

Lab 3: Mini Traffic light system

Report Due: Oct 1st

Demo Due: Oct 6th by the end of Lab Section

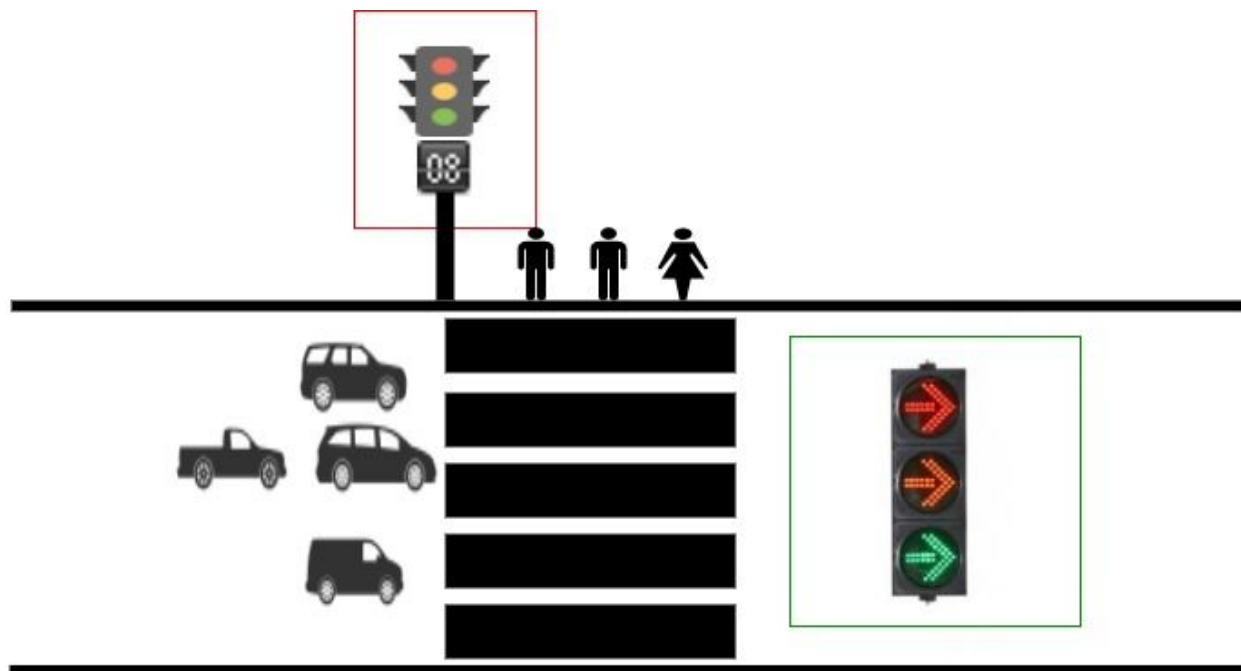
Learning Objective: In this lab, you are going to design and implement a finite state machine controller for a mini traffic light system. You are going to create a software system that will read some digital data, switch state by condition and display correct traffic signal.

Components Needed:

Pi 3 Board, RGB LEDS(We will use blue instead of yellow for traffic signal), Press button switch for control, 7-segment display for time count down, resistors and appropriate wires.

Lab Activities:

1. **Introduction:** Imagine a scenario like the image below you have a heavy traffic street(for example Holleman Dr. next to the HEB in town) where random people are



walking cross the street while cars are driving. In this case, an appropriate traffic light system is needed for this street to insure everyone's safety. Your goal is to design a control system for **traffic light 1(in the red box)** & **traffic light 2(in green box)**

2. **Components for traffic light 1:** RGB LED, countdown panel(7 segment display) and a press button (not shown in the figure). One RGB LED should work as it changes color and only one of the three colors is needed at any time.
3. **Components for traffic light 2:** RGB LED. Three LEDs are needed.
4. **Requirements:**
 - a. When button has not been pressed, traffic light 2 stay green
 - b. When button is pressed, traffic light 2 turn to blue and blue light flash 10 times then turn into Red.

- c. When Traffic light 2 turn into red, traffic light 1 become green and countdown panel begin to count down from 20 to 0, in second.(In real world will be longer)
 - d. When Countdown reach 10, the traffic light 1 flash with blue light.
 - e. When Countdown reach 0, the traffic light 1 become red, traffic light 2 become green.
 - f. When button is pressed once there will be a 30 seconds cooldown to be able to make another valid press.
5. **Procedure:** You will first develop a software that simulates the traffic situation per above requirements before actual/physical implementation of traffic control system using Pi. Once the simulator works for you then you would interface the LEDs, switch and display with the Pi 3 based control system. Please note that you will use the Pi 3's Timer/Counter (SysTick) to generate various timers/counters needed unlike what you did with the simulator in the computer. In particular, pay attention to the simulation speed as it depends on the amount of information to update into the windows and the speed of your personal computer. Since you would not like to wait long seconds during simulation(like one actually waits in the traffic), you will adjust the timing in the simulator for your convenience and to make the logic work for demonstration. Use C as programming language and make sure your circuit wiring is cleaned and organized.

Report: Draw FSM and provide working codes. Answers to the following questions.

Questions to Explore:

1. Share your experience on differences between a simulator and the actual implementation in 75-100 words.
2. Can we possibly have street-crossings for cars without traffic-signals like what we have now in the future? If yes, how can we implement that?
3. Consider you want to have similar waiting countdown display arrangement across the zebra crossing. How is your design going to change?