UNIVERSITI MALAYA

WIX1003
COMPUTER SYSTEMS AND ORGANIZATION
SEMESTER 1, 2023/2024

LAB ASSIGNMENT REPORT
TITLE: TRAFFIC LIGHT

GROUP MEMBERS:

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GitHub Link:

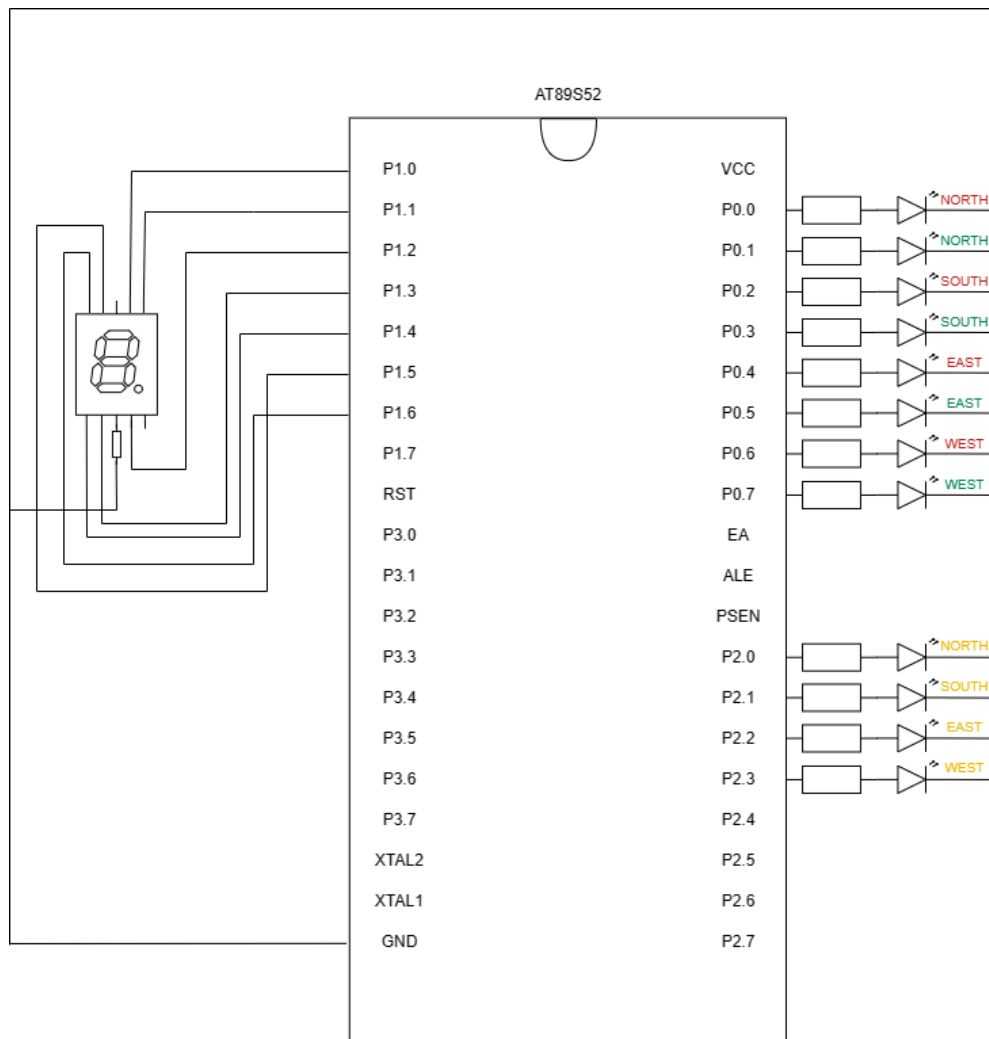https://github.com/szeyu/CSO-Assignment

Google Drive Video Presentation Link:
https://drive.google.com/file/d/1XyBoQ7YVf7b7Ow7yaj0Z2s3Ta_na7Grt/view?usp=sharing

Table of Contents

Component Connection Diagram

AT89S52

Left pins	Right pins
P1.0	VCC
P1.1	P0.0 — NORTH
P1.2	P0.1 — NORTH
P1.3	P0.2 — SOUTH
P1.4	P0.3 — SOUTH
P1.5	P0.4 — EAST
P1.6	P0.5 — EAST
P1.7	P0.6 — WEST
RST	P0.7 — WEST
P3.0	EA
P3.1	ALE
P3.2	PSEN
P3.3	P2.0 — NORTH
P3.4	P2.1 — SOUTH
P3.5	P2.2 — EAST
P3.6	P2.3 — WEST
P3.7	P2.4
XTAL2	P2.5
XTAL1	P2.6
GND	P2.7

Complete Code of The System

```
                    ORG    00H
                    AJMP   MAIN


MAIN:               MOV        A,#00H
                    MOV        P0,A    ; Set Port 0 as output for Green Light and Red Light
                    MOV        P1,A    ; Set Port 0 as output for 7 Segment display
                    MOV        P2,A    ; Set Port 2 as output for Yellow Light
                    MOV        DPTR,#SEG



START:              AJMP       TRAFFIC1      ; Start the whole traffic from traffic 1


NORTH:              ; G1 is on while others R is off
                    ; 10 01 01 01
                    MOV        A,#95H
                    ACALL      TRAFFIC_ROUTINE   ;Delay about 8 seconds
                    ; G1 is off
                    ; 00 01 01 01
                    MOV        A,#15H
                    MOV        P0,A
                    ; YELLOW 1 is on
                    ; 1 0 0 0
                    MOV        A,#08H
                    ACALL      YELLOW_ROUTINE  ;Run about 2 seconds


SOUTH:              ; G2 is on while other R is off
                    ; 01 10 01 01
                    MOV        A,#65H
                    ACALL      TRAFFIC_ROUTINE  ;Delay about 8 seconds
                    ; G2 is off
```

```
                         ; 01 00 01 01
                         MOV        A,#45H
                         MOV        P0,A
                         ; YELLOW 2 is on
                         ; 0 1 0 0
                         MOV        A,#04H
                         ACALL      YELLOW_ROUTINE   ;Run about 2 seconds


EAST:                    ; G3 is on while other R is off
                         ; 01 01 10 01
                         MOV        A,#59H
                         ACALL      TRAFFIC_ROUTINE   ; Delay about 8 seconds
                         ; G3 is off
                         ; 01 01 00 01
                         MOV        A,#51H
                         MOV        P0,A
                         ; YELLOW 3 is on
                         ; 0 0 1 0
                         MOV        A,#02H
                         ACALL      YELLOW_ROUTINE   ;Run about 2 seconds


WEST:                    ; G4 is on while other R is off
                         ; 01 01 01 10
                         MOV        A,#56H
                         ACALL      TRAFFIC_ROUTINE   ; Delay about 8 seconds
                         ; G4 is off
                         ; 01 01 01 00
                         MOV        A,#54H
                         MOV        P0,A
                         ; YELLOW 4 is on
                         ; 0 0 0 1
                         MOV        A,#01H
                         ACALL      YELLOW_ROUTINE   ;Run about 2 seconds
```

```
                    AJMP    TRAFFIC1


; Run about 8 seconds

TRAFFIC_ROUTINE:MOV         P0,A
                ACALL       LONG_DELAY          ;Delay about 4 seconds
                ACALL       COUNTDOWN5          ;Delay about 4 seconds
                MOV         A,#00H
                MOV         P1,A                ; clear countdown
                RET


;Delay for about 2 seconds

YELLOW_ROUTINE:MOV          P2,A
                ACALL       SHORT_DELAY
                ACALL       SHORT_DELAY
                MOV         A,#00H
                MOV         P2,A                ; Clear Yellow Light output
                RET


;Delay for about 4 seconds

LONG_DELAY:     ACALL       SHORT_DELAY
                ACALL       SHORT_DELAY
                ACALL       SHORT_DELAY
                ACALL       SHORT_DELAY
                RET


; Delay for about 1 second

SHORT_DELAY:    ACALL       DELAY
                ACALL       DELAY
                ACALL       DELAY
                ACALL       DELAY
                ACALL       DELAY
                ACALL       DELAY
```

```
                        ACALL           DELAY
                        RET


; Function to delay

DELAY:          MOV   R0,#0FFh
DELAY1:         MOV   R1,#0F0h
DELAY2:         DJNZ  R1,DELAY2   ;Decrement register1 and jump to delay2 if it is not 0
                DJNZ  R0,DELAY1   ;Decrement register0 and jump to delay1 if it is not 0
                RET


;Delay about 4 seconds

COUNTDOWN5:     MOV             A,#4            ; Set initial R5 point to digit 5
                MOV             R5,A
                ACALL           TIMER           ; Count down
                ACALL           TIMER           ; Count down
                ACALL           TIMER           ; Count down
                ACALL           TIMER           ; Count down


                TIMER:          DEC             R5
                MOV             A,R5            ;read input value of R5
                ACALL           SHORT_DELAY
                MOVC            A,@A+DPTR   ;load value from table
                MOV             P1,A            ;output value
                RET


TIMER:          DEC             R5
                MOV             A,R5            ;read input value of R5
                ACALL           SHORT_DELAY ;Delay about 1 second
                MOVC            A,@A+DPTR   ;load value from table
                MOV             P1,A            ;output value
                RET
```
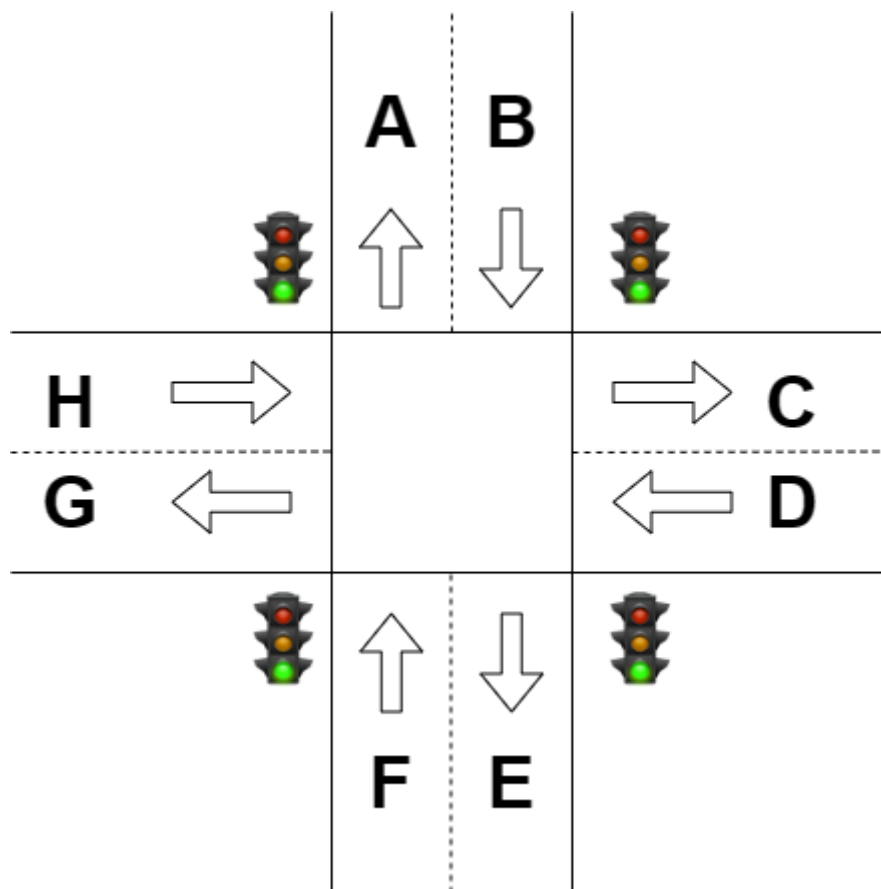
; Decoder to 7 display segment LED

SEG: DB 3FH,06H,5BH,4FH,66H,6DH,7DH,07H,7FH,6FH,77H,7CH,39H,5EH,79H,71H

END

Explanation

Simulation on Road

We divide the cross-junction traffic into, North traffic, South traffic, East traffic, and West traffic.

Stage 1:

At first, the North Green Light will be turn on, while the others remain Red Light. Vehicles from route B can enter routes C, E, and G. This traffic routine will delay about 8 seconds. For the last 4 seconds, the timer will light on and count down from 3 to 0. Then, it will turn to North Yellow light for 2 seconds and then turns to North Red Light. Vehicles from route B stop.

Stage 2:

After the Stage 1, the South Green Light will be turn on, while the others remain Red Light. Vehicles from route H can enter routes A, C, and E. This traffic routine will delay about 8 seconds. For the last 4 seconds, the timer will lights on and count down from 3 to 0. Then, it will turn to South Yellow light for 2 seconds and then turns to South Red Light. Vehicles from route H stop.

Stage 3:

After the Stage 2, the East Green Light will be turn on, while the others remain Red Light. Vehicles from route F can enter routes A, C, and G. This traffic routine will delay about 8 seconds. For the last 4 seconds, the timer will light on and count down from 3 to 0. Then, it will turn to East Yellow light for 2 seconds and then turns to East Red Light. Vehicles from route F stop.

Stage 4:

Finally, the West Green Light will be turn on, while the others remain Red Light. Vehicles from route D can enter routes A, E, and G. This traffic routine will delay about 8 seconds. For the last 4 seconds, the timer will light on and count down from 3 to 0. Then, it will turn to West Yellow light for 2 seconds and then turns to West Red Light. Vehicles from route D stop.

Note:

- The traffic lights in each stage are independent of each other.
- The stages repeat in a continuous loop.

Photos of the Circuit
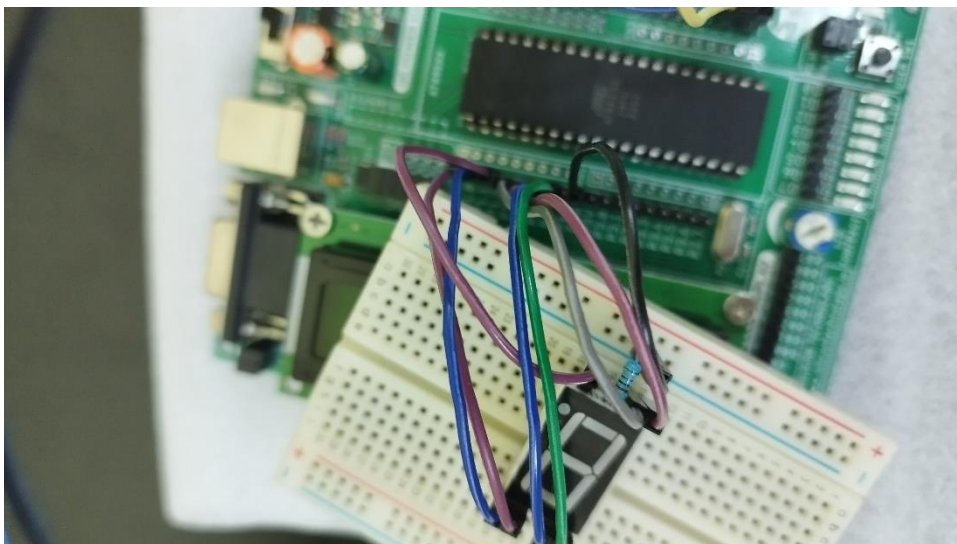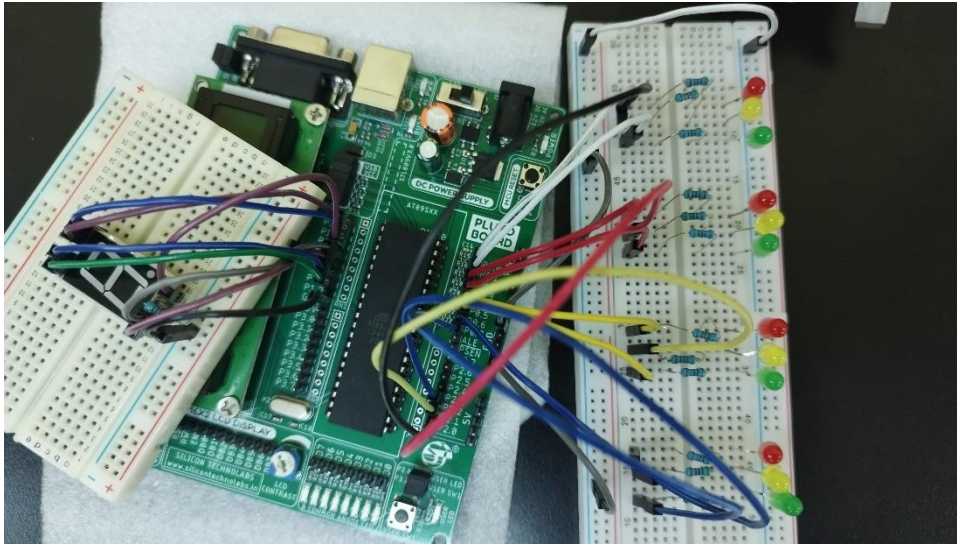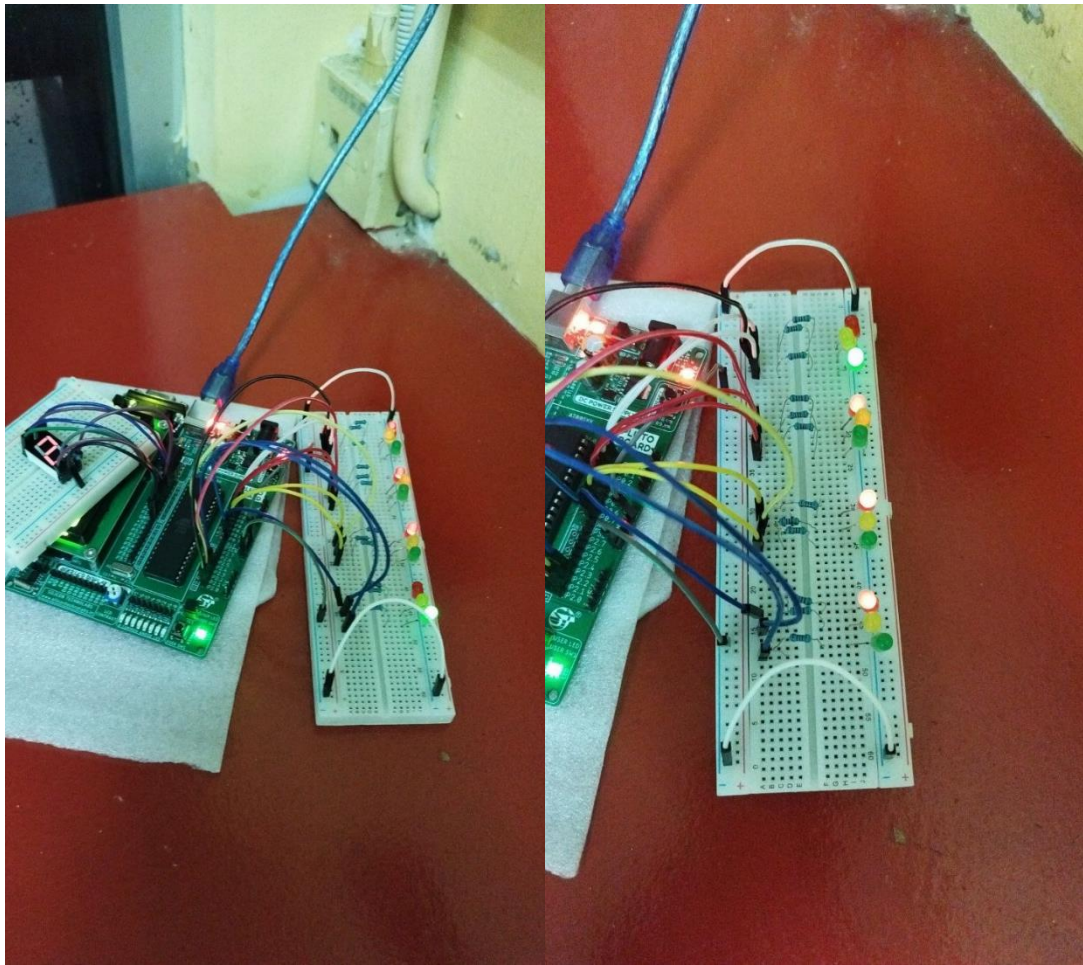
Design Consideration

Color Representation and Understanding

The traffic light system employs the familiar color code of red, yellow, and green to convey instructions to road users. The red light signifies 'stop,' the yellow light signals drivers to 'slow down,' and the green light grants permission to 'go.' This straightforward color scheme aims to enhance user understanding and promote safe driving practices.

Countdown Timer Display

A crucial addition to our system is the countdown timer display. Positioned alongside each traffic light, this feature ensures that drivers have a clear indication of the remaining time for each light phase. The green light stays illuminated for 8 seconds, the yellow light for 2 seconds, and the red light has an 8-second countdown. This empowers drivers to make informed decisions, reducing the likelihood of abrupt stops or accelerations.

Fair Sequential Light Phases

To provide fair chances and equal time for drivers from all directions, the traffic lights operate in a sequential manner. The green light of the first traffic light turns on for 8 seconds, followed by a 2-second yellow light phase. Afterward, the red light activates with a 3-second countdown. This sequential operation minimizes the risk of accidents caused by sudden changes in traffic light status.

Height and Placement for Visibility

Each traffic light is positioned at an appropriate height at the junction to optimize visibility for all road users. Placing the traffic lights at suitable heights encourages the smooth flow of traffic, reduces blind spots, and aids in preventing accidents. The design considers the entire intersection to ensure comprehensive coverage.

Countdown Timer for Green Light at Junction Center

A centralized countdown timer for the green light is at the middle of the junction. This ensures that all road users, including pedestrians, can clearly see the countdown. The visible timer allows drivers to anticipate when to slow down as the count decreases, ultimately reducing the risk of rear-end collisions.

Reducing Rear-End Collisions

By incorporating countdown timers and providing clear signals (yellow signal) to drivers, our design aims to significantly reduce rear-end collisions at intersections. Drivers, informed by the countdown, tend to slow down and make rational decisions based on the remaining time for the green light, mitigating the risk of collisions caused by abrupt stops or accelerations.

In summary, our traffic light system is meticulously designed to enhance traffic management, prioritize safety, and minimize the occurrence of accidents at crossroads. The combination of clear color coding, countdown timers, and strategic placement ensures a user-friendly and effective traffic control system.

System Limitation

Fixed Timing and Lack of Dynamic Adaptability

One notable limitation of the current traffic light system is its reliance on fixed timing intervals for each light phase. The predetermined durations may not account for varying traffic conditions, leading to inefficiencies during low or high traffic periods. A lack of adaptability to real-time changes could result in suboptimal traffic flow management.

Pedestrian Mode Constraints

The current traffic light system does not include pedestrian mode where pedestrians can press a stop button to cross the road safely. Hence, without this mode, it poses a potential risk of accident for the pedestrian to cross the road without the pedestrian mode.

Inability to Handle Emergency Situations

The system lacks specific provisions to handle emergency situations or urgent scenarios, such as ambulance prioritization. In the absence of mechanisms to adapt to critical events, emergency vehicles may face delays in navigating the intersection, potentially impacting response times.

In conclusion, while the current traffic light system addresses several key aspects of traffic control and safety, these limitations highlight the need for ongoing research and development to enhance adaptability, address emerging challenges, and integrate with evolving smart city initiatives.