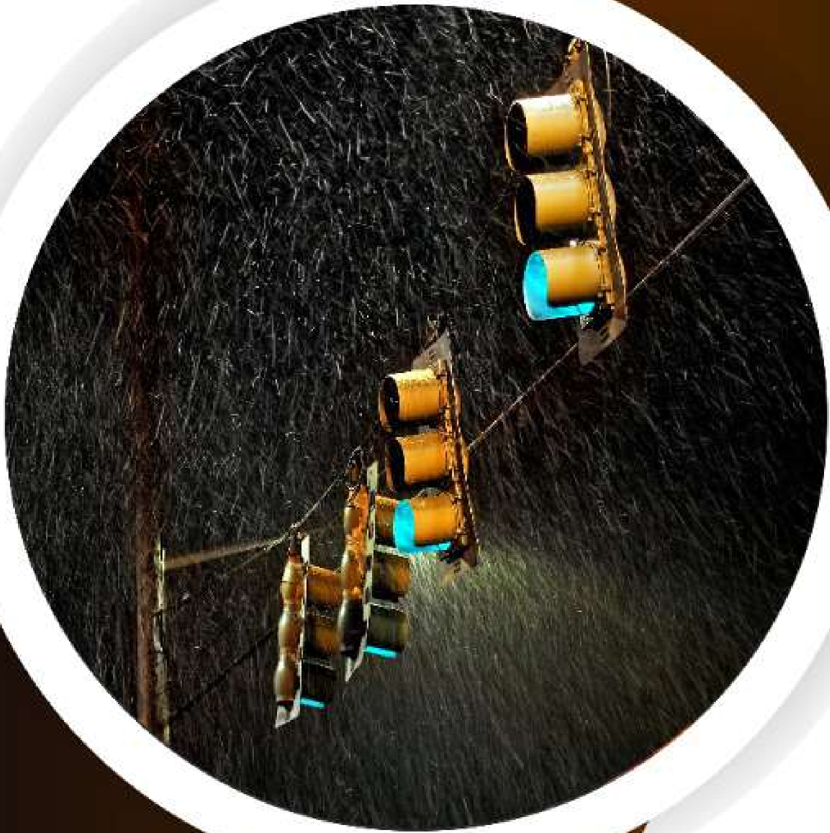
PROJECT



TRAFFIC CONTROL SYSTEM

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DIGITAL LOGIC DESIGN

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Introduction

Traffic lights, also known as traffic signals, traffic lamps, signal lights. Robots are signaling devices positioned at or near road intersections, pedestrian crossings, and other locations to control competing flows of traffic. Traffic lights were first installed in 1868 in London, United Kingdom; now used in almost every city of the world. Traffic lights alternate the right of way accorded to road users by displaying lights of a standard color (red, yellow/amber, and green) following a universal color code. In the recent years, the need of transportation has gain immense importance for logistics as well as for common human. This has given rise to the number of vehicles on the road. Due to this reason, traffic jams and road accidents are a common sight in any busy city. Traffic Signals provide an easy, cheap, automatic, and justified solution to the road points where the vehicles may turn to other directions e.g., roundabouts, culverts, busy walk throughs etc.

The project that is chosen is a one-way traffic controller using logic gates. The basic idea behind the design is to avoid the collision of vehicles by providing appropriate signals to different directions for a limited time slot, after which the next waiting drivers will be given same treatment. In this way a cycle will be established which will control the traffic.

Design Procedure

The concept of sequential circuit has been implemented that gives a great advantage in displaying a sequence of outputs that are continuously being run in a cycle for infinite number of time until the power supplied is being cutoff. The components that are used are NOT gates (Inverter), AND gates, J-K flip-flops, D flip-flops, and a clock.

State Diagram

A 3-bit counter is required to implement this sequence because the number of outputs that are required are three that can be attained by maximum binary count of seven. Since the required sequence contains specific combinations for the states, therefore, the remaining ones are set as "Don't Care" conditions or states.

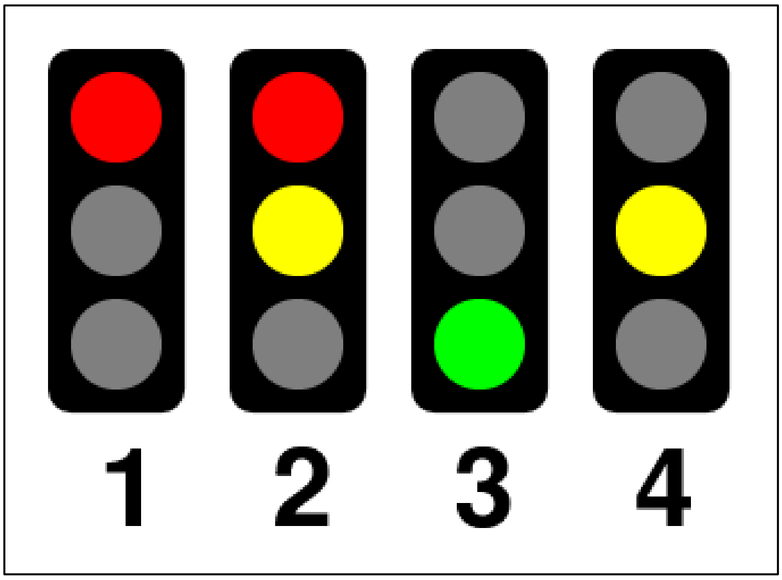

Figure 1: All Conditions of Traffic System [1]

Key

State 1: STOP

State 2: READY TO GO

State 3: GO

State 4: READY TO STOP

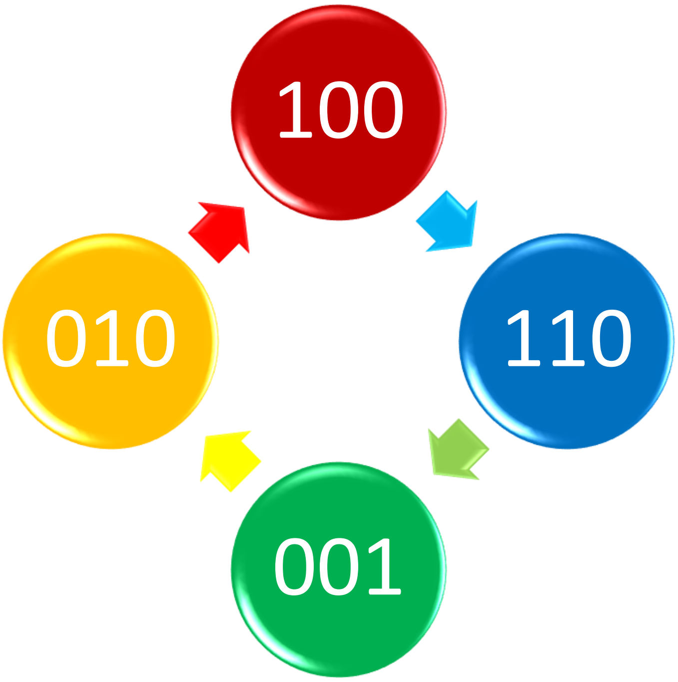

Figure 2: State Diagram

Next-State Table

The next-state table determines the next state that is going to be occurred after the present state. It completely describes the cycle by displaying the combinations of present as well as future state.

Present State			Next State		
R	**Y**	**G**	**R**	**Y**	**G**
1	0	0	1	1	0
1	1	0	0	0	1
0	0	1	0	1	0
0	1	0	1	0	0

Table 1: Next-State Table for Outputs

Present State		Next State	
Q2	**Q1**	**Q2**	**Q1**
0	0	0	1
0	1	1	1
1	1	1	0
1	0	0	0

Table 2: Next-State Table for Flip-Flops

Flip Flop Transition Table

Output Transitions		Flip Flop Inputs	
Q_N	Q_{N+1}	J_1	K_1
0	1	1	X
1	1	X	0
1	0	X	1
0	0	0	X

Table 3: Flip-Flop 1 Transition Table

Output Transitions		Flip Flop Inputs	
Q_N	**Q_{N+1}**	**J_2**	**K_2**
0	0	0	X
0	1	1	X
1	1	X	0
1	0	X	1

Table 4: Flip-Flop 2 Transition Table

Output Transitions		Flip Flop Inputs
Q_N	**Q_{N+1}**	**D_1**
0	1	1
1	1	1
1	0	0
0	0	0

Table 5: Flip-Flop 3 Transition Table

Output Transitions		Flip Flop Inputs
Q_N	**Q_{N+1}**	**D_2**
0	0	0
0	1	1
1	1	1
1	0	0

Table 6: Flip-Flop 4 Transition Table

Karnaugh Maps

Karnaugh Map for J1

Q2 \ Q1	0	1
0	1	X
1	0	X

Karnaugh Map for K1

Q2 \ Q1	0	1
0	X	0
1	X	1

Karnaugh Map for J2

Q2 \ Q1	0	1
0	0	1
1	X	X

Karnaugh Map for K2

Q2 \ Q1	0	1
0	X	X
1	1	0

Karnaugh Map for D1

Q4 \ Q3	0	1
0	1	1
1	0	0

Karnaugh Map for D2

Q4 \ Q3	0	1
0	0	1
1	0	1

Logic Expressions for Flip-Flop Inputs

The logic expressions for all flip-flops are following:

Logic Expression for Flip-Flop 1

$$J1 = \overline{Q2}$$

$$K1 = Q2$$

Logic Expression for Flip-Flop 2

$$J2 = Q1$$

$$K2 = \overline{Q2}$$

Logic Expression for Flip-Flop 3

$$D1 = \overline{Q4}$$

Logic Expression for Flip-Flop 4

$$D2 = Q3$$

Circuit Implementation

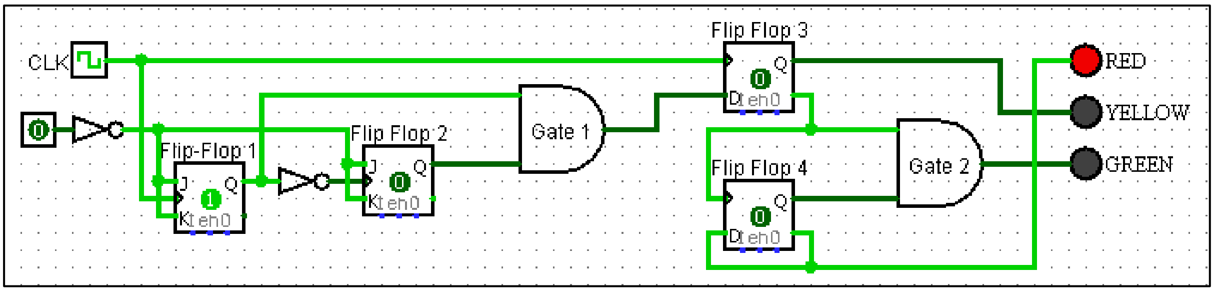

Figure 3: 1st Condition

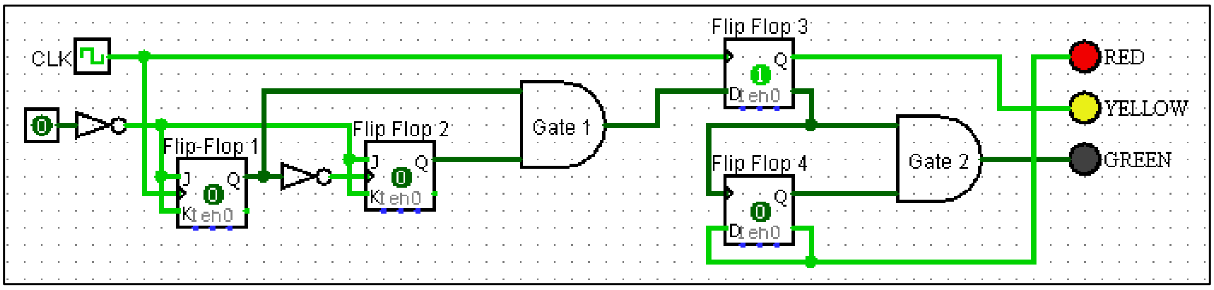

Figure 4: 2nd Condition

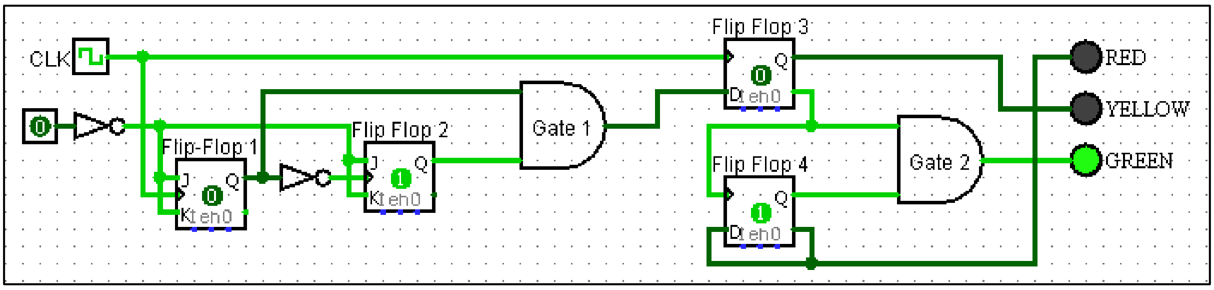

Figure 5: 4th Condition

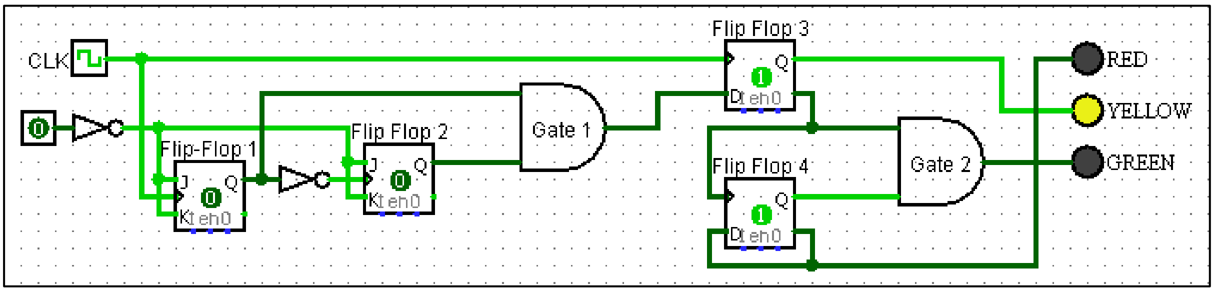

Figure 6: 5th Condition

Pulse Waveforms

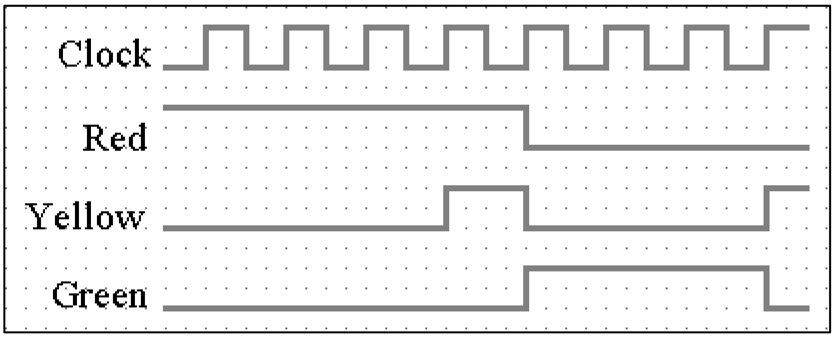

Figure 7: Pulse Waveforms of the Circuit

Result

This asynchronous circuit gives the clear output of all the states working properly in a cycle that runs infinitely until the circuit is cutoff. The future scope of this project is it can be directly applied in real time by employing more number of such circuits.

Conclusion

It is concluded that digital logic gates and latches that are used as counters are effective tools to convert analogue to digital that are way more efficient in our daily life.

Digital logic design helps us work on different projects related to logic gates and different digital instruments. The traffic light control system project by digital logic light system helps us lighting up LEDs and control the entire system infinitely. Traffic control is a big issue in today's world This system helps traffic warden who runs & controls the whole traffic but with the help of traffic control through digital system it has made life easy as it is controlled digitally not analog by some traffic controller it saves time runs infinitely as it repeats its process and run the digital light system through Timing repetitively. There is gray code that only one-bit changes at a time, there are 4 states in gray code. Group of flip flops used in project are called counters which helps determine the number of states. In traffic control system which is saving our time and money it necessary to make the rules proper and by making we need the implementation of some sensors and cameras which makes the passengers and drivers oblige and abide by the traffic rules for their safety. There should be camera check for speed control and that the driver doesn't break the signal system law because it is dangerous and cause accidents. In other countries there is digital system in which if driver breaks the signal it digitally captures and massage the challan to the drive at his place, so this saves our time and also helps traffic police in the implementation of traffic rules.

References

[1] [Online]. Available: https://upload.wikimedia.org/wikipedia/commons/f/f8/Traffic_lights_4_states.png.