Faculty of Enigeering

Cairo University

Embedded Systems Project Documentation

On Demand Traffic Light Control

Presented for ELC 2080 project

Presented to:

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On Demand Traffic Light Control

System Description

Abstract

In the current scenario, vehicular traffic is increasing all over the world, especially in large urban areas. With the ever - increasing number of road users and the limited resources provided by the existing infrastructures, intelligent traffic control will become a very important issue in the future. These needs led to an increased demand for the traffic control system. Therefore, there is a need to improve traffic control to better accommodate this increasing demand and to preserve pedestrians from accidents and to implement the movement of pedestrians first and then cars to preserve the lives of pedestrians.
In this project, we will show the improvement of traffic light control on the road.

Overview

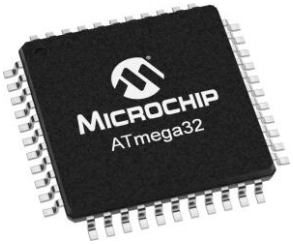
The main objective of this project is to control traffic lights based on pedestrians pressing the control button, and in this system some components installed at a fixed distance are used. All sensors are connected to the microcontroller, which in turn controls the traffic light system according to the pedestrian's pressure on the button, this aspect is given more priority,Refer to the Schematic in Section 3.

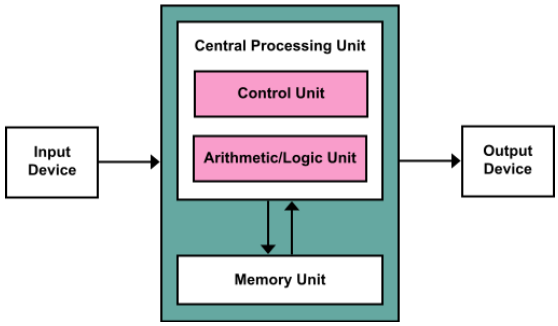
Functionality

The system can detect when the button is pressed. Afterwards, based on the current state it would decide what to do. It allows pedestrians to walk by making sure cars are stopped first. Refer to the Flow Charts in Section 3.

System Design

Requirement





The System Consists of:

- 2 Green LEDs.
- 2 Yellow LEDs.
- 2 Red LEDs.
- 6 Resistors $(300\ \Omega)$: To avoid LEDs Burning.
- 1 Resistor $(10\ \text{k}\Omega)$: To make the Signal directed from the Button to its Pin.
- 1 Push Button.
- CPU: AVR Atmega32 (1 MHZ Clock).
  - 32 (8-bit general-purpose) Registers + 64 (8-bit input/output) Registers, 2KB SRAM, 1KB ROM (EEPROM) , 32KB of on-chip in system programmable flash memory for program storage.
  - Atmel's ATmega32 is an 8-bit RISC processor, based on Harvard architecture, 32 GPIO Pins.

Operating Environment

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

Programming: Drivers and the Application Coded in Microchip Atmel Studio.

Drivers Folders Applying SOLID Principles → Items in Folders	
Application → $(\text{app.c}, \text{app.h})$ & main.c	
ECUAL (Electronic Control Unit Abstraction Layer) Button Driver → $(\text{button.c}, \text{button.h})$ & LED Driver $(\text{led.c}, \text{led.h})$	
MCAL (Microcontroller Abstraction Layer) DIO Driver → $(\text{dio.c}, \text{dio.h})$ & Timer Driver $(\text{timer.c}, \text{timer.h})$	
Utilities	→ $(\text{bit\_manipulation.h}, \text{interrupts.h}, \text{registers.h}, \text{types.h})$

Input , Output & Interfaces Formats

The only system input is in the form of the pedestrian push button.
When it comes to output it handles 6 LEDs at once given the current state, time and push button press state.

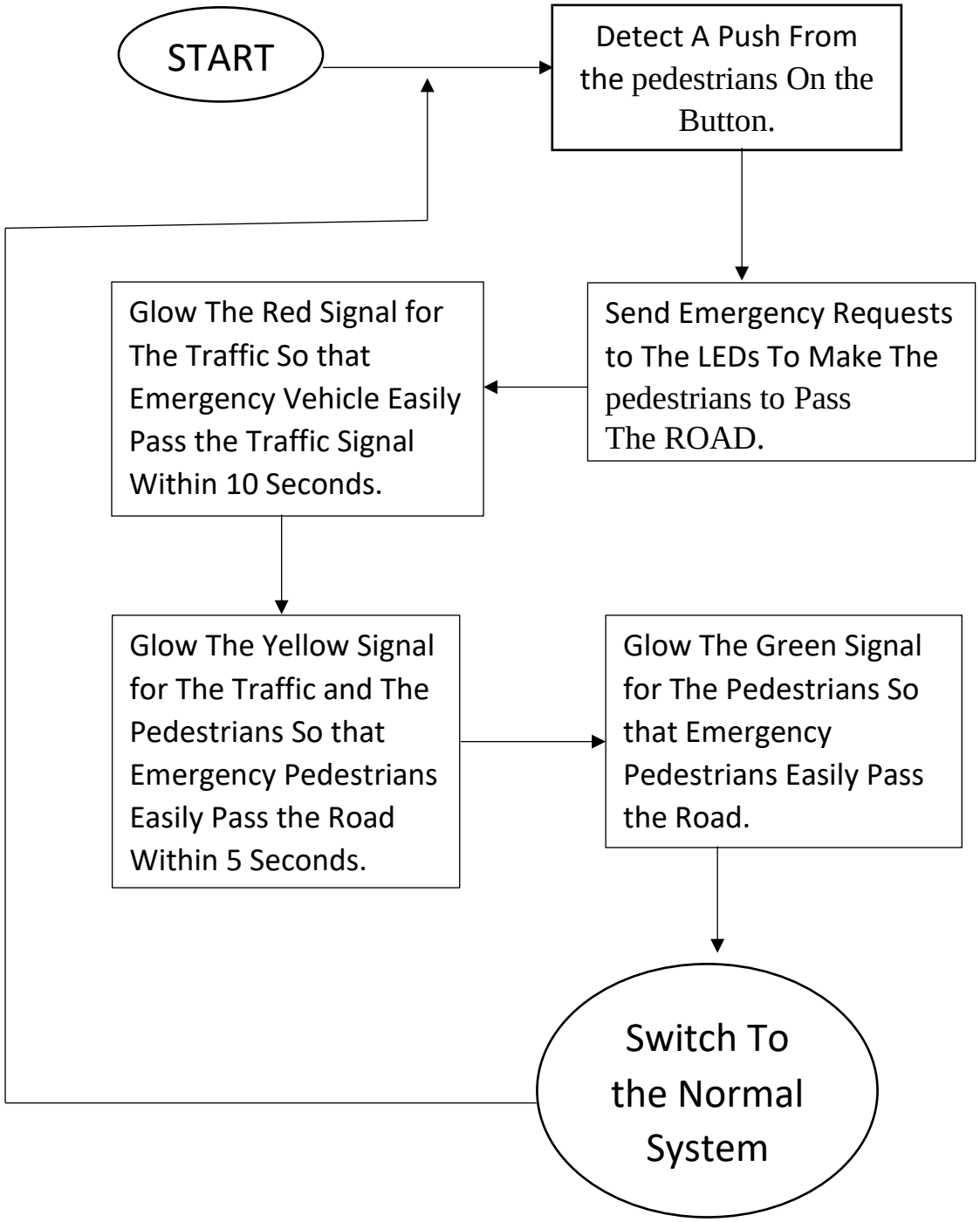
Input Devices	In ECUAL → Push Button.
	In MCAL → Pins.
Output Devices	In ECUAL → LEDS.
	In MCAL → Pins.
Interfaces	In MCAL → Timers (Timer0), Interrupts

User Stories

CRITERIA	MEETS SPECIFICATIONS
User story 1	**As a pedestrian when I will make a short press on the crosswalk button while the cars green light is on and pedestrian red light is off, I will wait for the yellow lights to blink for five seconds then the cars red light is on and pedestrian green light is on for five seconds, so that I can cross the street.**
User story 2	**As a pedestrian when I will make a short press on the crosswalk button while the cars yellow light is blinking and pedestrian red light is on, I will wait for all yellow lights to blink for five seconds then the cars red light is on and pedestrian green light is on for five seconds, so that I can cross the street.**
User story 3	**As a pedestrian when I will make a short press on the crosswalk button while the cars red light is on and pedestrian green light is on, I expect nothing to be done**
User story 4	**As a pedestrian when I made a long press on the crosswalk button, I expect nothing to be done.**
User story 5	**As a pedestrian when I made a double press on the crosswalk button, I expect that the first press will do the action and nothing to be done after the second press.**

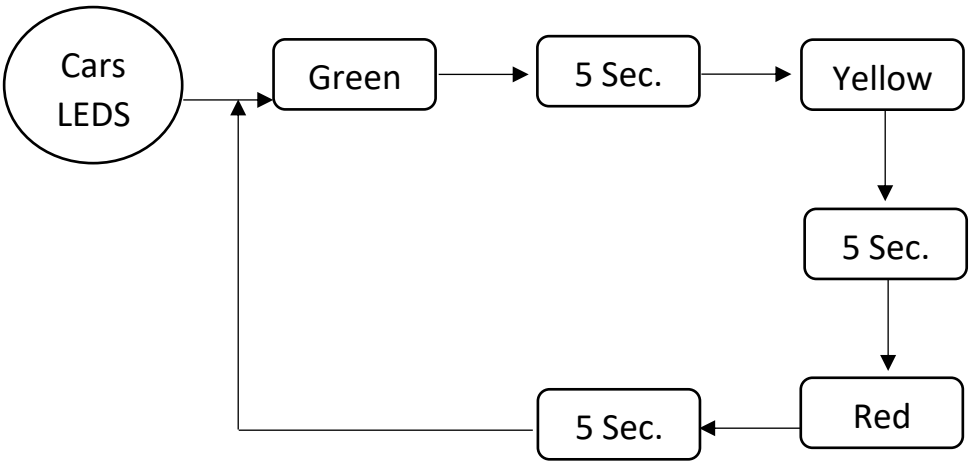
Flow Charts

IDEA:

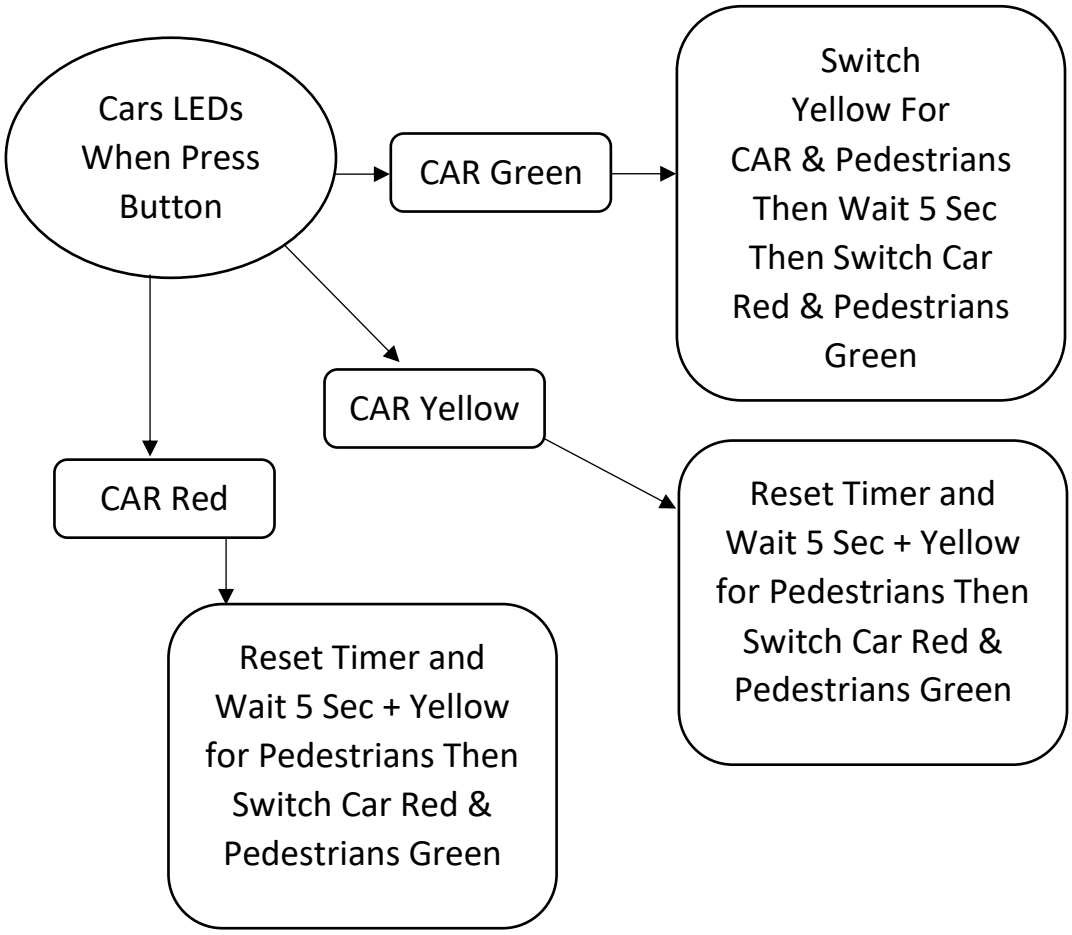


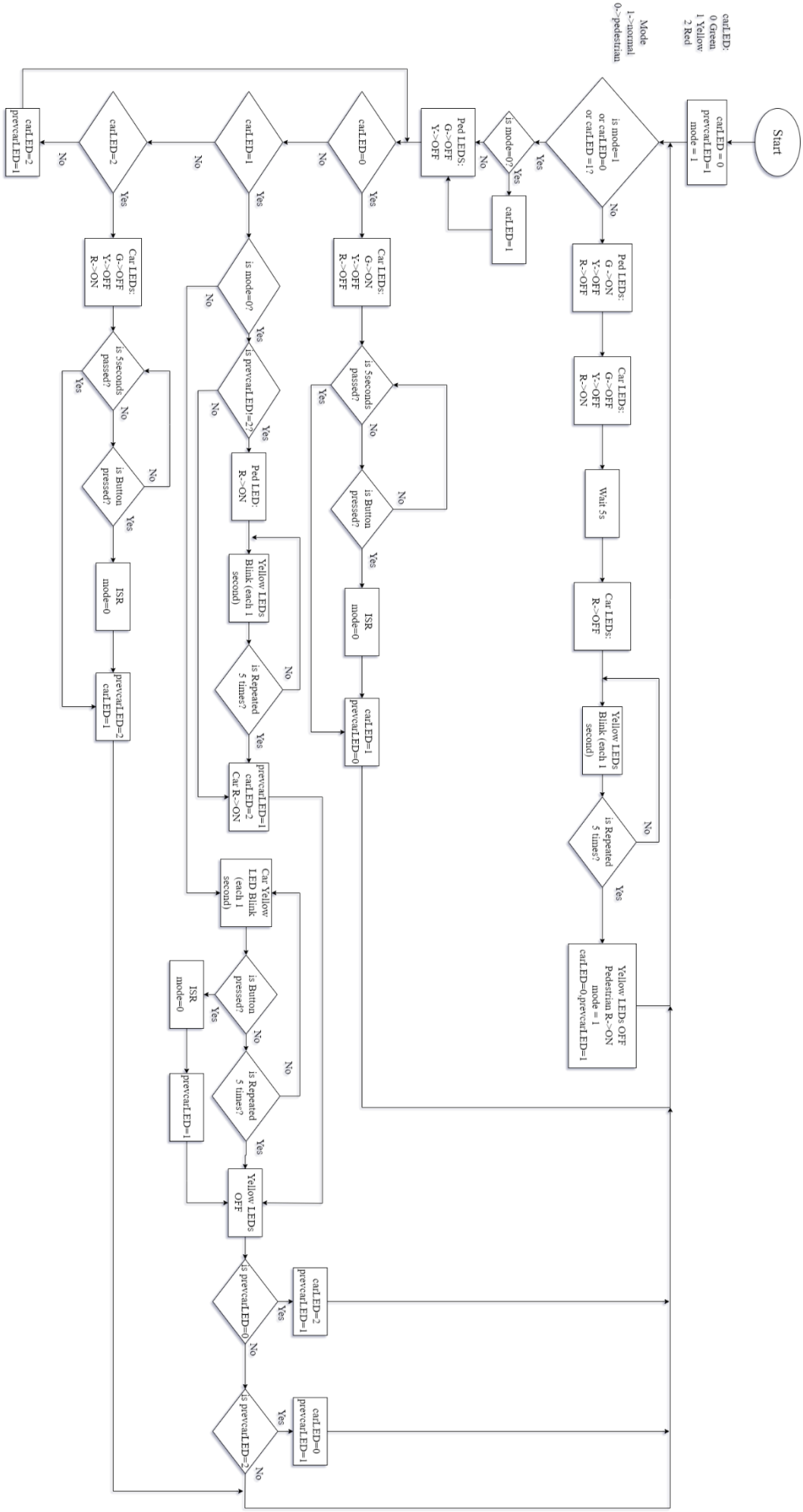
MODES:

Normal Mode:



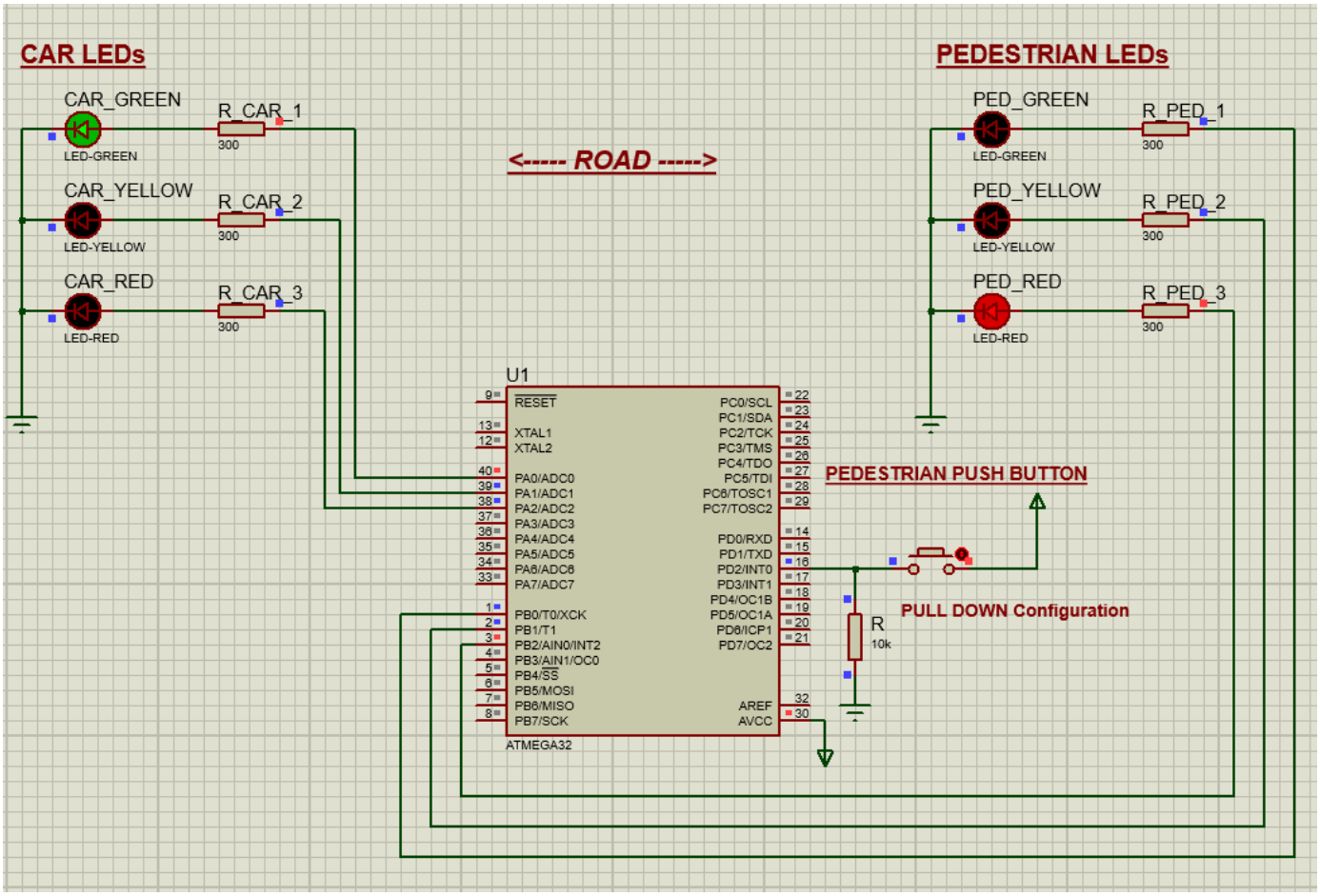
Pedestrians Mode:




Start
carLED = 0
prevcarLED=1
mode = 1
carLED:
0 Green
1 Yellow
2 Red
Mode
1->normal
0->pedestrian
is mode=1
or carLED=0
or carLED =1?
Yes
No
Ped LEDs:
G->ON
Y->OFF
R->OFF
Car LEDs:
G->OFF
Y->OFF
R->ON
Wait 5s
Car LEDs:
R->OFF
Yellow LEDs
Blink (each 1
second)
is Repeated
5 times?
Yes
No
Yellow LEDs OFF
Pedestrian R->ON
mode = 1
carLED=0,prevcarLED=1
is mode=0?
Yes
No
carLED=1
Ped LEDs:
G->OFF
Y->OFF
carLED=0
Car LEDs:
G->ON
Y->OFF
R->OFF
is 5seconds
passed?
Yes
No
is Button
pressed?
Yes
No
ISR
mode=0
carLED=1
prevcarLED=0
carLED=1
is mode=0?
Yes
No
is prevcarLED=2?
Yes
No
Ped LED:
R->ON
Yellow LEDs
Blink (each 1
second)
is Repeated
5 times?
Yes
No
prevcarLED=1
carLED=2
Car R->ON
carLED=2
Car LEDs:
G->OFF
Y->OFF
R->ON
is 5seconds
passed?
Yes
No
is Button
pressed?
Yes
No
ISR
mode=0
prevcarLED=2
carLED=1
carLED=2
prevcarLED=1
Car Yellow
LED Blink
(each 1
second)
is Button
pressed?
Yes
No
ISR
mode=0
prevcarLED=1
is Repeated
5 times?
Yes
No
Yellow LEDs
OFF
is prevcarLED=0
Yes
No
carLED=2
prevcarLED=1
is prevcarLED=2
Yes
No
carLED=0
prevcarLED=1

Section 3

Schematic



Section 4

System Constrains

→ The Unuse of Stop Sign or Walk Sign for Pedestrians use Only LEDs.
→ The Unuse of Stop Sign or Walk Sign for CARS use Only LEDs.
→ The Unuse of Communications Protocols in Embedded Systems.

Section 5

Future Work

→ Instead of Return Void for All Function Will Set A Value Return For ERROR Handling in the Application in the Future.
→ Use LCD to Counts the Remaining time of the Transitions between LED States.
→ Use A sensor is used to see if someone is walking slowly, an old man, or someone who has fallen, to increase the walking time.