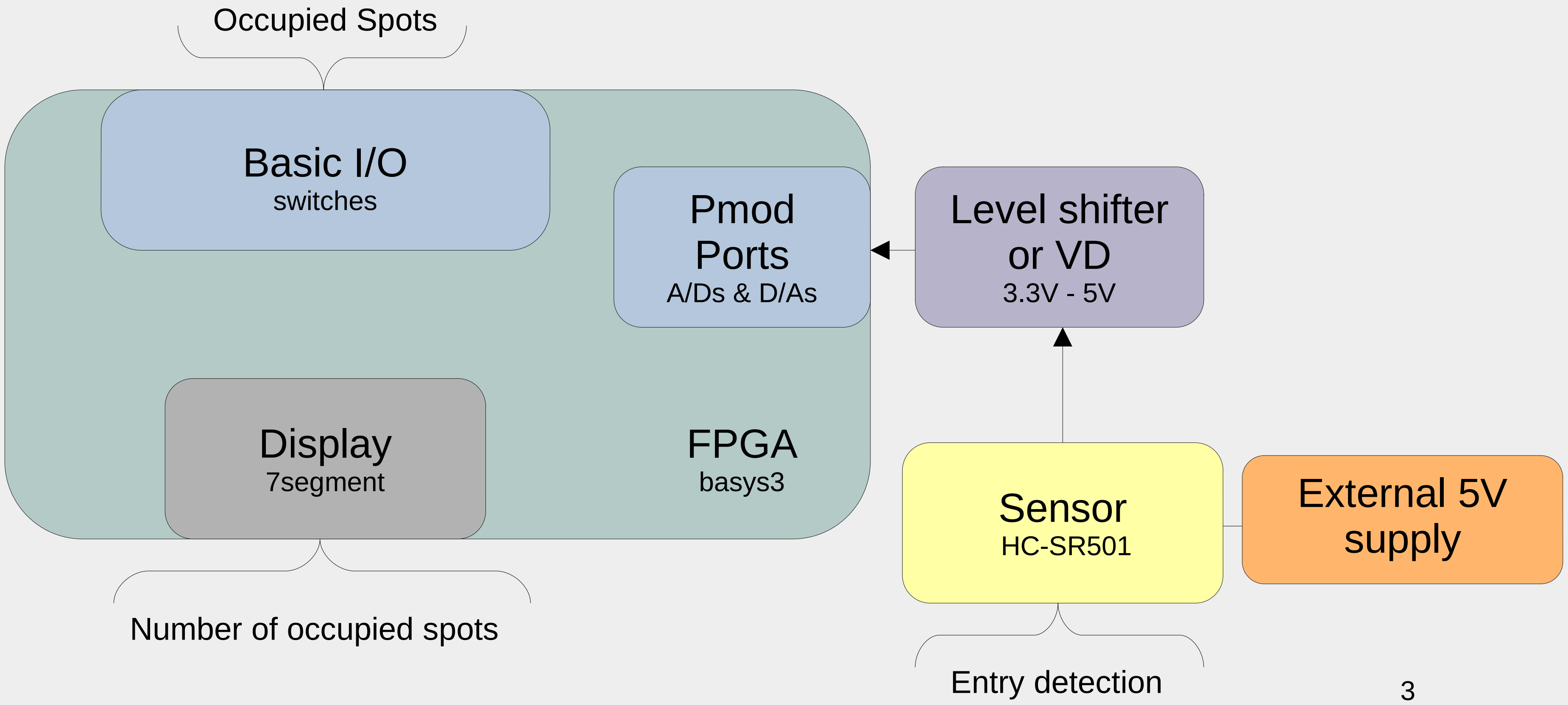
The goal of this project is to develop a small version of a car parking system. In the entrance, there would be a motion sensor detecting whenever a car enters in the park. Once the sensor in is triggered the car can go through and the system would count that as one more car in the park. Otherwise,if the sensor out is triggered, means that a car left the park.

Features:

- 12 park slots,
- Entry and Exit detection with LED,
- Tracking the occupied traces.
- Empty or Full warning.

Project Description

FPGA car parking system – Example with HC-SR501



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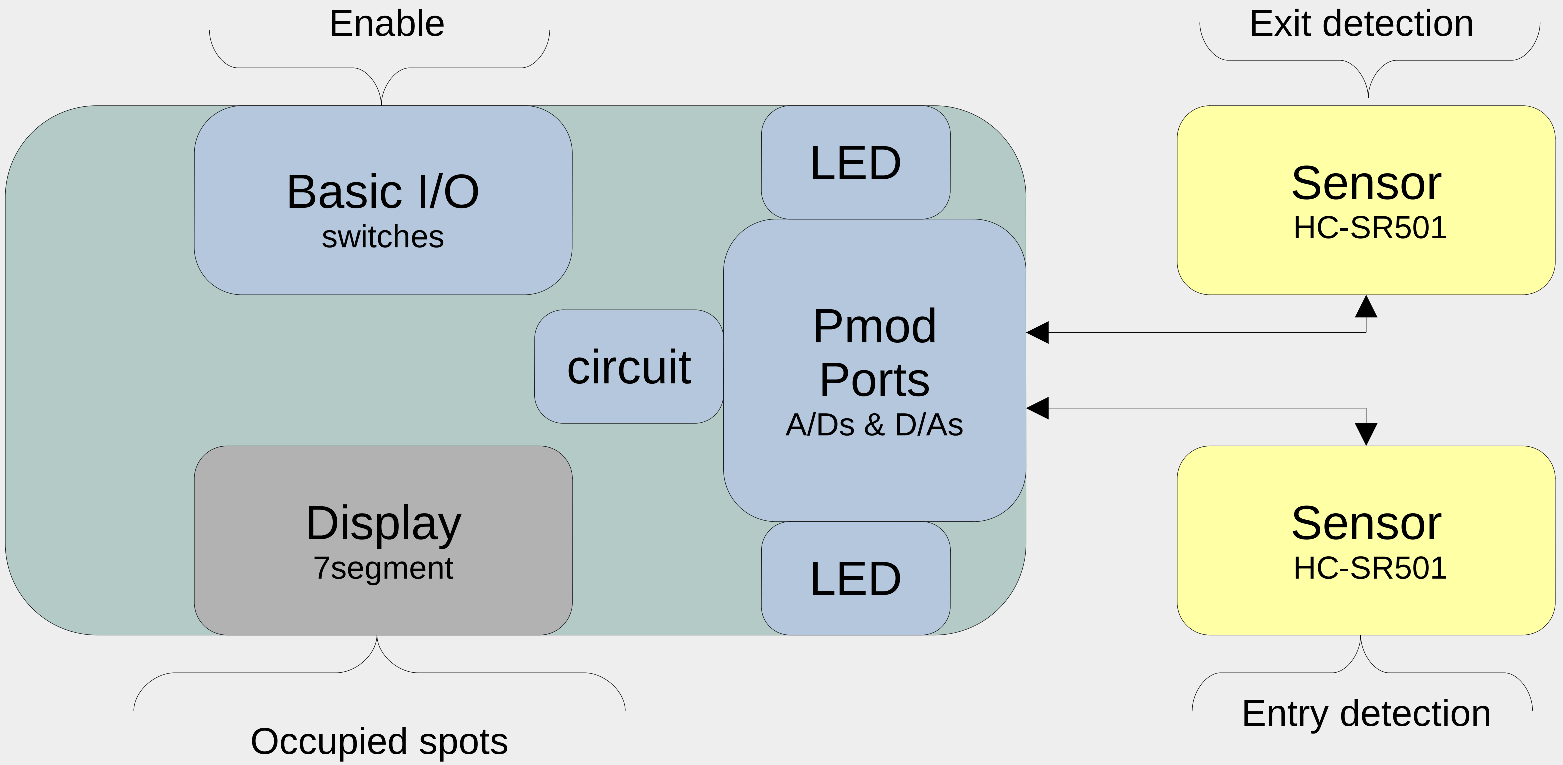
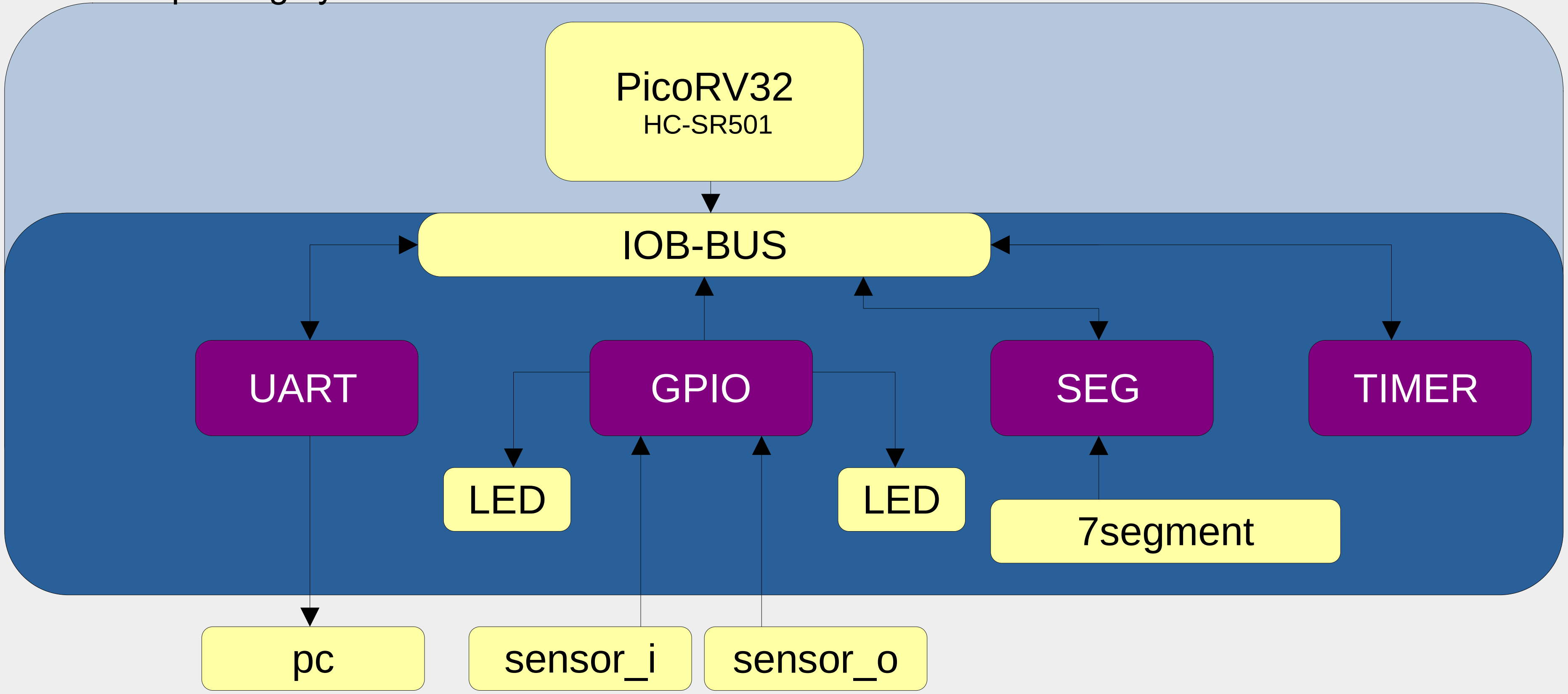


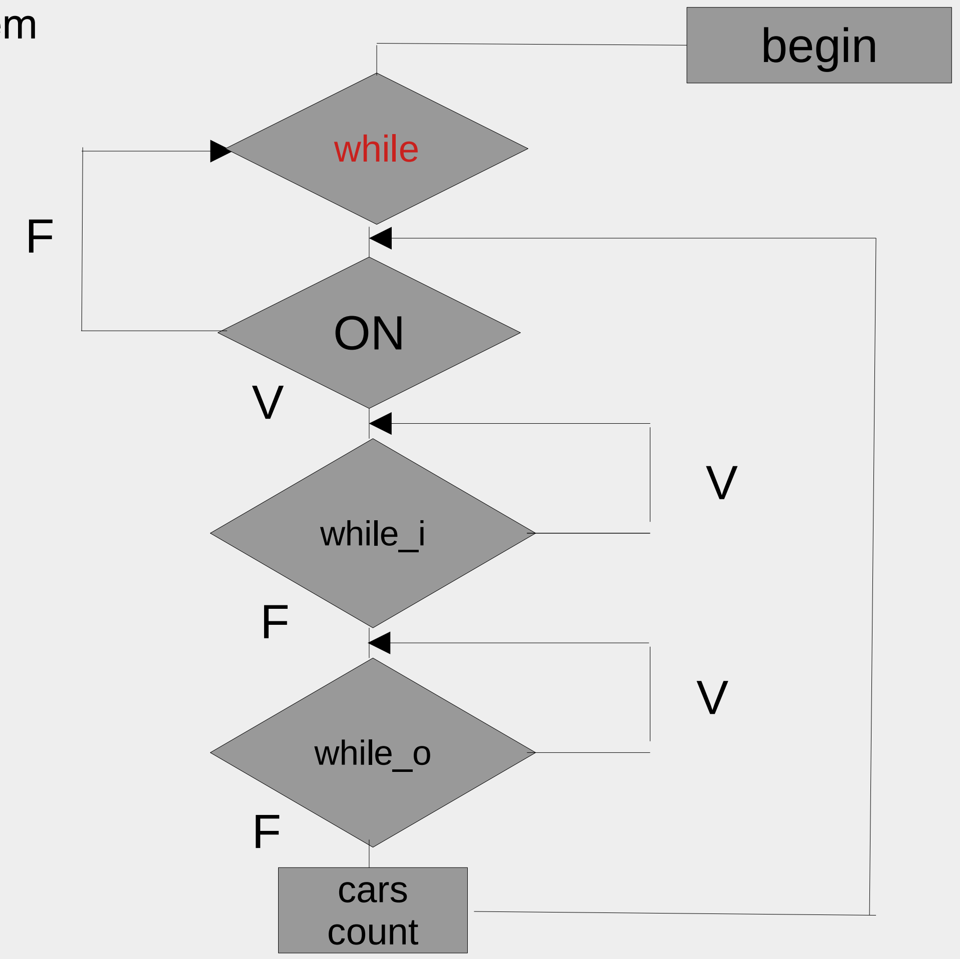
Dependencies Diagram

FPGA car parking system



System state machine

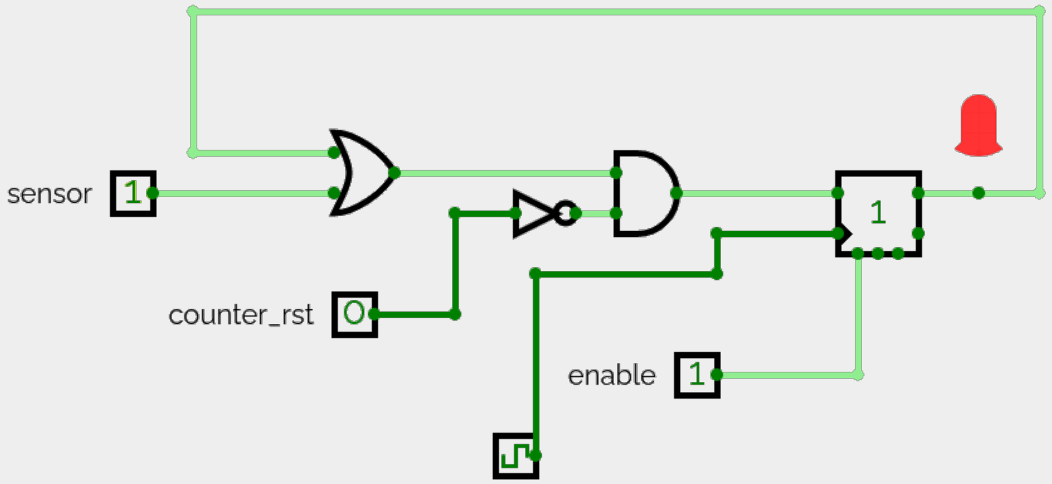
FPGA car parking system



GPIO

FPGA car parking system

- GPIO submodule was modified to configure the moviment sensor capability.
- The following circuit was used to keep the LED high for some time whenever there was a sensor trigger.



SEG

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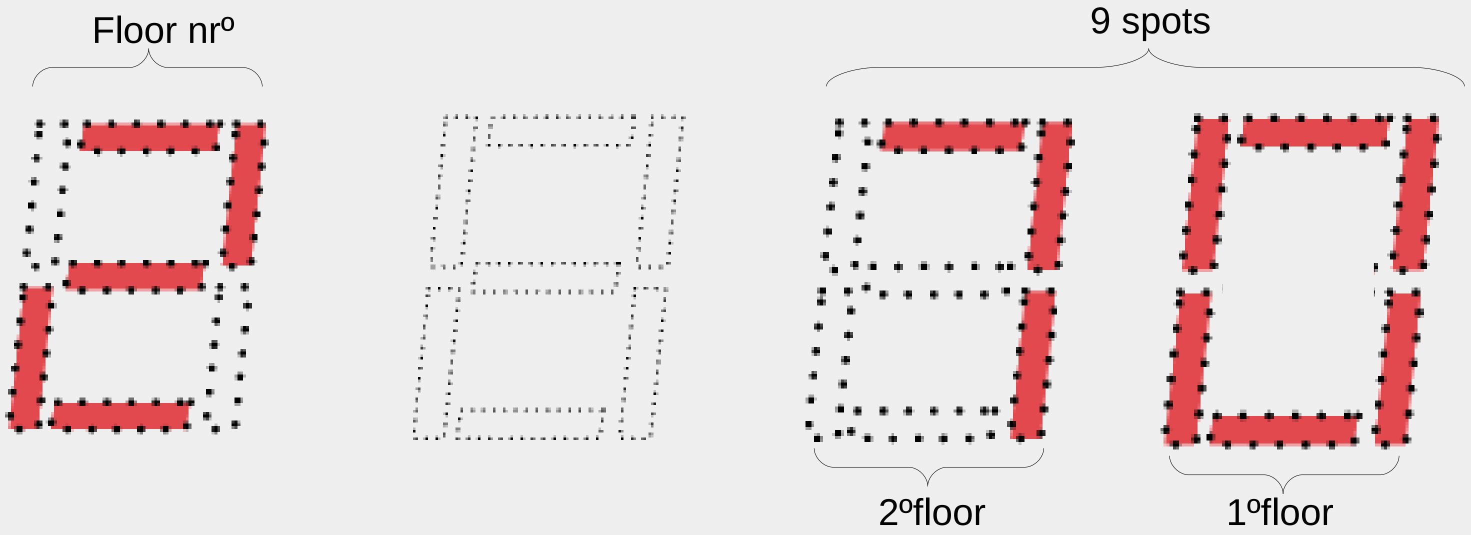
- SEG submodule was created to configure the 7segment display pins like the logic used in the GPIO submodule.
- Instead of using the display to count the number of occupied spots we used the single traces as a parking spot.



BUGS

FPGA car parking system

- Bug1: The LED HIGH timing is not accurate all the time, because of the COUNTER reset.

  Possible Solution: Instead of using the CPU rst(reset) to reset the counter, using the SENSOR_IN as reset to start counting from the detection signal.

- Bug2: Using active waiting to wait for each sensor trigger, disables the state when both sensors are triggered at the same time and consumes more resources.

  Possible Solution: Using hardware to detect when sensor trigger happens and convert the multiple false detections to a single detection, using a counter.

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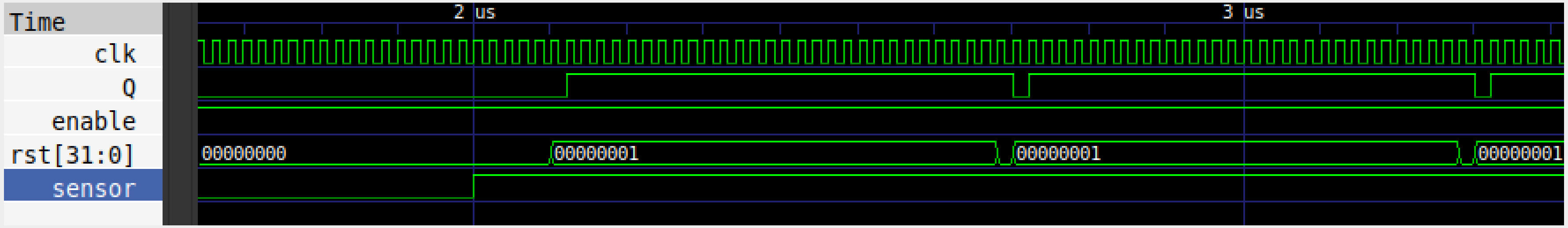
Time
clk
Q
enable
rst[31:0]
sensor
2 us
3 us
00000000
00000001
00000001
00000001