DIGITAL LOGIC DESIGN

PROJECT REPORT

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OBJECTIVE:

Four Way Traffic Lights Circuit using 555 Timer

INTRODUCTION:

In this traffic light project we are going to design a circuit, to control traffic lights on a four-way signal. This circuit is designed by 555 TImer IC timer and a decade counter.
The timer generates pulses and these pulses are fed to the ten stage decade counter. The ten stage DECADE COUNTER have a memory of TEN. It can count up to ten pulses. So for every peak at clock, the counter admits it as an event and remembers it. The number of events that counter memorized outputted by corresponding pin.

CIRCUIT COMPONENTS:

(1) Voltage:

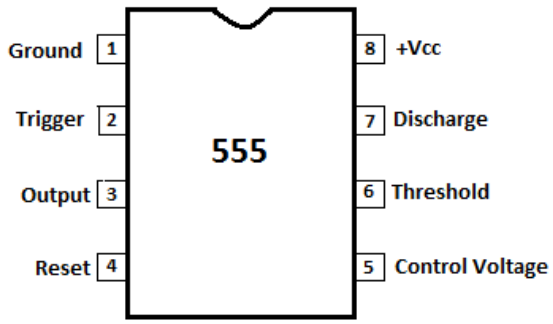
Voltage is the pressure from an electrical circuit's power source that pushes charged electrons (current) through a conducting loop.
In this project we use **+9v to +1 2v** supply voltage

(2) 555 Timer IC:

Defination:

555 Timer IC The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications.

Pin Dagram:



Description:

Pin	Name	Purpose
1	GND	Ground reference voltage, low level (0 V)
2	TRIG	The OUT pin goes high and a timing interval starts when this input falls below 1/2 of CTRL voltage (which is typically 1/3 *V*cc, CTRL being 2/3 *V*cc by default if CTRL is left open). In other words, OUT is high as long as the trigger low. Output of the timer totally depends upon the amplitude of the external trigger voltage applied to this pin.
3	OUT	This output is driven to approximately 1.7 V below +*V*cc, or to GND.
4	RESET	A timing interval may be reset by driving this input to GND, but the timing does not begin again until RESET rises above approximately 0.7 volts. Overrides TRIG which overrides threshold.

5	CTRL	Provides “control” access to the internal voltage divider (by default, 2/3 *V*cc).
6	THR	The timing (OUT high) interval ends when the voltage at threshold is greater than that at CTRL (2/3 *V*cc if CTRL is open).
7	DIS	Open collector output which may discharge a capacitor between intervals. In phase with output.
8	*V*cc	Positive supply voltage, which is usually between 3 and 15 V depending on the variation.

555 TIMER WORKING:

The 555 generally operates in 3 modes:

1. A-stable
2. Mono-stable
3. Bi-stable modes.

Astable mode:

This means there will be no stable level at the output. So the output will be swinging between high and low. This character of unstable output is used as a clock or square wave output for many applications.

Mono-stable mode:

This configuration consists of one stable and one unstable state. The stable state can be chosen either high or low by the user. If the stable output is set at high (1), the output of the timer is high (1). At the application of an interrupt, the timer

output turns low (0). Since the low state is unstable it goes to high (1) automatically after the interrupt passes. Similar is the case for a low stable monostable mode.

Bi-stable model:

In bistable mode, both the output states are stable. At each interrupt, the output changes from low (0) to high (1) and vice versa, and stays there. For example, if we have a high (1) output, it will go low(0) once it receives an interrupt and stays low (0) till the next interrupt changes the status.

This data sheet should provide an insight into the specifics: 555 Timer IC

The below video from Skinny R&D gives an insight into 555 timer as well.

(3) Resistors:

A **resistor** is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. **Resistors** can also be used to provide a specific voltage for an active device such as a transistor. ... Another type of **resistor** is made from winding Nichrome or similar wire on an insulating form. In this project we use **1Kohm,10Kohm, 200ohm, resistors (3 pieces).**

(4) Capacitors:

Capacitors are simple passive device that can store an electrical charge on their plates when connected to a voltage source. In this project we use **10uF,100uF capacitors**

(4)RED LED (4 pieces),
(5)BLUE LED (4 pieces)

- **YELLOW LED (4 pieces)**

(6) CD 4017 Decade Counter Ic:

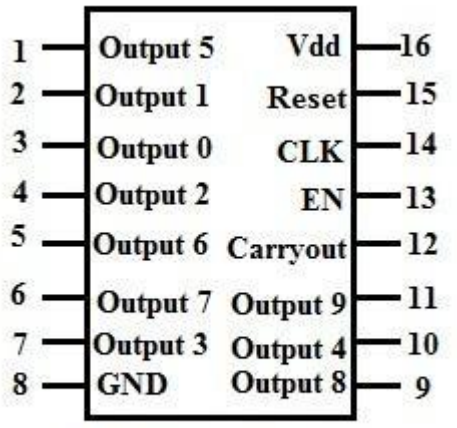
Most of us are more comfortable with 1, 2, 3, 4… rather than 001, 010, 011, 100. We mean to say that we will need a decimal coded output in many cases rather than a raw binary output. We have many counter ICs available but most of them produce binary data as an output. We will again need to process that output by using decoders or any other circuitry to make it usable for our application in most of the cases.
It can count from zero to ten and its outputs are decoded. This saves a lot of board space and time required to build our circuits when our application demands using a counter followed by a decoder IC.

Features:

- The supply voltage of this IC is 3V to 15V.
- It is compatible with TTL (Transistor -Transistor Logic).
- The clock speed or operational speed of CD4017 IC is 5 MHz.

This IC is also used in electronic industries, automotive industries, manufacturing medical electronic devices, alarms and in electronic instrumentation devices.

CD4017 Pin description



4017 -Decade Counter

It has 16 I/O pins.

Output pins of CD4017(Pin 1 to 7 & 9 to 11)

- Pins 1 to 7 and 9 to 11 are outputs pins.
- These pins changes to ‘high’ level one by one (one after another) in a sequence. For each clock signal each pin goes high in a sequence.

Enable pin/Clock Inhibit(Pin 13)

- Enable pin enables the CD4017 IC.IC is enabled when the pin is active low.
- In order to disable or switch off the IC,this pin should be connected to active high input.When this pin is active high ,it ignores the clock signals.

Clock pin(pin 14)

- Clock signal provided to 14 th is responsible for sequential output.
- When the first clock pulse is detected pin 3 goes ,for next clock pulse pin2 goes high,like this sequence is formed.
- The important thing to remember is, if we don’t connect any clock signal to this input pin, it must be connected to either positive or negative voltage supply.
- It is not left unconnected as per the CMOS input standard rules.
- The clock input pin (pin number 14) responds only to the positive voltage signal or positive clock

Reset pin(Pin 15)

- Reset pin resets the output of the sequence.That is the current state of the output sequence is set to initial state.
- Reset pin should be connected to ground in order to reset the circuit.

Ground pin & supply pin(Pin 8 & Pin 16)

Pin number 8 acts as ground and it must be connected to negative supply voltage & pin number 16 is the supply pin for CD4017 and it is connected to positive voltage supply.

Carry out pin(pin12)

The pin 12 is supplied with the CARRY OUT signal. It completes one full cycle for every 10 clock cycles. This is used to ‘ripple’ the IC, which means to delay in counting operations.

Diodes:

A **diode** is defined as a two-terminal electronic component that only conducts current in one direction (so long as it is operated within a specified voltage level). An ideal **diode** will have zero resistance in one direction, and infinite resistance in the reverse direction.

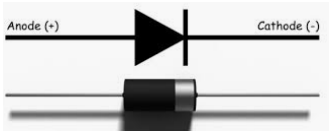
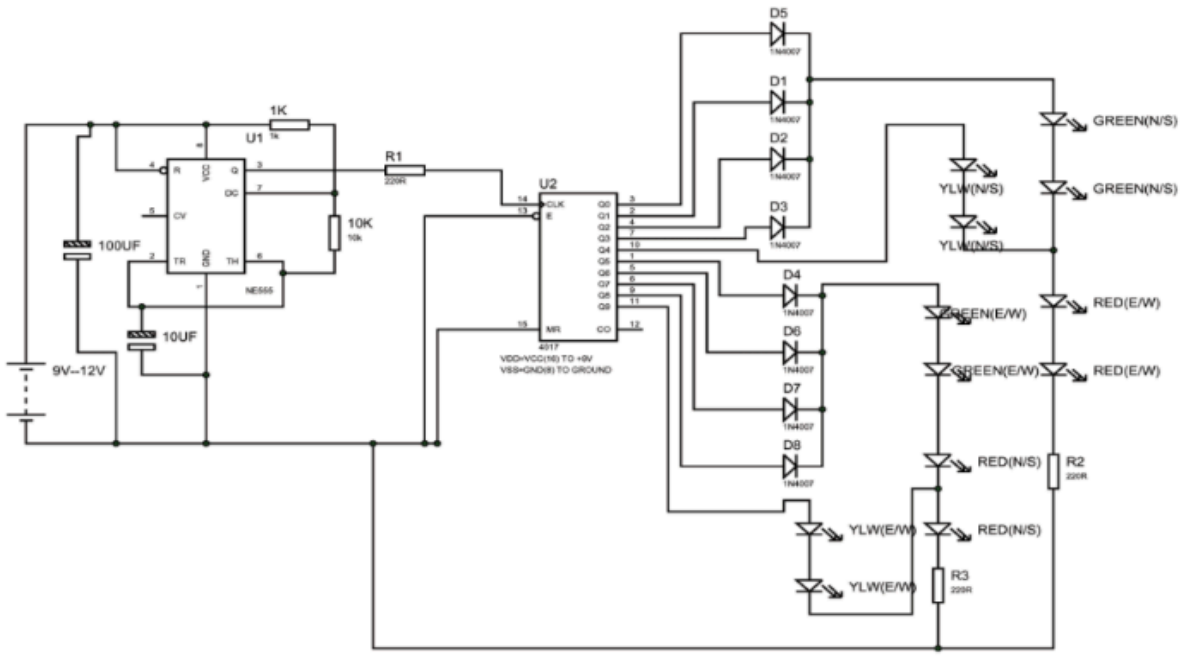


Diagram:



WORKING EXPLANATION:

Four way traffic light circuit diagram using 555 Timer IC is shown in the above diagram. The timer here generates pulses of time period l00ms approximately. So the ON time is 50ms and OFF time is 50ms.

This time duration can be changed by changing the capacitor value. Although Street lights have a shift time for 2minutes, here we are reducing the time for testing the circuit.

The time shift for a four way traffic light can be achieved in this circuit by replacing the l0uF capacitor with a 470uF one. Once the power is tune ON, the timer acts as a square wave generator and generates clock, this clock is fed to the DECADE BINARY COUNTER. Now the decade binary counter counts the number of pulses given at the clock and lets the corresponding pin output go high, for example, if the event count is 3 then Q2 pin of counter will be high and if 5 is count the pin Q4 will be high. So for every 100ms there will be a peak, with this peak the counter memory gains by one and so is the output.

The diodes here prevent the shorting of counter outputs, say if the count is two with this the Q1 will be high (since Q1 is high all other outputs will be low including Q0, Q2) in the absence of diodes, Q1 with positive voltage gets hardly pulled down to LOW by Q0(as Q0 voltage be +0V when Q1 is high), as they are connected together. With this short circuit takes place.

So during Q0, Q1, Q2, Q3 high the GREEN LED on NORTH and SOUTH will be ON along with RED LED on EAST and WEST. So if we assume clock is of 1 Hz. the NORTH and SOUTH side are signaled GREEN to go for four sec and also the EAST and WEST side are signaled RED to STOP during this time.

When Q4 goes high, the YELLOW LED on NORTH and SOUTH will be ON along with RED LED on EAST and WEST. So if we assume clock is of 1 Hz, the NORTH and SOUTH side are signaled YELLOW to slow down for isec and also the EAST and WEST side are signaled RED to STOP during this time.

When Q5, Q6, Q7, Q7 high the GREEN LED on EAST and WEST will be ON along with RED LED on NORTH and SOUTH. So if we assume clock is of 1Hz, the EAST and WEST side are signaled GREEN to go for four sec and also the NORTH and SOUTH side are signaled RED to STOP during this time.

When Q4 goes high, the YELLOW LED on EAST and WEST will be ON along with RED LED on NORTH and SOUTH. So if we assume clock is of 1 Hz, the EAST and WEST side are signaled YELLOW to slow down for isec and also the NORTH and SOUTH side are signaled RED to STOP during this time.
These above four stages form a continuous cycle, to control the trafic light on four way.