

CSC-105L Digital Logic Design

Project Report

Smart Traffic Signal System



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SMART TRAFFIC SIGNAL SYSTEM

(4017 TIMER-BASED DESIGN)

PROJECT OVERVIEW

This project aims to design a basic automatic smart traffic signal system for a 2-way road using simple digital logic components such as the 555 Timer and CD4017 Decade Counter. The circuit controls the traffic lights in a fixed, sequential, and time-based manner without requiring any sensors or microcontrollers.

OBJECTIVE

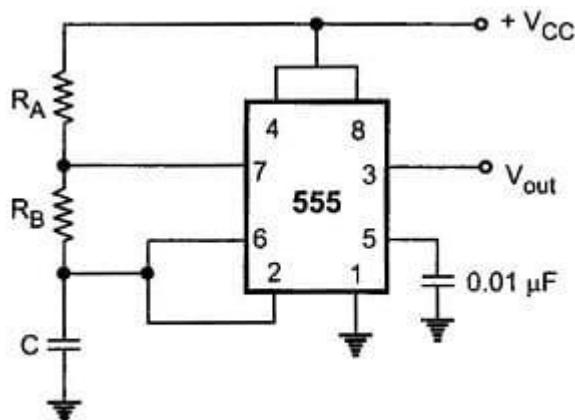
- To simulate and implement a cost-effective 2-way traffic signal system.
- To automate traffic signal switching using sequential logic (no manual control).
- To demonstrate the real-life application of timers and counters in traffic management.
- To build a simple yet efficient hardware prototype.

COMPONENTS USED

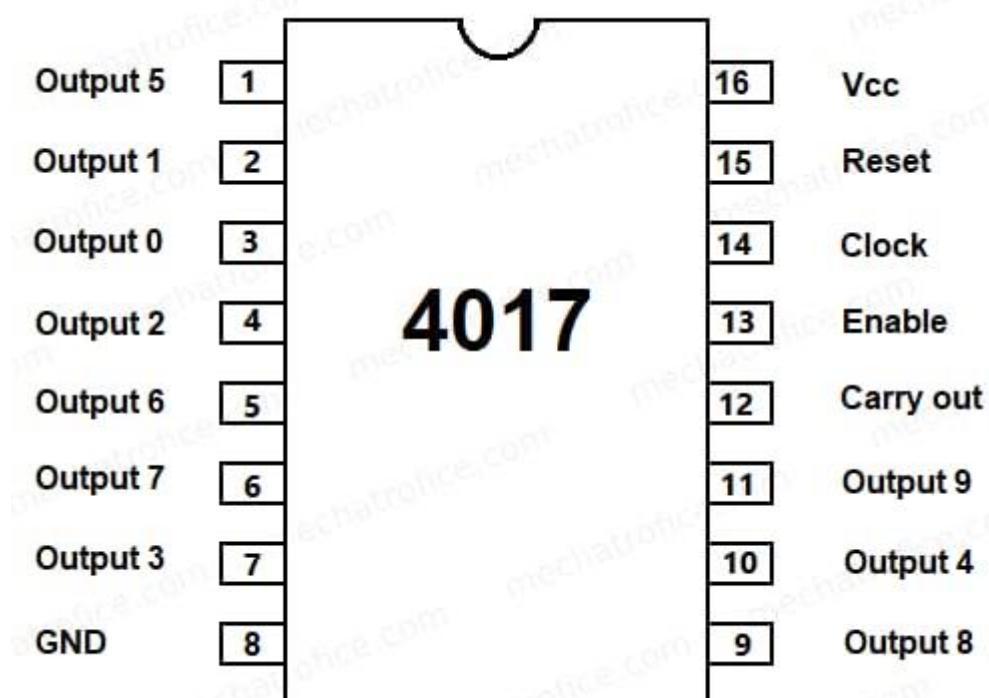
Component	Quantity
555 Timer IC	1
CD4017 Counter IC	1
1N4007 Diodes	14
10kΩ Resistor	1
100kΩ Resistor	1
10µF Capacitors	1
Red LEDs	4
Yellow LEDs	4
Green LEDs	4
5V Power Supply	1
Breadboard	3
Wires	—

WORKING PRINCIPLE

1. The 555 Timer IC acts as a clock pulse generator.
 - The frequency of the timer is determined by the formula:
$$f = 1.44 / ((R_1 + 2 \times R_2) \times C)$$
 - These clock pulses are sent to the CD4017 Decade Counter.



2. The 4017 IC has 10 outputs (Q₀ to Q₉). Each output goes HIGH sequentially on every clock pulse.
 - These outputs are connected to different combinations of LEDs (Red, Yellow, Green) to simulate a 2-way traffic signal.



TRAFFIC LIGHT TIMING LOGIC (2-WAY CONTROL)

This system simulates traffic flow for two roads (Road A and Road B).

Cycle for Road A:

- Green ON for 5 seconds
- During this time:
 - Road B is Red for 3 seconds, then Yellow for 2 seconds

Cycle for Road B:

- Green ON for 5 seconds
- During this time:
 - Road A is Red for 3 seconds, then Yellow for 2 seconds

Important Rule:

Whenever one road has a Red signal ON, the other road's Green signal is ON.

This ensures safe, alternate traffic flow with no overlap or collision.

The cycle continuously repeats using the 4017 outputs to maintain the sequence.

IMPLEMENTATION STEPS

1. Circuit was designed and simulated in Proteus Design Suite.
2. Components like resistors and capacitors were adjusted to get desired time delays.
3. LEDs were connected according to the output of the 4017 to reflect the proper sequence.
4. Breadboard implementation was done after simulation testing was successful.

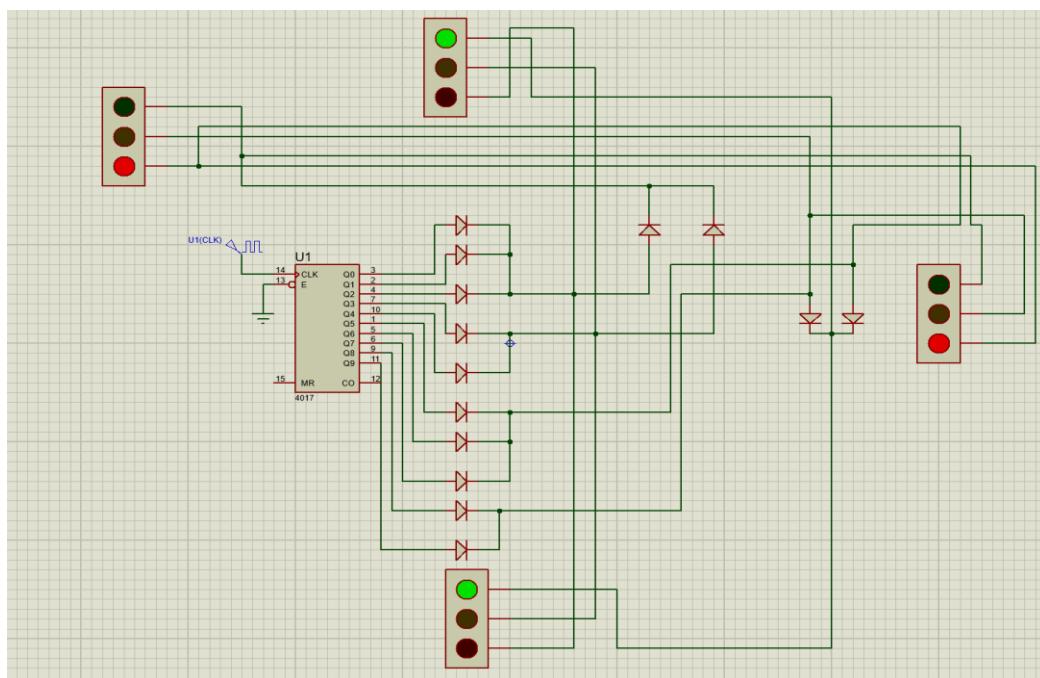
RESULTS ACHIEVED

- The LEDs followed the correct Red → Yellow → Green sequence.
- The switching was smooth and completely automatic.
- The hardware prototype successfully controlled both directions based on time intervals.
- No sensors or programming were needed, which kept it simple and affordable.

LESSONS LEARNED

- CD4017 IC can manage multiple timed outputs efficiently with a single clock.
- 555 Timer is a reliable and adjustable source of clock pulses.
- Even simple digital ICs can be used to build useful real-world systems like traffic lights.
- Simulation tools like Proteus are valuable for catching wiring issues early.

CIRCUIT DIAGRAM



CIRCUIT

