System Design

System Explanation:
A traffic light system contains three LED lights (RED, Yellow and Green) and a Pedestrian. In the normal mode the red light continues for five seconds then the yellow one will blink for five seconds then the green led will work for five seconds also.

In the pedestrian mode:

The normal mode will change to pedestrian mode when the pedestrian button is pressed and should follow these cases:

- If pressed when the cars' Red LED is on, the pedestrian's Green LED and the cars' Red LEDs will be on for five seconds.
- If pressed when the cars' Green LED is on or the cars' Yellow LED is blinking, the pedestrian Red LED will be on then both Yellow LEDs start to blink for five seconds, then the cars' Red LED and pedestrian Green LEDs are on for five seconds
- At the end of the two states, the cars' Red LED will be off and both Yellow LEDs start blinking for 5 seconds and the pedestrian's Green LED is still on.
- After the five seconds the pedestrian Green LED will be off, and both the pedestrian Red LED and the cars' Green LED will be on.
- Traffic lights signals are going to the normal mode again.
- Should consider the long press and double press on the button

Static Design

The project includes four layers:

- ***Microcontroller layer***
- ***Microcontroller Abstraction layer (MCAL)***
- ***Electronic unit Abstraction layer (ECUAL)***
- ***Application layer***

System Drivers

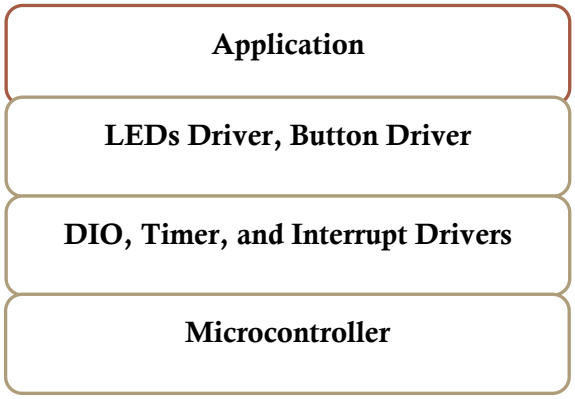
MCAL ----------> DIO Driver

----------> Timer Driver

----------> Interrupt Driver

ECUAL ----------->LEDs Driver

----------->Button Driver



APIs

DIO APIs at dio header file

```
EN_DIO_state DIO_init(uint8_t PinNumber, uint8_t PortNumber, uint8_t direction);   //initialize DIO direction
EN_DIO_state DIO_write(uint8_t pinNumber, uint8_t PortNumber,uint8_t value);      // write to DIO (0 = OFF) or(1=ON)
EN_DIO_state DIO_toggle(uint8_t pinNumber, uint8_t PortNumber);                  // toggle DIO
EN_DIO_state DIO_read(uint8_t pinNumber, uint8_t PortNumber,uint8_t* value);    // read the value of DIO
```

Timer APIs at timer header file

```
////////////////////////////////////////////////////////////////////////
    //Functions prototypes
EN_TimerState Init_timer(EN_TimerMode TimerMode); // to set the timer configuration
EN_TimerState Start_timer(EN_CLOCK_SOURCE clock_source); //to start the timer
EN_TimerState Delay_timer(uint16_t time_in_milisecond ); // to delay the program by time in millisecond seconds
EN_TimerState stop_timer();      // stop the timer
```

Interrupt APIs at interrupt header file

```
EN_EXTI_State interrupt_init();  // to initialize the interrupt
EN_EXTI_State interrupt_enable(); // to enable and start the interrupt
EN_EXTI_State CallFucntion(void(*pointerToFunc)(void)); // this the function used to get the function from the higher layers
void(*ptrfunc)(void) ; //pointer to function
```

LED APIs at led header file

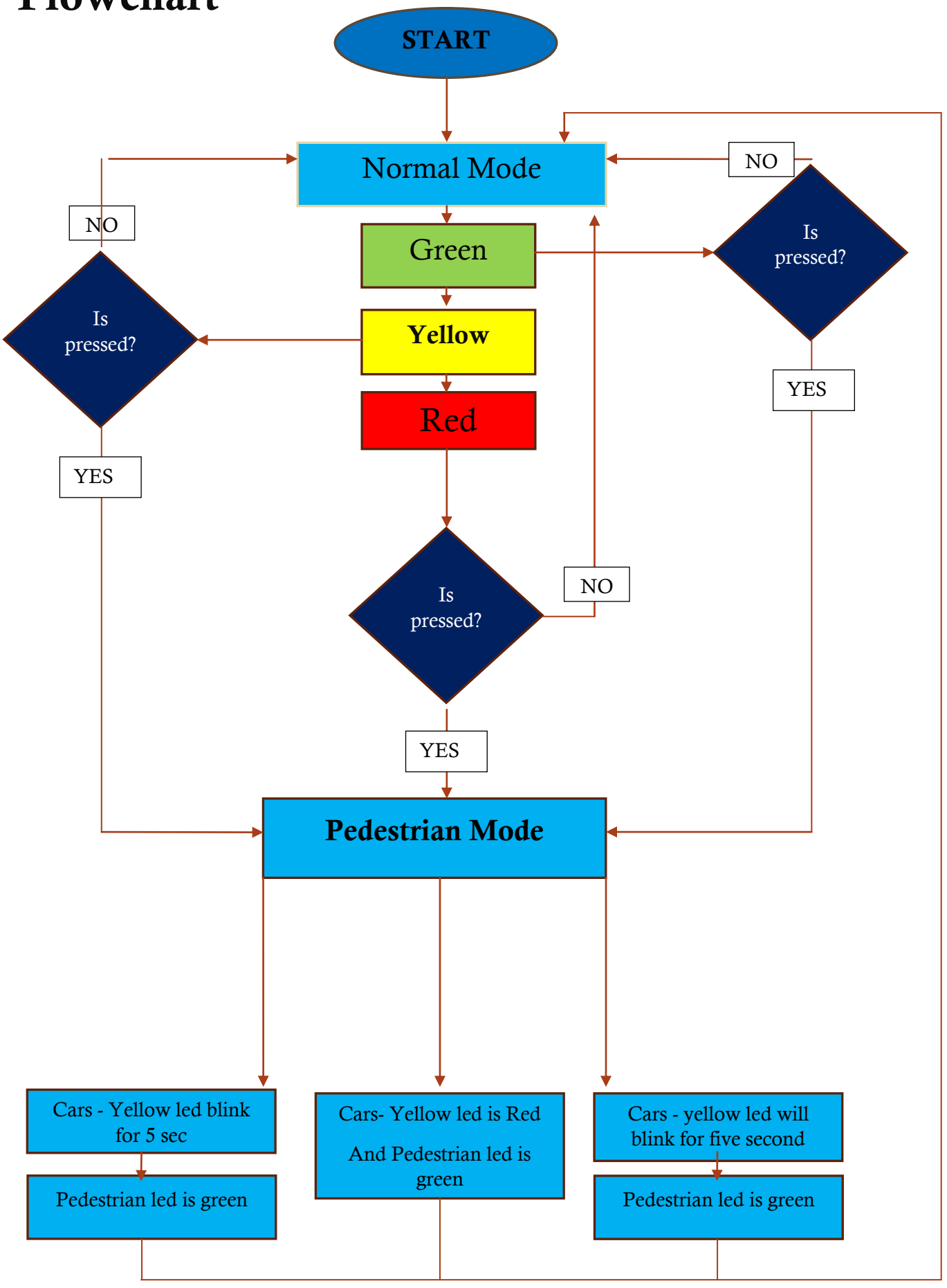
```
EN_LED_STATE LED_init(uint8_t ledPort, uint8_t ledPin); // to set the led as out put device
EN_LED_STATE LED_On(uint8_t ledPort, uint8_t ledPin);  //to write high to port in pin no to switch on the light
EN_LED_STATE LED_Off(uint8_t ledPort, uint8_t ledPin); //to write low to port in pin no to switch off the light
EN_LED_STATE LED_toggle(uint8_t ledPort, uint8_t ledPin); // to change the case from on to off or vice versa
EN_LED_STATE Yellow_blink(uint8_t ledPort, uint8_t ledPin);//to blink the yellow led
```

Button APIs at button header file

```
EN_Button_state button_init(uint8_t buttonPort, uint8_t buttonPin);// to initialize the button as input device

EN_Button_state button_read(uint8_t buttonPort, uint8_t buttonPin,uint8_t* value); // to read the button value
```

Flowchart


START
Normal Mode
Green
Yellow
Red
Is pressed?
NO
YES
Is pressed?
NO
YES
Is pressed?
NO
YES
Pedestrian Mode
Cars - Yellow led blink for 5 sec
Pedestrian led is green
Cars- Yellow led is Red
And Pedestrian led is green
Cars - yellow led will blink for five second
Pedestrian led is green

System constrains

1.the short press will make the interruption

2. Long press has no effect on the Traffic light

3. Double press should be considered as one press and the second one will be ignored