



UNIVERSITY OF MALAYA

WIX1003 COMPUTER SYSTEMS AND ORGANIZATION

SEMESTER 1, 2020/2021

Lab Assignment Report

Title: Traffic Light Control System

Lecturer: Dr. Tey Kok Soon

Course Occurrence: 1

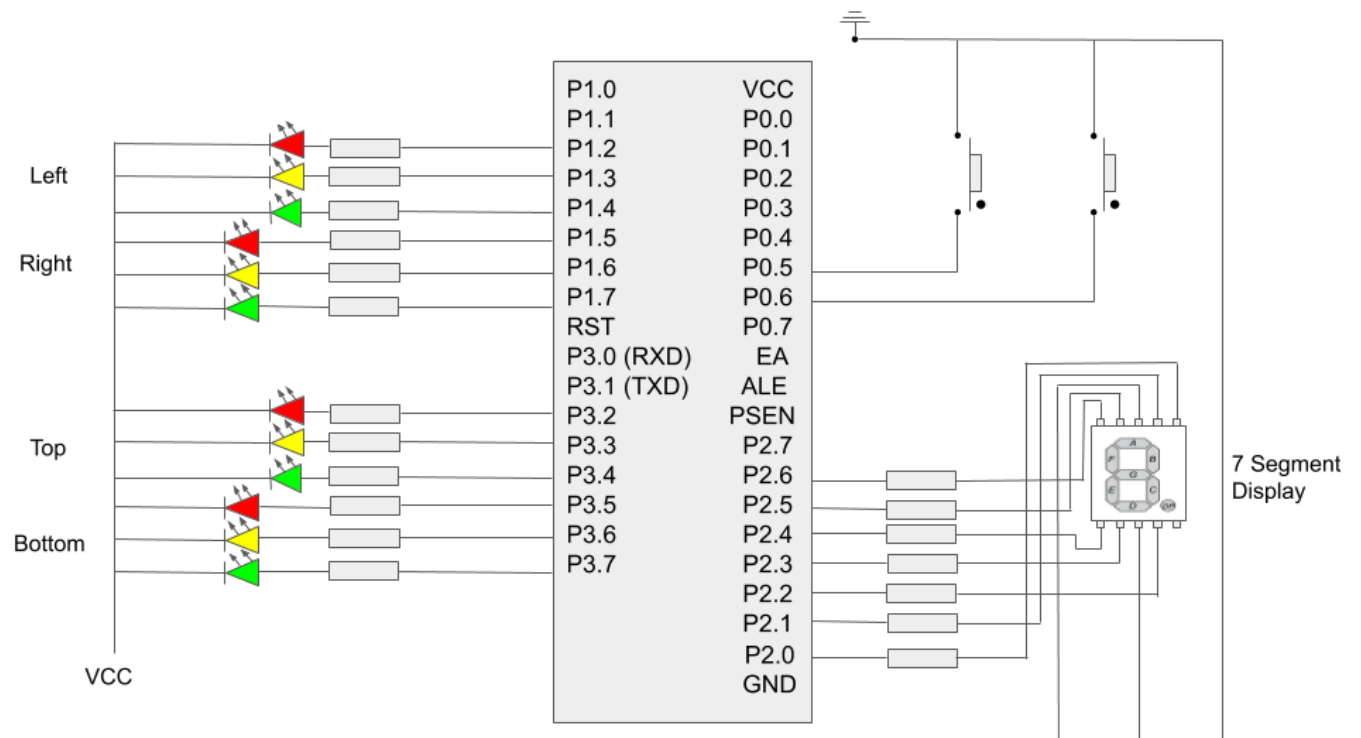
Group No.: Group 16

Student Name	Matric No.
Goh Chee Lam	U2005382/1
Saw Chen Min	U2005384/1
Lim Jia Yee	U2005385/1
Ho Yi Liang	U2005386/1
Wong Yu Xuan	U2005388/1

Table of Contents

Contents:	No. of pages
Components Connection Diagram of Traffic Light System	3
Complete Source Code of the System	4-13
How the System Operates?	14-16
Design Consideration	17
System Limitation	18

Components Connection Diagram of Traffic Light System



Complete Source Code

```
ORG 00h

AJMP MAIN

MAIN:    MOV  A,#0D8h           ;1101 1000 Make all red lights
        MOV  P1,A
        MOV  P3,A
        MOV  A,#00h           ;0000 0000 //
        MOV  P2,A             ;Let 7SegDisp become no lights //
        MOV  A,#0FFh          ;1111 1111 //
        MOV  P0,A             ;Make P0 as input //
        MOV  DPTR,#SEG
        MOV  B,#00h           ;Delay use
        AJMP UP

UP:      JNB   P0.5,INTDOWN    ;if (button1 == 1) { INTDOWN{} }//
        JNB   P0.6,INTLEFT    ;if (button2 == 1) { INTDOWN{} }//
        MOV   B,#0Ah          ;10 seconds delay
        ACALL DELAYGREENUP    ;Pass to delay
        ACALL RESETTIMER      ;Reset 7SegDisp
        SETB  P3.4            ;turn off green
        CLR   P3.3            ;turn on yellow
        MOV   B,#02h
```

```

ACALL DELAY
ACALL RESETTIMER
SETB P3.3          ;turn off yellow
CLR P3.2           ;turn on red
MOV B,#02h
ACALL DELAY
ACALL RESETTIMER
AJMP RIGHT
INTLEFT: MOV A,#0D8h      ;1101 1000 Make all red lights
MOV P1,A
MOV P3,A
SETB P1.2          ;turn off red
CLR P1.4           ;turn on green
MOV B,#0Ah
ACALL DELAYGREENLEFT
ACALL RESETTIMER
SETB P1.4          ;turn off green
CLR P1.3           ;turn on yellow
MOV B,#02h
ACALL DELAY
ACALL RESETTIMER
SETB P1.3          ;turn off yellow
CLR P1.2           ;turn on red

```

```

MOV B,#02h
ACALL DELAY
ACALL RESETTIMER
JMP UP ;//
RIGHT: JNB P0.5,INTDOWN ; //
JNB P0.6,INTLEFT ; //
MOV B,#0Ah
ACALL DELAYGREENRIGHT
ACALL RESETTIMER
SETB P1.7 ;turn off green
CLR P1.6 ;turn on yellow
MOV B,#02h
ACALL DELAY
ACALL RESETTIMER
SETB P1.6 ;turn off yellow
CLR P1.5 ;turn on red
MOV B,#02h
ACALL DELAY
ACALL RESETTIMER
AJMP DOWN

INTDOWN: MOV A,#0D8h ;1101 1000 Make all red lights
MOV P1,A

```

```

MOV P3,A
SETB P3.5                ;turn off red //
CLR P3.7                 ;turn on green //
MOV B,#0Ah
ACALL DELAYGREENDOWN
ACALL RESETTIMER
SETB P3.7                ;turn off green //
CLR P3.6                 ;turn on yellow //
MOV B,#02h
ACALL DELAY
ACALL RESETTIMER
SETB P3.6                ;turn off yellow //
CLR P3.5                 ;turn on red //
MOV B,#02h
ACALL DELAY
ACALL RESETTIMER
AJMP RIGHT                ;//

DOWN: JNB P0.6,INTLEFT    ; //
MOV B,#0Ah
ACALL DELAYGREENDOWN
ACALL RESETTIMER
SETB P3.7                ;turn off green

```

```

        CLR  P3.6                ;turn on yellow
        MOV  B,#02h
        ACALL DELAY
        ACALL RESETTIMER
        SETB P3.6                ;turnn off yellow
        CLR  P3.5                ;turn on red
        MOV  B,#02h
        ACALL DELAY
        ACALL RESETTIMER
        AJMP LEFT

LEFT:    JNB  P0.5,INTDOWN        ; //
        MOV  B,#0Ah
        ACALL DELAYGREENLEFT
        ACALL RESETTIMER
        SETB P1.4                ;turn off green
        CLR  P1.3                ;turn on yellow
        MOV  B,#02h
        ACALL DELAY
        ACALL RESETTIMER
        SETB P1.3                ;turn off yellow
        CLR  P1.2                ;turn on red
        MOV  B,#02h

```



```

                                ACALL DELAY
                                ACALL RESETTIMER
                                AJMP UP

RESETTIMER:                    MOV  A,#00h                        ;0000 0000
                                MOV  P2,A
                                RET

DELAYGREENUP:                  SETB P3.2                        ;turn off red
                                CLR   P3.4                      ;turn on green
                                MOV  R1,B                        ;FOR UP

DELAY1GREENUP:                 MOV  R2,#05H

DLYCALCGREENUP:                DJNZ R2, DLYCALCGREENUP
                                DEC   R1
                                MOV  A,R1
                                MOVC  A,@A+DPTR
                                MOV  P2,A
                                CJNE R1,#03H,DELAY1GREENUP

DELAY2GREENUP:                 MOV  R2,#05H

DLYCALC2GREENUP:               DJNZ R2, DLYCALC2GREENUP
                                DEC   R1
                                MOV  A,R1
                                MOVC A,@A+DPTR

```

```

MOV P2,A
SETB P3.4
CLR P3.4
CJNE R1,#00H,DELAY2GREENUP
RET

```

```

DELAYGREENRIGHT: SETB P1.5           ;turn off red
                  CLR P1.7           ;turn on green
                  MOV R1,B           ;FOR RIGHT

```

```

DELAY1GREENRIGHT: MOV R2,#05H

```

```

DLYCALCGREENRIGHT: DJNZ R2, DLYCALCGREENRIGHT
                   DEC R1
                   MOV A,R1
                   MOVC A,@A+DPTR
                   MOV P2,A
                   CJNE R1,#03H,DELAY1GREENRIGHT

```

```

DELAY2GREENRIGHT: MOV R2,#05H

```

```

DLYCALC2GREENRIGHT:DJNZ R2, DLYCALC2GREENRIGHT
                   DEC R1
                   MOV A,R1
                   MOVC A,@A+DPTR
                   MOV P2,A
                   SETB P1.7

```

```

        CLR  P1.7

        CJNE R1,#00H,DELAY2GREENRIGHT

        RET

DELAYGREENDOWN:  SETB P3.5                ;turn off red

                  CLR  P3.7                ;turn on green

                  MOV  R1,B                ;FOR DOWN

DELAY1GREENDOWN: MOV  R2,#05H

DLYCALCGREENDOWN: DJNZ R2, DLYCALCGREENDOWN

                  DEC  R1

                  MOV  A,R1

                  MOVC  A,@A+DPTR

                  MOV  P2,A

                  CJNE R1,#03H,DELAY1GREENDOWN

DELAY2GREENDOWN: MOV  R2,#05H

DLYCALC2GREENDOWN:DJNZ R2, DLYCALC2GREENDOWN

                  DEC  R1

                  MOV  A,R1

                  MOVC  A,@A+DPTR

                  MOV  P2,A

                  SETB P3.7

                  CLR  P3.7

                  CJNE R1,#00H,DELAY2GREENDOWN

```

RET

DELAYGREENLEFT: SETB P1.2 ;turn off red
CLR P1.4 ;turn on green
MOV R1,B ;FOR LEFT

DELAY1GREENLEFT: MOV R2,#05H

DLYCALCGREENLEFT: DJNZ R2, DLYCALCGREENLEFT

DEC R1

MOV A,R1

MOVC A,@A+DPTR

MOV P2,A

CJNE R1,#03H,DELAY1GREENLEFT

DELAY2GREENLEFT: MOV R2,#05H

DLYCALC2GREENLEFT: DJNZ R2, DLYCALC2GREENLEFT

DEC R1

MOV A,R1

MOVC A,@A+DPTR

MOV P2,A

SETB P1.4

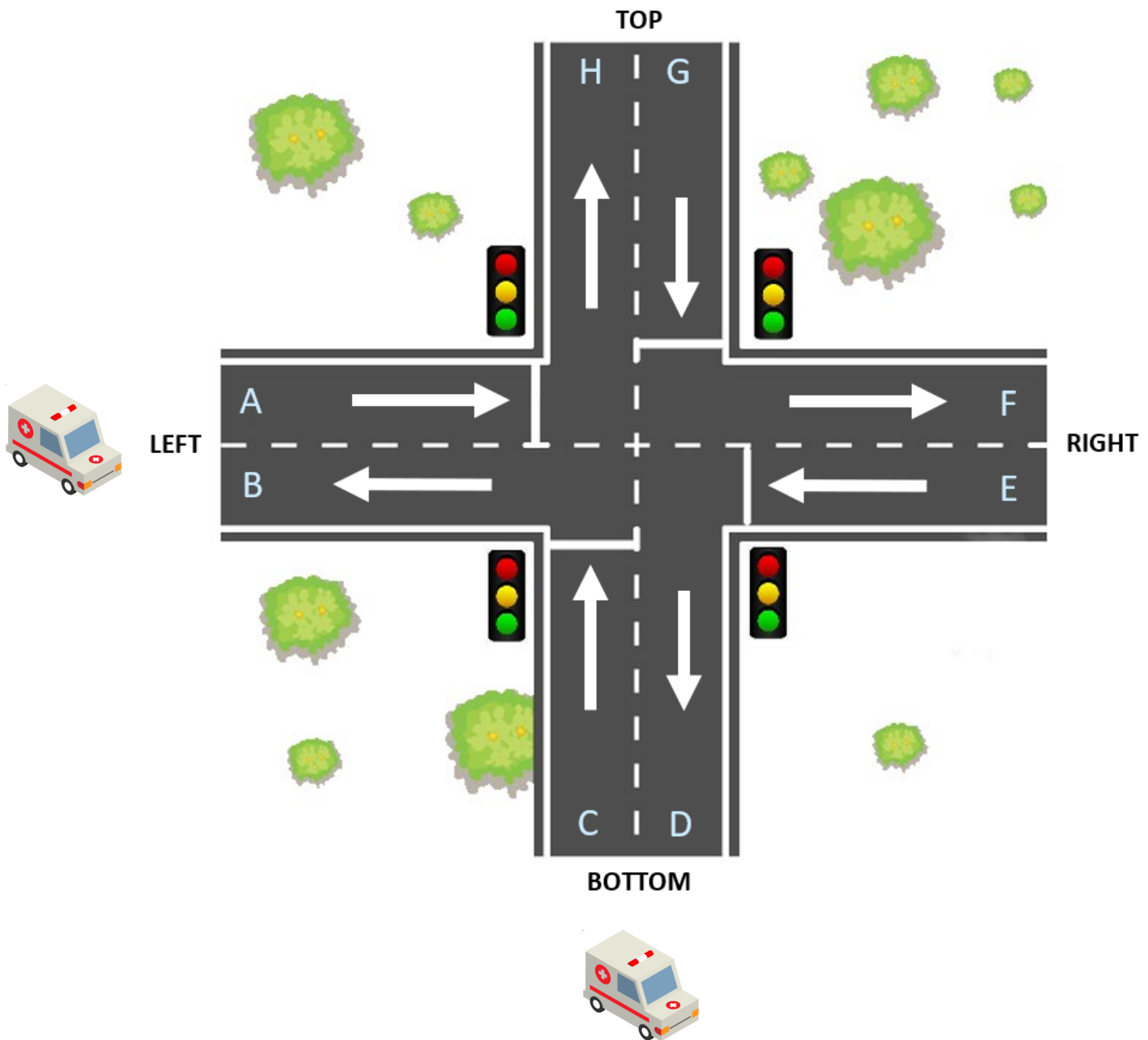
CLR P1.4

CJNE R1,#00H,DELAY2GREENLEFT

RET

DELAY:	MOV R1,B
DELAY1:	MOV R2,#05H
DLYCALC:	DJNZ R2, DLYCALC
	DEC R1
	MOV A,R1
	MOVC A,@A+DPTR
	MOV P2,A
	CJNE R1,#00H,DELAY1
	RET
SEG:	DB 06H, 5BH, 4FH, 66H, 6DH, 7DH, 07H, 7FH, 6FH, 77H, 7CH, 39H, 5EH, 79H, 71H
	END

How the System Operates?



Phase 1

At first, all traffic lights remain red. Then, the TOP traffic light turns green. Therefore, vehicles from G can turn to B, F, or go straight to D. After 7 seconds green light, it then will blink for 3 seconds (Total green light time: 10 seconds). After that, the traffic light turns yellow for 2 seconds, lastly turns red. Vehicles from G stop. The system proceeds to Phase 2.

Phase 2

After the TOP traffic light turns red for 2 seconds, the traffic light at RIGHT turns green, the others remain red. Hence, only vehicles from E can turn to D, H, or go straight to B. After 7 seconds green light, it then will blink for 3 seconds (Total green light time: 10 seconds). Then the traffic light turns yellow for 2 seconds, lastly turns red. Vehicles from E stop. The system proceeds to Phase 3.

Phase 3

After the RIGHT traffic light turns red for 2 seconds, the traffic light at BOTTOM turns green and the others remain red. Therefore, only vehicles from C can turn to B, F, or go straight to H. After 7 seconds green light, it then will blink for 3 seconds (Total green light time: 10 seconds). Then the traffic light turns yellow for 2 seconds, lastly turns red. Vehicles from C stop. The system proceeds to Phase 4.

Phase 4

After the BOTTOM traffic light turns red for 2 seconds, the traffic light at LEFT turns green and the others remain red. Therefore, only vehicles from route A are allowed to turn left to route H or go straight to route F or turn right to the opposite route, which is route D. After 7 seconds green light, it then will blink for 3 seconds (Total green light time: 10 seconds). Then the traffic light turns yellow for 2 seconds, lastly turns red. Vehicles from route A stop. The system continues the loop back to Phase 1.

Interruptions:

- There are cases when **INTERRUPT BUTTON 1** or **INTERRUPT BUTTON 2** is pressed due to an emergency case. When the INTERRUPT BUTTON is pressed, the whole system will stop immediately and proceed to an Emergency Phase.
- **INTERRUPT BUTTON 1** is located at the BOTTOM part, while **INTERRUPT BUTTON 2** is located at the LEFT part, only from BOTTOM and LEFT can interrupt the traffic light system.
- When the system is operating normally, if **INTERRUPT BUTTON 1** is pressed the system stops and proceeds to Emergency Phase 5. If **INTERRUPT BUTTON 2** is pressed, the system stops and proceeds to Emergency Phase 6.

Emergency Phase 5

The previous traffic light will finish the green light remaining time and turn red from green. Then, the traffic light at BOTTOM will turn green. At the same time, other traffic lights remain at red lights. Only vehicles from C can turn to B, F, or go straight to H. After 7 seconds green light, it then will blink for 3 seconds (Total green light time: 10 seconds). Then the traffic light turns yellow for 2 seconds, lastly turns red. Vehicles from C stop. The system continues by returning to the next Phase of previous Phase (i.e. Previous Phase: Phase 1; INTERRUPT BUTTON 1 is pressed, after traffic light at BOTTOM turns red, Next Phase: Phase 2), and proceeds to the normal cycle.

Emergency Phase 6

The previous traffic light will finish the green light remaining time and turn red from green. After that, the LEFT traffic light will turn green. At the same time, other traffic lights remain at red lights. Vehicles from route A are allowed to turn left to route H or go straight to route F or turn right to the opposite route, which is route D. After 7 seconds green light, it then will blink for 3 seconds (Total green light time: 10 seconds). Then the traffic light turns yellow for 2 seconds, lastly turns red. Vehicles from route A stop. The system continues by returning to the next Phase of previous Phase (i.e. Previous Phase: Phase 2; INTERRUPT BUTTON 2 is pressed, after traffic light at LEFT turns red, (Next Phase: Phase 3), and proceeds to the normal cycle.

Design Consideration

1. 4 traffic lights are built at the corner of each junction, which are the TOP traffic light, BOTTOM traffic light, LEFT traffic light and RIGHT traffic light. The traffic lights are designed at an appropriate height to make sure all the drivers are able to see and obey traffic signs. Each time, only one traffic light will turn green to allow the vehicles from one direction to cross the junction. For example, if the top traffic light turns green, the other 3 traffic lights will remain red. This helps to eliminate confusion, smoothen the traffic flow, reduce traffic congestion and prevent road accidents.
2. The traffic system provides a suitable and equal time length for all the vehicles in all directions to cross the junction. For example, initially, the top traffic light turns green from red. The green light will remain for 10 seconds to allow vehicles at that junction to move. After 10 seconds, the top traffic light will turn yellow for 2 seconds and finally turn red for 2 seconds. After the 2 seconds red light, the next traffic light which is the right traffic light will turn green for 10 seconds, turn yellow for 2 seconds and turn red for 2 seconds. These procedures are repeated for every traffic light continuously.
3. A countdown timer is provided at each traffic light for the drivers to clearly know the state of the traffic lights. With the countdown timer, drivers are able to know the remaining time for them to cross the junction and estimate whether they can safely cross the junction to prevent chaos. For example, when the traffic light turns green, drivers are able to see the allocated time left for them to cross the junction. They can also estimate whether the allocated time left is enough for them to cross the junction to prevent them from running the red light.
4. The traffic system provides a “blink” feature for the drivers to be better informed about the state of the green light. The green light will blink for 3 times before it turns yellow. This allows the drivers to get extra reminders and safety warnings on the state of the traffic light. This can also help to make sure that the drivers are obeying the traffic rules.
5. The traffic system provides an interrupt feature for the use in emergency cases. The traffic light that initially red or yellow will turn green when there is an emergency signal. For example, when the left traffic light is red and there is an ambulance with its siren on approaching the left cross junction, the switch will turn on to change the red light into green for the ambulance to cross the junction. This acts as a special remote control for the sake of emergency situations and can also be used by police, ambulance drivers and firefighters to change traffic lights into green so that they are able to pass the junction in a shortest time.

System Limitations

Our traffic signals are not perfect because this is only the prototype to show the concept. If this traffic light is used without any adjustment in reality, it might even cause serious accidents. This is because the time of the traffic light might not be enough for the car to pass as this is implemented to a crossroad.

Next, we do not consider the real life condition, for example, the traffic flow during working hours and school hours which there will be greater car flow. We do not set multiple adjustments for various traffic flows at a different time of a day.

The third system limitation is we do not add additional hardware to the traffic light. For example, car flow sensors and closed-circuit television (CCTV). If we added these additional features, we can adjust the time of the lights to control the car flow.

Besides that, we only considered the traffic for the cars but we neglected the pedestrians. But this is because we do not think a pedestrian will cross a road at the crossroad that is always busy and chaotic, that is why we did not add the traffic signals for the pedestrian.