Required Design Parameters:

There are 4 road sections, as you can see in the diagram below. Initially the traffic of 1 section is flowing. After some time it stops and the adjacent section's traffic starts to flow. Similarly the traffic of section 3 and 4 will flow at their turn. Consider the flow as (North, East, South and West).

The traffic from a road section flows straight, left and right at the same time while all other traffic (from rest of the 3 road sections) is stopped. This means when the Green Light is 'On' on section 1, the 'Red' light will be 'On' on all other (3) road sections. Similar will be the case for other road sections as well.

The system should be designed for the following road intersection:

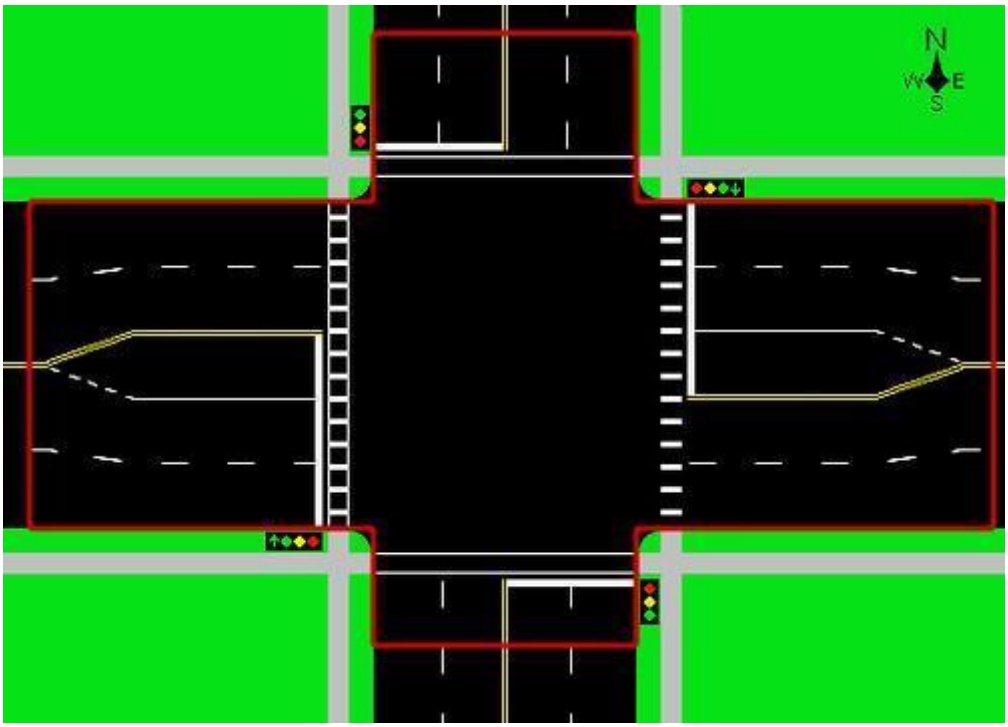

Figure No. 1

The traffic lights turn from 'Red' to 'Yellow' and then to 'Green'. Similarly, it turns from 'Green' to 'Yellow' to 'Red'. The duration for which each light is 'On' is different (e.g. Orange Light stays on for the shortest duration). Make sure no accident happens at the intersection. The whole design should be logical and all values used should be justifiable. You should be able to defend your design.

Design Strategy:

In order to regulate the traffic lights as per rules mentioned above, we used two port 2 & 3 of 8051 microcontroller to control light functioning. First three bits of port 2 are used for traffic signal at north, and three bits (4, 5 & 6) of port 2 are used for traffic signal at east. In same way, first three bits of port 3 are used for traffic signal at south, and three bits (4, 5 & 6) of port 2 are used for traffic signal at West. Now, 16 bit timer register is used for creating delay function. Furthermore, state diagram *as shown below* is implemented using the switch case in C language.

State Diagram:

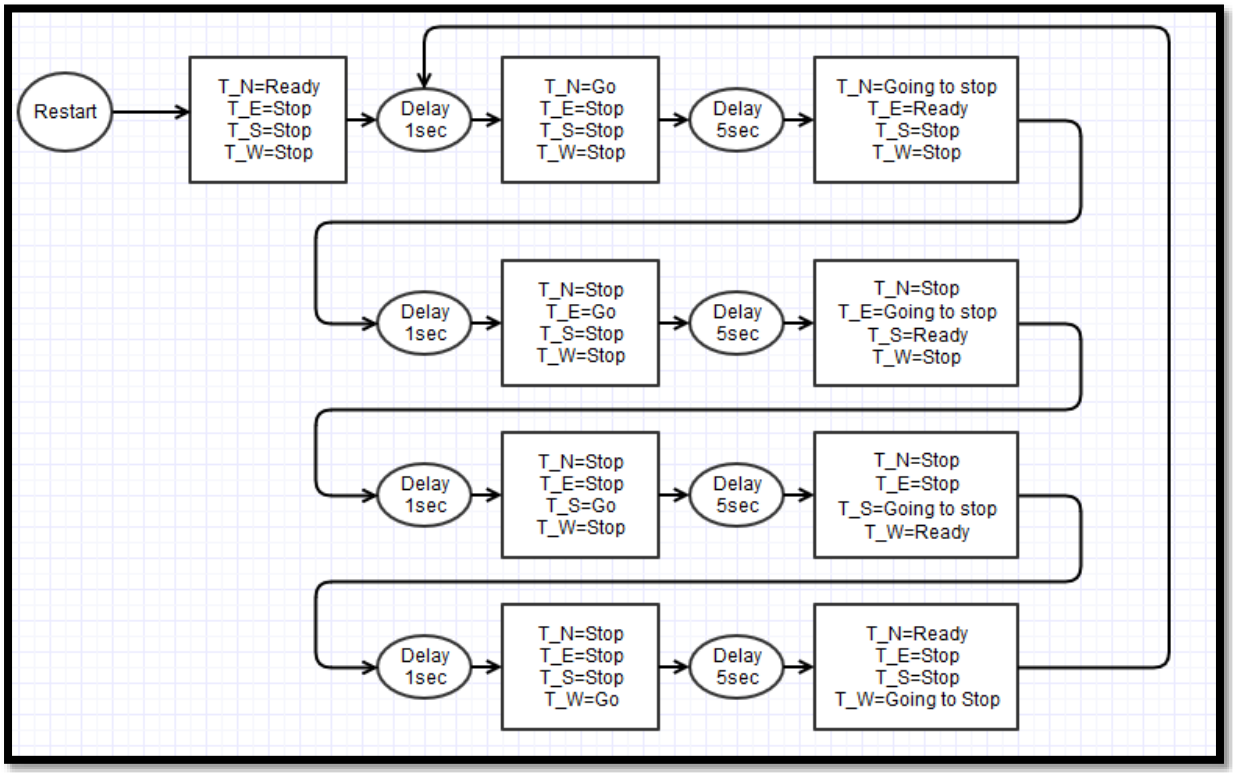

Figure No. 2 State Diagram of program

Embedded C Code of Program:

```
#include<reg51.h>        //Header file of generic 80C51

/*
R1, Y1, G1 are red,Yellow and green lights for north
side traffic regulate by first three bits of port 2 of 8051
*/
sbit R1=P2^0;
sbit Y1=P2^1;
sbit G1=P2^2;

/*
R2, Y2, G2 are red,Yellow and green lights for east
side traffic regulate by three bits(4,5&6) of port 2 of 8051
*/
sbit R2=P2^4;
sbit Y2=P2^5;
sbit G2=P2^6;

/*
R3, Y3, G3 are red,Yellow and green lights for south
side traffic regulate by first three bits of port 3 of 8051
*/
sbit R3=P3^0;
sbit Y3=P3^1;
sbit G3=P3^2;

/*
R4, Y4, G4 are red,Yellow and green lights for west
side traffic regulate by three bits(4,5&6) of port 3 of 8051
*/
sbit R4=P3^4;
sbit Y4=P3^5;
sbit G4=P3^6;


void Delay_msec(unsigned int);   //Delay Function declaration using onboard timer

void main()                      // Start of program
{
        int looper;                      //Variable to regulate the State of program
        TMOD=0x10;                       //Setting mode: timer,software based, 16 bit register
        looper=0;                        //Initialization of variable
        P2=0x12;                         //Initialization of port 2[Set Y1,R2]
        P3=0x11;                         //Initialization of port 3[Set R3,R4]
        Delay_msec(1000);        //calling delay function
  while(1)            // infinite loop
  {
        switch(looper)           //Switch case
        {
```

```
/*
Transition of traffic lights b/w North and East
*/
case 0 :
Y1=0;
G1=1;                           //Go signal for North traffic
Delay_msec(5000);       //Timer of 5 seconds
G1=0;
Y1=1;
R2=0;
Y2=1;                           //Ready signal for East traffic
Delay_msec(1000);       //Timer of 1 second
Y1=0;
R1=1;                           //Stop signal for North traffic
break;

/*
Transition of traffic lights b/w East and South
*/
case 1 :
Y2=0;
G2=1;                           //Go signal for East traffic
Delay_msec(5000);       //Timer of 5 seconds
G2=0;
Y2=1;
R3=0;
Y3=1;                           //Ready signal for South traffic
Delay_msec(1000);       //Timer of 1 second
Y2=0;
R2=1;                           //Stop signal for East traffic
break;

/*
Transition of traffic lights b/w South and West
*/
case 2 :
Y3=0;
G3=1;                            //Go signal for South traffic
Delay_msec(5000);        //Timer of 5 seconds
G3=0;
Y3=1;
R4=0;
Y4=1;                            //Ready signal for West traffic
```

```
Delay_msec(1000);        //Timer of 1 second
Y3=0;
R3=1;
break;                           //Stop signal for South traffic

/*
Transition of traffic lights b/w West and North
```

```
        */
        case 3 :
        Y4=0;
        G4=1;                           //Go signal for West traffic
        Delay_msec(5000);       //Timer of 5 seconds
        G4=0;
        Y4=1;
        R1=0;
        Y1=1;                           //Ready signal for North traffic
        Delay_msec(1000);       //Timer of 1 second
        Y4=0;
        R4=1;                           //Stop signal for West traffic
        break;
        default :
        break;
        }
        looper=looper+1;        //Increment in case
        looper=looper%4;        // To bound variable b/w 0 to 4
  }
}

void Delay_msec(unsigned int num_msec)        //Delay function with input in milliseconds
{
        int i;
        TH1=0x00;
        TL1=0x00;                                       //Clear the timer 1 register
        TR1=0x40;                                       //Start timer
/*
Timer register is 16 bit
Clock speed =occilator speed/12
Occilator Speed is 11.5 MHz
Timer register overflow in 71 milliseconds
*/
        for(i=0; i<num_msec/71;i++){ //Set delay
        TF1=0;                                          //Clear overflow flag
        while(TF1==0){                          //while overflow flag is clear
        }
        }
}
```

Proteus Simulation:

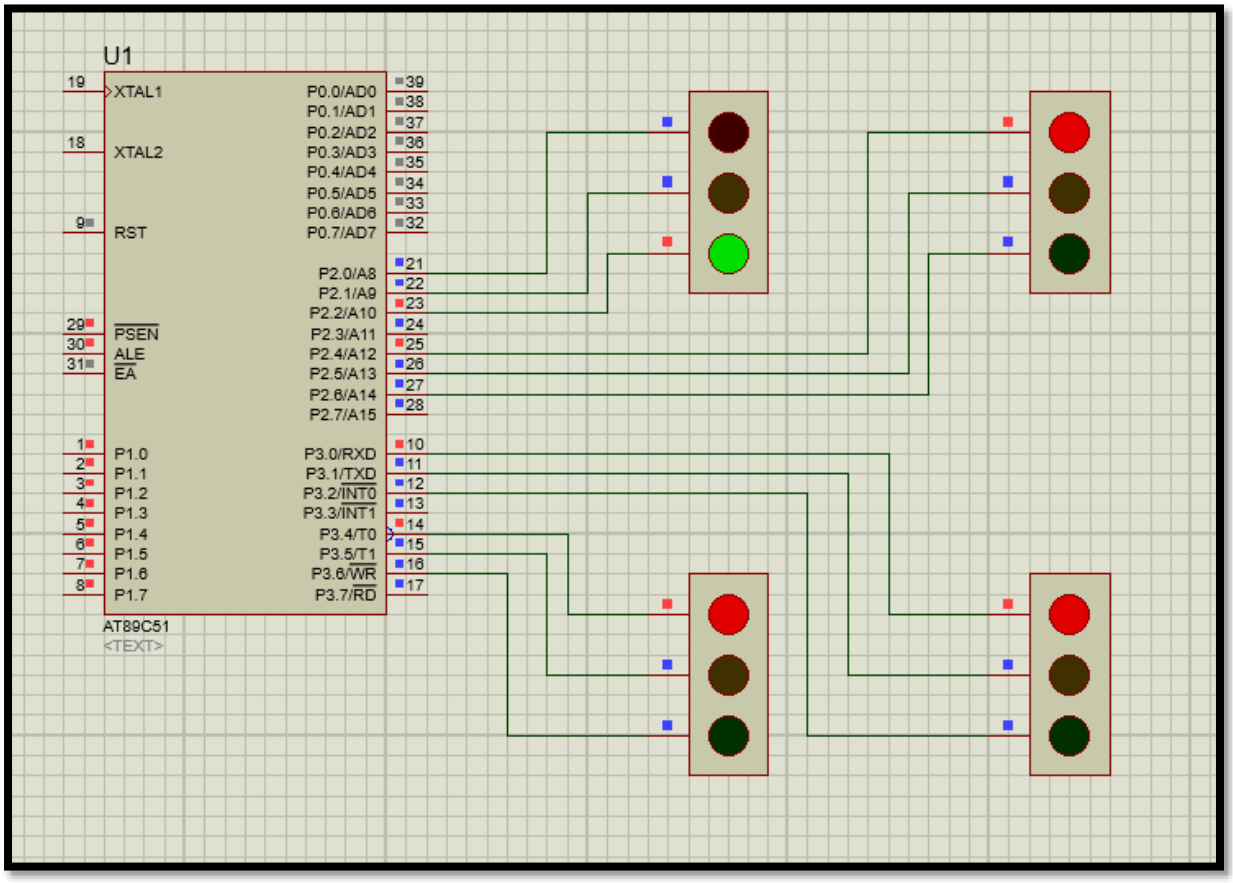

Figure No. 1 Proteus Simulation
