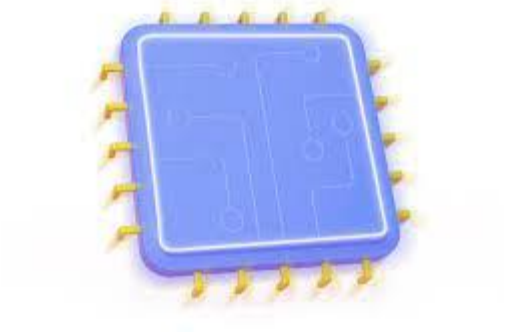
egypt fwd initiative

UDACITY



Embedded Systems Professional Track

EgFWD - Udacity

On-demand Traffic Light control

Project Documentation

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October_2022

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1. System Description

This is an On-demand Traffic light control system project for the EgFWD Embedded Systems Professional Nanodegree Program. This project was developed in **C** using **Microchip Studio** and simulated by **Proteus 8 professional**.

1.1 System overview

The system aims to provide an on-demand traffic control system. It includes a pedestrian button to allow pedestrians to pass.

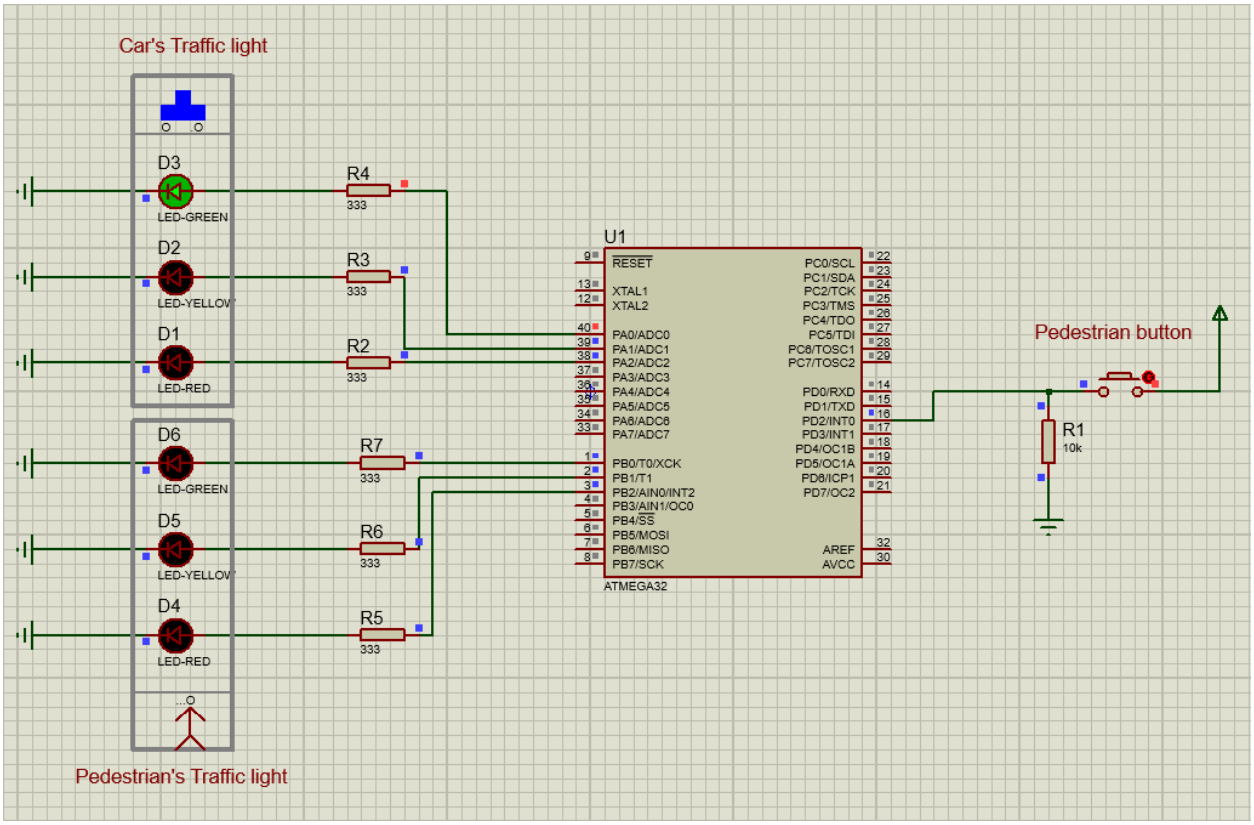


Figure 1 Screenshot for Proteus 8 professional

1.2 System Functionality

- The system handles six LEDs and one button.
- Cars' LEDs are green, yellow and red.
- Pedestrian's LEDs are green, yellow and red.
- pedestrian Button: This button acts as a request for a pedestrian to cross the street.
- The system can detect when the button is pressed.
- The system will decide what to do based on which state the button pressed.
- The system allows pedestrians to walk by making sure cars are stopped first.

2. System Design

2.1 System Requirements

Hardware requirements:

- AVR Atmega32
- Two Green LEDs
- Two Yellow LEDs
- Two Red LEDs
- Six 333 Ohm resistors
- One 10k Ohm resistor
- One Push Button

Software requirements:
In normal mode:

1. Cars' LEDs will be changed every five seconds starting from Green then yellow then red then yellow then Green.
2. The Yellow LED will blink for five seconds before moving to Green or Red LEDs.

In pedestrian mode:

1. Change from normal mode to pedestrian mode when the pedestrian button is pressed.
2. 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, this means that pedestrians can cross the street while the pedestrian's Green LED is on.
3. 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, this means that pedestrian must wait until the Green LED is on.
4. 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.
5. 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.
6. Traffic lights signals are going to the normal mode again.

2.2 Operating Environment

The program has been tested on **Proteus** simulator provided by LabCenter. It should be used in traffic light control systems on streets with a pedestrian push button included to allow for full system functionality.

2.3 Static architecture

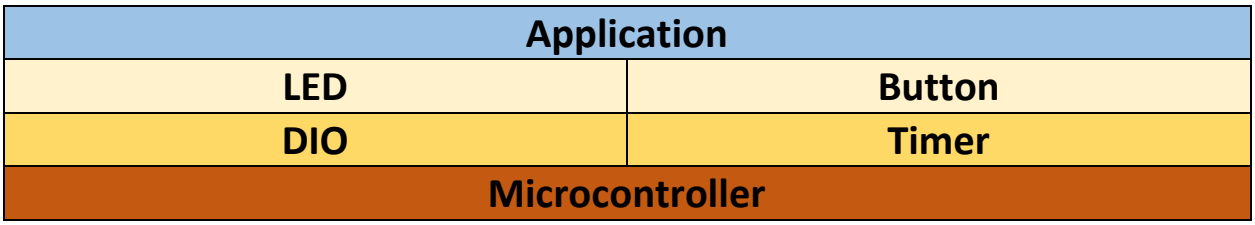
System layers:

- Microcontroller
- MCAL (microcontroller abstraction layer)
- ECUAL (electronic unit abstraction layer)
- Application

System module/driver:

- DIO
- Timer
- LED
- Button

MCAL contains **DIO** driver and **Timer** driver.
ECUAL contains **LED** driver and **Button** driver.



APIs for each module:

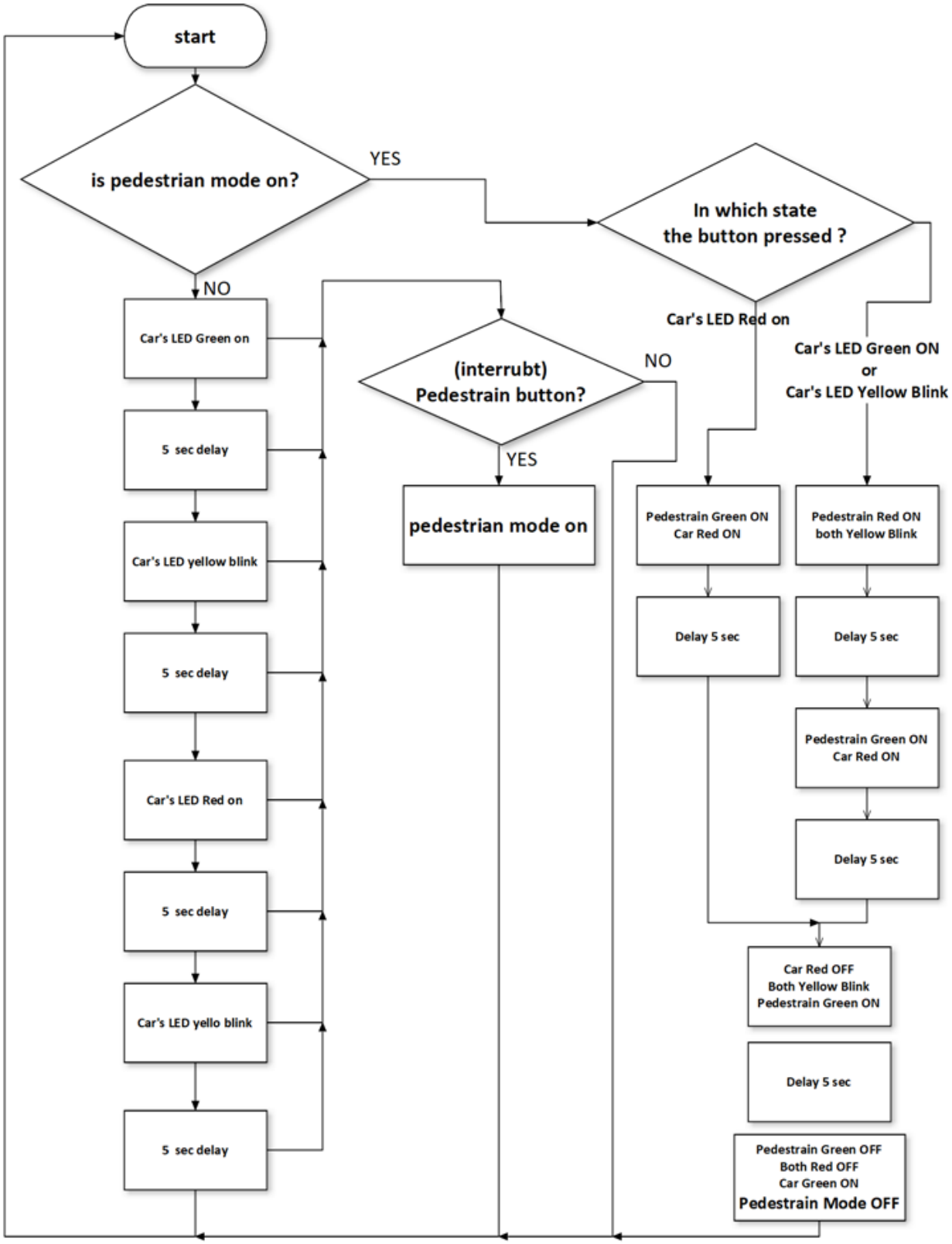
```
DIO     EN_DIO_error_t DIO_init(uint8_t portNumber,uint8_t pinNumber,uint8_t direction);
        EN_DIO_error_t DIO_write(uint8_t portNumber,uint8_t pinNumber,uint8_t value);
        EN_DIO_error_t DIO_read(uint8_t portNumber,uint8_t pinNumber,uint8_t *value);

TIMEER  void timer0_init(void);
        void delay500ms (void);
        void delay_5_sec (void);

LED     void LED_init(uint8_t ledPort,uint8_t ledPin);
        void LED_ON(uint8_t ledPort,uint8_t ledPin);
        void LED_OFF(uint8_t ledPort,uint8_t ledPin);
        void LED_blink_for_N_sec(uint8_t ledPort,uint8_t ledPin,uint8_t numberOfSecond);
        void LED_both_blink_for_N_sec(uint8_t ledPort,uint8_t ledPin,uint8_t numberOfSecond,uint8_t
        ledPort2,uint8_t ledPin2);

App     void app_init(void);
        void app_start(void);
```

3. System Flow chart



4. System Constrains:

- When the pedestrian presses the button twice, the system responds to the first press and will ignore the second one.
- When the pedestrian presses the button for a long press, the system will respond to the cross-passing request and for one time and ignore the release of the button
- In the normal mode, the pedestrian's LEDs will be off until the button will be pressed
- The pedestrian must press the button before crossing the street.