

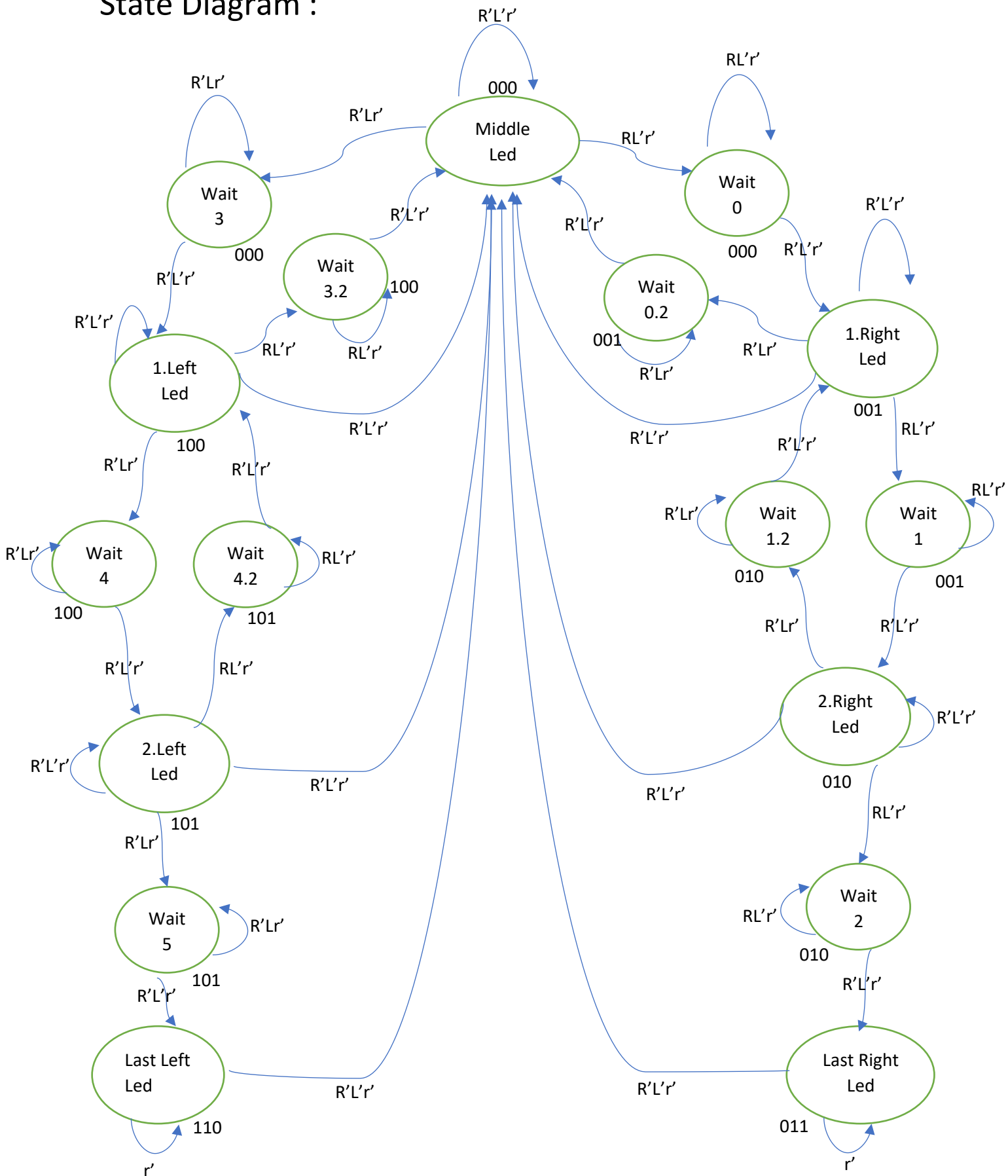
# **LOGIC CIRCUIT AND DESIGN**

## **PROJECT #1**

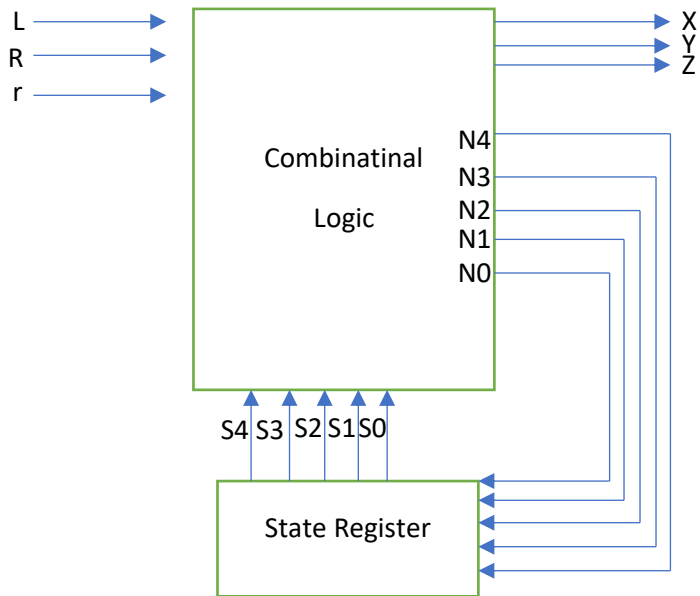
**MUSTAFA TOKGÖZ      171044077**

R = Right Button L=Left Button r=Reset Button

## State Diagram :



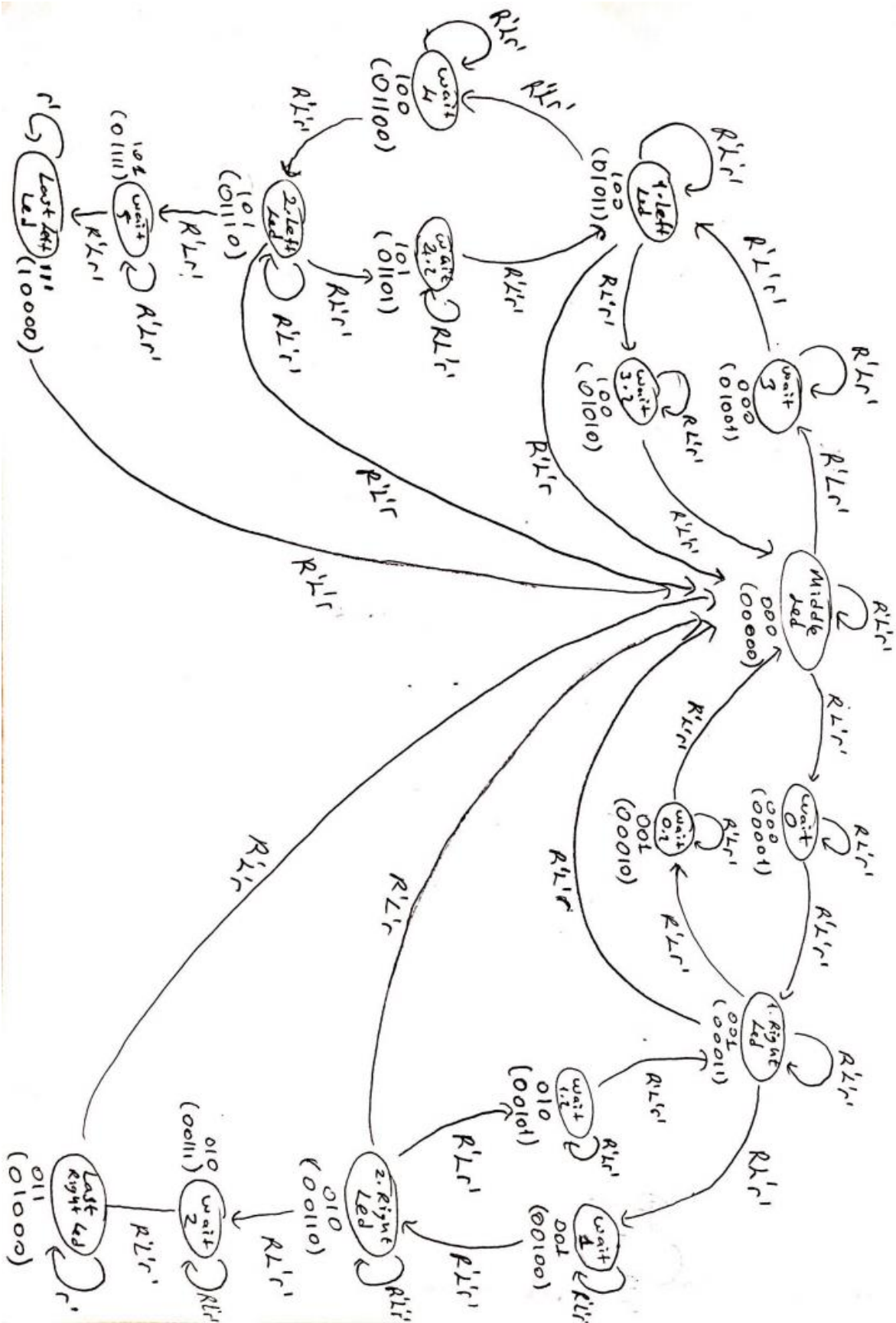
## Setting up Arhitecture



## Encoding the states:

MiddleLed=00000 , Wait0=00001 , Wait0.2=00010 , 1.RightLed=00011 ,  
Wait1=00100 , Wait1.2=00101 , 2.RightLed=00110 , Wait2=00111 ,  
LastRightLed=01000 , Wait3=01001 , Wait3.2=01010 , 1.LeftLed=01011 ,  
Wait4=01100 , Wait4.2=01101 , 2.LeftLed=01110 , Wait5=01111 ,  
LastLeftLed=10000

Scanned Paper:



## Truth Table:

| L | R | r | S4 | S3 | S2 | S1 | S0 | N4 | N3 | N2 | N1 | N0 | X | Y | Z |
|---|---|---|----|----|----|----|----|----|----|----|----|----|---|---|---|
| 0 | 0 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 |
| 0 | 0 | 1 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 |
| 0 | 1 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 |
| 0 | 1 | 1 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 |
| 1 | 0 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 1  | 0 | 0 | 0 |
| 1 | 0 | 1 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 |
| 1 | 1 | 0 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 |
| 1 | 1 | 1 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 |
| 0 | 0 | 0 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 1  | 1  | 0 | 0 | 1 |
| 0 | 0 | 1 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 |
| 0 | 1 | 0 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 |
| 0 | 1 | 1 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 |
| 1 | 0 | 0 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 |
| 1 | 0 | 1 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 |
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| 1 | 1 | 1 | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0 | 0 | 0 |
| 0 | 0 | 0 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 1  | 0 | 0 | 1 |
| 0 | 0 | 1 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 |
| 0 | 1 | 0 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 1  | 0  | 0  | 0 | 0 | 1 |
| 0 | 1 | 1 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 1  | 0 | 0 | 1 |
| 1 | 0 | 0 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 0  | 0 | 0 | 1 |
| 1 | 0 | 1 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 1  | 0 | 0 | 1 |
| 1 | 1 | 0 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 1  | 0 | 0 | 1 |
| 1 | 1 | 1 | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 1  | 1  | 0 | 0 | 1 |
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|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
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| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
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| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
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| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
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|   |   |   |  |   |   |   |   |   |  |   |   |   |   |   |  |   |   |   |
|---|---|---|--|---|---|---|---|---|--|---|---|---|---|---|--|---|---|---|
| 0 | 0 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 1 | 0 | 1 |
| 0 | 1 | 0 |  | 0 | 1 | 1 | 1 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 1 | 0 | 1 |
| 0 | 1 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 1 | 0 | 1 |
| 1 | 0 | 0 |  | 0 | 1 | 1 | 1 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 1 | 0 | 1 |
| 1 | 0 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 1 | 0 | 1 |
| 1 | 1 | 0 |  | 0 | 1 | 1 | 1 | 1 |  | 0 | 1 | 1 | 1 | 1 |  | 1 | 0 | 1 |
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| 1 | 0 | 0 |  | 1 | 0 | 0 | 0 | 0 |  | 1 | 0 | 0 | 0 | 0 |  | 1 | 1 | 0 |
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| 1 | 1 | 1 |  | 1 | 0 | 0 | 0 | 0 |  | 1 | 0 | 0 | 0 | 0 |  | 1 | 1 | 0 |

To avoid confusion  $a = L$  ,  $b = R$  ,  $c = r$  ,  $d = S4$  ,  $e = S3$  ,  $f = S2$  ,  $g = S1$  ,  $h = S0$

```
N4 = (a && d && !e && !f && !g && !h) || (!a && !b && !c && !d && e && f && g && h)
      || (b && d && !e && !f && !g && !h) || (!c && d && !e && !f && !g && !h)
```

**N3** = (a && ! b && ! c && ! d && ! f && ! g && ! h) || (a && ! d && e && ! f) || (! a && ! b && ! c && ! d && ! e && f && g && h) || (! a && ! c && ! d && e && ! g && ! h) || (! a && ! d && e && f && ! g && ! h) || (b && ! d && e && ! f) || (c && ! d && e && ! f && g && ! h) || (! c && ! d && e && ! f && h) || (! d && e && ! f && ! g && h) || (a && ! d && e && f) || (b && ! d && e && f && g) || (c && ! d && e && f && h) || (! c && ! d && e && f && g && ! h) || (! d && e && f && ! g && h)

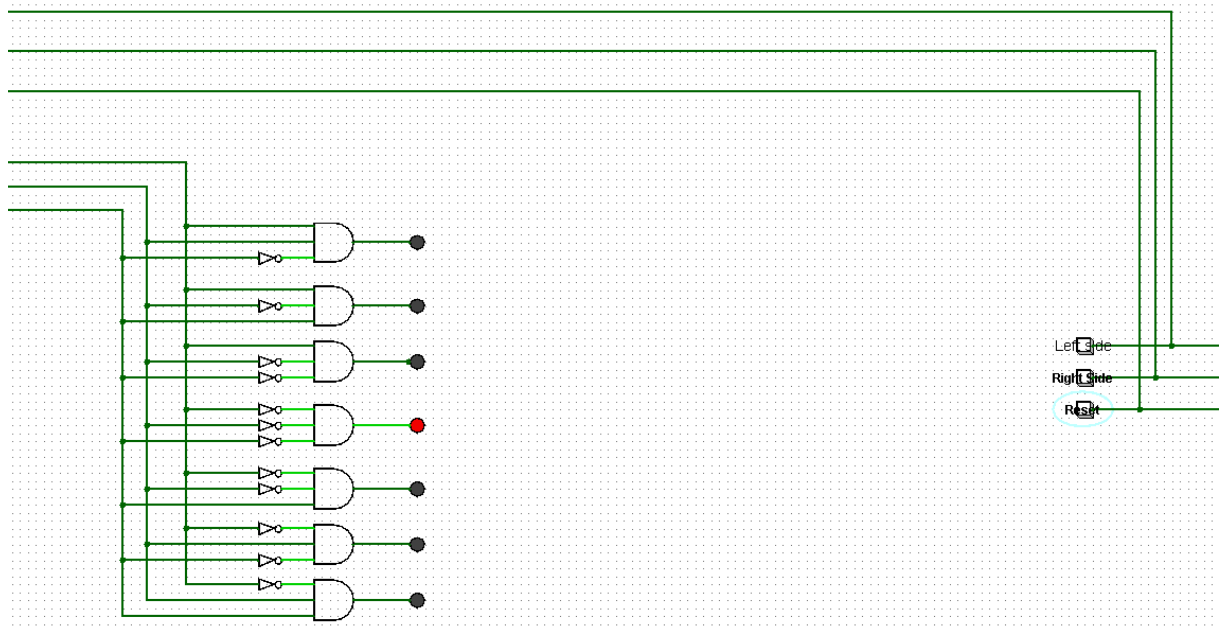
**N2** = (a && ! b && ! c && ! d && e && ! f && g && h) || (a && ! d && ! e && f) || (! a && b && ! c && ! d && ! e && g && h) || (! a && ! b && ! d && f && ! g && ! h) || (! a && ! c && ! d && f && ! g && ! h) || (b && ! d && ! e && f) || (c && ! d && ! e && f && h) || (! c && ! d && ! e && f && ! h) || (a && ! d && e && f) || (b && c && ! d && e && f) || (b && ! d && e && f && h) || (c && ! d && e && f && h) || (! c && ! d && e && f && g && ! h)

**N1** = (a && c && ! d && ! e && g) || (a && ! d && ! e && ! f && g) || (a && ! d && ! e && g && h) || (! a && ! b && ! c && ! d && ! e && f && ! g) || (! a && ! b && ! c && ! d && ! e && f && ! h) || (! a && ! b && ! c && ! d && ! f && h) || (! a && ! c && ! d && e && ! f && g && h) || (b && c && ! d && ! e && g) || (b && ! d && ! e && f && g) || (b && ! d && ! e && g && ! h) || (c && ! d && ! e && f && g && h) || (c && ! d && ! e && ! f && g && ! h) || (a && b && ! d && e && g) || (a && c && ! d && e && g) || (a && ! d && e && f && g) || (a && ! d

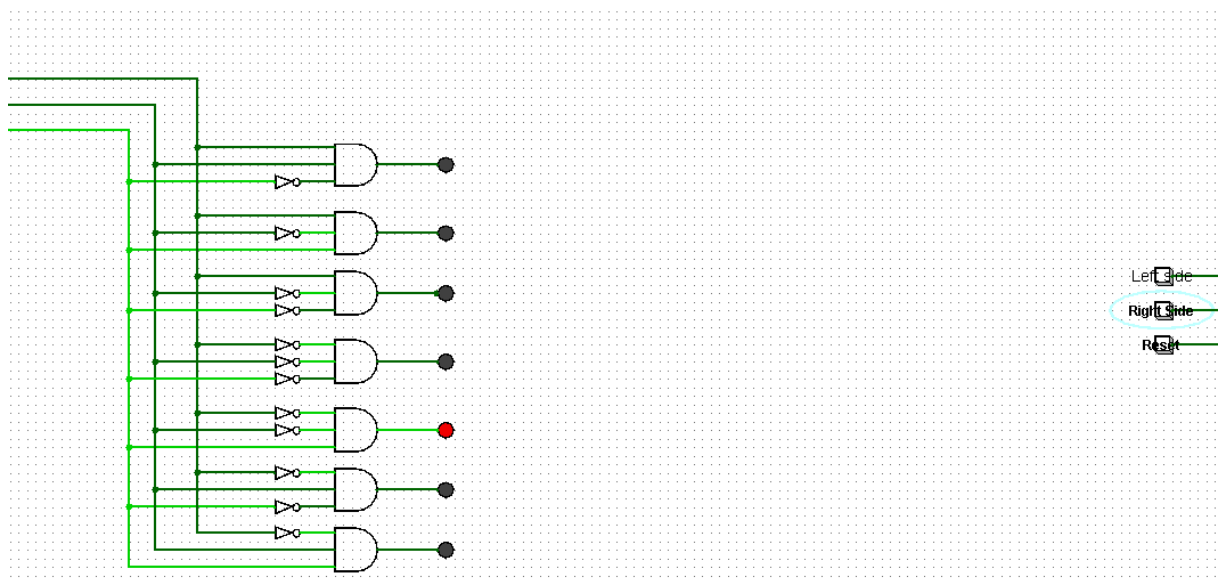


## Results :

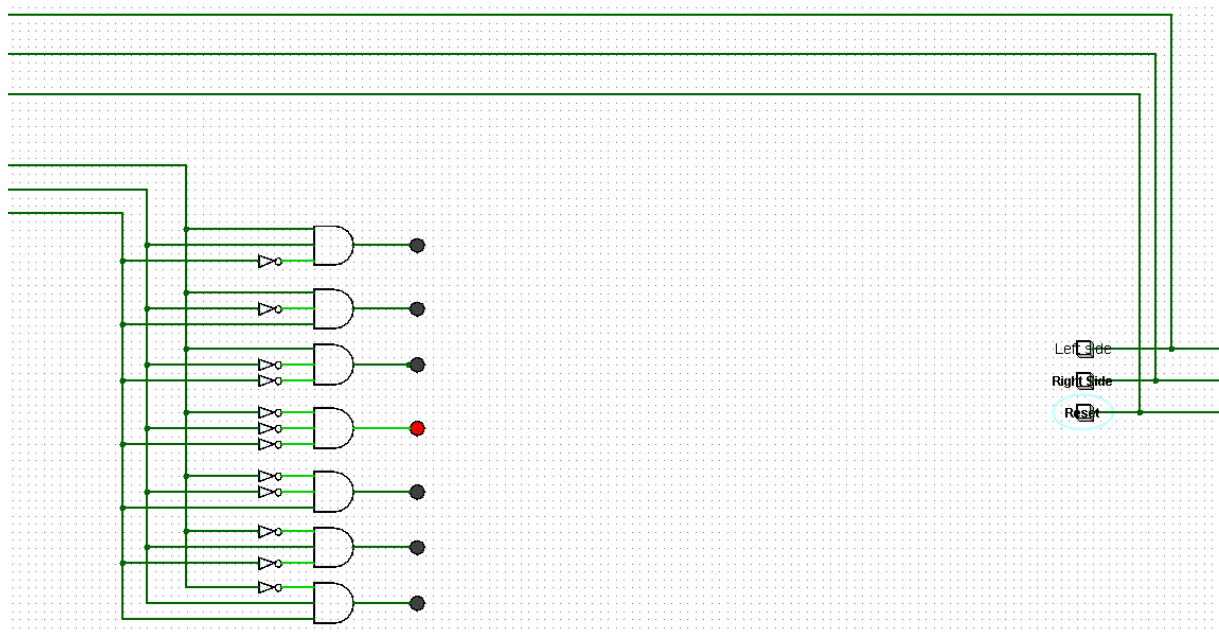
At the beginning



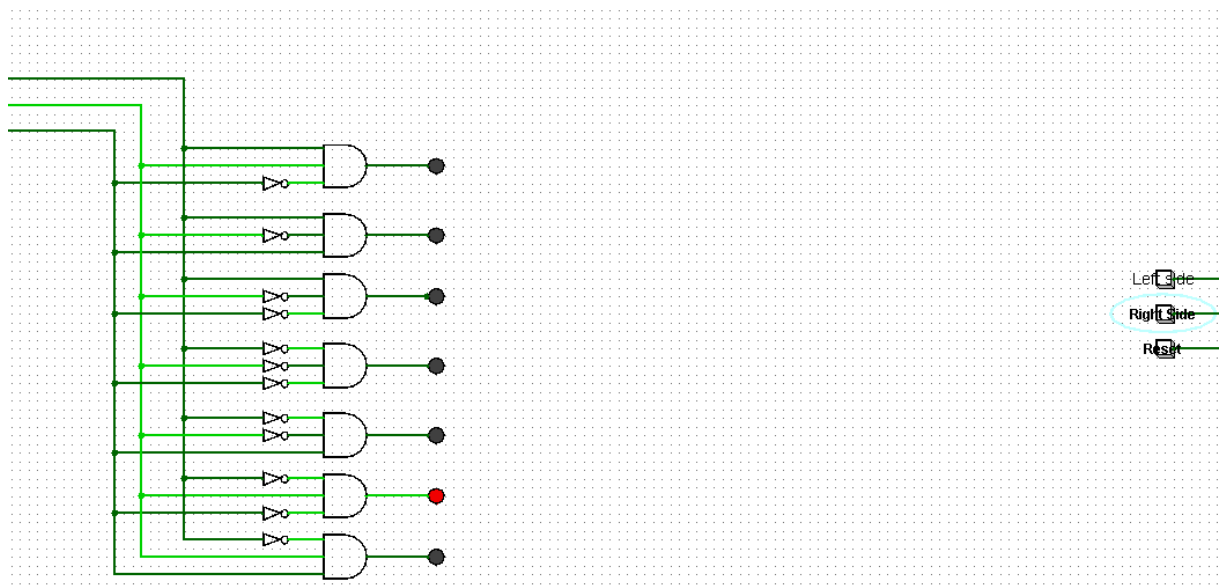
Pushing Right button long time then pulling from the button



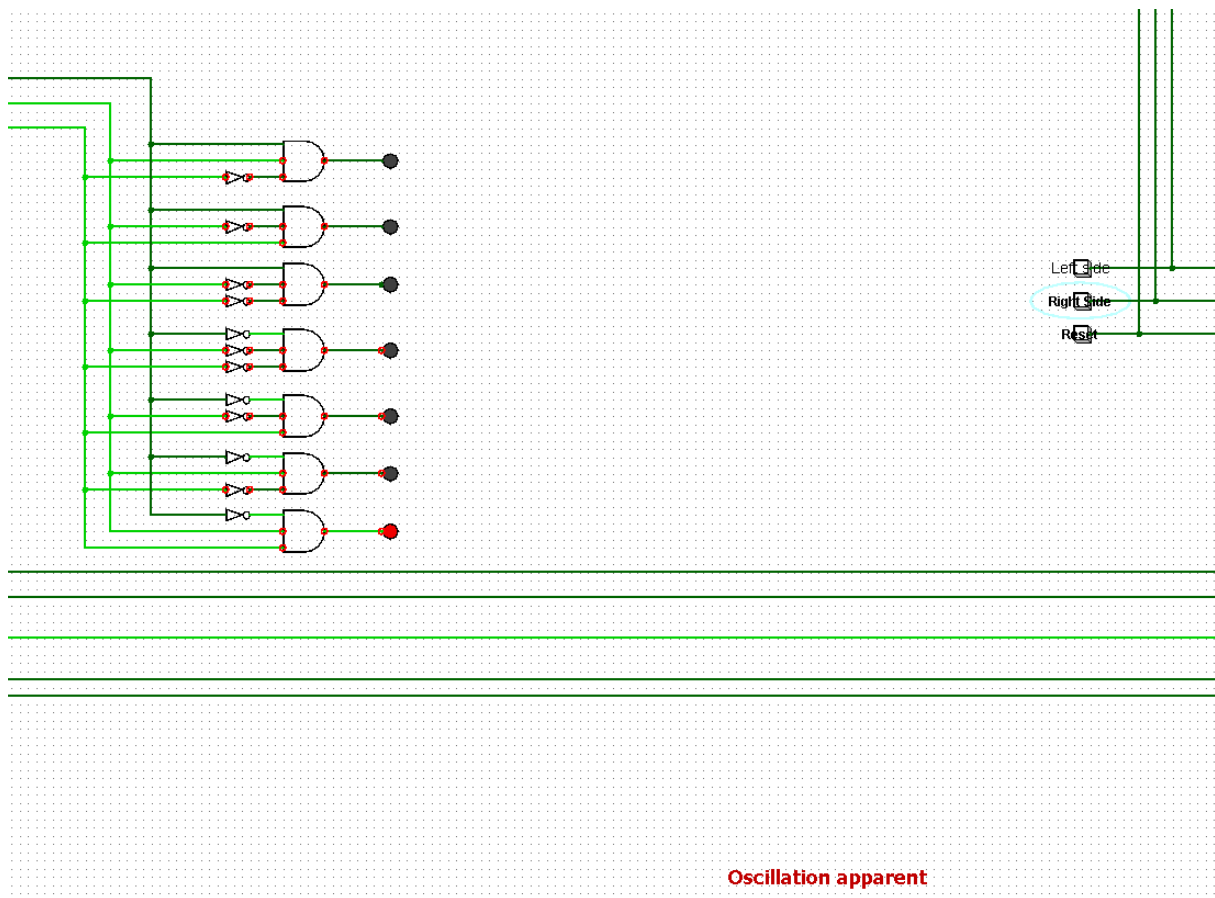
Then Pushing left button to control if it comes back or not



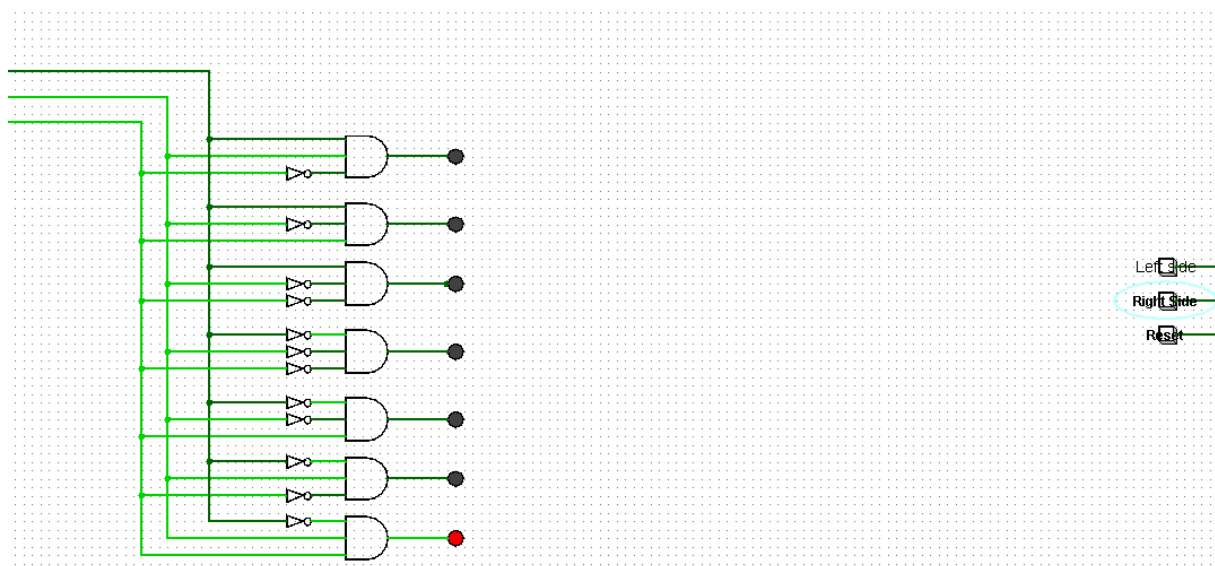
Pushing right two times



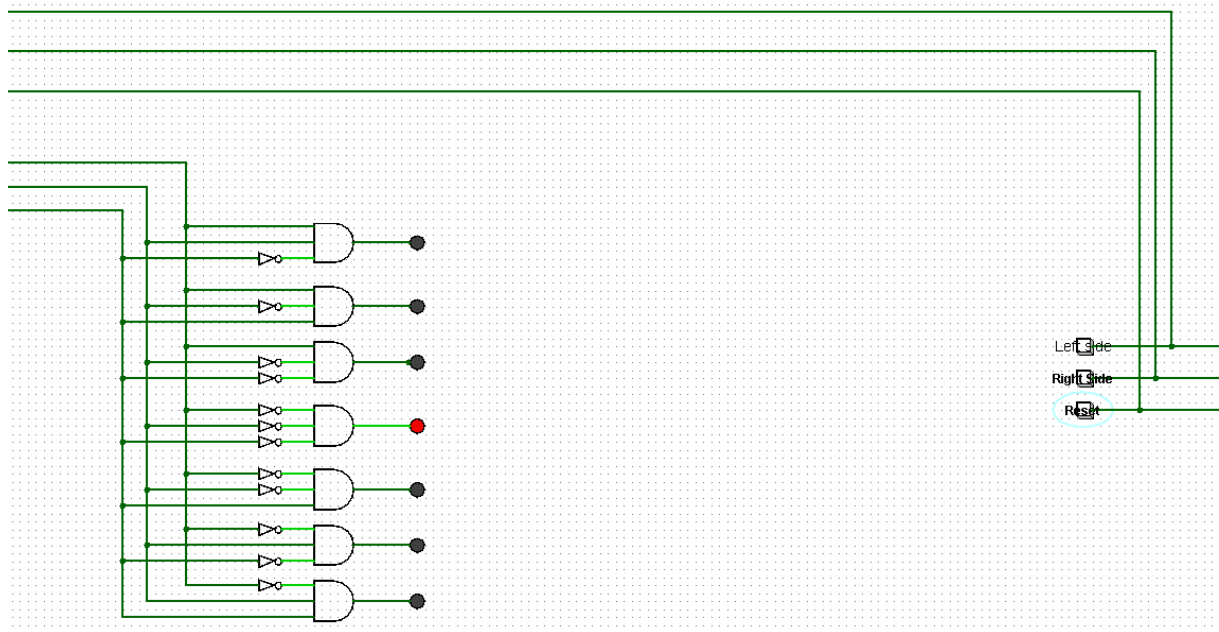
Then Pushing right for winning the game



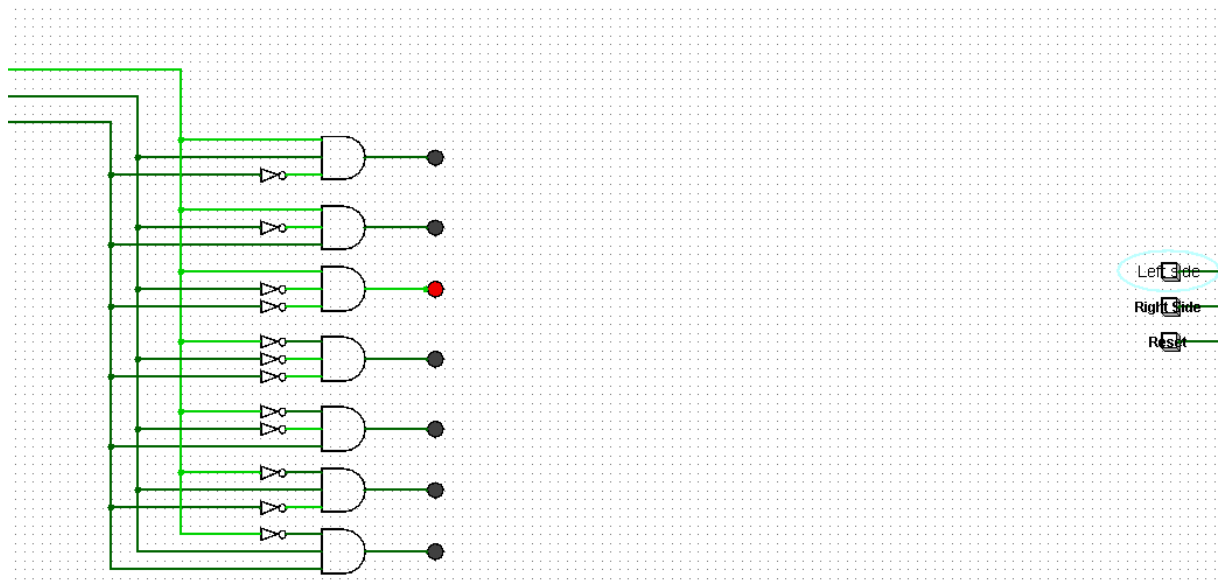
So There is a problem here .I don't know why ,but It occurs Oscillation apparent problem. Maybe I did some mistakes when I simplify equations or connect wires . When you push simulation enable button , simulation continues from that led.



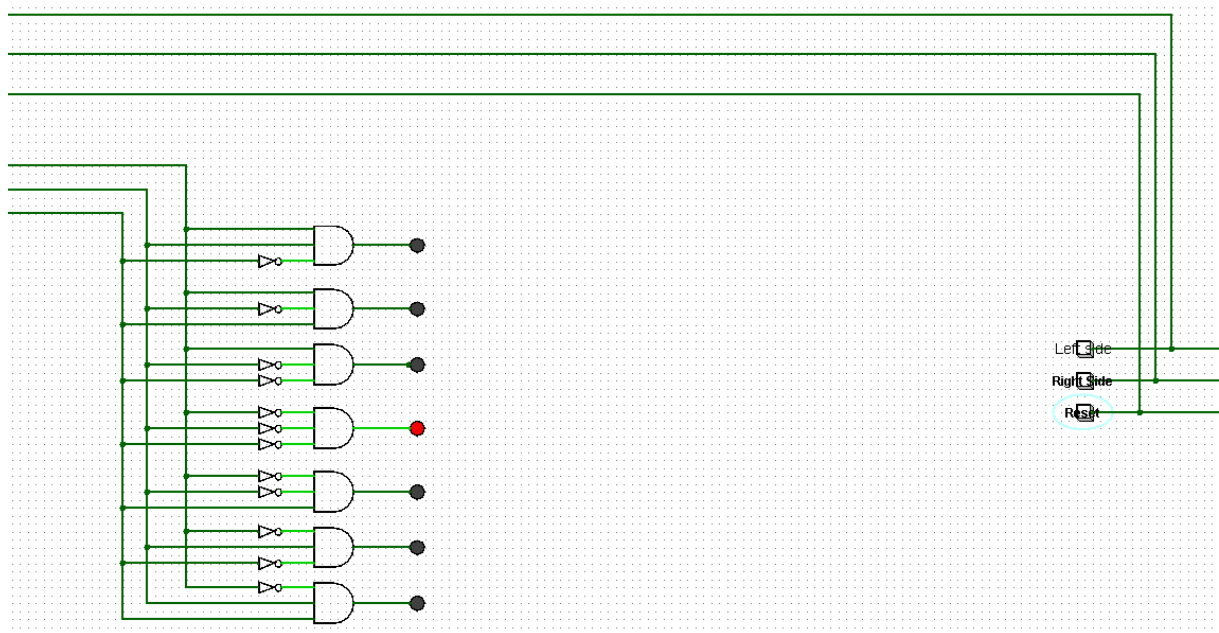
Then if you push right and left button , there won't be any changing. You can push reset button to reset the game.



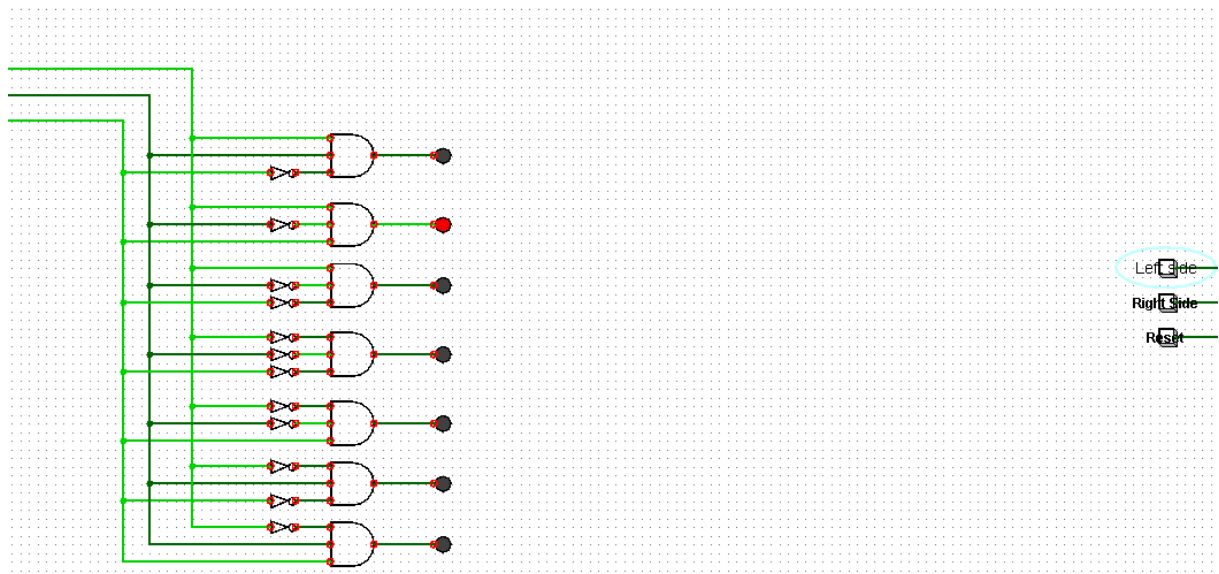
Then pushing left button



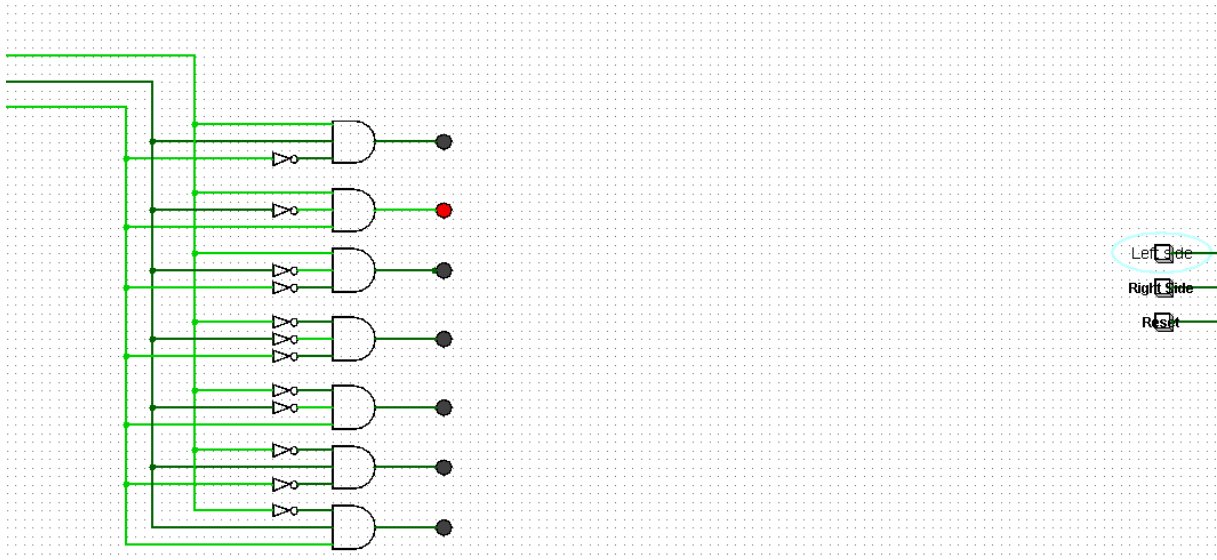
Then pushing right button to control whether it comes back or not



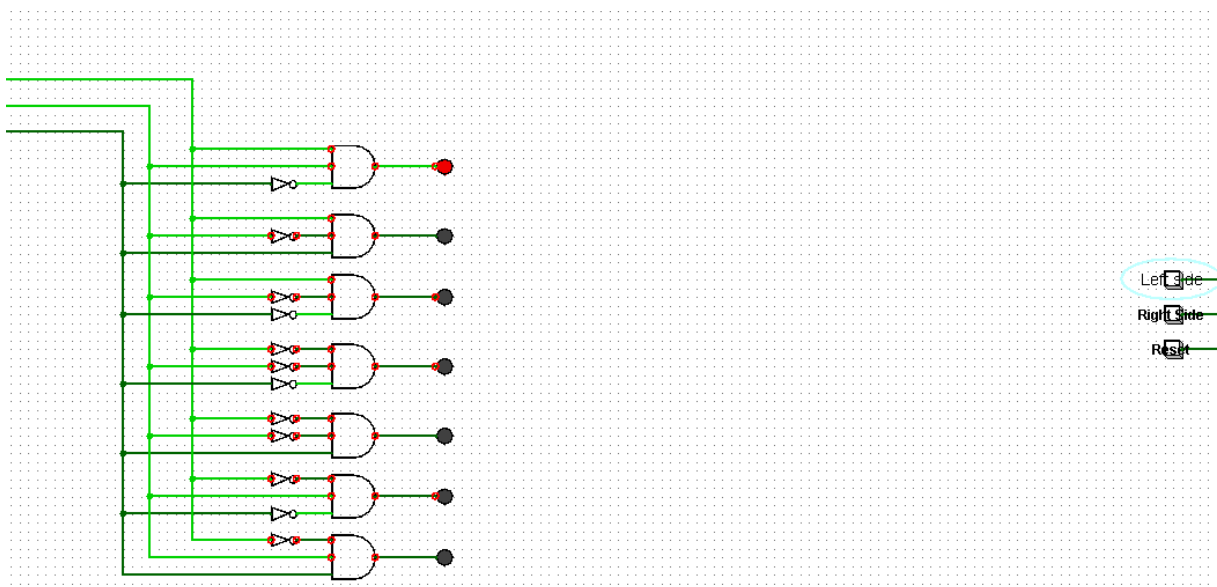
Then pushing left button two times



There is a Oscillation Apperent problem again. It occurs when you arrive 2. left led. Maybe I did some mistakes when I simplify equations or connect wires . When you push simulation enable button , simulation continues from that led.

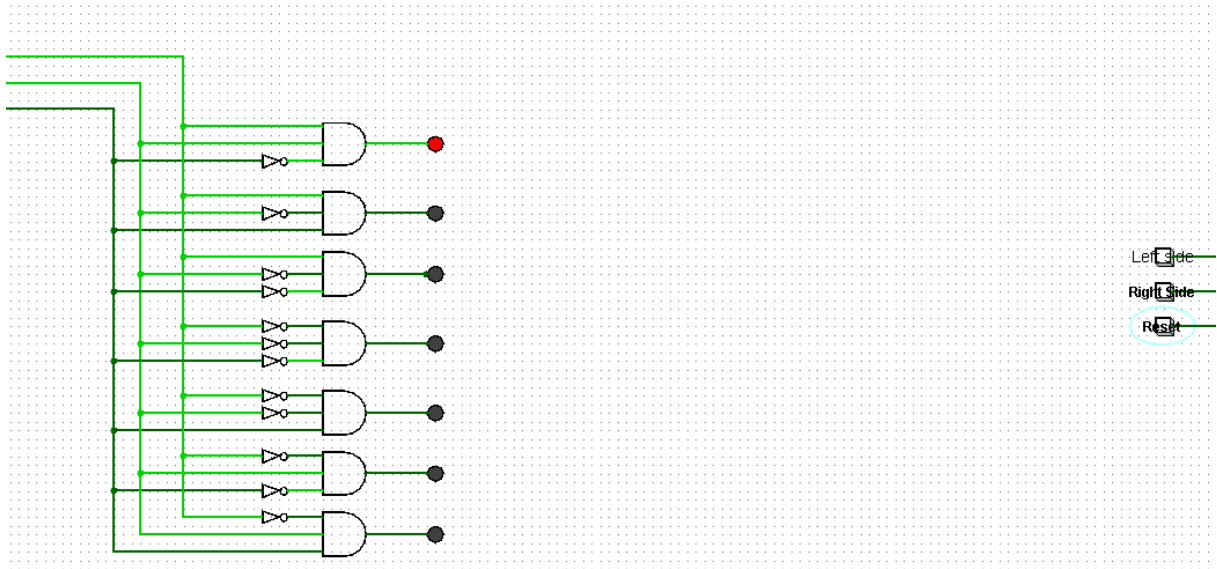


Then again pushing left button to win the game



But there is again Oscillation apparent problem. Maybe I did some mistakes when I simplify equations or connect wires . When you push simulation enable button , simulation continues from that led.





So there are 3 Oscillation Apperant Problem that I face 2.Right led , 2. Left led and Last Left led. Otherhand It works fine , When you push reset or when 2 people push buttons at the same time or when person push the button long time and when person win the game (right button and left button should not affect).

Mustafa Tokgöz

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