UNIVERSITI MALAYA

WIX1003

COMPUTER SYSTEMS AND ORGANIZATION

SEMESTER 1, 2023/2024

LAB ASSIGNMENT REPORT

TITLE: TRAFFIC LIGHT

GROUP MEMBERS:

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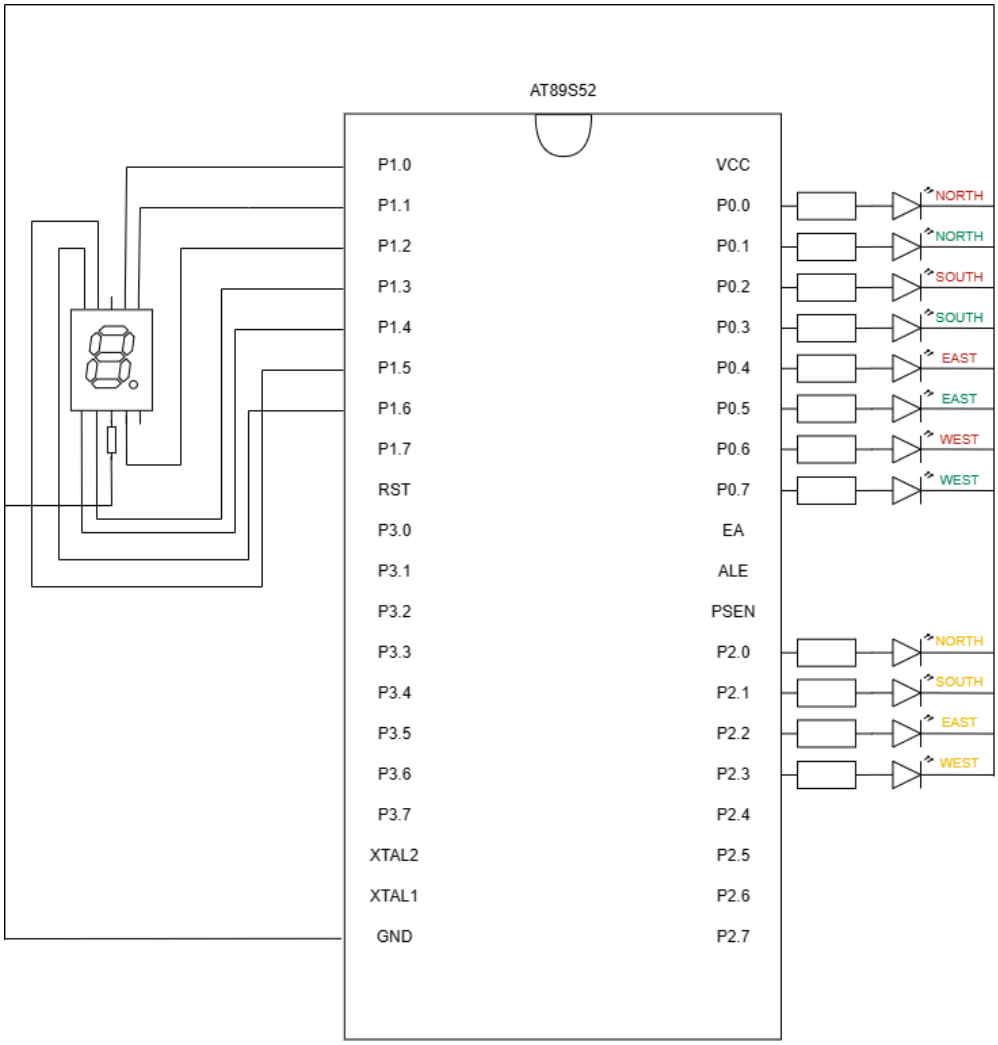
GitHub Link:

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



Complete Code of The System

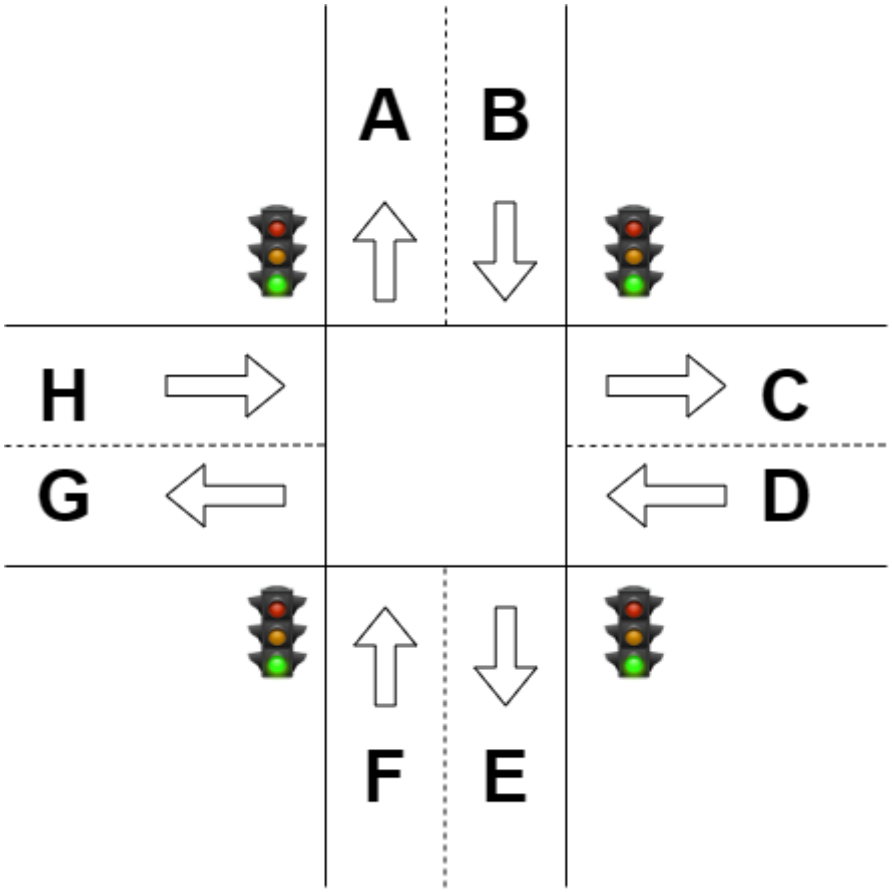
```
                ORG     00H
                AJMP    MAIN

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    NORTH       ; 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    NORTH

; 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 ;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:

First, the North Green Light will be turned on, while the others remain Red Light. Vehicles from route B can enter routes C, E, and G. This traffic routine will be delayed 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 Stage 1, the South Green Light will be turned on, while the others remain Red Light. Vehicles from route H can enter routes A, C, and E. This traffic routine will be delayed 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 South Yellow light for 2 seconds and then turns to South Red Light. Vehicles from route H stop.

Stage 3:

After Stage 2, the East Green Light will be turned on, while the others remain Red Light. Vehicles from route F can enter routes A, C, and G. This traffic routine will be delayed 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.

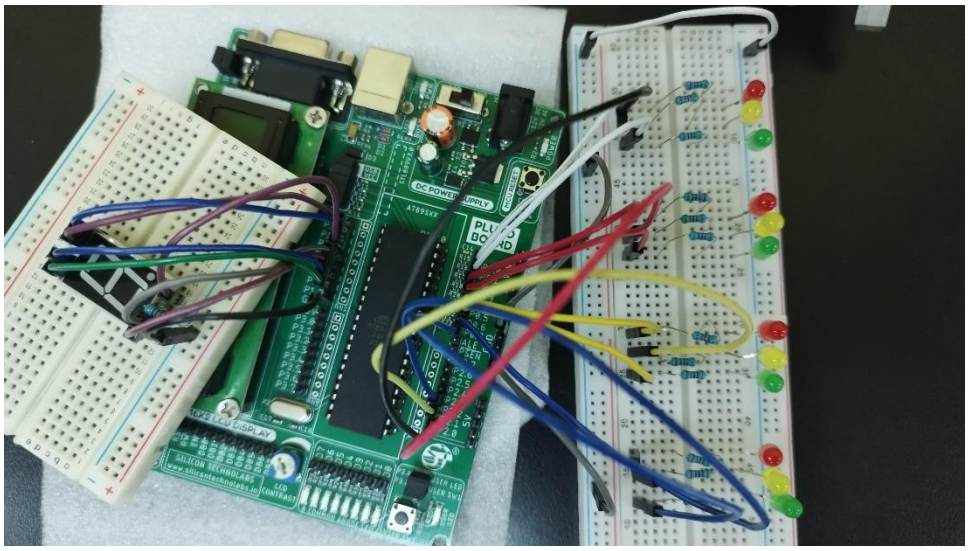
Stage 4:

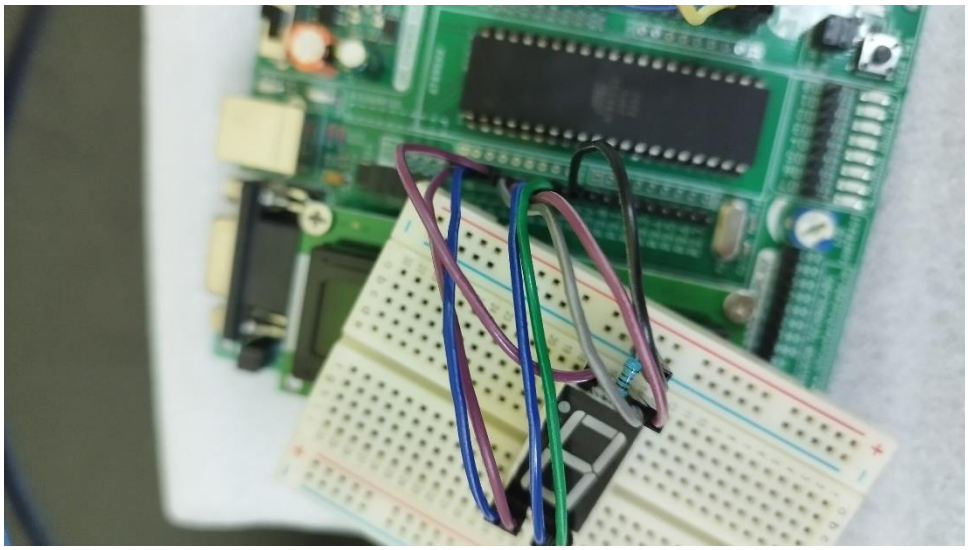
Finally, the West Green Light will be turned on, while the others remain Red Light. Vehicles from route D can enter routes A, E, and G. This traffic routine will be delayed about 8 seconds. For the last 4 seconds, the timer will light on and count down from 3 to 0. Then, it will turn to West Yellow light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

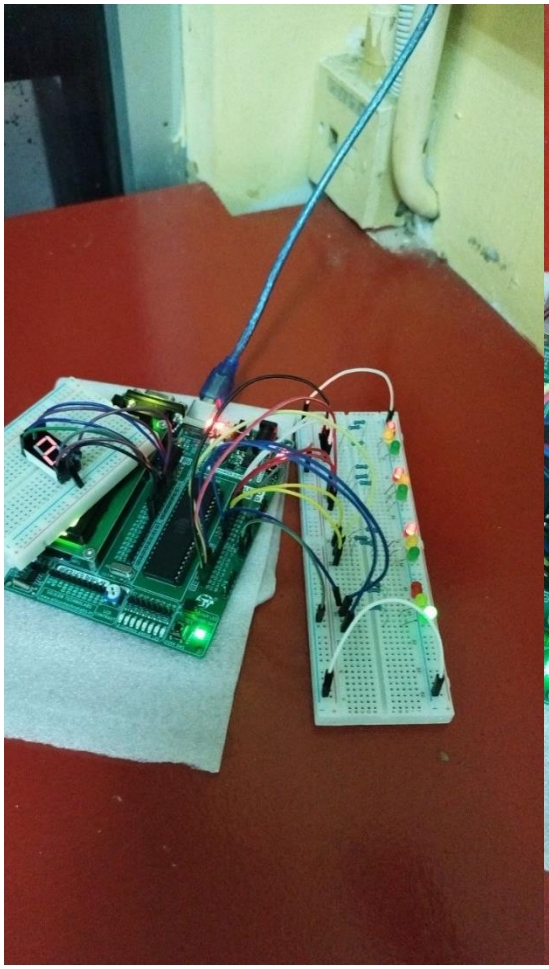
Note:

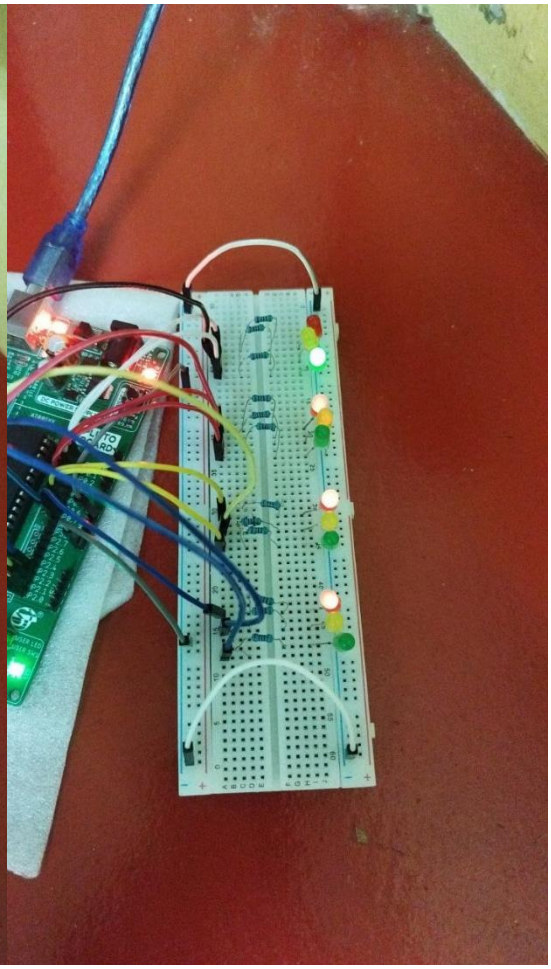
- The traffic lights in each stage are independent of each other.
- The stages repeat in a continuous loop.

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.