

# DLD PROJECT

**MCTE 2332**

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SECTION : 1

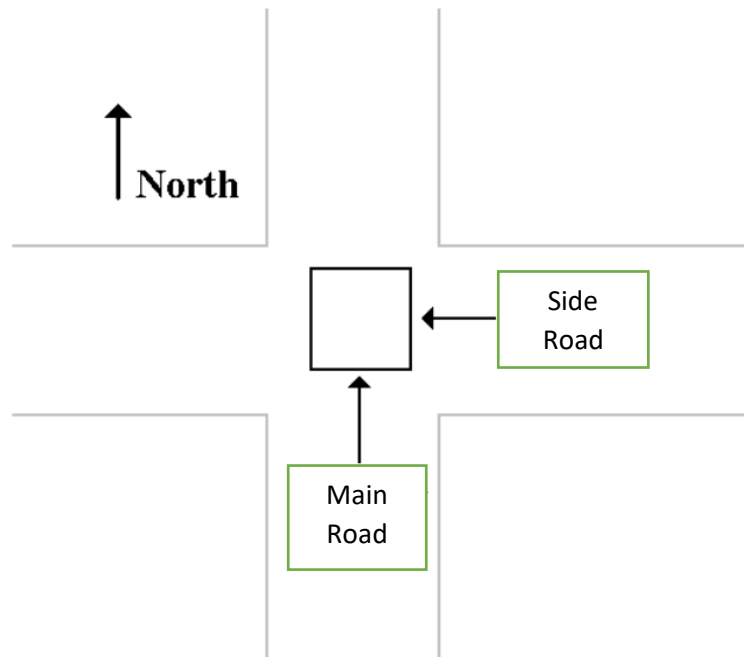
TOPIC :2-WAYS TRAFFIC LIGHT

## OBJECTIVES

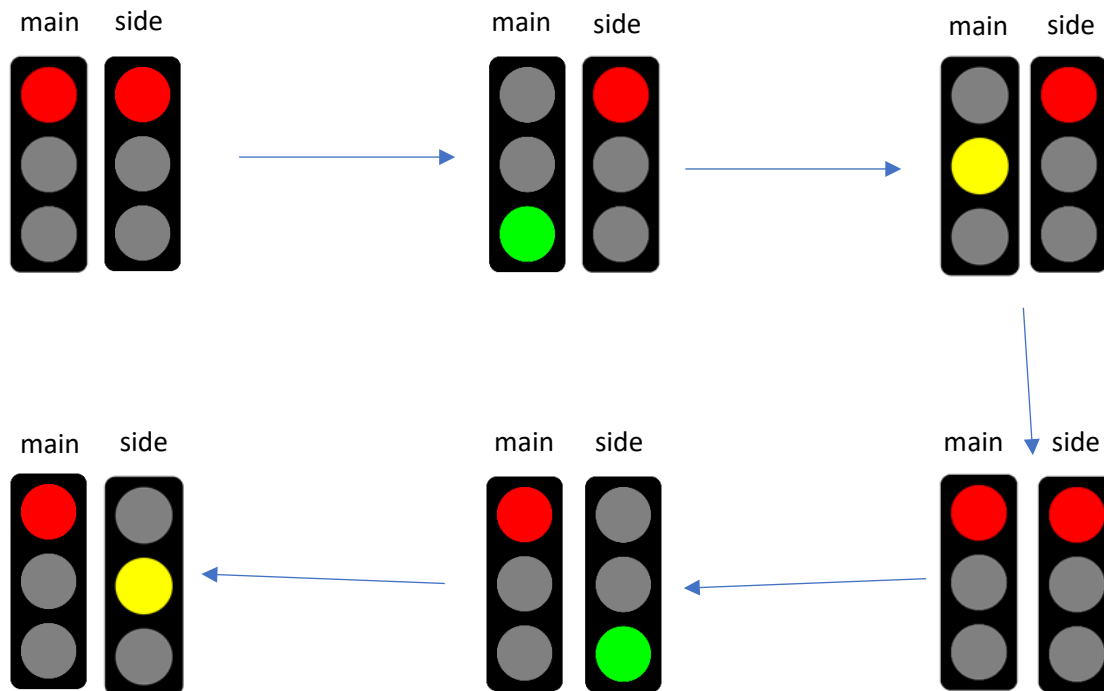
- To implement the knowledge that have learned in Digital System Design Topics.
- To make simple traffic light system that can be applied in daily life.

## DESIGN PROCESS

Assumption: two link pairs of traffic light.



If the main road is Green, the side road must be red.

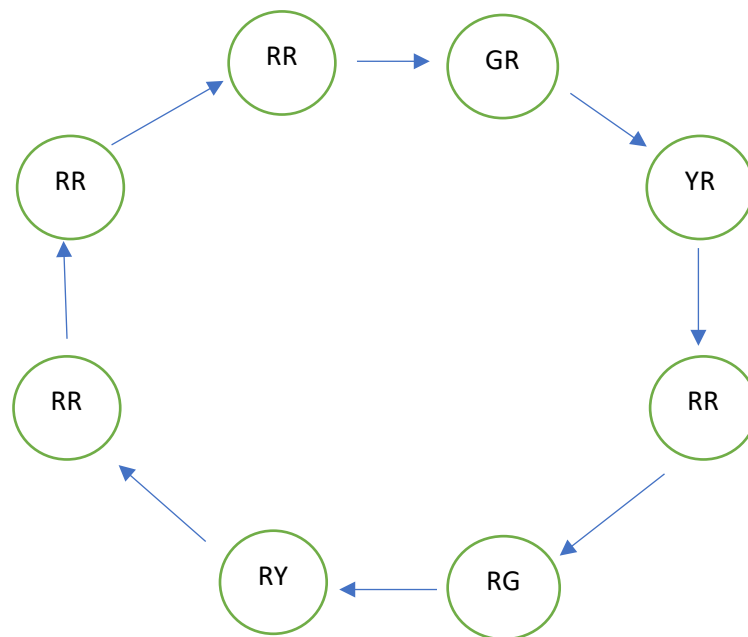


Name the state.

| State | Main   | Side   | Short form | Comment  |
|-------|--------|--------|------------|--|
| 0     | Red    | Red    | RR         | Both light red for a second                                |
| 1     | Green  | Red    | GR         | Main road is green. Traffic moving on one street           |
| 2     | Yellow | Red    | YR         | Traffic on side road must wait for this light to turn red. |
| 3     | Red    | Red    | RR         | Both light red for a second                                |
| 4     | Red    | Green  | RG         | Side road is green. Traffic moving on one street           |
| 5     | Red    | Yellow | RY         | Traffic on main road must wait for this light to turn red. |
| 6     | Red    | Red    | RR         | Both light red for a second                                |
| 7     | Red    | Red    | RR         | Both light red for a second, for safety purpose.           |

## DETAIL DESIGN

### STEP 1: STATE DIAGRAM



### STEP 2: ASSIGN 3-BIT BINARY NUMBER

| STATE | Q2 | Q1 | Q0 | SHORT FORM |
|-------|----|----|----|------------|
| 0     | 0  | 0  | 0  | RR         |
| 1     | 0  | 0  | 1  | GR         |
| 2     | 0  | 1  | 0  | YR         |
| 3     | 0  | 1  | 1  | RR         |
| 4     | 1  | 0  | 0  | RG         |
| 5     | 1  | 0  | 1  | RY         |
| 6     | 1  | 1  | 0  | RR         |
| 7     | 1  | 1  | 1  | RR         |

### STEP 3 : DERIVE THE OUTPUT EQUATION

| STATE | S.F | Q2 Q1 Q0 | R1 | G1 | Y1 | R2 | G2 | Y2 |
|-------|-----|----------|----|----|----|----|----|----|
| 0     | RR  | 0 0 0    | 1  | 0  | 0  | 1  | 0  | 0  |
| 1     | GR  | 0 0 1    | 0  | 1  | 0  | 1  | 0  | 0  |
| 2     | YR  | 0 1 0    | 0  | 0  | 1  | 1  | 0  | 0  |
| 3     | RR  | 0 1 1    | 1  | 0  | 0  | 1  | 0  | 0  |
| 4     | RG  | 1 0 0    | 1  | 0  | 0  | 0  | 1  | 0  |
| 5     | RY  | 1 0 1    | 1  | 0  | 0  | 0  | 0  | 1  |
| 6     | RR  | 1 1 0    | 1  | 0  | 0  | 1  | 0  | 0  |
| 7     | RR  | 1 1 1    | 1  | 0  | 0  | 1  | 0  | 0  |

The output equation:

$$G1 = Q2' Q1' Q0$$

$$Y1 = Q2' Q1 Q0'$$

$$R1 = (G1 + Y1)'$$

$$G2 = Q2 Q1' Q0'$$

$$Y2 = Q2 Q1' Q0$$

$$R2 = (G2 + Y2)'$$

### STEP 4 : DERIVE THE STATE TABLE

| STATE | PRESENT STATE |    |    | NEXT STATE |    |    |
|-------|---------------|----|----|------------|----|----|
|       | Q2            | Q1 | Q0 | Q2         | Q1 | Q0 |
| 0     | 0             | 0  | 0  | 0          | 0  | 1  |
| 1     | 0             | 0  | 1  | 0          | 1  | 0  |
| 2     | 0             | 1  | 0  | 0          | 1  | 1  |
| 3     | 0             | 1  | 1  | 1          | 0  | 0  |
| 4     | 1             | 0  | 0  | 1          | 0  | 1  |
| 5     | 1             | 0  | 1  | 0          | 0  | 0  |
| 6     | 1             | 1  | 0  | 0          | 0  | 0  |
| 7     | 1             | 1  | 1  | 0          | 0  | 0  |

# STEP 5: SELECT THE FLIP FLOP

Use **D flip flop**.

| Q | Q(t+1) | D |
|---|--------|---|
| 0 | 0      | 0 |
| 0 | 1      | 1 |
| 1 | 0      | 0 |
| 1 | 1      | 1 |

D flip flop transition table.

# STEP 6: DERIVE THE INPUT TABLE

| STATE | PRESENT STATE |          |     | NEXT STATE |    |    | D FLIP FLOP |  |  |
|-------|---------------|----------|-----|------------|----|----|-------------|--|--|
|       | S.F           | Q2 Q1 Q0 | S.F | Q2 Q1 Q0   | D2 | D1 | D0          |  |  |
| 0     | RR            | 0 0 0    | GR  | 0 0 1      | 0  | 0  | 1           |  |  |
| 1     | GR            | 0 0 1    | YR  | 0 1 0      | 0  | 1  | 0           |  |  |
| 2     | YR            | 0 1 0    | RR  | 0 1 1      | 0  | 1  | 1           |  |  |
| 3     | RR            | 0 1 1    | RG  | 1 0 0      | 1  | 0  | 0           |  |  |
| 4     | RG            | 1 0 0    | RY  | 1 0 1      | 1  | 0  | 1           |  |  |
| 5     | RY            | 1 0 1    | RR  | 0 0 0      | 0  | 0  | 0           |  |  |
| 6     | RR            | 1 1 0    | RR  | 0 0 0      | 0  | 0  | 0           |  |  |
| 7     | RR            | 1 1 1    | RR  | 0 0 0      | 0  | 0  | 0           |  |  |

The equation from the present:

$$D2 = Q2' Q1 Q0 + Q2 Q1' Q0'$$

$$D1 = Q2' Q1' Q0 + Q2' Q1 Q0'$$

$$D0 = Q2' Q1' Q0' + Q2' Q1 Q0' + Q2 Q1' Q0'$$

$$= Q1' Q0' (Q2 + Q2') + Q2' Q1 Q0'$$

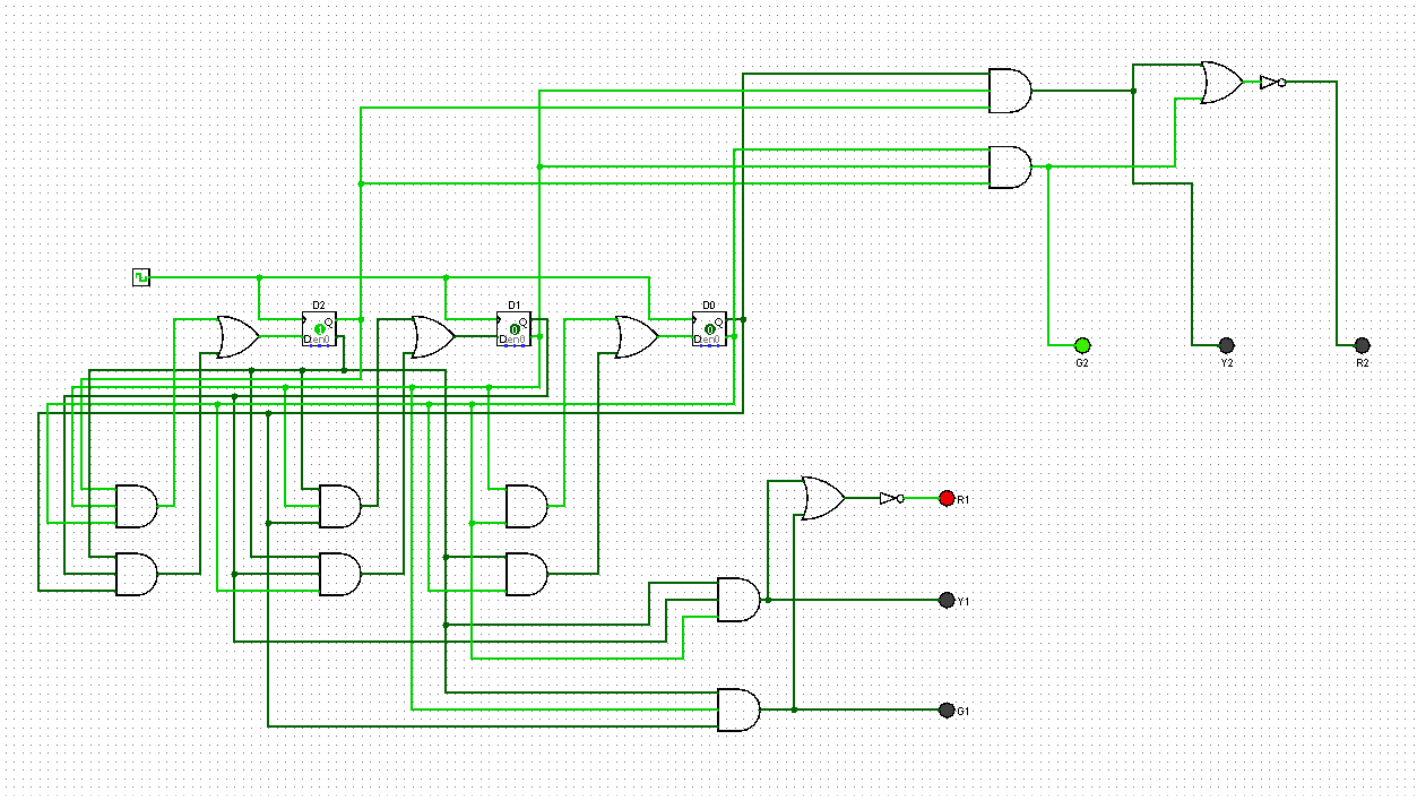
$$= Q1' Q0' + Q2' Q1 Q0'$$

$$= Q0' (Q1' + Q1 Q2')$$

$$= Q0' (Q1' + Q2')$$

$$= Q0' Q1' + Q2' Q0'$$

## STEP 7: DRAW THE CIRCUIT.



## CONCLUSION

From this project it can be concluded that there are 7 steps that must be followed to make a simple traffic light system. In addition, we can use the same method to make three or more ways of traffic light road but the process might be more challenging as we have to deal with more than 3-bit of binary number. Furthermore, instead of using D flip flop as the input for the traffic light, JK flip flop and T flip flop also can be used in this project. Just follow these steps and change the D flip flop to others.