

DESIGNING AND CHARACTERISTICS OF TIMER WITH LIGHT SENSOR CIRCUIT USING CMOS IC

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ABSTRACT

We present a new timer with light sensor discharging all disadvantage of earlier one. The newly developed timer circuit use CMOS IC 4060B. We can adjust the different type of time interval using resistance and capacitance coupling in circuit. The aim of this paper is to present the timer circuit which work on light sensor with musical alarm.

Keywords- CMOS IC 4060B, Light Sensor, R.C. constant, 14-bit binary ripple counter.

INTRODUCTION

In the past decade electronic instrumentation and engineering techniques have undergoes a revaluation. The revaluation any change in recent years is due to the advancement in the field of microelectronics. In early time we use to work IC 555 as a timer circuit., how were it has some disadvantage, like introducing a actual value capacitance should remains precisely constant, then and then only time interval will be precisely maintained constant. It is not possible to introduce longer duration of time with 555-timer circuit. This is responsible for it's poor efficiency. We present a new timer with light sensor discarding all disadvantage of IC555. We made of CMOSIC 4060 B, which is 14-bit binary ripple counter. We use RC coupling for setting different time interval light sensor circuit is mainly design using IC555. The output of light sensor circuit is connected to timer circuit. In this way out put signal to light sensor is fed to relay. Timer circuit is connected to relay of light sensor. Another relay is connected to the timer, which is out put of timer unit. The ON-OFF action for the present time interval such as 20 min, 30 min, 1-hours etc. can be adjusted with this timer. The ON and OFF state of instrument is know the timer interval for musical alarm. This circuit is work on 12 V DC supply or battery. The instrument is easy to design with low cost and yet good in performance.

Principal and working of timer unit

In this circuit was use light sensor to activate a timer unit. In light sensor circuit, we use IC555

and LDR as main components. It works on light signal. In dark LDR resistance is so large (100h Ω) that's why current cannot flows in circuit. In light, LDR resistance is less (10K) hence current flows in the circuit and output is obtained at pin no 3 of IC 555. Output of light sensor is fed to the timer and timer turns ON. In timer; delay time is introduced by different combination of resistance and capacitance. This is the principal of timer with light sensor circuit.

Working of circuit

As the name suggested, light sensor circuit it's work on light signal. This circuit activates a relay or speaker which help to detecting the presence of light fall on LDR. It is necessary to known the operation of IC555. The output goes high upon receipt of a trigger (start) pulse on input pin 2. This pulse is voltage, whose level is lower than $\frac{1}{3}$ of the supply voltage (V_{ic}). The output goes low again when the voltage at the second input pin 6 has suddenly exceed $\frac{2}{3}$ of the supply level. In present design the second input is not used. However output of IC 555 cannot reverse of the low state, because of pin 6 is connected to positive terminal. The supply voltage for the circuit must equal the coil voltage of relay in light sensor. However supply should not be more than 16 V. The Current consumption of the circuit is 4ma exclusive of the current drawn by relay on speaker. At the supply voltage level of 12 V components such as R2 and C1, the relay is energized, so that the circuit is rendered insensitive to rapid changes in the light intensity. Basically circuit has no hysteresis effect. However, when the

supply voltage is not required the activation of relay. The lower supply level lower the internal threshold of IC555 since the trigger point is defined as $2/3$ of supply level (pin2). Therefore the hysteresis of the circuit can be dimensioned as required by connecting a resistor in series with supply. It is also possible to fit a resistance between pin5 possible to fit a resistance between pin5 and pin7 of the IC555 as shown in circuit diagram(5.2a). The amount of hysteresis in inversely proportional to the value of the resistor. A 100K is a minimum resistance used for setting time interval.

The sensitivity of trigger circuit can be controlled, if R1 is replaced by IME potentiometer or present.

In light sensor IC555 pin number 3 is output pin. Output pin3 is connected to timer circuit.

In timer circuit we used wellknown component IC4060B, which is 14 bit binary counter and oscillator. In that IC Pin number 8 is negative terminal and pin number 16 is positive terminal, 11 and 12 are time setting pins. These two pins are connected to 2M2 resistance and different variable resistance 100K, 220K, 400K etc. At Pin 9 and 10 capacitance like 220nf, 470 nf etc are connected.

Delay time depends on resistance p1 and capacitance d (220nf, 470nf, 1000nf).

Frequency of the circuit is given by

$$F = 1/\{2.2 \times C2 \times (R2 + p1)\} \text{ HZ}$$

The frequency is divided by 14 different ways than when the switch is ON light falls on LDR then timer circuit will be On, the pulse received by junction R4-C2 rest counter and counting starts. When counting reaches bit 14 (Q13), pin3 out put voltage activities the relay and relay turn on via drive BC147). The time delay is set by using different resistance (P1) and different capacitors.

In this circuit use a two selector switch the selected a capacitor, time will be selected by using a selector switch. By taking different combination of capacitor and resistances different time intervals are noted. Time delays of between 1 second to 10 hours are possible by appropriate value of the timing components

12V battery or eliminator powers the timer unit. Light emitting diode D1 does not effect the operation of the circuit. It is merely used to indicate that the timer works. Diode D1 and resistance R3 and used are optional components. Circuit diagram of timer unit show in Fig. (a) and circuit diagram of whole circuit is shown on Fig (5.3 a)

In timer unit one alarm circuit is used which helps to know the ON-OFF state of the instruments

on timer.

In Alarm circuit IC555 used pin number 4 is reset pin of IC555, which is connected to the selector pole. Which activate of instrument the alarm to know ON OFF state.

Part list and circuit diagram

Part List

Semiconductors

IC ₁	-NE555	IC ₂	-NE555
D ₁	-4148	IC ₃	-4060B
D ₂ , D ₃	-IN4003	T ₁	-BC147

Resistance

R1-	-10kΩ	R5	-2M
R2	-1kΩ	R6	-10K
R3	-LDR	R7	-20K
R4	-10Ω	R8	-5KVC

Capacitance

C1-	1000 μF/25V	C6	-100nF
C2-	100 μF/25V	C7	-200nF
C3-	10 nF	C8	-1000nF
C4-	100 nF	C9	-1nF

C5- 470 nF

Miscellaneous

X₁- 230 A C primary to 12-0-12/500 mA secondary

Transformer

RL, - relay 12V/500E

IC socket

Flat ribbon cable

Speaker - 8 E, Blank PCB, One pole six way switch (rotary switch/ selector switch)

Limitations and improvements

Limitations of timer

In this circuit there are some disadvantage such as large value capacitance and resistance are used, LDR taken large response time. These introduce error in time setting. Also this required high intensity of light from torch.

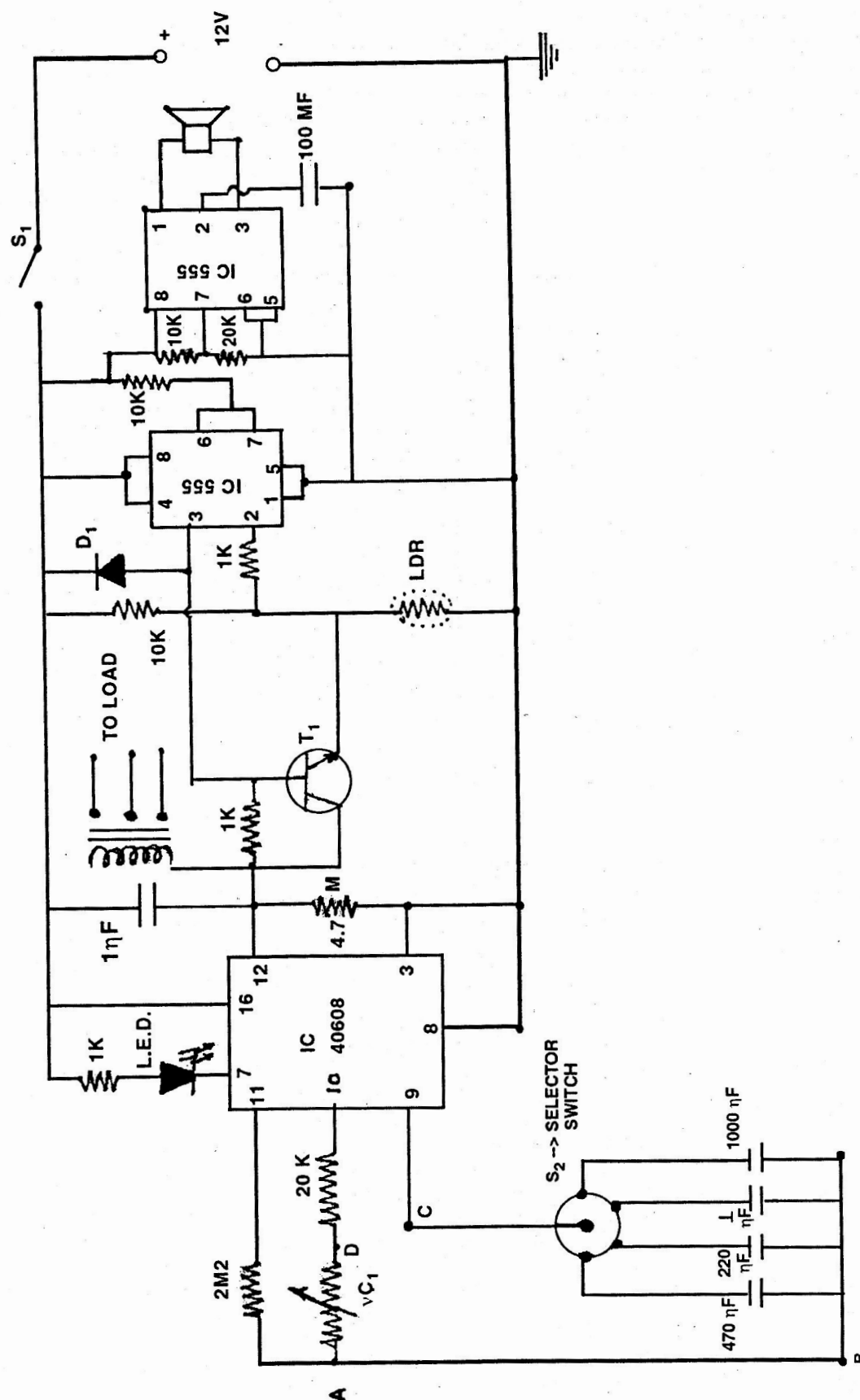
Advantage of timer unit

1. This is low cost of timer unit as compared to the timer available at market price.
2. High sensitivity of circuit
3. This circuit provides accurate time delay than 555 timer.
4. This circuit is easy to design.
5. As per requirement, we can set. precise time interval.

Application of timer unit

Timer unit has lot of uses, Which are described as follows

1. Road traffic light control.
2. TV. Timer



- 3. Incubator (Egg timer)
- 4. In circuit we used this circuit as counter in office light sensor with few modifications.
- 5. One part of this circuit i.e. light sensor circuit, can be used in bank lockers security system.
- 6. An instruments ON or OFF at particular time delay by light signals.

RESULTS AND CONCLUSION

From graphs.as the time interval which is given by slope of the lines. The slope increases as

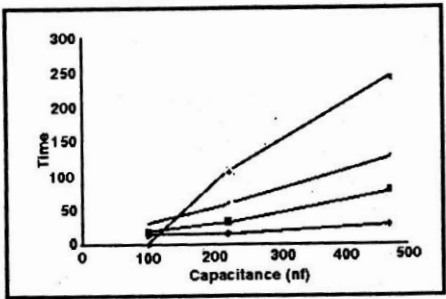


Fig. 2. Capacitance vs time

Reset Trigger		Threshold	Output(3	Dis-
Voltage		Voltage		charge
(2)		(6)		switch
Low	Irrelevant	Irrelevant	Low	OFF
High	<1/3VDD	Irrelevant	High	OFF
High	>1/3VDD	2/3 VDD	Low	ON
High	>1/3VDD	<2/3VDD	As previosuly	establi sh

the resistance increases this shows that resistance increasing time delay in timer unit also increases.

Slope of graph

For 200K : For 500K
 $10.5/250 = 0.04$ $22.5/120 = 0.18$
For1000K: For2000K
 $20.55/110 = 0.25$ $55.5/110= 0.56$

From observation table, we compare the experimental time i.e. observed time and calculated time nearly equal. This shown that time period is correct to observe. It also shows resistance and capacitance value increase time delay also increases with RC factor.

Also it is found that as RC time constant increase the delay time also increase. Table indicates time theoretical and experimental observed value of time intervals. It is found that there is a good agreement in them.

The slope, which decide the time interval, can be known from the graph. It is found that, slope increases with the increase of resistance ultimately this increases of resistance time delay of circuit.

The sensitivity if timer circuit can be controlled if R1 in light sensor circuit is replaced with 1 ME potentiometer. If the sensitivity increases the timer delay error should automatically decreases.

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