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Research Article

Traffic Light Controller using IC 555 Timer

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Abstract

The proposed design of IC555 timer is used to control the traffic light signals. In the design of timer applications used LED to indicate light signals. The traffic signals move at particular time of 20ms.The software connection is made by cadencepspice and using bread board we have did hardware connections. The alteration is achieved by tuning the value of the variable resistor. In addition, the frequency is varied at selected value ranging from Hz to MHz, just to show that 555- timer IC can provide various frequency levels. The frequency can be determined by choosing the right value of the resistor and capacitor in the circuitry system.

Keywords: IC555 timer; Light-emitting diode; Bipolar junction transistor; Flip flop; Integrated circuits.

Introduction

The operations are carried out according to the required time specifications. The raw materials are proposed and used for the particular time period [1]. There are numerous applications where even Integrated circuits (ICs) are used for the time delaying specifications [2]. Among that, IC555 is popularly used to build the timer circuits [3]. The IC555 timer is used for both Monostable and Astable multivibrator circuits [4-5]. It is a circuit consisting of comparators and flip flop (FF). The entire circuit is usually containing 8 pin packages. The inverting terminal of the IC555 timer is connected to 2/3Vcc where Vcc is the input voltage given at the pin 8 and the noninverting terminal is connected to 1/3Vcc, whereas the output of the proposed design is collected at the pin 3 [6-7].

Comparators compare the input voltage from the circuit. A transistors (BJT) is also used in the construction of IC555 timer. The output from the comparators is fed into the flip flop (R-S Flip flop). The two outputs are Q and inverse of Q are taken from the collectors and the output value depends on the transistor operations [9]. In this circuit designed, the output depends on the particular range of resistor values. The capacitor gets charged through the resistance R1 and R2 and the discharging time is very less through the corresponding resistors [10].

Design

The main objective of this paper is to produce sinusoidal waveform using multi-vibrator ICs. Therefore, the application has been realized using NE555 timer IC which is suitable for both mono-stable and astable applications. Like others ICs, the on-off time of this IC is also dependent on external capacitor. The capacitor (C) takes finite period of time to charge and discharge through resistor (R) which can be determined using R & C values using expression:

$$T=R \times C$$

One of the most common operational modes of this IC is its use as Astable multi-vibrator for varying duty cycle generation. Astable multi-vibrator is arrangement of bistable multi-vibrator to switch states periodically. Bistable multivibrator is connected with RC network in feedback loop to control the RC time constant [8]. In this mode, it simply acts as an oscillator generating a continuous waveform of rectangular ON-OFF pulses alternating between two voltage levels. The frequency and duty cycle can be set using Resistor (R) & capacitor (C) values. Fig. 1 shows the operating configuration of NE555 Timer IC.

The 555 is connected as an astable multi-vibrator. Trigger (pin 2) and Threshold (pin 6) to the two comparators are shorted together. Both

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pins are connected to external capacitor. When the voltage is applied, the external capacitor charges via Resistor R1 and R2. The discharge Pin (7) is linked to a transistor internally and externally connected to the junction of those two resistors.

Two timer ICs biased with 12 volt power supply, the left side timer provides output through Red LED, the right side timer LED provides output through yellow LED and Green LED, here the yellow LED output controlled by discharge pin, Vcc supply for this IC provides through output and timer elements of left side timer IC 555. By varying VR1 and VR2 variable resistors we can vary the time delay between LEDs, here two timer ICs control voltage pin 5 left as no connection, LED arrangement of traffic light is shown in circuit diagram (Fig. 1).

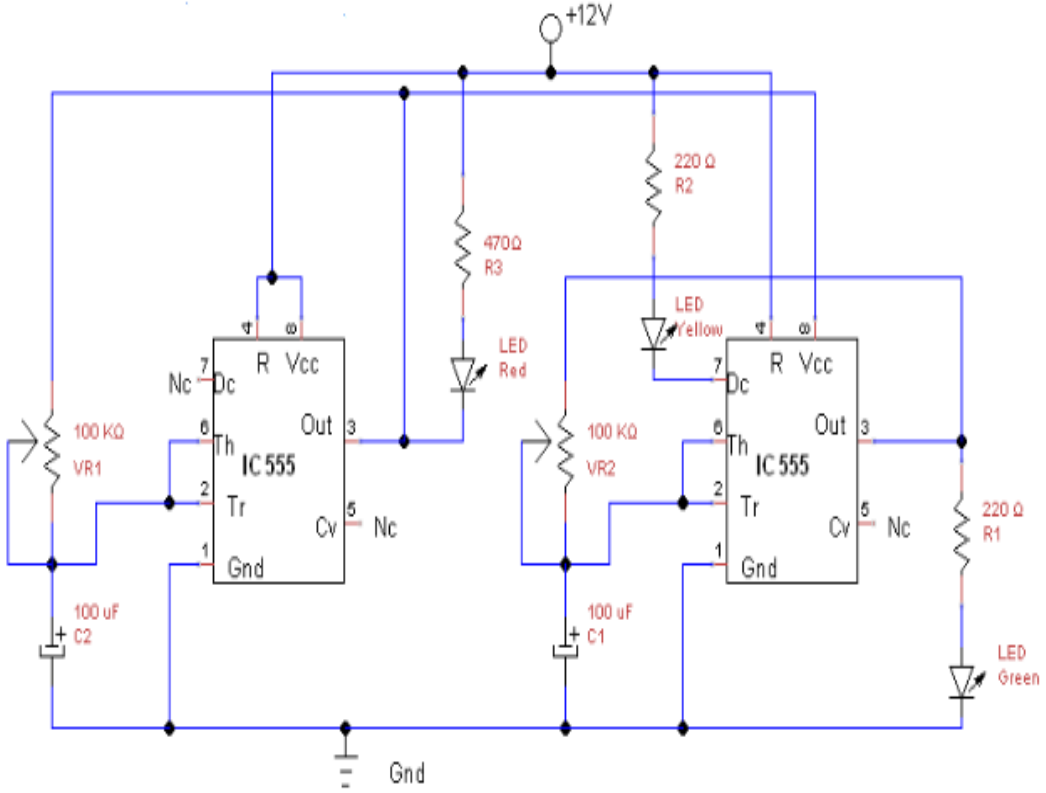

Fig. 1. Circuit diagram for traffic light controller

Case 1

Generation of clock signal for first timer, We have to assume

R1=470Ω,R2=100KΩ,C=100μF

The general formula to find out T_{high}

T1=(R1+R2)0.693*C;T1=6.96ms

The general formula to find out T_{low}

T2=0.693*(R2*C);T2=6.93ms

The total time period of the generating one square waveform,

T=0.693(R1+2R2)*C;T=13.89ms

The frequency of the one oscillation for first timer is,

f=1/T=72Hz

Case 2

Generation of clock signal for second timer, we have to assume

R1'=220ΩR2'=47KΩ,C=100 μF

The general formula to find out T_{high}

T1=(R1+R2)0.693*C;T1=3.27ms

The general formula to find out T_{low}

T2=0.693*(R2*C);T2=3.25ms

The total time period of the generating one square waveform,

T=0.693(R1+2R2)*C;T=6.52ms

The frequency of the one oscillation for second timer is,

F=1/T=15Hz

Results and discussion

To examine the result of the proposed circuit, IC555 timer controlled the traffic light signals. The simulations provide a fixed and approximate result. In the case of real time application, the experimental result has been verified by hardware. The experimental verification for both hardware and software has been shown below. The animation shows the lighting sequence and this follows the

Australian-standard. The red LED has an equal on-off period and when it is off, the first 555 delivers power to the second 555.

This illuminates the Green LED and then the second 555 changes state to turn off the Green LED and turn on the Orange LED for a short period of time before the first 555 changes state to turn off the second 555 and turn on the red LED. A supply voltage of 9v to 12v is needed because the second 555 receives a supply of about 2v less than rail.

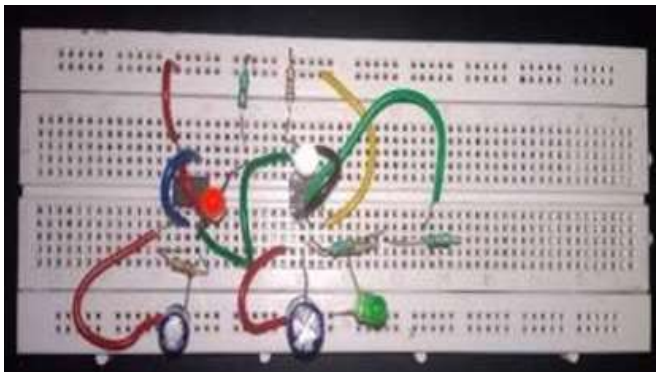

Fig. 2. Experimental setup of traffic light controller

This circuit also shows how to connect LEDs high and low to a 555 and also turn off the 555 by controlling the supply to pin 8. Connecting the LEDs high and low to pin 3 will not work and since pin 7 is in phase with pin 3, it can be used to advantage in this design.

The Fig. 3 shows the traffic light controller with red color glowing. Fig. 4 shows the traffic light controller with yellow color glowing. Fig. 5 shows the traffic light controller with green color glowing.

The IC 555 Timer output is fed to switches S1 and S4 of High Boost Converter. During TON when a high pulse from IC 555 Timer is giving to S1and S4, S1 and S4 will be in ON state while during TOFF a low pulse from IC 555 Timer is giving to S1 and S4,S1and S3 will be in ON state while S1 and S4 will be in OFF state. In the given circuit the Duty Ratio can be varied by varying TON and TON can be varied by varying resistance of potentiometer Ra which is connected to brake of electric car. Thus resistance of Potentiometer can be varied by movement of brake.

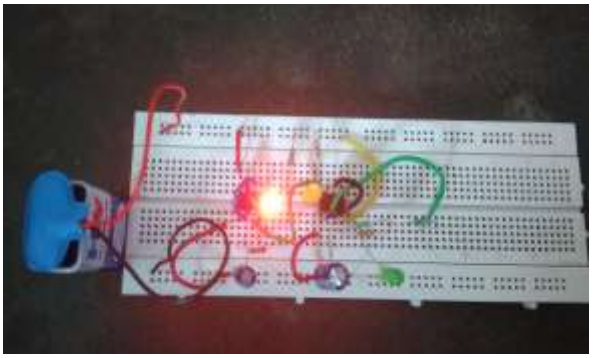

Fig. 3. Experimental setup of traffic light controller with red color glowing

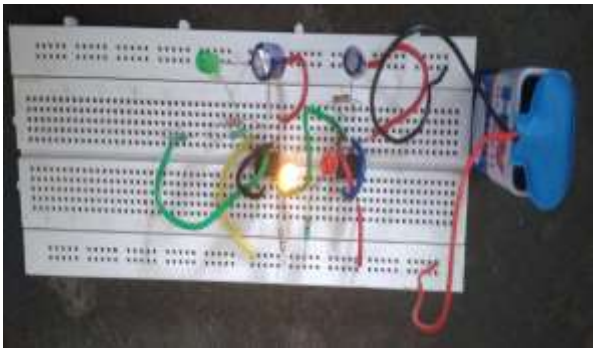

Fig. 4. Experimental setup of traffic light controller with yellow color glowing

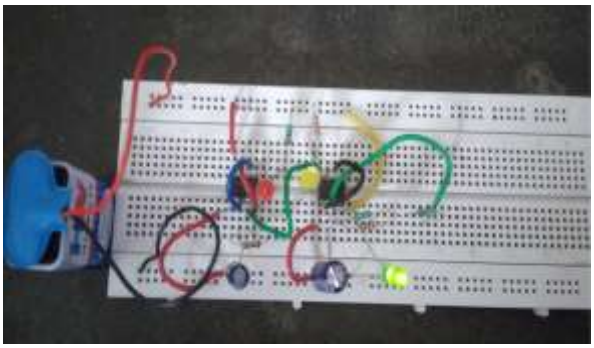

Fig. 5. Experimental setup of traffic light controller with green color glowing

Conclusions

It provides that the indication of traffic light signals at a particular time period of charging and discharging. The experimental results have been shown by the both hardware and software. In this project, the performance of this IC555 timer is directly controlled by the values of R1, R1', R2, R2', C1 and C2. So the IC555 timers are used to control the traffic light signals. The simulation provides a guidance and approximate result. In this project, the performance of this boost converter is directly control by the value of R1, R2, C1, and L1.

Conflicts of Interest

Authors declare no conflict of interest

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