**DESIGN OF CAR WIPER SPEED CONTROLLER**

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**MAY 2009**

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**This Report Is Submitted In Partial Fulfillment of Requirements for the
Degree of Bachelor in Electrical Engineering**

**(Industrial Power)**

**Fakulti Kejuruteraan Elektrik**

**Universiti Teknikal Malaysia Melaka (UTeM)**

**May 2009**

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Power Industry)"

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Date       : 13 MAY 2009

"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references."


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# ACKNOWLEDGEMENT

I wish to thank my project supervisor, Prof. Madya Dr. Musse Mohamud Ahmed for his guidance and teachings. And also would like to thank both the panels for their guidance.

I would also wish to extend my gratitude to my parents for their support and their understanding.

And of course to all my friends who helped me in this project.

ABSTRACT

The main objective of this project is to design and develop a wiper speed controller. In this project, wiper speed controller will be explained. It will describe the discipline where some of power electronic methods are developed that attempt to emulate the important characteristics of human intelligence. A continuously working wiper in a car may prove to be nuisance, especially when it is not raining heavily. By using the circuit described here, one can vary sweeping rate of the wiper from once a second to once in ten seconds. For this project, two timers are used namely NE555 $IC_1$ and NE555 $IC_2$, one decade counter is also used namely TIP32 driver transistor, a 2N3055 power transistor and few other discrete components are also used. A pulse will be produced by a timer that is acted as a monostable multivibrator and then this pulse acts as a clock pulse for the decade counter. Then the output of the timer is applied to PNP driver transistor for driving the final power transistor which in turn drives the wiper motor at the selected sweep speed. The power supply for the wiper motor as well as the circuit is tapped from the vehicle"s battery itself.

## ABSTRAK

Objektif utama projek ini ialah untuk mereka cipta dan menghasilkan pengawal kelajuan pengelap cermin kereta. Di dalam projek ini, pengawal pengelap cermin kereta akan dihuraikan. Ia akan menjelaskan tentang penggunaan beberapa kaedah elektronik kuasa yang dihasilkan untuk mencontohi ciri-ciri penting kepandaian manusia. Pengelap cermin kereta yang berfungsi secara berterusan telah menunjukkan ia menjadi gangguan kepada pemandu terutamanya apabila hujan tidak lebat. Dengan menggunakan litar ini, ia dapat mengelap cermin sekali dalam sesaat dan sekali dalam masa 10 saat. Di dalam projek ini, ia menggunakan dua alat pencatat masa iaitu NE555, sebuah pengira dekad CD4017, dua transistor TIP32 dan 2N3055, dan beberapa komponen lain juga digunakan. Satu nadi akan dihasilkan oleh alat pencatat masa yang berfungsi sebagai „monostable multivibrator" dan kemudian ia berfungsi sebagai nadi masa kepada pengira dekad. Kemudian, keluaran daripada alat pencatat masa dihantar ke transistor PNP untuk membolehkan transistor terakhir menggerakkan motor pengelap cermin kereta pada kelajuan yang telah dipilih. Sumber kuasa untuk motor pengelap cermin kereta diperolehi daripada bateri kereta itu sendiri.

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1.6     Background

A continuously working wiper in a car may prove to be nuisance, especially when it is not raining heavily. By using the circuit described here one can vary sweeping rate or the wiper from once a second to once in ten seconds. The circuit comprises two timers NE555 ICs", one CD4017 decade counter, one TIP32 driver transistor, a 2N3055 power transistor (or TIP3055) and a few other discrete components. Timer $IC_1$ is configured as a monostable multivibrator which produces a pulse when one presses of switch $S_1$ momentarily. This pulse acts as a clock pulse for the decade counter ($IC_2$) which advances by one count on each successive clock pulse or the push of switch $S_1$. Ten preset ($VR_1$ through $VR_{10}$), set for different values by trial and error are used at the ten outputs of the $IC_2$. But since only one output of $IC_2$ is high at a time, only one preset (at selected output) effectively come in series with the timing resistors $R_4$ and $R_5$ connected in the circuit of timer $IC_3$ which functions in astable mode. As presets $VR_1$ through $VR_{10}$ are set for different values, different time periods (or frequencies) for astable multivibrator $IC_3$ can be selected. The output of $IC_3$ is applied to PNP driver transistor $T_1$ (TIP32) for driving the final power transistor $T_2$ (2N3055) which in turn drives the wiper motor at the selected sweep speed.

The power supply for the wiper motor as well as the circuit is tapped from the vehicle"s battery itself. The duration of monostable multivibrator $IC_1$ is set for a nearly one second period. The key feature of

this project are timer, decade counter, driver transistor, power transistor and wiper motor.

1.7     Problem Statement

Nowadays, a working wiper in a vehicle may prove to be nuisance, especially when it is not raining heavily. At low speeds, rainfalls on the window at high rate reducing  visibility greatly and necessitating the use of the wiper. As speed increases, less water stays on the window, making an intermittent function desirable. At high speeds, almost no water gets on the window. In this project, a pre-set control circuit (VR1-VR10)will be used to increase and decrease the desired speed of the wiper. Otherwise, the driver can select different time periods (or frequencies) which  in turn drives the wiper motor at the selected sweep speed.

1.8     Project Objective

- To design and develop an intelligent wiper speed controller.
- To make the controller operate at the selected sweep speed.
- To increase the driver"s visibility when it is not raining heavily.
- To build and upgrade the function of the basic wiper speed controller.

1.9     Project Scope

- To study about the operation of timer NE555 IC, decade counter CD4017, TIP32 driver transistor, and 2N3055 power transistor

- To understand the basic operation of the circuit.

- To design and testing the circuit.

- To make full report.


1.10    Methodology

The block diagram of the system is shown in Figure 1.0 below:
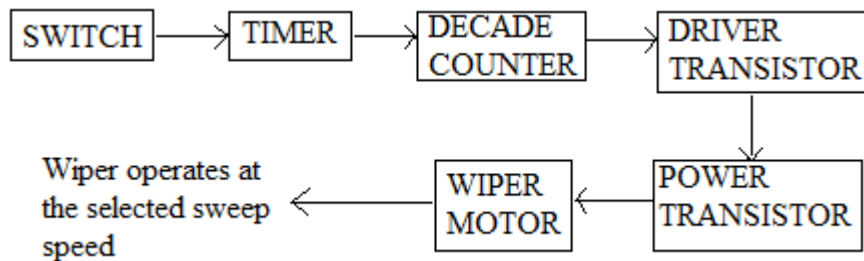


Figure 1.0: The block diagram of the circuit operation.

Switch is pressed momentarily which causes timer to produce pulse. This pulse acts as a clock pulse for the decade counter which advances by one count on each successive clock pulse or the push of the switch. Then the output of the timer is applied to the driver transistor for driving the final power transistor. The wiper motor will operate at the selected sweep speed. For designing and executing this project, there are few methods that should be taken for consideration. In order to do this project successful the following planning and scheduling will be pursued.

Figure 1.1: Project flow chart

CHAPTER 2.0

LITERATURE REVIEW

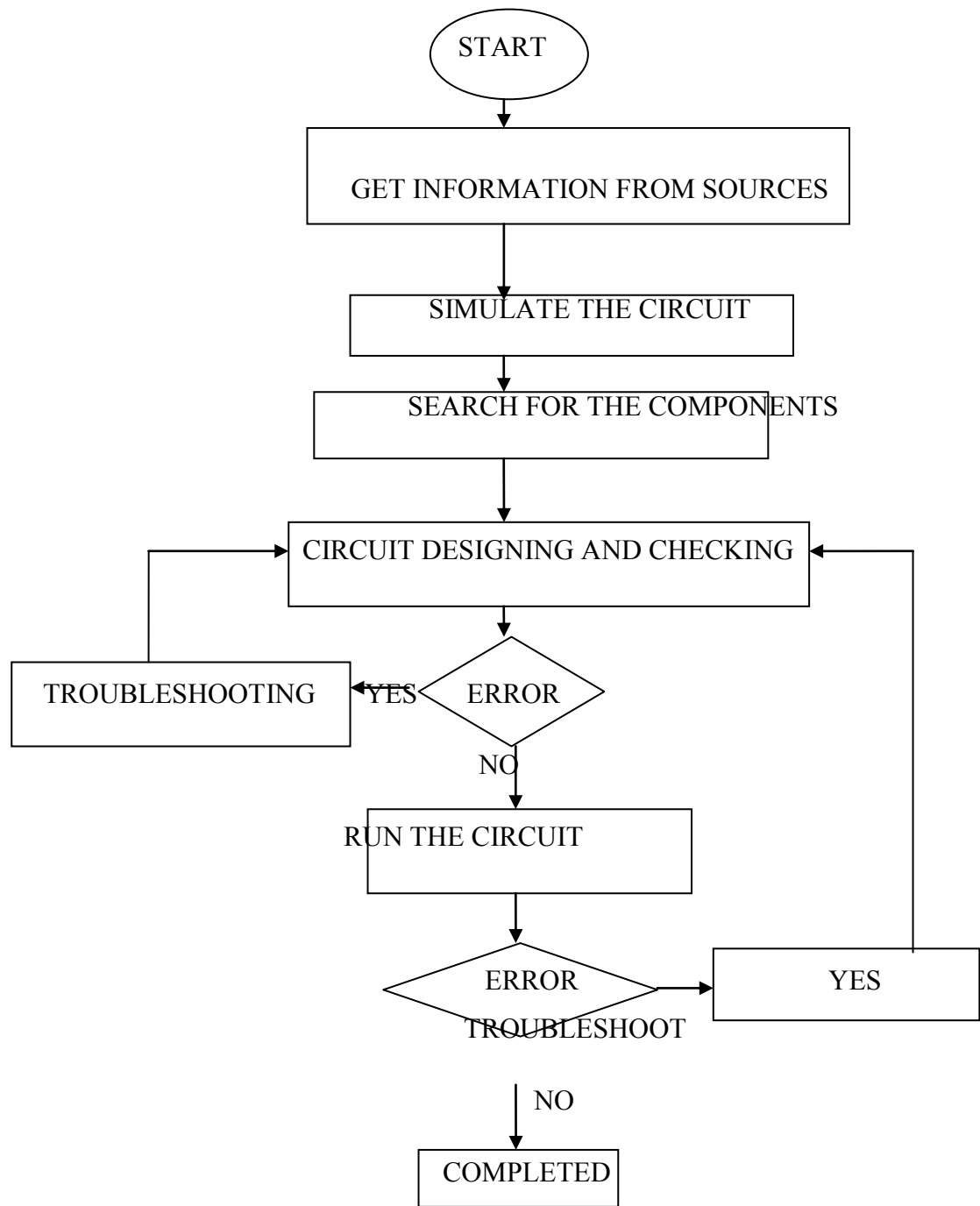2.4     Introduction

In electronics, an integrated circuit (also known as IC, microcircuit, microchip, silicon chip, or chip) is a miniaturized electronic circuit (consisting mainly of semoconductor devices, as well as passive components) which are manufactured in the surface of a thin substrate of semiconductor material. Integrated circuits are used in almost all electronic equipment in use today and have revolutionized the world of electronics. A hybrid integrated circuit is a miniaturized electronic circuit constructed of individual semiconductor devices, as well as passive components, bonded to a substrate or circuit board. [6]

Integrated circuits were made possible by experimental discoveries which showed that semiconductor devices could perform the functions of vacuum tubes, and by mid-20th-century technology advancements in semiconductor device fabrication. The integration of large numbers of tiny transistors into a small chip was an enormous improvement over the manual assembly of circuits using discrete electronic components. The integrated circuit mass production capability, reliability, and building-block approach to circuit design ensured the rapid adoption of standardized ICs in place of designs using discrete transistors. [6]

2.5     Integrated Circuit (IC) [6]

There are two main advantages of ICs over discrete circuits:

- cost
- performance

Cost is low because the chips, with all their components, are printed as a unit by photolithography and not constructed one transistor at a time. Furthermore, much less material is used to construct a circuit as a packaged IC die than as a discrete circuit.  Performance is high since the components switch quickly and consume little power (compared to their discrete counterparts), because the components are small and close together. As of 2006, chip areas range from a few square mm to around 350 mm², with up to 1 million transistors per mm².

Among the most advanced integrated circuits are the microprocessors or "**cores**", which control everything from computers to cellular phones to digital microwave ovens. Digital memory chips and ASICs are examples of other families of integrated circuits that are important to the modern information society. While cost of designing and developing a complex integrated circuit is quite high, when spread across typically millions of production units the individual IC cost is minimized. The performance of ICs is high because the small size allows short traces which in turn allows low power logic (such as CMOS) to be used at fast switching speeds. ICs have consistently migrated to smaller feature sizes over the years, allowing more circuitry to be packed on each chip.

This increased capacity per unit area can be used to decrease cost and/or increase functionality.

## 2.6    NE 555 (timer) [10]

The NE555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays or oscillation. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For astable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200mA. The NE555 is available in plastic and ceramic minidip package and in a 8-leadmicropackage and inmetal can package version.

The 555 timer is an extremely versatile integrated circuit which can be used to build lots of different circuits. You can use the 555 effectively without understanding the function of each pin in detail.

Frequently, the 555 is used in astable mode to generate a continuous series of pulses, but you can also use the 555 to make a one-shot or monostable circuit. The 555 can source or sink 200 mA of output current, and is capable of driving wide range of output devices.

### 2.3.1    Timer NE555 Features

- Low turn off time
- Maximum operating frequency greater than 500kHz
- Timing from microseconds to hours
- Operates in both astable and monostable modes

- High output current can source or sink 200mA

- Adjustable duty cycle

- TTL Compatible

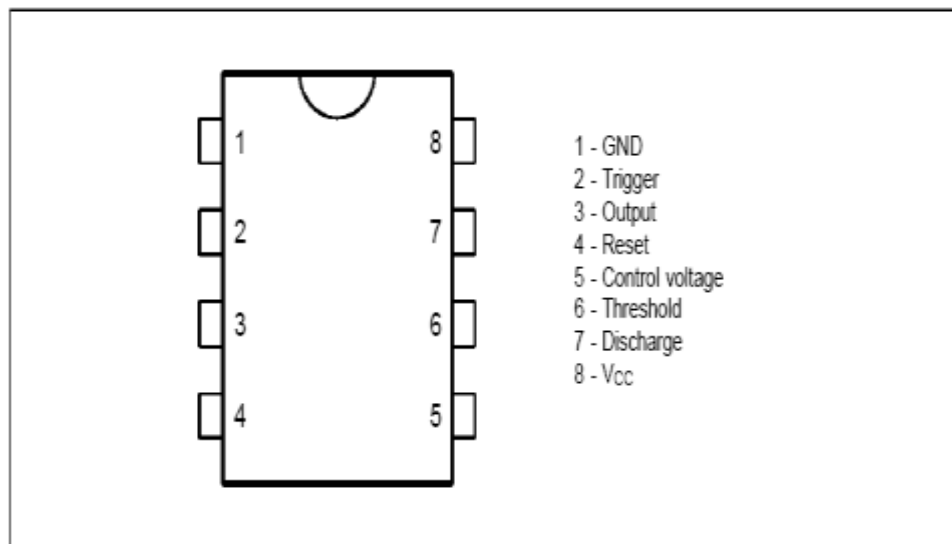- Temperature stability of 0.005% per $^0$C



Figure 2.0: Pin Connection (top view)

2.3.2    Pin Functions - 8 pin package

**-Ground (Pin 1)**

This pin is connected directly to ground.

**-Trigger (Pin 2)**

This pin is the input to the lower comparator and is used to set the latch, which in turn causes the output to go high.

**-Output (Pin 3)**

Output high is about 1.7V less than supply. Output low is capable of Isink up to 200mA.

**-Reset (Pin 4)**

This is used to reset the latch and return the output to a low state. The reset is an overriding function and when not used connect to V+.

**-Control (Pin 5)**

Allows access to the 2/3V+ voltage divider point when the 555 timer is used in voltage control mode. When not used it is connected to ground through a 0.01 uF capacitor.

**-Threshold (Pin 6)**

This is an input to the upper comparator. See data sheet for comprehensive explanation.

**-Discharge (Pin 7)**

This is the open collector of a NPN transistor.

**-V+ (Pin 8)**

This connects to Vcc and the Philips databook states the ICM7555 cmos version operates 3V - 16V DC while the NE555

version is 3V - 16V DC. Note comments about effective supply filtering and bypassing this pin below under "General considerations by using a 555 timer".

### 2.3.5   NE555  timer in astable operation

When configured as an oscillator, the 555 timer is configured as in figure 2.1 below. This is the free running mode and the trigger is tied to the threshold pin. At power-up, the capacitor is discharged, holding the trigger low. This triggers the timer, which establishes the capacitor charge path through Ra and Rb. When the capacitor reaches the threshold level of 2/3 Vcc, the output drops low and the discharge transistor turns on. The timing capacitor now discharges through Rb.

When the capacitor voltage drops to 1/3 Vcc, the trigger comparator trips, automatically retriggering the timer, creating an oscillator whose frequency is determined by the formula shown in figure 2.1.
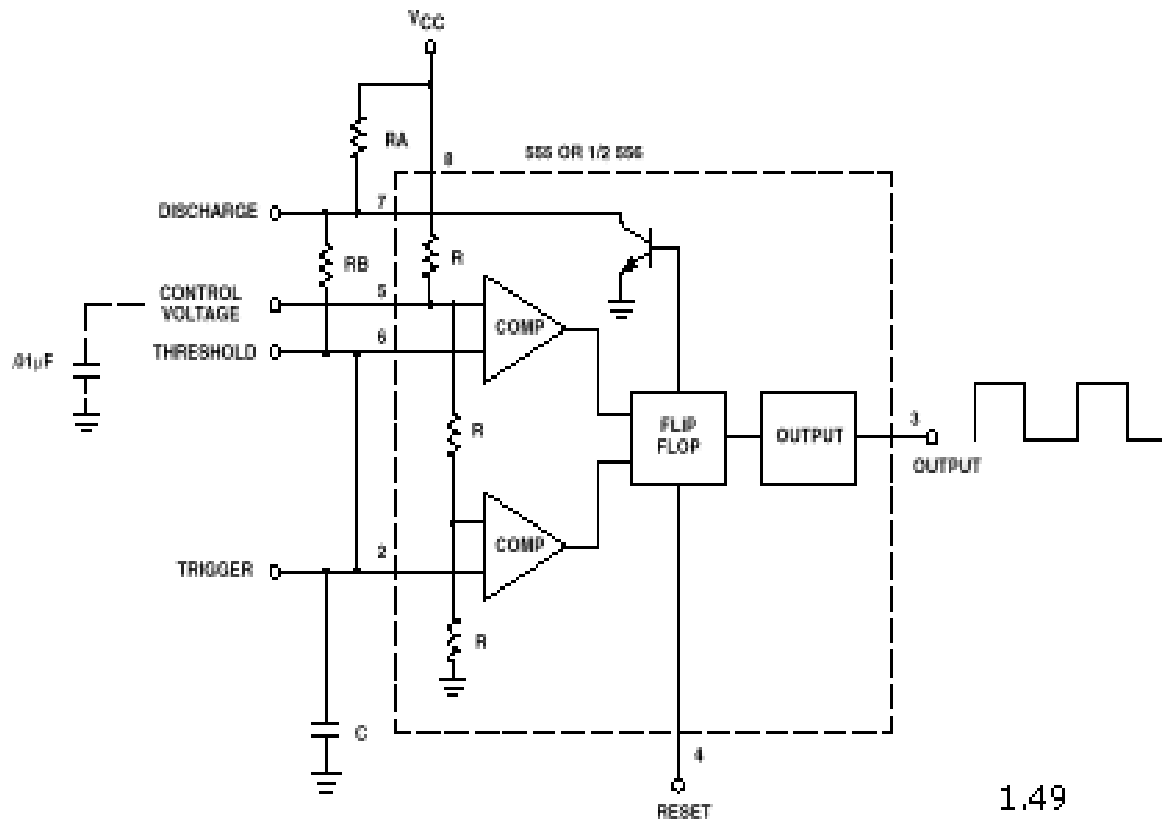
**Astable Operation**

$$F = \frac{1.49}{(Ra + 2Rb) * C}$$
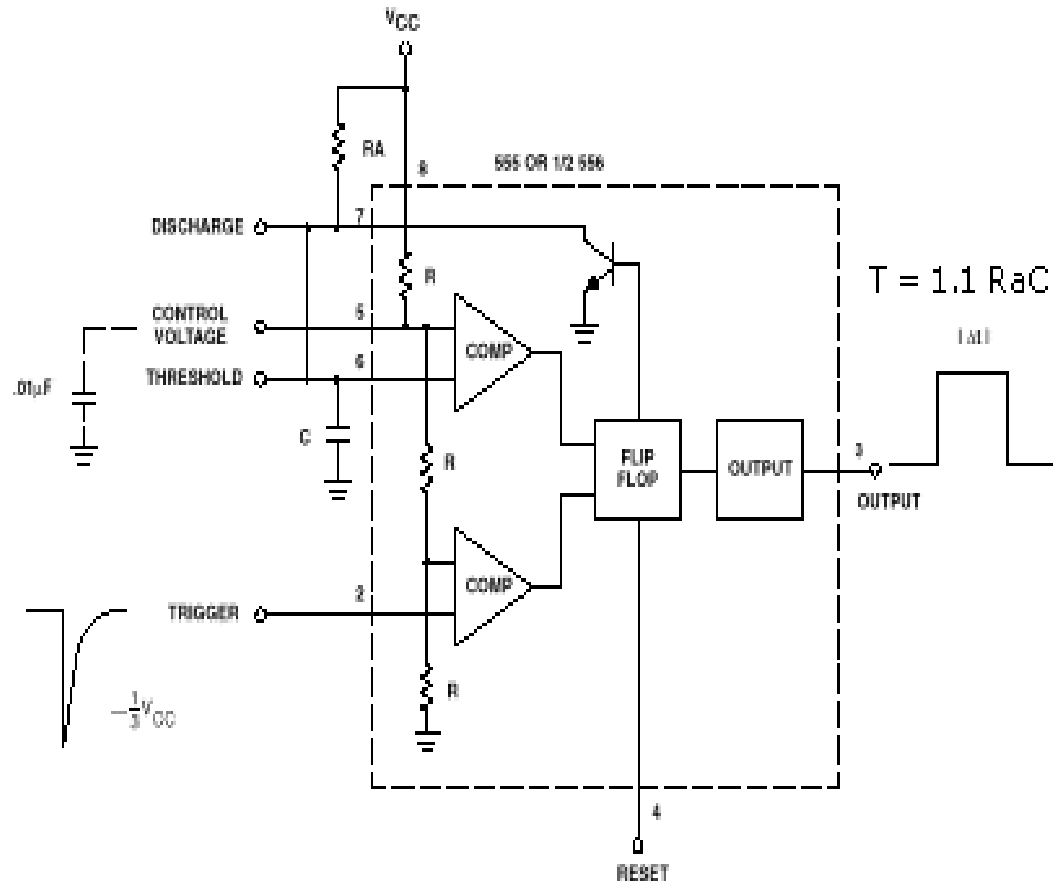
Figure 2.1: Astable operation

2.3.6  NE555 in monostable state

Another popular application for the 555 timer is the monostable mode (one shot) which requires only two external components, Ra and C in figure 2.2 below. Time period is determined by

T = 1.1 x Ra x C



Figure 2.2: Monostable operation