Traffic light System

General system description:

You are required to design and implement an embedded software of a digital traffic light system. The system has the following input:
1- Push button for pedestrian cross request. (Analogue interface)
2- Emergency detection control unit. (UART interface)

The system has the following outputs:
1- an LED with red color.(PWM interface).
2- an LED with yellow color. (PWM interface).
3- an LED with Green Color. (PWM interface).
4- two seven segments displaying data. (7 DIO pins). (both are connected on the same data bus).
5- two seven segments displaying enable pin(1 DIO pin per each one).

The system requirements are listed below:

General system logic:

Requirement ID	Requirement description
REQ_001	Traffic light system shall monitor the press from the pedestrian button and the emergency detection control unit.
REQ_002	By default, the traffic light LEDs shall be green and the two seven segment displays shall display 0.
REQ_003	Upon the detection of the pedestrian button, the system shall check first if there is an emergency vehicle on the road.
REQ_004	If there is an emergency vehicle on the road, the pedestrian request will not be ignored. Rather than that, it will be handled once the emergency vehicle does not exist.
REQ_005	If the decision was taken to handle the pedestrian request, the LEDs will switch to yellow for 10 seconds.
REQ_006	During the 10 seconds of the yellow color, the seven segments displays shall display the current time count in seconds.
REQ_007	At the end of the 10 seconds of the yellow color, the LEDs will switch to red for 30 seconds.
REQ_008	During the 30 seconds of the red color, the seven segments displays shall

	display the time count in seconds.
REQ_009	During the 10 seconds of yellow color, the 30 seconds of the red color and the pending time for emergency vehicles, all the pedestrian requests shall be ignored.
REQ_010	At the end of the 30 seconds of red color, the LEDs shall be switched normally to green light.
REQ_011	At the end of the 30 seconds of red color, the seven segments display shall display 0.
REQ_012	At the end of the 30 seconds of red color, if a pedestrian request is detected in the first 10 seconds, the pedestrian request will not be ignored. Rather than that, it will be handled once the10 seconds passed.

Pedestrian request detection:

REQ_013	Button shall be read via ADC.
REQ_014	If the read analogue value is from xx to xx , it will be considered as active.
REQ_015	ADC value shall be sampled every 10 ms.
REQ_016	If 10 consecutive samples are detected as active, pedestrian request shall be considered as detected.

Emergency vehicle detection:

REQ_017	Every vehicle shall communicate to the Traffic light system via RFID.
REQ_018	The RFID frame shall be simulated via UART terminal.
REQ_019	The RFID frame is consisted of the following Header | Car type | TAIL 0xaa | xx | 0x55

REQ_020	The car type will be ox02 for ambulance and 0x03 for fire truck.
REQ_021	The emergency vehicle shall be considered detected upon the reception of the car type values above.
REQ_022	The emergency vehicle shall be considered not detected if 10 seconds passed without receiving the car types above, That means not receiving at all or receiving other car types for 10 seconds.

LEDs and seven segments display :

REQ_023	LEDs shall be controlled via PWM.
REQ_024	When the LED is on ,the duty cycle shall be 70%.
REQ_025	When the LED is off, the duty cycle shall be 0%.
REQ_026	The PWM frequency shall be constant to 100Khz.
REQ_027	As the two seven segment displays share the same data bus, the seven segments displays shall be alternately enabled.
REQ_028	The enable alternation period shall be 10ms.