

Deadline	November 24th 2015 - 12 p.m.
	Send as email to your tutor
Mail Subject	<code>[PFE15][Assignment2]\$matriculationnumber</code>
Accepted Formats	PDF, txt
File Name Convention	<code>PFE15_Assignment2_\$matriculationnumber.\$format</code>

Include all code examples, your name and matriculation number into your document.

1 Automatic Traffic Light Control [10 + 10 Points]

In this exercise you are supposed to experiment with `delay(ms)`, `millis()` and `if () {}` in a practical project. You are going to realise a traffic light control, which typically is used to show people, if they are allowed to drive or not.

- Setup the traffic light control on your breadboard as shown in Figure 1. Pay attention to the shorter pin of the LED (cathode). It has to be directed towards GND. In the figure, the cathode is illustrated by the straight pin. Furthermore it is essential to add a resistor (330Ω) to the circuit. Buttons are grounded by a $1k\Omega$ resistor.
- The traffic light changes in steps of 1 second from *RED* to *RED-YELLOW* to *GREEN* to *YELLOW* and back to *RED*. Use the `delay(ms)` function, which expects the time parameter in milliseconds.

2 Interactive Traffic Light Control [30 Points]

Extend the traffic light control from the previous task:

- Pin 5 is attached to a pull down resistor (pedestrian button) see Figure 1
- the traffic light will still show vehicles, if they are allowed to drive or not
- the traffic light will stay green, as long no pedestrian wants to cross the street
- if the button is pressed, the traffic light will turn red. The transition will still work as in the previous task (i.e. every phase takes 1 second)
- the traffic light stays green for at least 1 second after a red period
- button presses will **never** be ignored, but may be executed with a delay

To ensure that a button press is always recognised, you are not able to use the `delay(ms)` method. Instead, use `millis()` to get the current time and control the traffic light, accordingly.

☞ Try to adapt your previous code to use `millis()` instead of `delay(ms)`. Install the button **afterwards**.

☞ use a variable to store when the last red period was concluded

☞ use a variable to store when the button has been pushed, but the event has not been processed yet

3 Bonus: Night Service Extension [15* Points]

Extend your traffic light control yet another time to allow the *night service extension*:

- another pull down resistor is attached to pin 4
- on first press, the traffic light will switch to night service
- in night service mode, the green and red LEDs are disabled. The yellow LED blinks (250ms on/off)
- pressing the new button again re-enables daylight service
- the traffic control switches to night mode in red phases only. No button press is ignored.

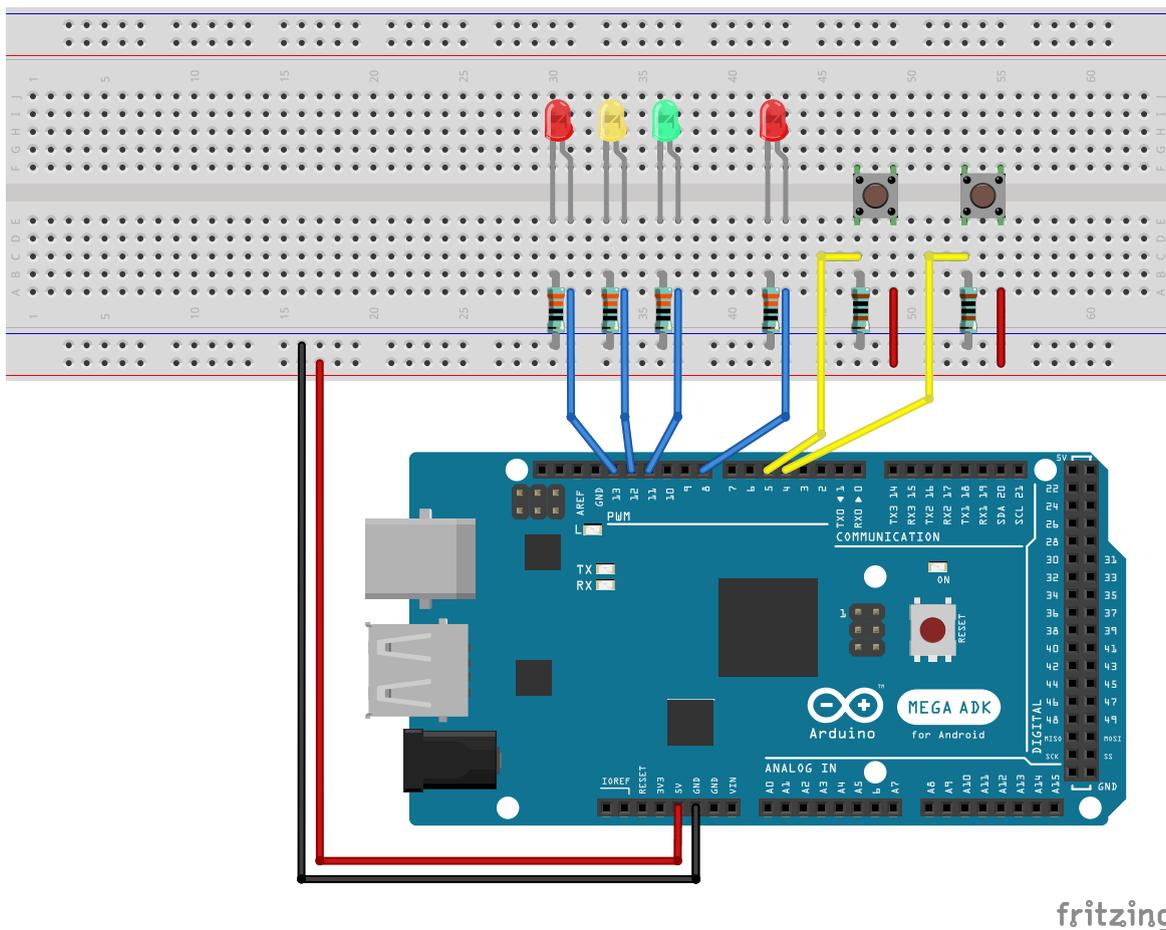


Figure 1: Traffic light control circuit