

Exercise 1: Traffic lights

Description

The objective of this lab exercise is to simulate the operation of a highway intersection, consisting of a main road and a perpendicular railway. The main road features a traffic light for vehicles and a pedestrian light that activates only after pressing a push button. Trams pass through the railway at regular intervals $t = T1$ and interrupt the normal traffic flow, activating the red light for the main road and the green light for pedestrians for a duration of $t = T2$. Additionally, when the pedestrian button is pressed, the red light for vehicles on the main road and the green light for pedestrians activate for the same duration $t = T2$. After this period, the pedestrian red light and the main road green light activate. The pedestrian button can be pressed again only after a time period $t = T3$ has elapsed. If the pedestrian light button is pressed while it is already active (either due to a previous press or because the tram is passing through), the current operation should not be interrupted, and the active time intervals should be maintained until their completion.

Assumptions

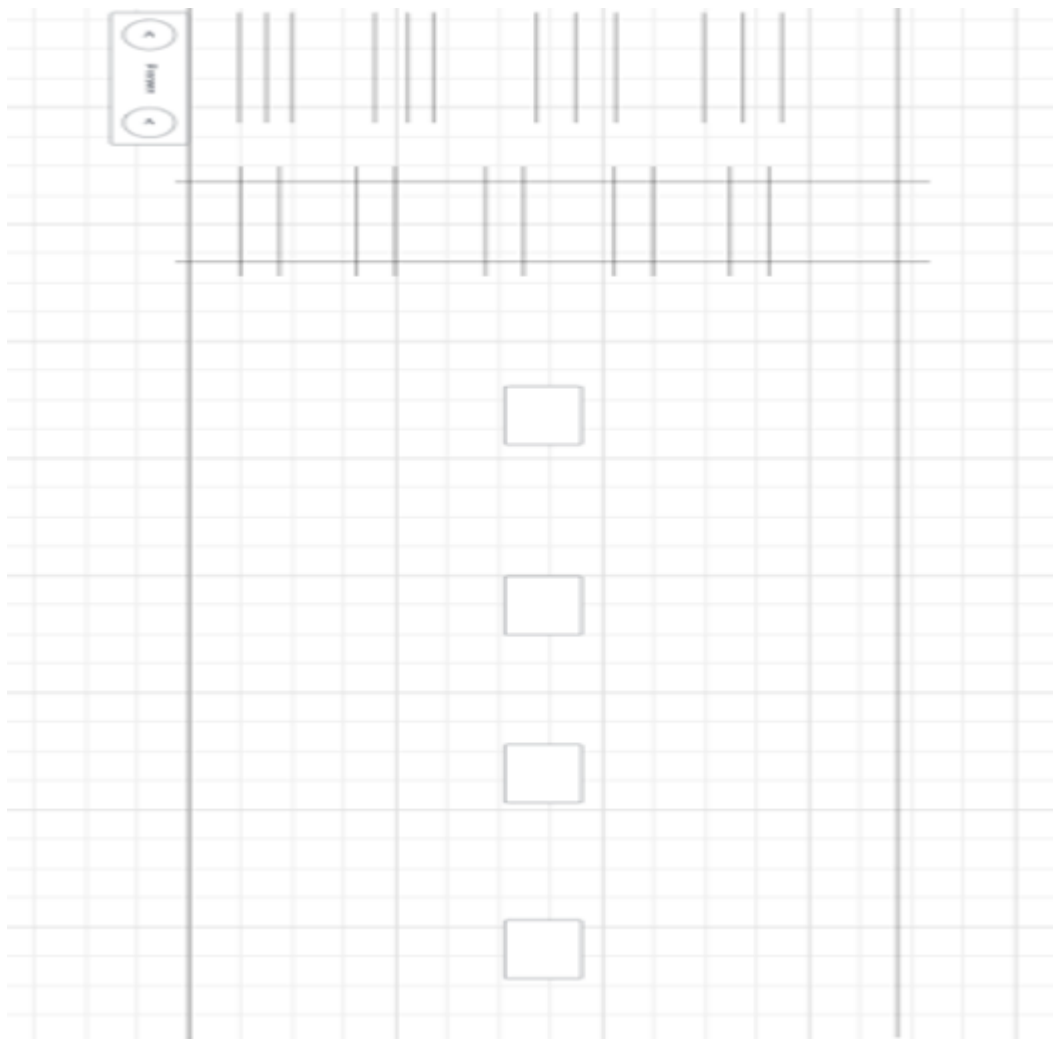
-The traffic light is green when the LED is on (logical '0') and red when it is off (logical '1'). The three pins of PORTD used are PIN0, PIN1, and PIN2. For simulating the tram, the corresponding LED (PIN1) will be activated when the tram passes through this point of the railway and deactivated otherwise.

-The pedestrian button press should be implemented using an interrupt. Use PIN5 of PORTF for this purpose.

- The TCA0 timer/counter can be divided into two smaller 8-bit timers/counters with the TCA0.SPLIT set of instructions. One of these will be used for the two time intervals $t = T2$ and $t = T3$. The other will be used for the time interval $t = T1$, which defines the tram passage frequency, activating the corresponding function.

Exercise Questions

1. Implement the function of managing the highway and the pedestrian lights, using all the procedures explained.
2. Add the tram and time interval management function which it passes by the given point of the railway.



A picture showing the crossings