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Faculty of Engineering (EEE)

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Assignment	Project Report
Experiment Name	Electronic Dice using LEDs
Experiment Name	Flashing LED using Ic-555
POI	**P.j.3.A4**

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Title: Electronic Dice using LEDs

Abstract

Dice is a small cube shaped material with each side having different numbers, it is often used to play indoor games like ludo. Generally, dice is made of plastic, wood, stone, metal and even 3D printing. Out of all these options in this project we decided to create digital dice circuit with the help of ic-555 timer and decade counter. The mechanism is simple a push button is pressed and the LEDs start blinking at a high rate makes it difficult for human eyes that what number is the count for the chance.

Introduction

The project's basic concept is to incorporate a new dice-rolling technique into a game. The traditional method is sometimes unfair, and the game suffers as a result. With this in mind, an unbiased electronic dice is created. Simply pressing a button on an electronic dice causes a fast blink of six LEDs representing six numbers of dice, eventually leaving any number of dice behind as a result of the corresponding LED glowing. The game's fairness is ensured because the blinking rate can be adjusted by changing the value of the variable resistor used. The circuit design's practicality is ensured by its simple design and compact size, as well as its method of use. The IC 555 is used here as an astable multi-vibrator so that the pattern is never visible and a fair game can be played. The IC CD4017 functions as a decade counter.

Theory

The various technics and concepts involved in designing the electronic dice are as follows:

Astable Multivibrator

An astable multivibrator, also known as a free running multivibrator, is a multivibrator that has no stable states and alternates between them. Without external triggering, its output oscillates continuously between two unstable states. Each state's time period is determined by the Resistor Capacitor (RC) time constant. This type of multivibrator has two amplifying stages that are connected in positive feedback by two capacitive-resistive coupling networks. The amplifying elements include FETs, JFETs, Op-Amps, vacuum tubes, are to name a few. The output terminals of the multivibrator can be defined as active tubes. The output terminals of the multivibrator can be defined as active devices with opposing states; one with low voltage and the other with high voltage.

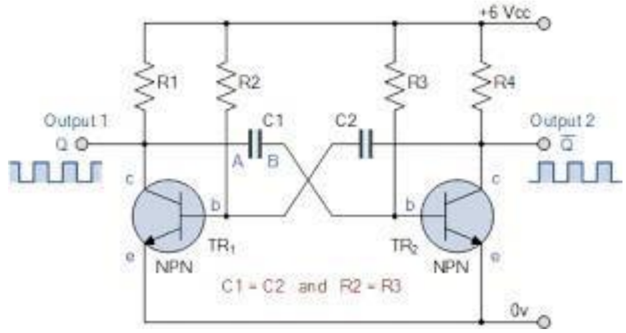


Figure 1: Circuit diagram of an astable multivibrator

Decade Counter

A decade counter is a ten-counting electronic circuit. Typically, this type of counter has decoded outputs, which means that it has 10 outputs, each of which goes high in sequence, with the others remaining low. The 4017 in the 4000 series CMOS logic family is an example of this type of integrated circuit. A decade counter is used as a demultiplexer in a radio control receiver, which is an unusual application. Each channel in a traditional RC system is encoded as a pulse of a certain length, followed by a gap, followed by the next pulse. A longer gap after 7 pulses indicates that the sequence must be restarted. By clocking the decade counter with the pulse train, each output is isolated as a separate channel.

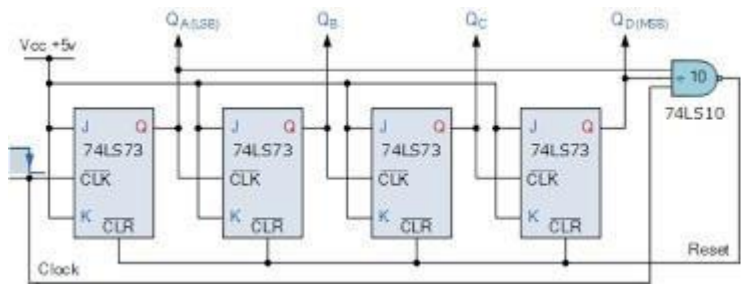


Figure 2: Circuit diagram of a decade counter

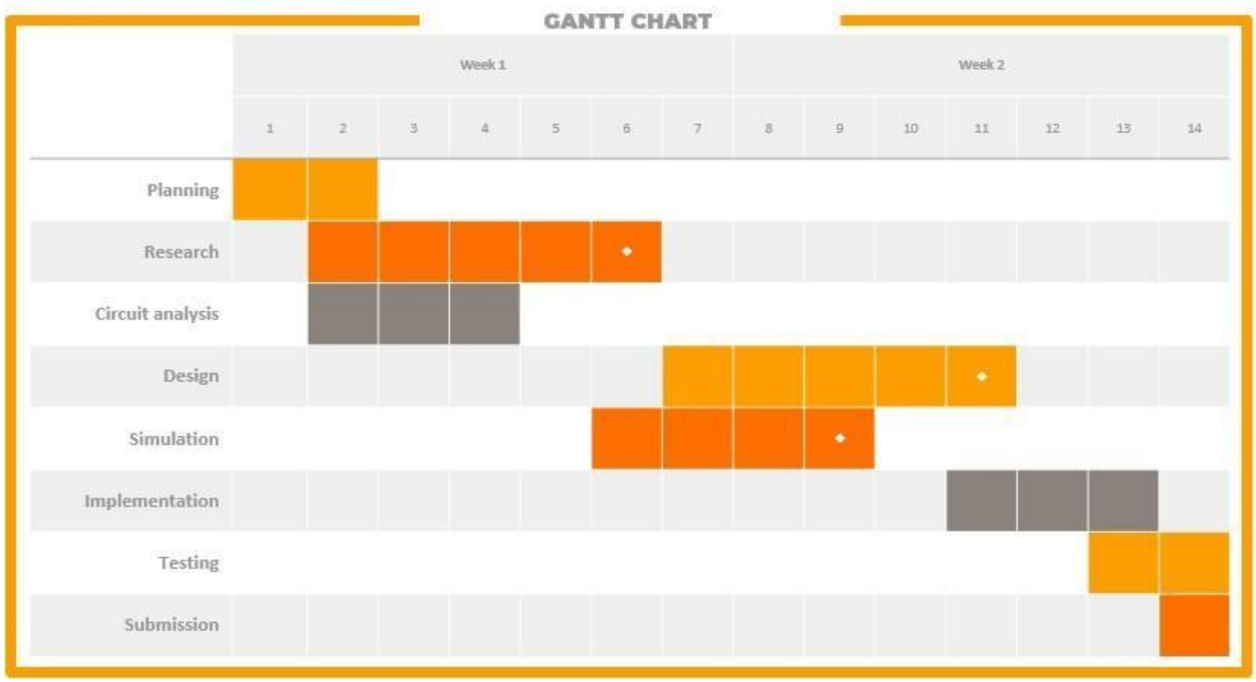
Apparatus:

1. LED’s × 6
2. Ic-555 timer
3. Ic-4017 Decade counter
4. Resistors
5. Capacitors
6. Push button
7. Batter
8. Breadboard

Working of circuit

In this circuit design we used 6 LED's each LED representing number (1-6) of the dice. LED's start illuminating once the push button is pressed and stop when the button is released. After illuminating the dice tells a number. For example, if the 3rd LED is ON that means it indicates number 3 on dice. The LEDs are connected to the output of Q_0 to Q_5 and the seventh output Q_6 is connected to the RESET Pin so that after LED6 the flashing start from Q_0. We applied clock pulse at PIN 14 of 4017 IC555 timer in astable mode. The oscillated output generated at PIN 3 of IC-555 timer has been applied to PI 14 of 4017 so that the output advances with each clock pulse. The speed of the illumination LEDs is controlled by the potentiometer. In digital dice we kept the oscillation frequency high so that there is no biasing or deformation. The frequency can be adjusted by rotating the potentiometer.

Gantt Chart



Cost Estimation

Component Name	Number Of Component	Cost
555 Timer IC	1	৳10.00
4017 Decade Counter IC	1	৳23.00
Led	6	৳6.00
Resistor	3	৳3.00
Capacitor	2	৳5.00
Button	1	৳2.35
Battery	1	৳32.00
Breadboard	1	৳100.00
Jumper Wires	-	৳1.50
Total Cost		৳182.85

Circuit Setup

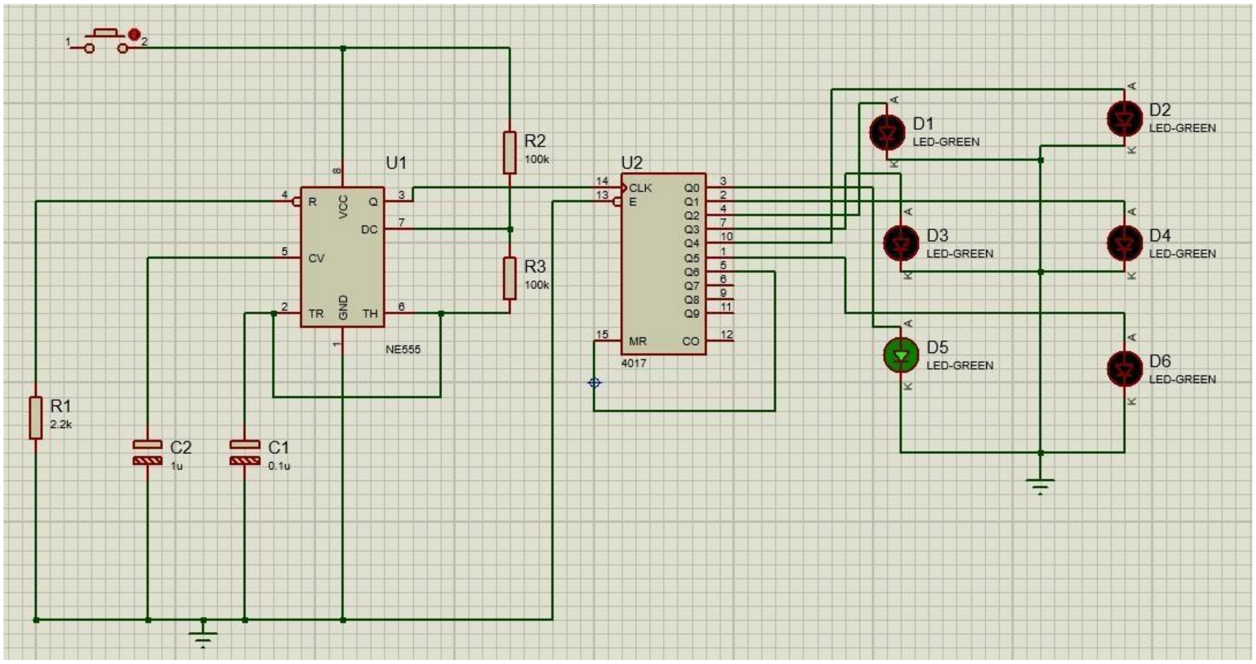


Figure 3: Schematic diagram of Electronic Dice using LEDs

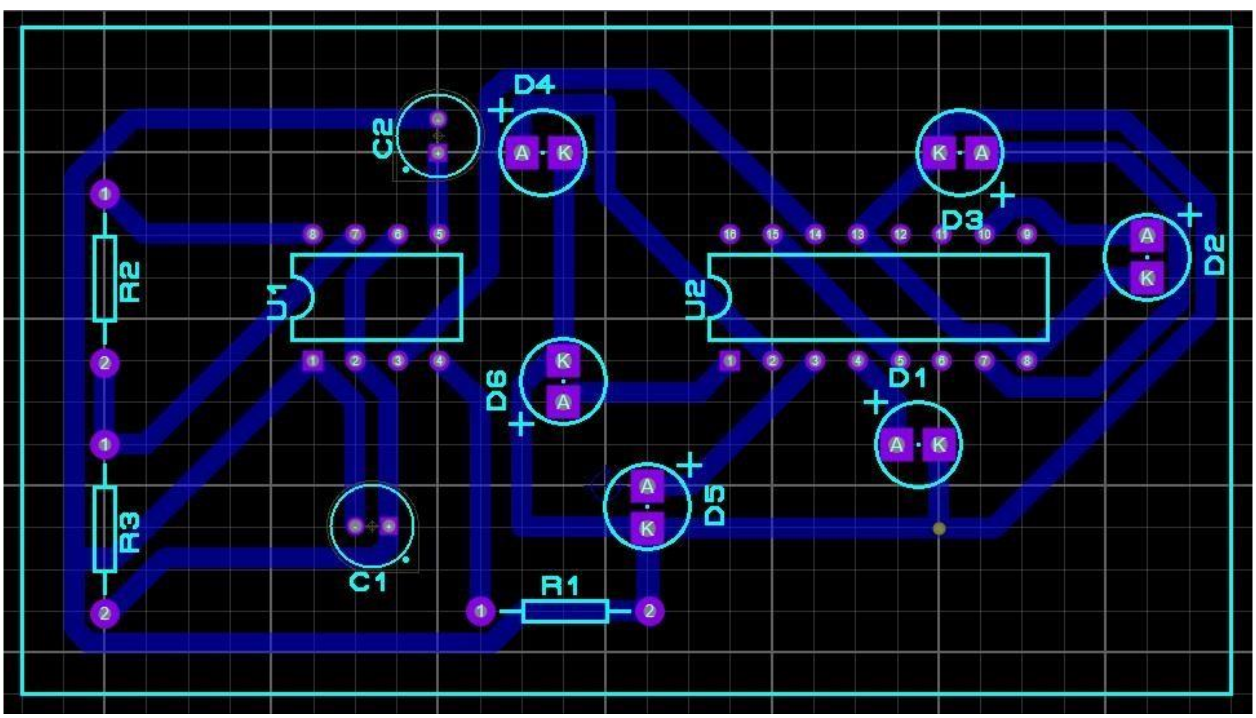


Figure 4: PCB Top-Copper layout

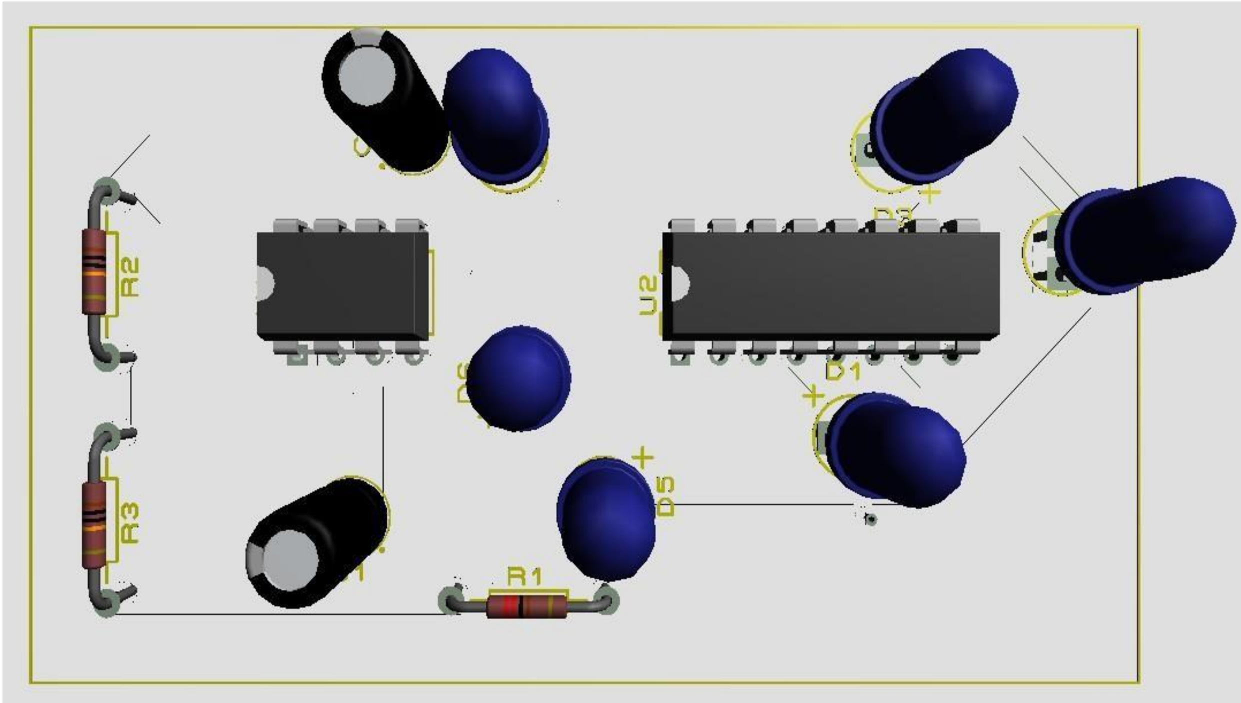


Figure 5: 3D view (Top silk)

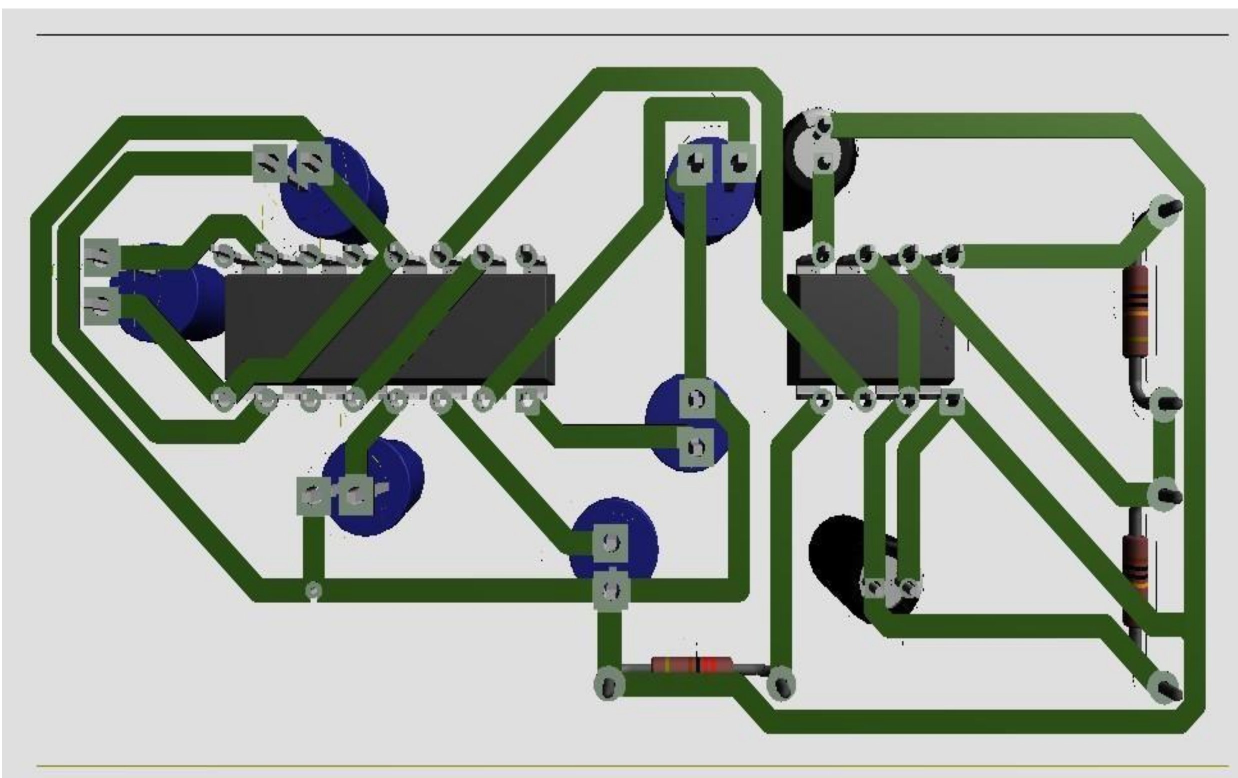


Figure 6: 3D view (Bottom Copper)

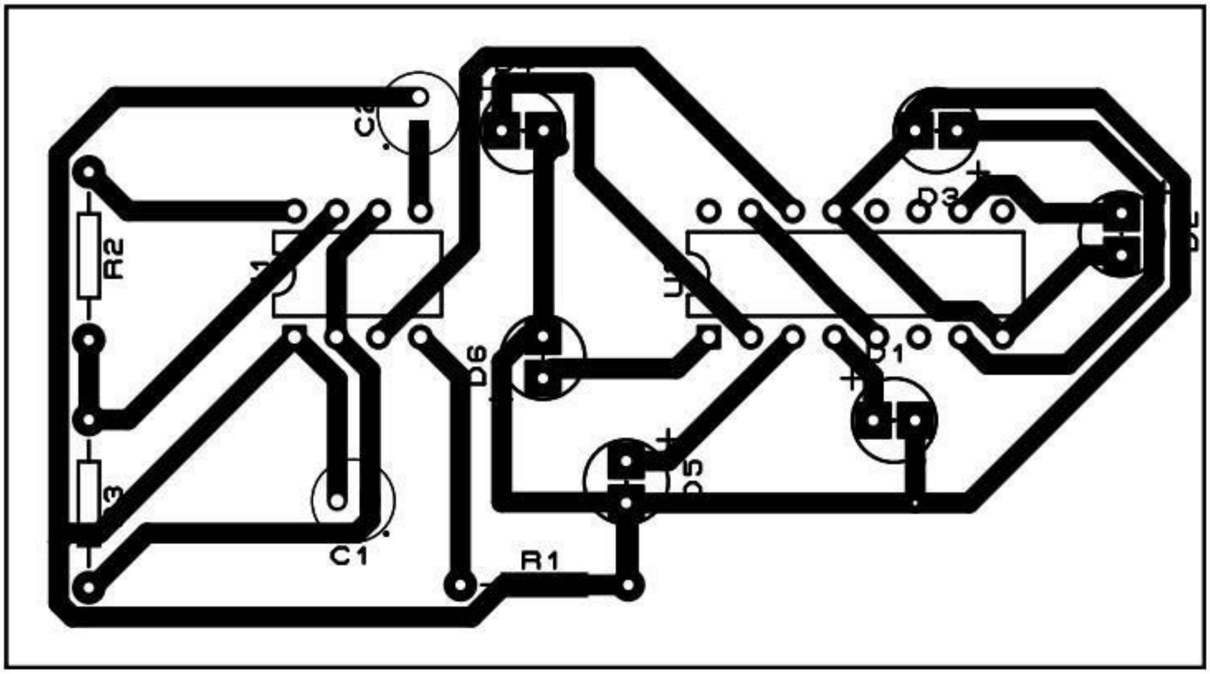


Figure 5: Printed PDF copy

Conclusion

It is observed that an electronic Dice is nearly unbiased, hence, we have an effective alternative of the older version of dice where biasing and deformation was easy. Additionally, an electronic dice gives higher accuracy and definition towards the unbiased results. Hence, with the help of current electronic advancement and its uses we can perform operations like this in order to get rid of unfair games which can be used in frequent applications. Finally, the usage of the applied design has its adaptation on large scale which leads to a lot more efficient and fair result which is trustworthy.

Reference

[1] https://www.electronicshub.org/unbiased-electronic-dice-with-leds/

[2]https://circuitdigest.com/electronic-circuits/digital-dice-circuit-usingic-555

[3]https://www.electronics.com.bd/ [4]https://qed.ai/pow-dice-running-total/

[5]https://www.youtube.com/watch?v=GYAHwYUUs34

[6] https://www.electronicshub.org/unbiased-electronic-dice-with-leds/

[7] https://circuitdigest.com/electronic-circuits/digital-dice-circuit-usingic-555

[8]https://circuits-diy.com/electronic-dice-circuit-using-cd4017-icelectronics-projects/

[9]https://www.spsvit.com/post/unbiased-electronic-dice-with-leds

[10]https://www.hackster.io/pranoti-deshmukh/how-to-make-a-digitaldice-using-ic555-andic4017-e67925

[11]https://www.homemade-circuits.com/electronic-dice-circuit-digitaldice/

Title: Flashing LED using Ic-555

Abstract

A 555 timer, as it is called generates a square wave when it is configured for an astable mode of operation. External resistors and capacitors determine the frequency of the square wave, which can be directly used by TTL circuits in this configuration. In a monostable mode, a pulse of a specific duration is produced, after which the timer returns to the state that it was previously in. Timers are traditional types that are divided into two types: analogue timers and digital timers. A timer is an electronic circuit that sends periodic signals to the system that can change the state of a digital signal. This timer is a small device in which a timer is used with a fixed time so that it will beep once the desired time has been reached. The working principle of such an 8-pin timer chip is the set and reset of two flip flops inside it. The set and reset times are decided by the external resistors and capacitors.

Introduction

The IC-555 timer is an integral part of an electronics project. The 555 generally operates in 3 modes. A-stable, Mono-stable and Bi-stable modes. It has a particular set of configurations, which has a single 8-bit micro-controller and some peripherals or a complex one involving system on chips (SoCs), 555 timer working is involved. An IC-555 timer provides time delays, as an oscillator and as a flip-flop element among other applications. 555 is used in almost every electronic circuit today, it works as a flip flop or as a multivibrator. Besides, the duty cycle of the timer is adjustable. Hence, by conducting this project we designed a schematic and PCB layout for the circuit where the motive was to design an ideal sized PCB layout for the 555 timer which shows the delay time assigned to it. The pattern will be seen when a current is assigned for a finite period of time to the (green) led and the delay time is given by using IC-555 timer.

Theory

The 555 timer has two basic operational modes: one shot and astable. In the one-shot mode, the 555 acts like a monostable multivibrator. A monostable is said to have a single stable state--that is the off state. Whenever it is triggered by an input pulse, the monostable switches to its temporary state. It remains in that state for a period of time determined by an RC network. It then returns to its stable state. In other words, the monostable circuit generates a single pulse of a fixed time duration each time it receives and input trigger pulse. Hence, the name one-shot. One-shot multivibrators are used for turning some circuit or external component on or off for a specific length of time. It is also used to generate delays. When multiple one-shots are cascaded, a variety of sequential timing pulses can be generated. Those pulses will allow you to time and sequence a number of related operations. The other basic operational mode of the 555 is as and astable multivibrator. An astable multivibrator is simply and oscillator. The astable multivibrator generates a continuous stream of rectangular off-on pulses that switch between two voltage levels. The frequency of the pulses and their duty cycle are dependent upon the RC network values.

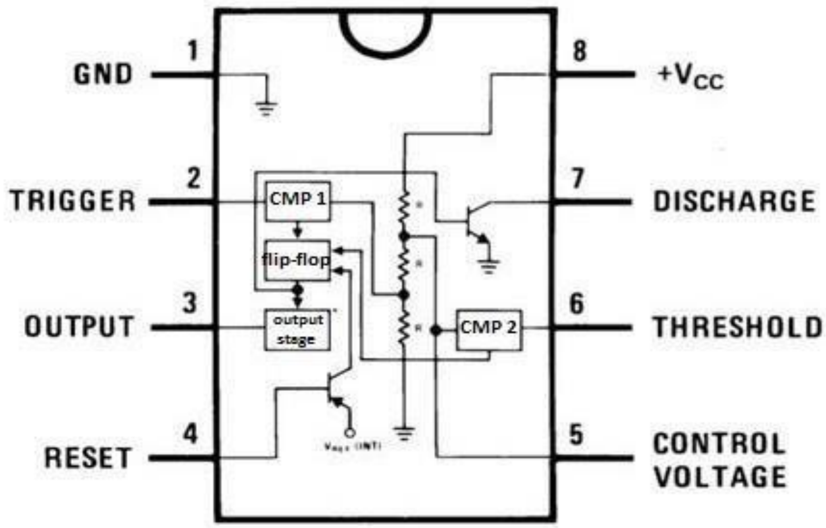


Figure 1: 555 timer IC pinout

The basic circuit of the 555 connected as a monostable multivibrator. An external RC network is connected between the supply voltage and ground. The junction of the resistor and capacitor is connected to the threshold input which is the input to the upper comparator. The internal discharge transistor is also connected to the junction of the resistor and the capacitor. An input trigger pulse is applied to the trigger input, which is the input to the lower comparator. With that circuit configuration, the control flip-flop is initially reset. Therefore, the output voltage is near zero volts. The signal from the control flip-flop causes T1 to conduct and act as a short circuit across the external capacitor. For that reason, the capacitor cannot charge. During that time, the input to the upper comparator is near zero volts causing the comparator output to keep the control flip-flop reset.

Astable Mode

Astable mode means there will be no stable levels at the output. Hence, the output will fluctuate from high and low. This character of the astable output is used as a clock or square wave output for many applications.

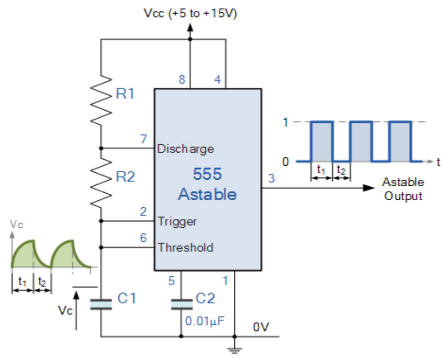


Figure 2: Astable Mode

Monostable Mode

The 555 monostable mode is shown here in its utmost basic mode of operation; as a triggered monostable. One immediate observation is the extreme simplicity of this circuit. Only two components to make up a timer, a capacitor and a resistor. And for noise immunity maybe a capacitor on pin 5. Due to the internal latching mechanism of the 555, the timer will always time-out once triggered, regardless of any subsequent noise (such as bounce) on the input trigger (pin 2). This is a great asset in interfacing the 555 with noisy sources. Just in case you don't know what 'bounce' is: bounce is a type of fast, short-term noise caused by a switch, relay, etc. and then picked up by the input pin. The trigger input is initially high (about 1/3 of +V). When a negative-going trigger pulse is applied to the trigger input (see fig. 2), the threshold on the lower comparator is exceeded. The lower comparator, therefore, sets the flip-flop. That causes T1 to cut off, acting as an open circuit. The setting of the flip-flop also causes a positive-going output level which is the beginning of the output timing pulse.

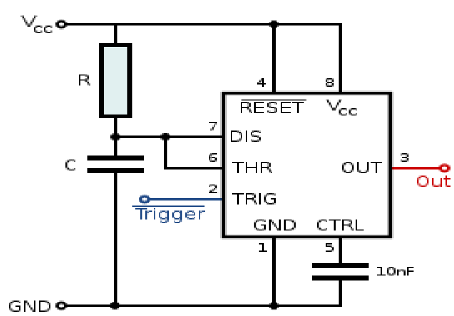


Figure 3: Monostable Mode

Application

There are thousands of different ways that the 555 can be used in electronic circuits. In almost every case, however, the basic circuit is either a one-shot or an astable. The application usually requires a specific pulse time duration, operation frequency, and duty cycle. Additional components may have to be connected to the 555 to interface the device to external circuits or devices.

Apparatus

1. 555 Timer
2. 9V Battery
3. Capacitors (1uF & 10n)
4. Resistors (1K,10K,470R)
5. LED'S
6. Breadboard

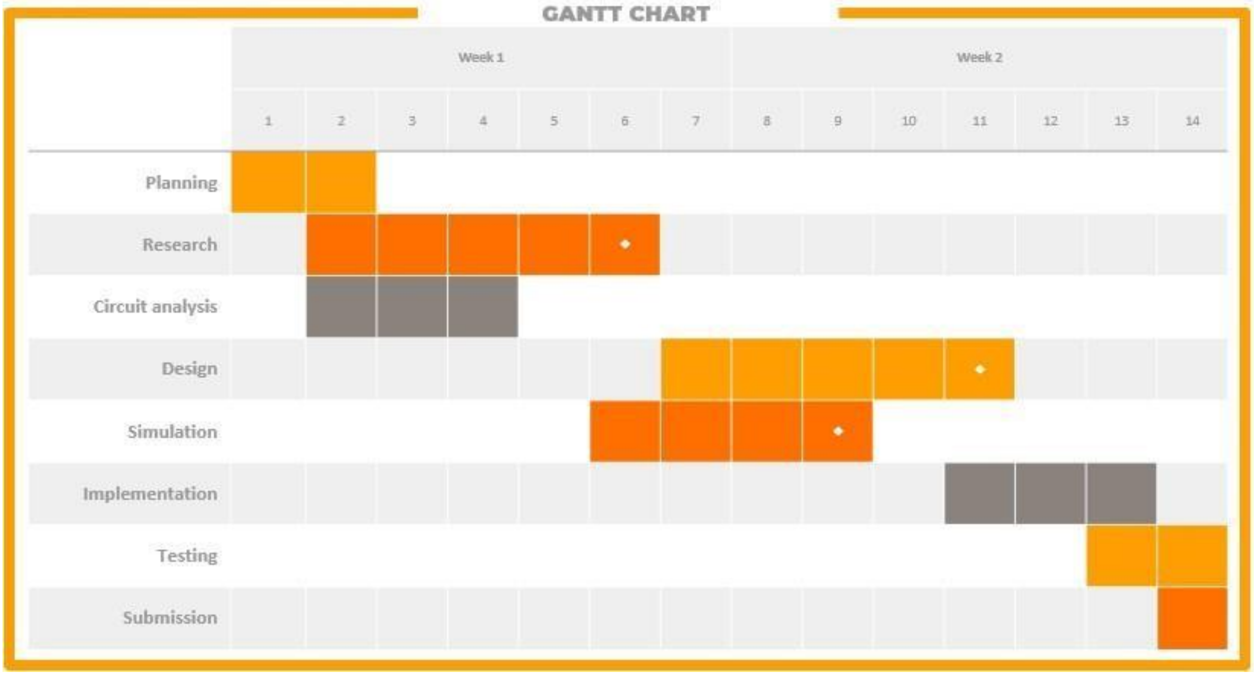
Procedure

In the Porteous circuit design explains the design of the blinking LED (Light Emitting Diode) with the 555 timer IC.

- Collecting all the required components and place the 555 timer IC on the Porteous.
- Connecting the pin 1 of a 555 timer IC to the ground.
- The longer lead of a polarized capacitor is the positive and the shorter lead is negative. Connecting the pin 2 to the positive end of a capacitor. Connect the negative lead of the capacitor to the ground of the battery.
- Now we short the pin 2 to pin 6 of the 555 timer IC.
- Connecting the output pin 3 with the positive lead of the LED using a 1kΩ resistor and the negative lead of LED is connected with the ground.
- Connecting pin 4 to the positive end of the battery.
- Pin 5 connect with C2 capacitor(10N).
- Pin 7 is connected to the positive end of the battery using a 10kΩ resistor.
- Pin 8 is connected to the positive end of the battery and 470Ω and LEDs
- Finally, an output result will be showing in Oscilloscope but connecting an output wire

After doing this Schematic diagram we implement the PCB layout and 3D visualization.

Gantt Chart



Cost Estimation

Component Name	Number Of Component	Cost
555 Timer IC	1	৳10.00
Battery	1	৳32.00
Led	2	৳2.00
Resistor	4	৳4.00
Capacitor	2	৳5.00
Breadboard	1	৳100.00
Total Cost		৳ 153.00

Circuit Setup

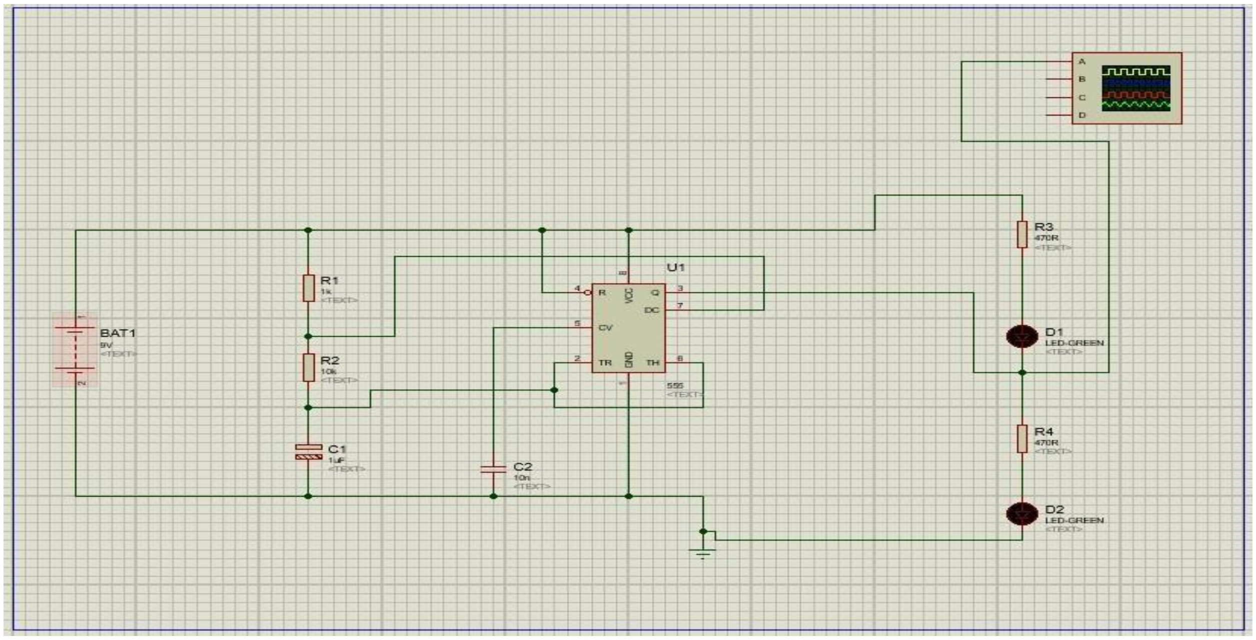


Figure 4: Schematic of Flashing LED using ic-555

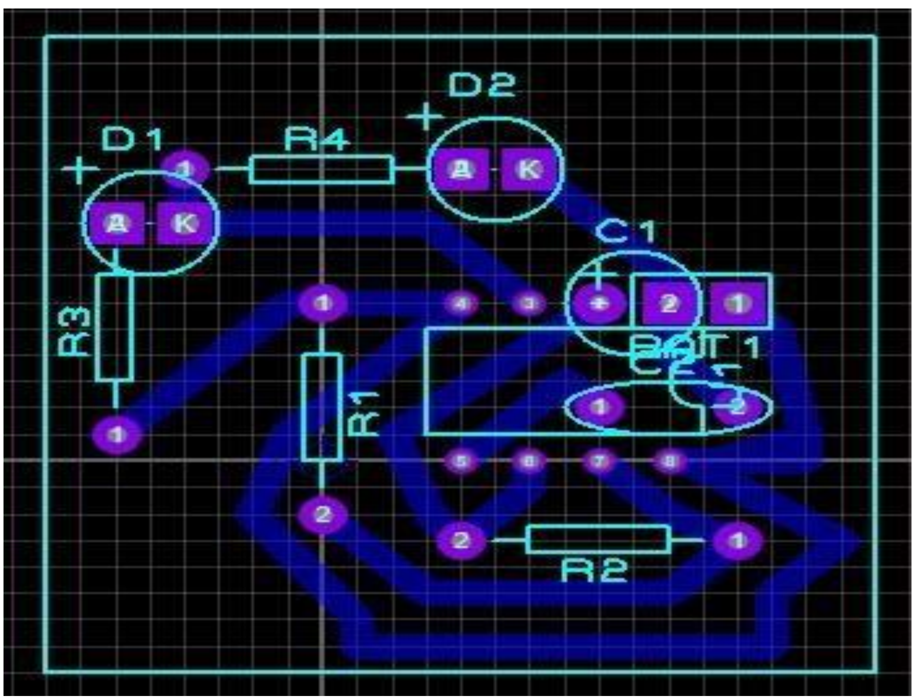


Figure 5: PCB Top Copper layout

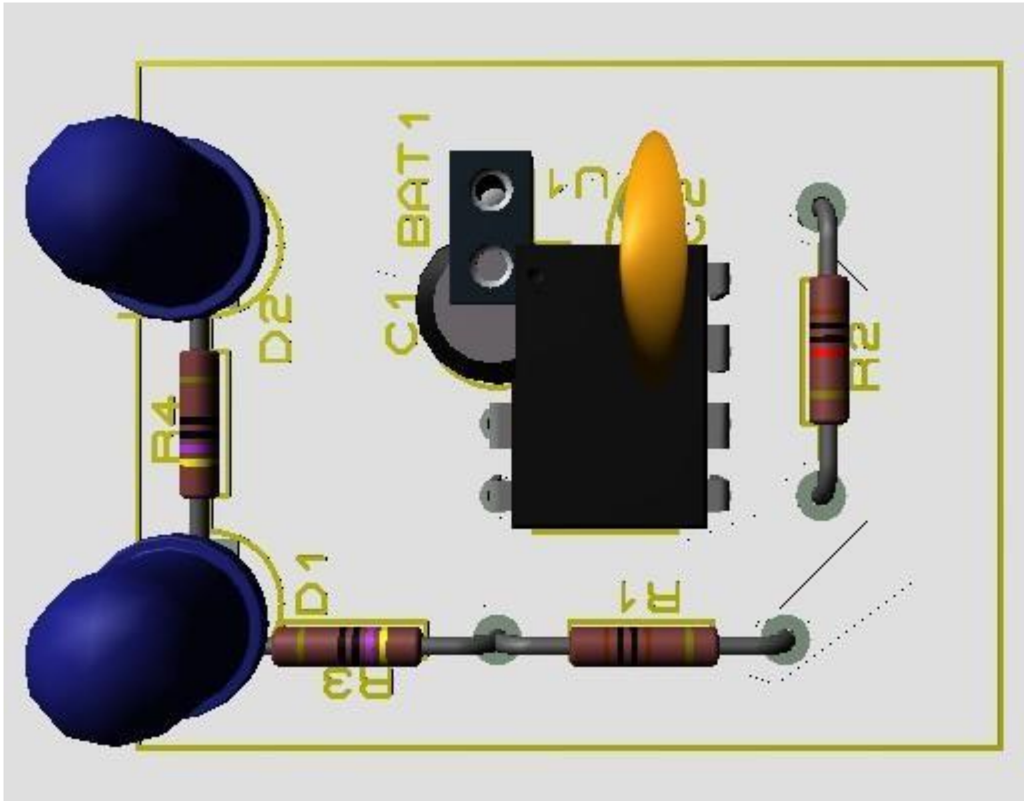


Figure 6: 3D view (Top Silk)

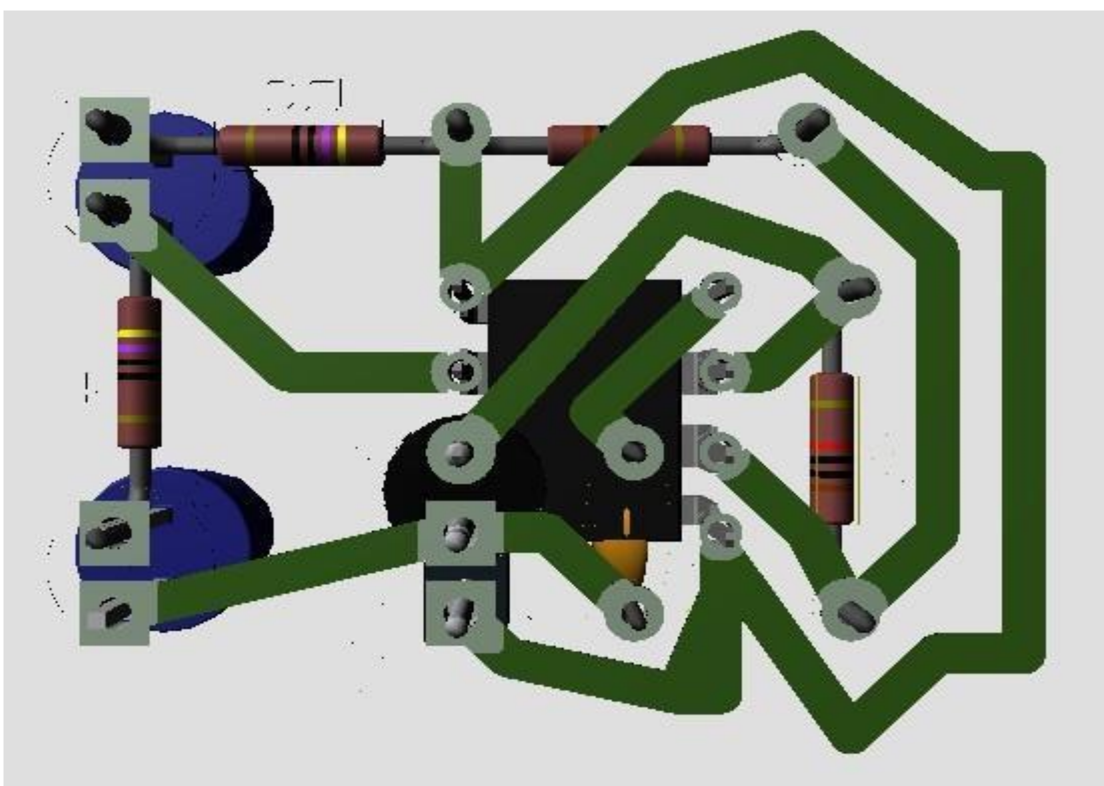


Figure 7: 3D view (Bottom Copper)

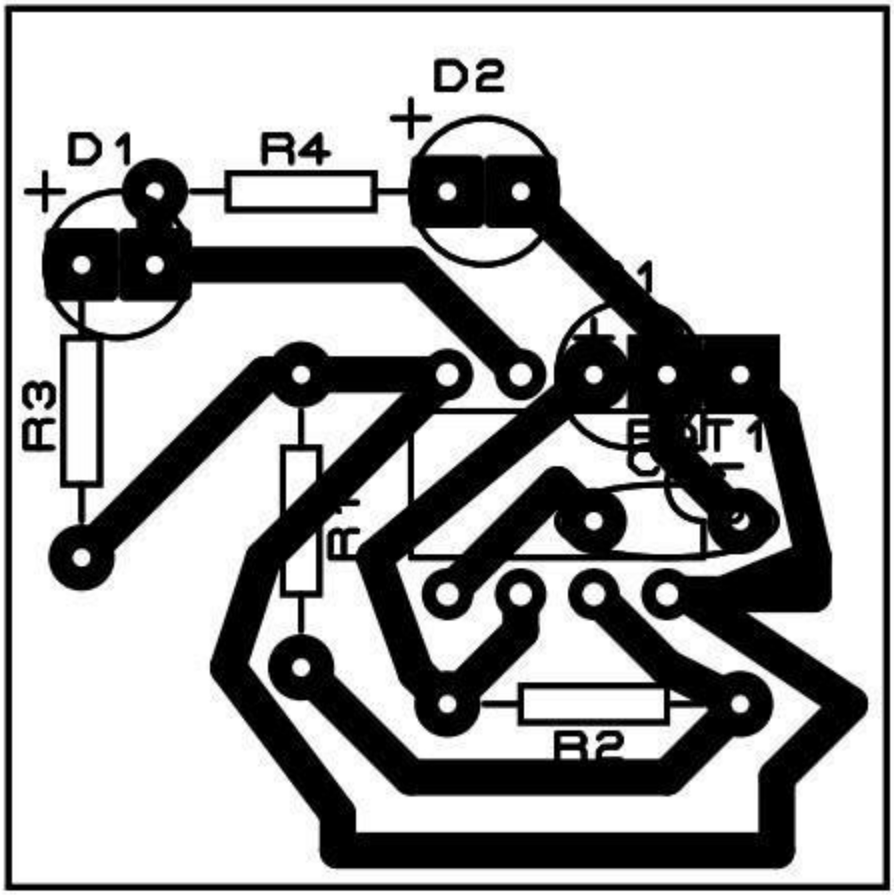


Figure 8: Printed Copy

Conclusion

The 555 timer IC is an integrated circuit which is used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. One should know, ic-555 can generate PWM (Pulse Width Modulation) and square wave easily as compared to others, which helps to create different types of waveforms. Again, by adding integrator to it, it is able to generate sine wave by the LPF (Low Pass Filter). Hence, the design procedure of an astable multivibrator using ic-555 timer circuit was not complicated to perform.

Reference

[1] https://www.dummies.com/programming/electronics/components/electronicscomponentshow-the-555-timer-chip-works/

[2] https://www.electronicsforu.com/technology-trends/learn-electronics/555timer-workingspecifications

[3] https://www.elprocus.com/blinking-led-using-555-timer-ic/

[4]https://www.electronicstutorials.ws/waveforms/555_timer.html#:~:text=The%20555%20timer%20IC%20is,cycles%20from%2050%20to%20100%25

[5] https://www.engineersgarage.com/555-timer-ic-introduction-basics-workingwith-differentoperating-modes/

[6]https://www.google.com/search?q=ic+555+timer+objective&sxsrf=ALeKk03fRsbHhfWjPivkhWP5916anzsbXQ%3A1628184878853&ei=LiEMYbfNM5iwrQHr0b3wAQ&oq=ic+555+timer+objective&gs_lcp=Cgdnd3Mtd2l6EAMyBAgjECcyBQgAEIAEOgcIABBHELADSgQIQRgAUNA_WNA_YMJBaAFwAngAgAGOAYgBjQKSAQMwLjKYAQCgAQHIAQjAAQE&sclient=gwswiz&ved=0ahUKEwi3nNSqtZryAhUYWCsKHetoDx4Q4dUDCA4&uact=5

[7] https://howtomechatronics.com/how-it-works/electronics/555-timer-icworking-principleblock-diagram-circuit-schematics/

[8] https://www.indiabix.com/digital-electronics/multivibrators-and-555-timer/

[9] https://how2electronics.com/led-blinking-circuit-using-555-timer/

[10] https://www.youtube.com/watch?v=TTQnhIkw4Bk