Day and Night Traffic Light Controller

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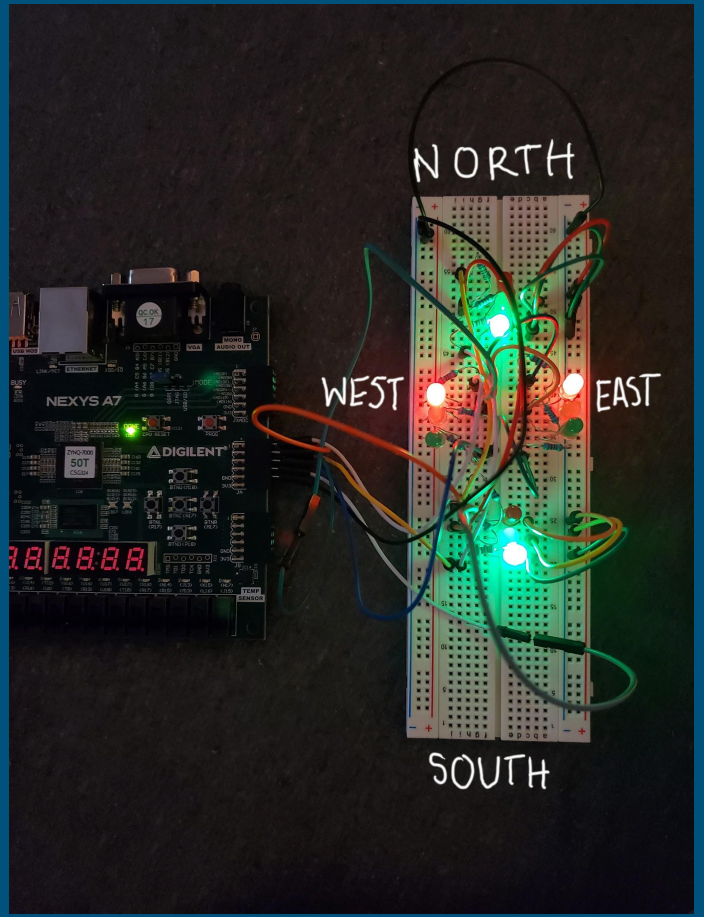
What is it?

- Traffic light simulator for a 4-way intersection
- Switches between day and night mode
  - **In Day Mode:**
    - 50 sec duration for states ex. N/S = Green _ E/W = Red & N/S = Red _ E/W =Green
    - 24 sec duration for in between states ex. N/S = yellow _ E/W = Green, N/S = Red _ E/W = Yellow, etc.
    - 40 sec duration for the red states ex. N/S = Red _ E/W = Red, etc.
  - **In Night Mode:**
    - on for 10 sec off for 10 sec (blinking) N/S = Yellow : E/W = Red

What Was Used...

- Nexys A7 with Vivado Software
- 1 clock divider
- 4 counters
- 1 8-to-1 MUX (a bit different than a traditional mux though)
- 1 Day/Night FSM
- Breadboard
- 12 Leds & 12 Resistors

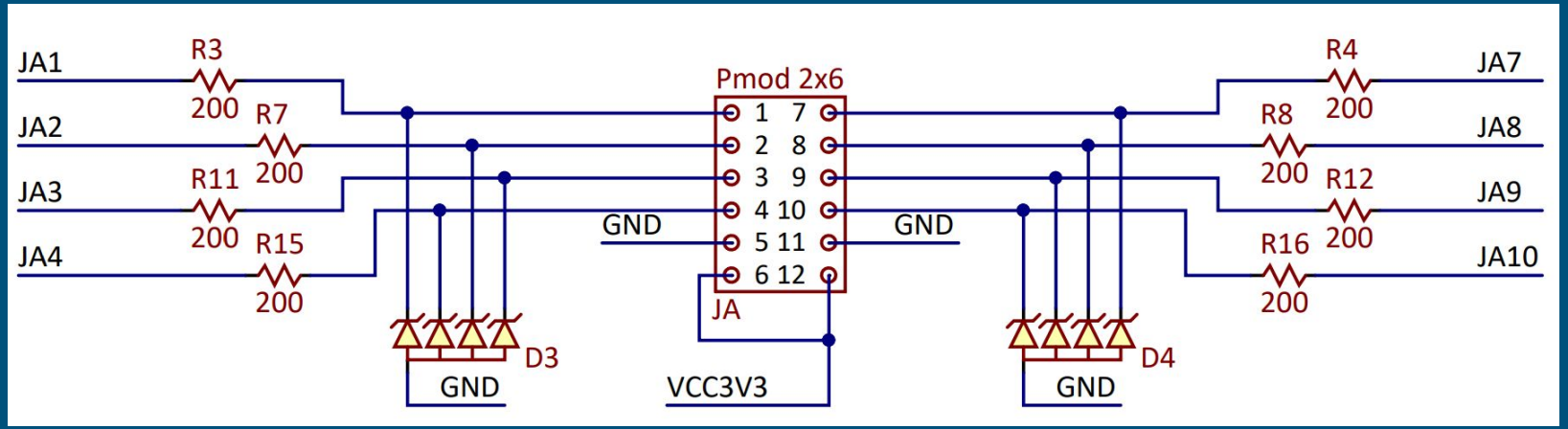


How it Functions

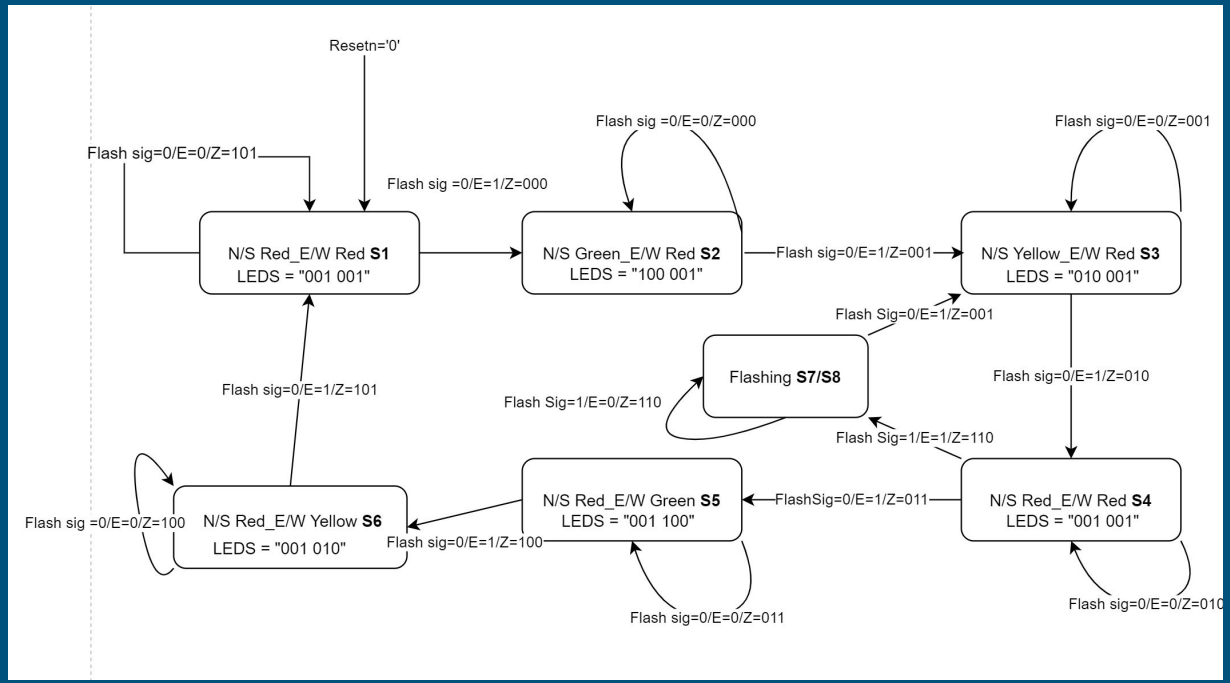
- The clk divider will change our 100 MHz master clock to get approximately 10 sec per pulse. These pulses will guide how fast the counters will count
- Four counters will be used that will correspond to various states. Counters will each have different timing values such as 10 sec, 40 sec, 50 sec, and 24 sec.
- Those counters will lead to a 8-to-1 MUX controlled by a 3 bit select line z. Each z value is unique to each state and will select the correct counter to be used for that state
- The FSM will start at S1 since resetn will be enabled there, from that when the output of the 8-to-1 MUX, enable = 1, it will make the states transition. The flash signal will be triggered by a switch to move between night and day

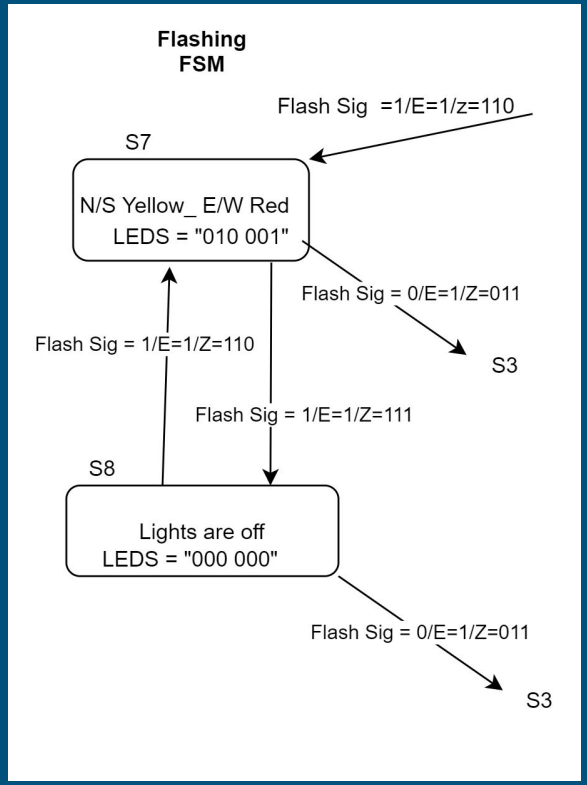
Implementation With LEDs

The PMOD port JA was used to send signals to the LEDs on the breadboard. Pins 1, 2, 3, 4, 7, and 8 were the pins that were used to send the logic from the FPGA to the LEDs. Pin 5 was used as GND for the LEDs

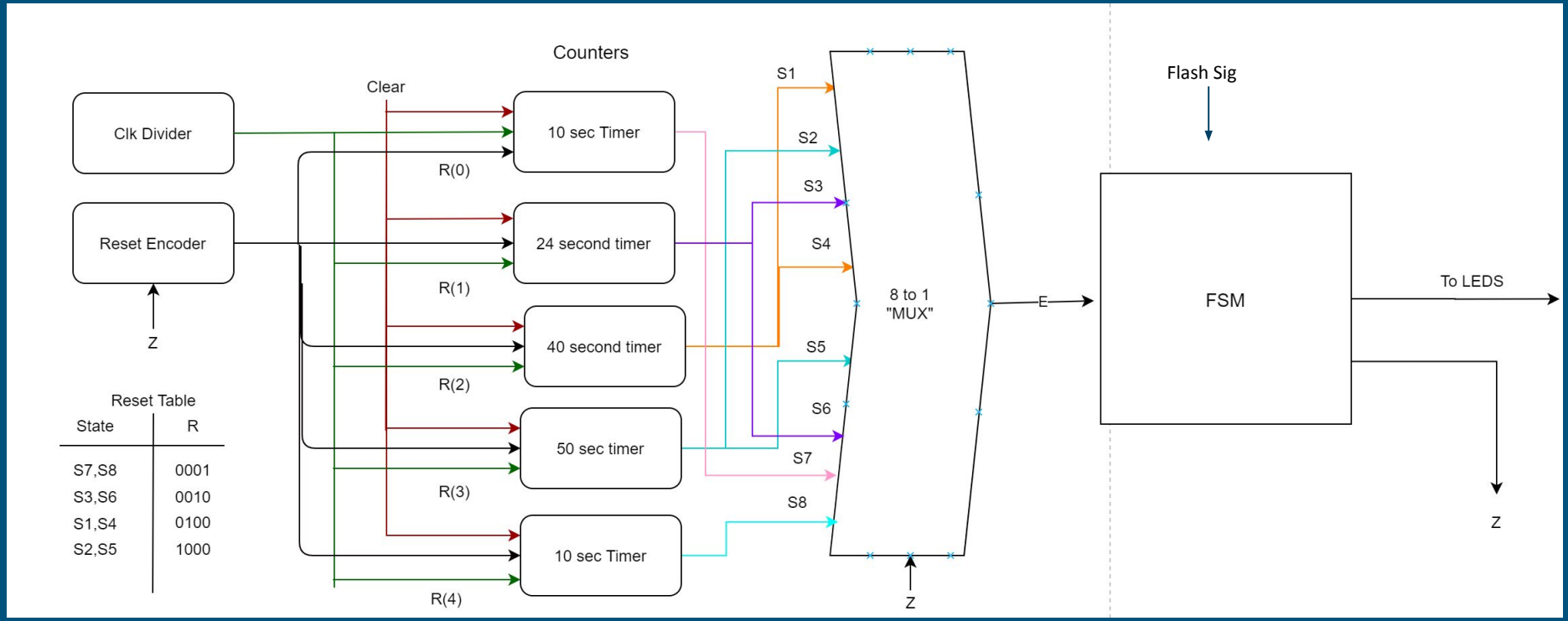


Detailed FSM





Block Diagram



Issues and Improvements

- Issues
  - Originally only 3 counters were used, but 5 counters being used was easier to code logically and it helped the flashing states S7 and S8 transition between each other better
  - Implementing the system on an outside source, like a breadboard, was a bit challenging in the beginning because we weren't sure how to use the PMOD ports
  - Tried a few different integers to put in the clock divider so the counters could count slower
- Improvements
  - Could have included a crosswalk system using the 7-seg display
  - There could have been options so that the cars could be allowed to turn left or right too
  - The circuit could have looked prettier but all the LEDs had to be constructed on one breadboard and not two, which made it look bulky