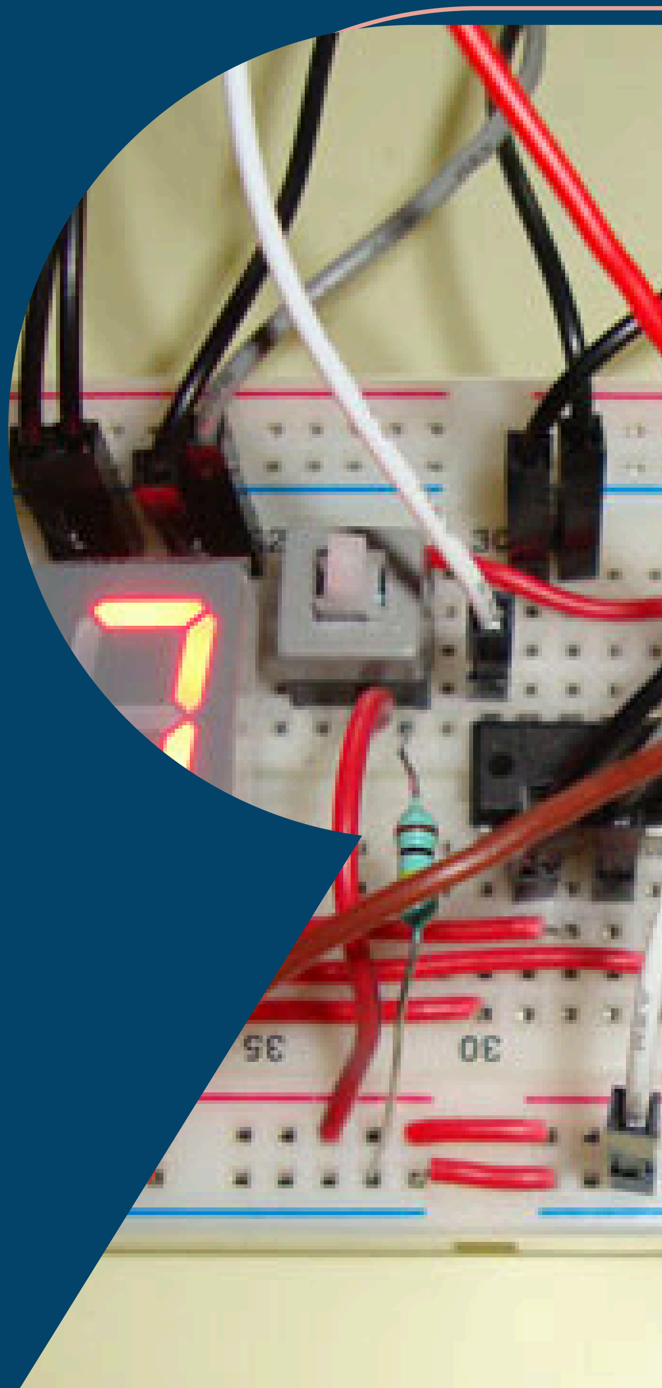
REACTION TIMER GAME



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2025

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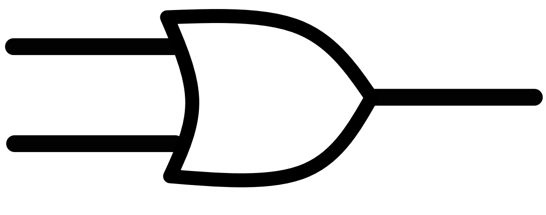
Introduction

Reaction timer is a game to test how fast you reacts. This game which we have developed using 555 IC is for two players where first player starts the game by pressing start button. As soon as the START button is pressed, 7 segment display starts displaying 0 to 9 numbers in a high speed. Then other player stops the counting by pressing the STOP button. As the frequency of displaying numbers is very high, it is difficult and needs full attention to react on the correct time.

$$Y = A + B$$

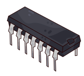
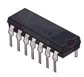
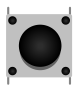
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1



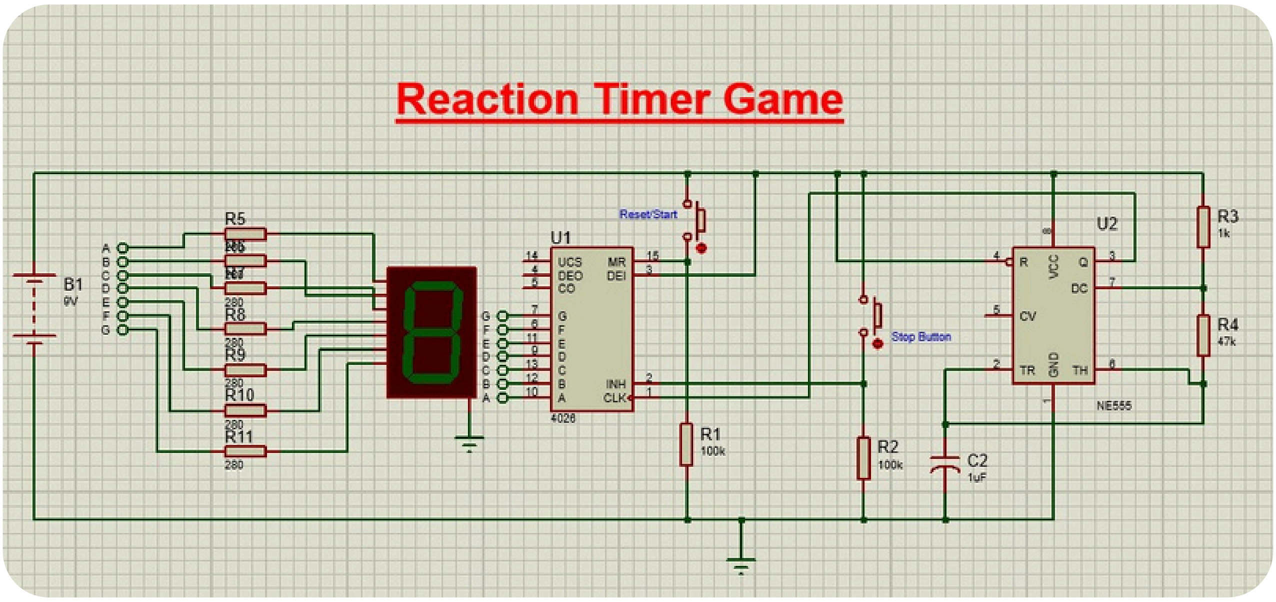
Objectives

- To design a game circuit that measures human reaction time.
- To apply IC 555 in Astable modes.
- To create a user-interactive experience using switches.

Components

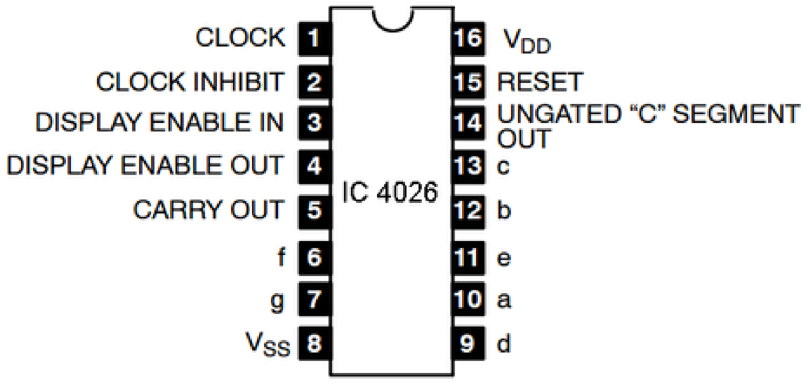
COMPONENT	QUANTITY
555 timer IC 	1
4026 IC 	1
7-segment display 	1
push ON, push OFF button. 	2
Resistors – 100k (2), 1k, 47k 	4
Capacitor 1uF 	1

Circuit Diagram and Explanation



Here we are using 4026 IC, which is a 4000 series CMOS seven-segment counter IC. It is used to display numbers on seven segment displays and increment the number by one, when a clock pulse is applied to its PIN 1. That means more the clock pulse rate, faster the numbers change on 7 segment. Below is the pin diagram and pin description of 4026 IC.

Circuit Diagram and Explanation



PIN NUMBER	NAME	DESCRIPTION
1	CLK	Clock in
2	CI	Clock inhibit - when low, clock pulses increment the seven-segment
3	DE	Display enable- chip will be ON when this pin is HIGH, and OFF if it is LOW.
15	RST	Reset PIN, active HIGH.
10-12-13-9-11-6-7	A-B-C-D-E-F-G	Connected to the 7-segment.

Working Principle

Pin 2 is used to freeze the display in 7 segment when connected to HIGH, which we have used on STOP button. Pin 15 is used to reset the IC when HIGH and seven segment displays 0, this PIN is used on START/RESET switch. Both the PIN 2 and 15 are active high pins.

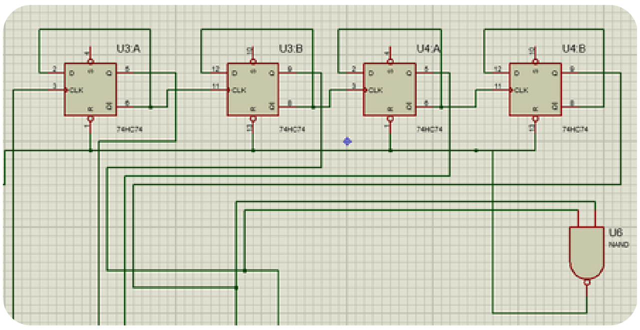
PINS 6,7,9,10,11,12,13 are used to connect with the 7segemet display, we have used common cathode seven segment display, in which cathodes, of the all LEDs inside 7 segment, are connected together.

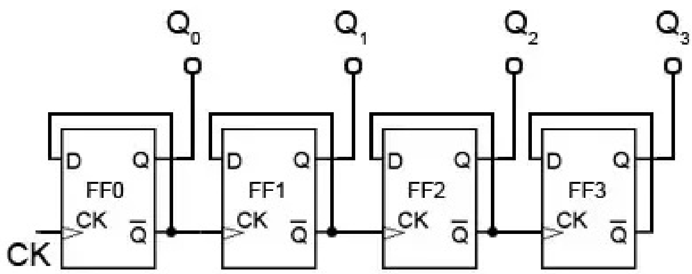
Now the main component of the circuit, 555 timer IC comes into picture. 555 is used here to provide the CLOCK pulse to 4026 IC at PIN 1 so that numbers can be changed in 7 segment. 555 is used in Astable multivibrator mode, and the clock pulse rate can be controlled by the Resistor R1, R2 and the Capacitor. Here we have used approximately 15 pulses/second, i.e. numbers are changing 15 times in a second. If we want to slow down the rate at which the numbers are changing, we can increase the value of capacitor, like you can try using capacitor between 1uf to 10uf, and get the desired speed.

ICs

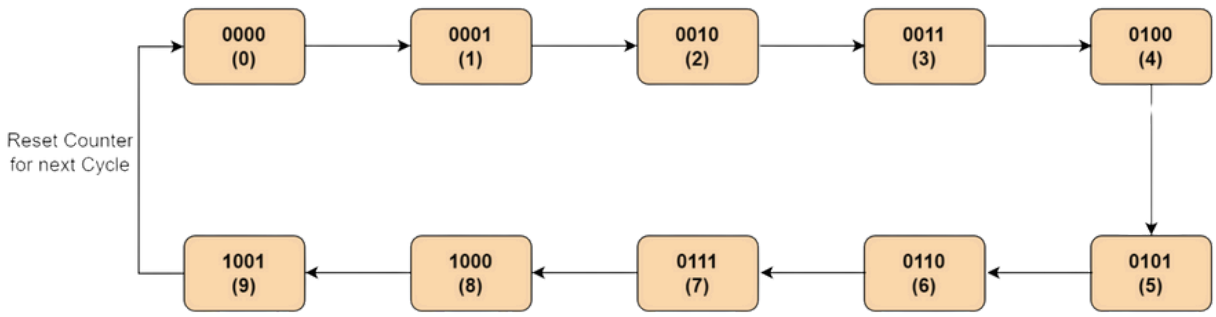
IC 4026 (Decade Counter with 7-Segment Decoder/Driver)

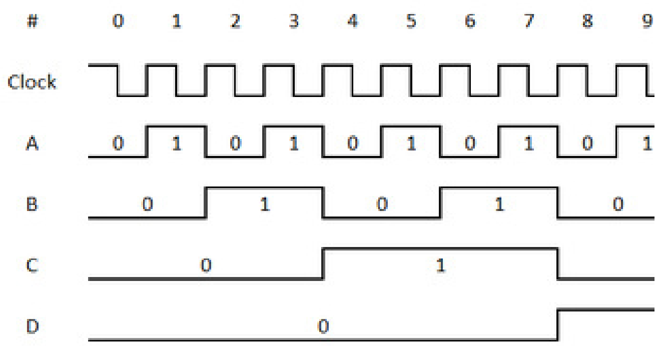
Counter Block





Counter State Diagram





ICs

Function of the NAND Gate in a Counter That Resets the 7-Segment Display to Zero

In digital counters that display numbers on a 7-segment display, we sometimes need the counter to automatically reset to zero when it reaches a specific number — for example, resetting after 9 to create a mod-10 (0 to 9) counter.

Role of the NAND Gate:

A NAND gate is used to detect a specific count value (like 10) by connecting certain output bits of the counter to its inputs. When the counter reaches that value, the NAND gate's output goes LOW (0), which is used to trigger the reset of the counter back to 0.

Example: Mod-10 Counter (Counts from 0 to 9)

Binary for 10 is: 1010
Assume a 4-bit counter with outputs: Q3 Q2 Q1 Q0

Q3 = 1

Q2 = 0

Q1 = 1

Q0 = 0

We connect Q3 and Q1 to the inputs of a NAND gate, since these two bits are 1 when the count is 10. When both Q3 and Q1 = 1:

The NAND gate outputs 0

This LOW signal is fed into the RESET input of the counter

The counter then resets to 0000 (decimal)

ICs

IC 4026 (Decade Counter with 7-Segment Decoder/Driver)

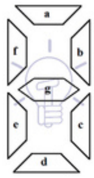
Counter Truth Table

Truth Table				
Count	Q_A	Q_B	Q_C	Q_D
0-[Start]	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10 [New Cyle]	0	0	0	0

ICs

IC 4026 (Decade Counter with 7-Segment Decoder/Driver)

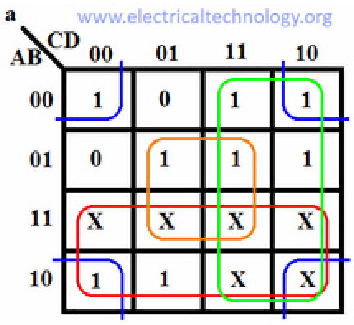
7-Segment Decoder Block



7-segment Truth Table

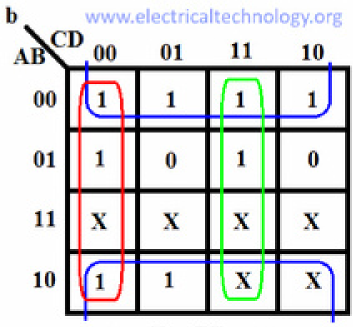
	INPUT				OUTPUT						
Digits	A	B	C	D	a	b	c	d	e	f	g
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	1	1

For output a:



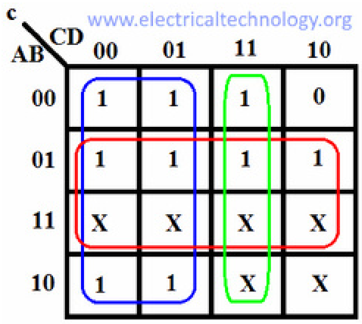
$a = A + C + BD + \bar{B}\bar{D}$

For output b:



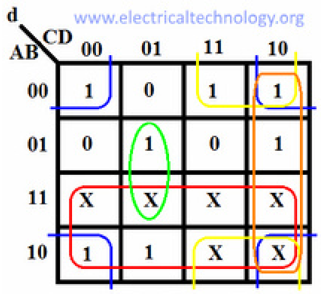
$b = \bar{B} + \bar{C}\bar{D} + CD$

For output c:



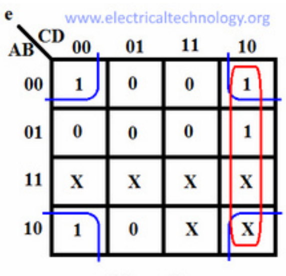
$c = B + \bar{C} + D$

For output d:



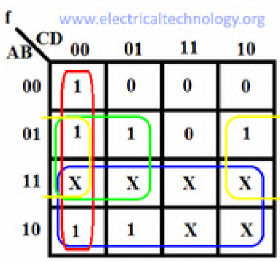
$d = A + \bar{B}\bar{D} + \bar{B}C + C\bar{D} + B\bar{C}D$

For output e:



$e = \bar{B}\bar{D} + C\bar{D}$

For output f:



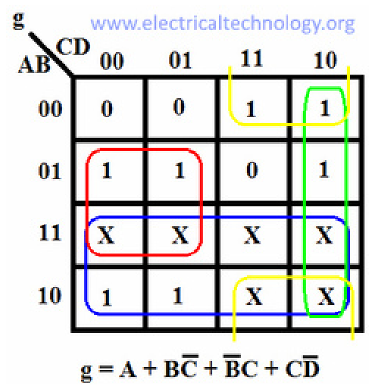
$f = A + B\bar{C} + B\bar{D} + \bar{C}\bar{D}$

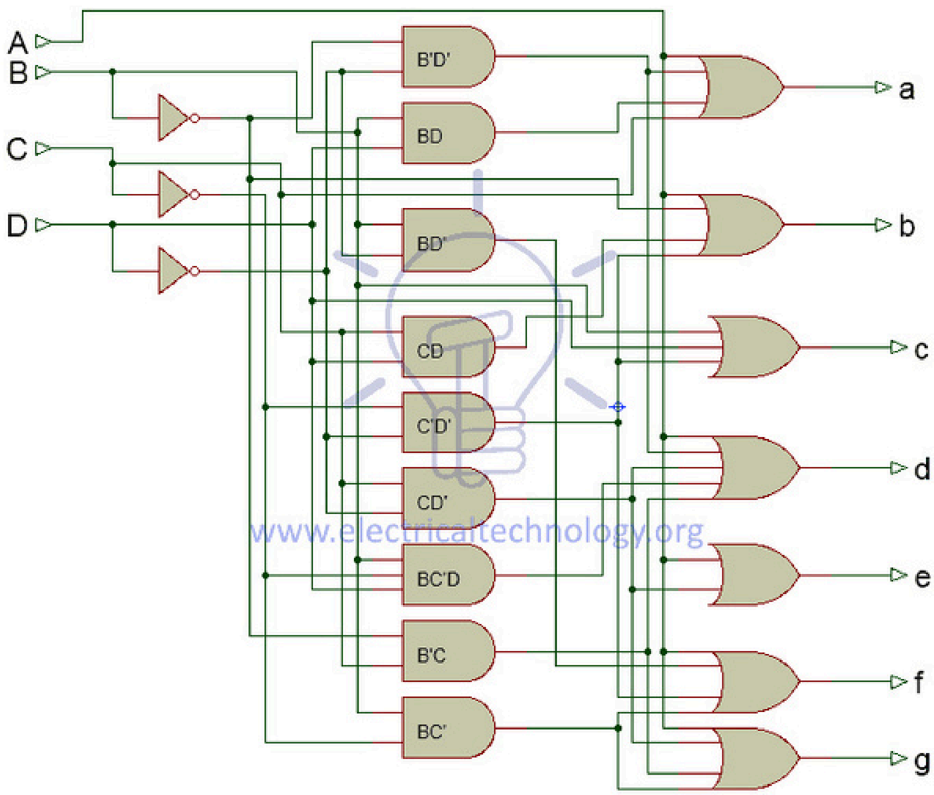
ICs

IC 4026 (Decade Counter with 7-Segment Decoder/Driver)

7-Segment Decoder Block

For output g:



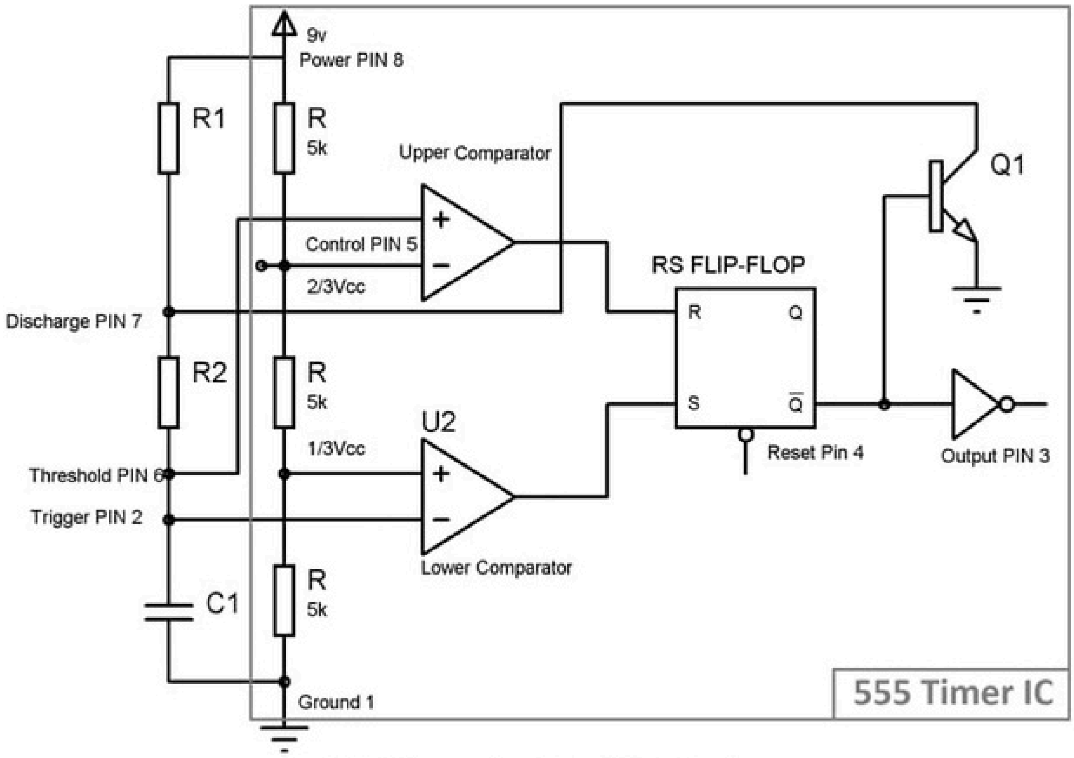


Schematic of BCD to 7-Segment Decoder

ICs

IC 555 Timer

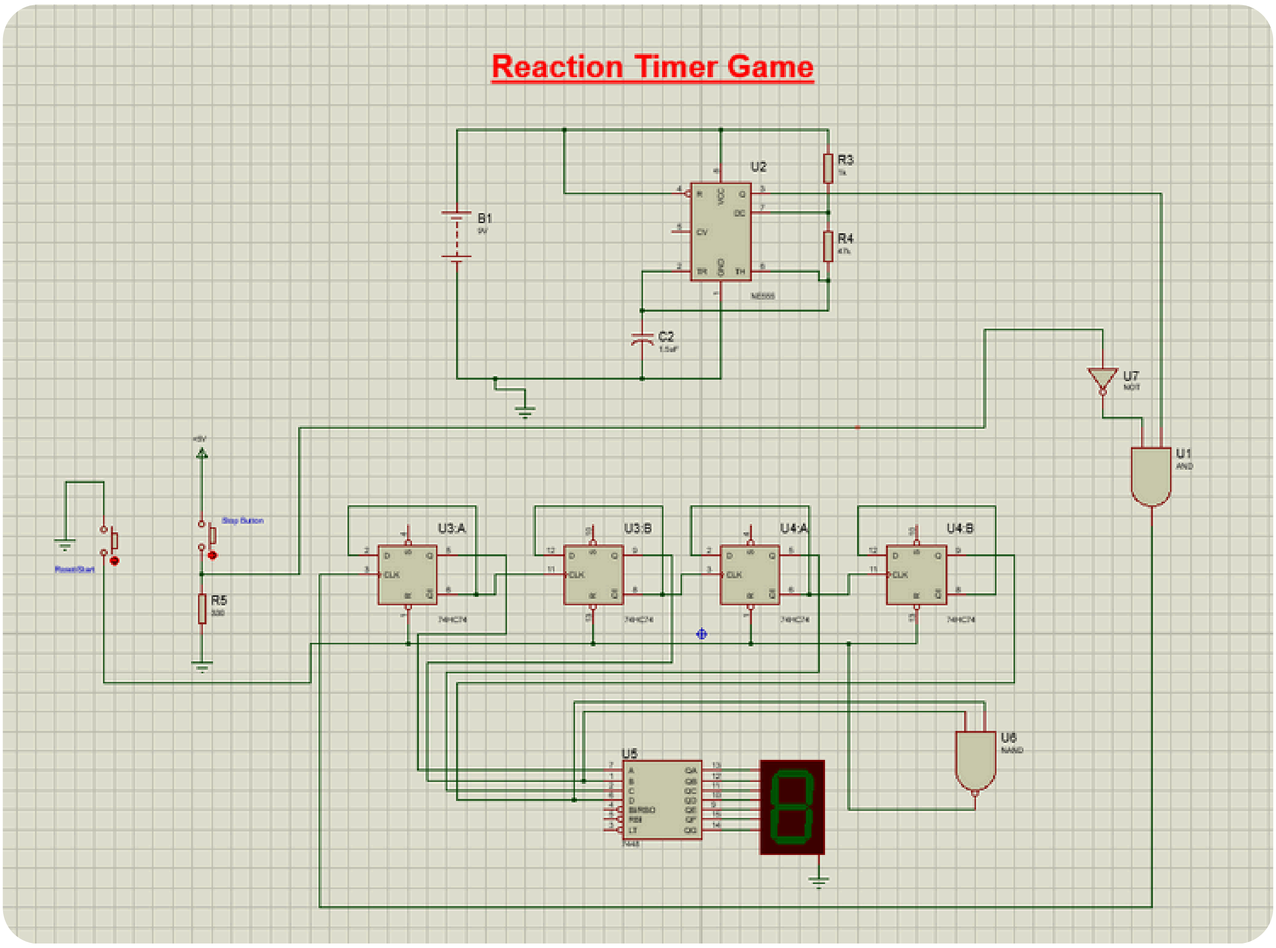
IC 555 Timer Block



555 Timer in Astable Mode

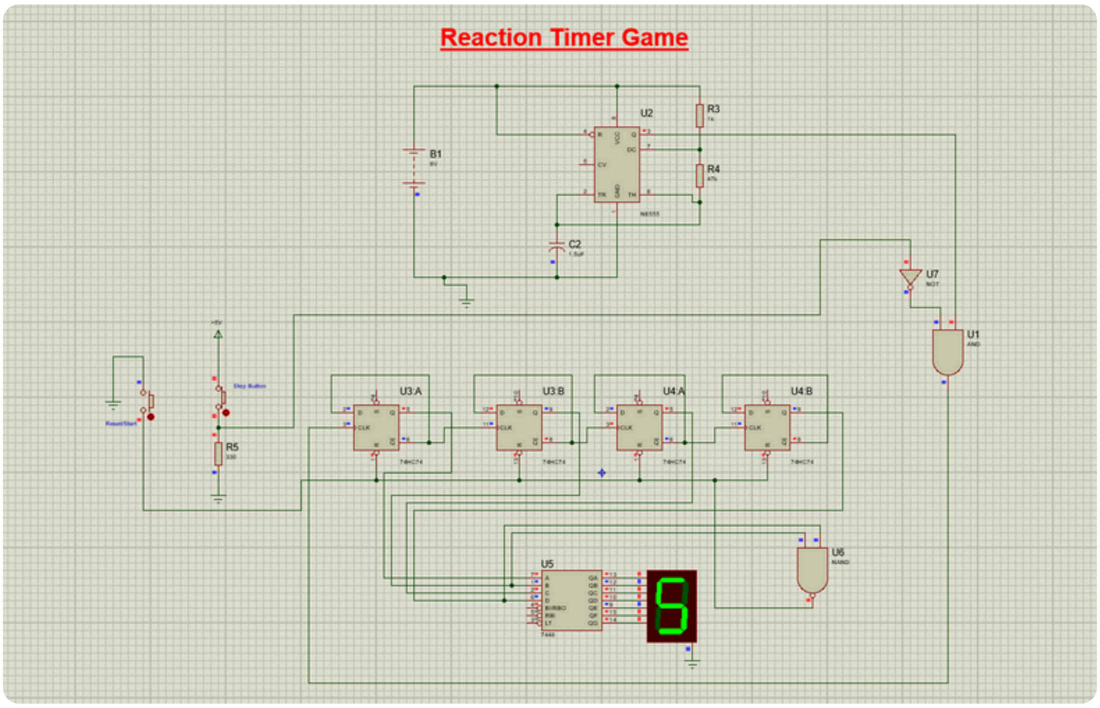
Results

Circuit Diagram

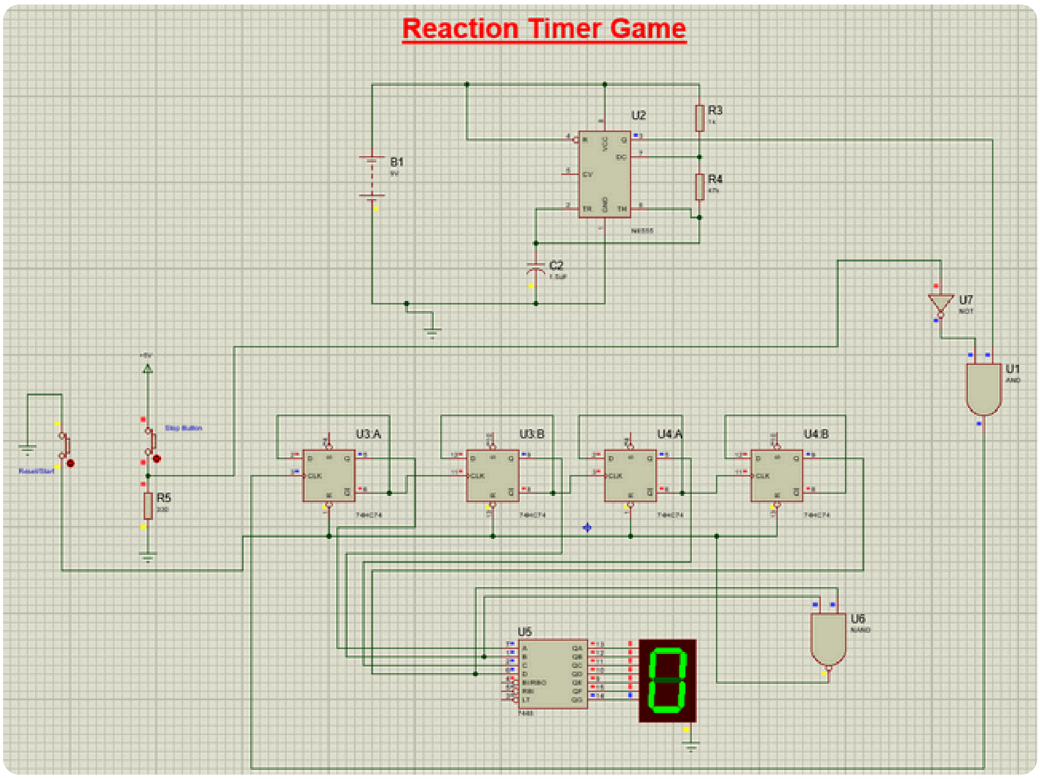


Results

Stop Button

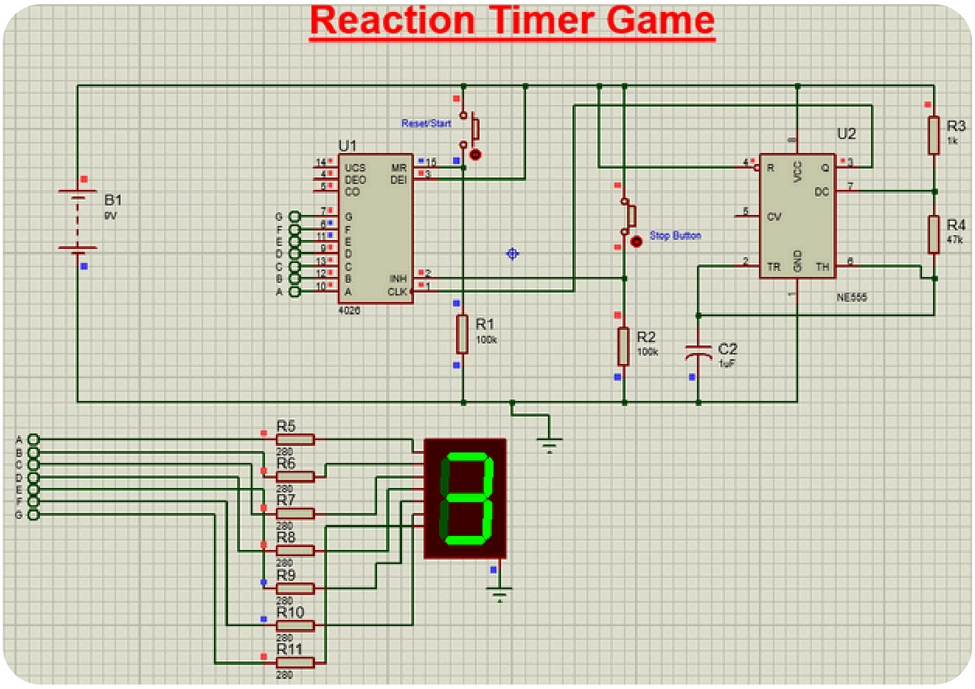


Restart Button

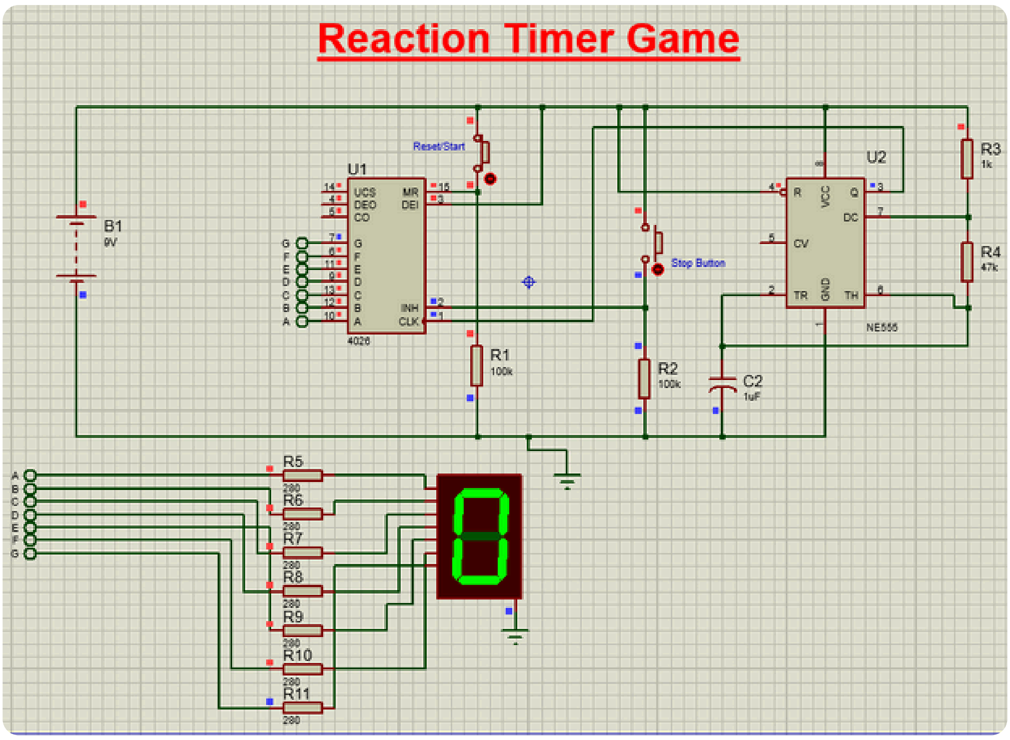


Results

Stop Button



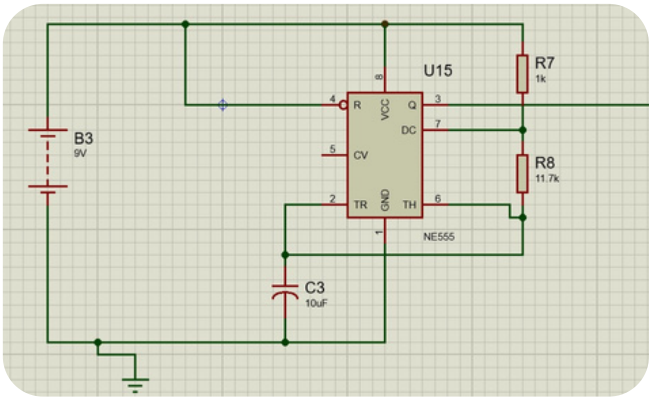
Restart Button



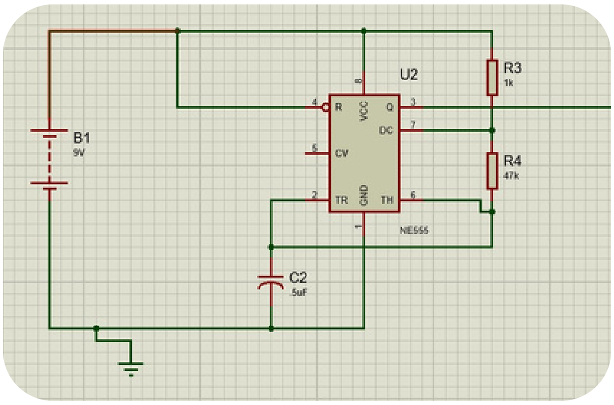
Results

I ran the circuit three different times to count the seconds and every fraction of a second, changing the values of the resistors and capacitors to change the timer speed according to the fractions of a second.

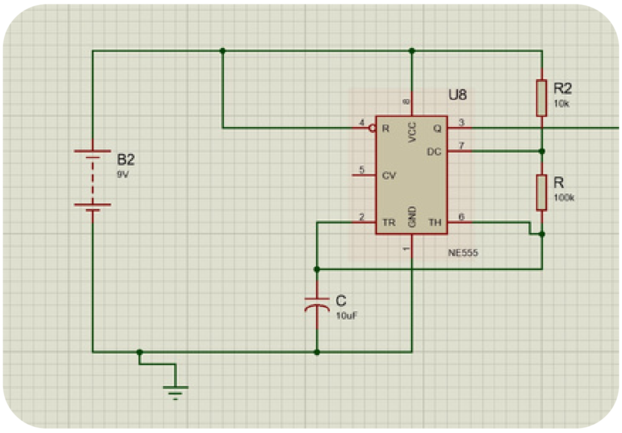
$$f = 1.44 / (R_a + 2R_b)\,C$$



(1)



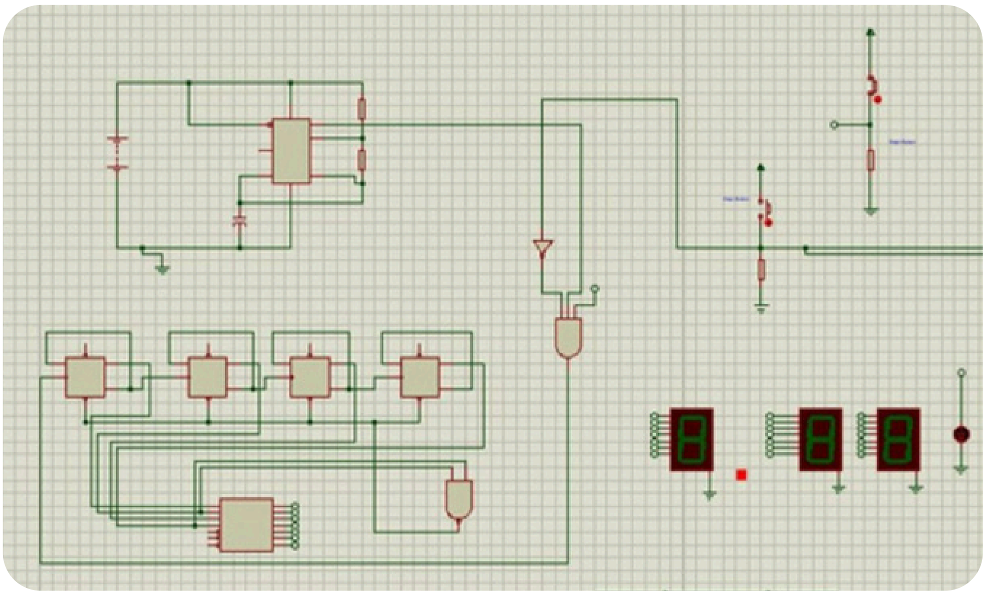
(2)



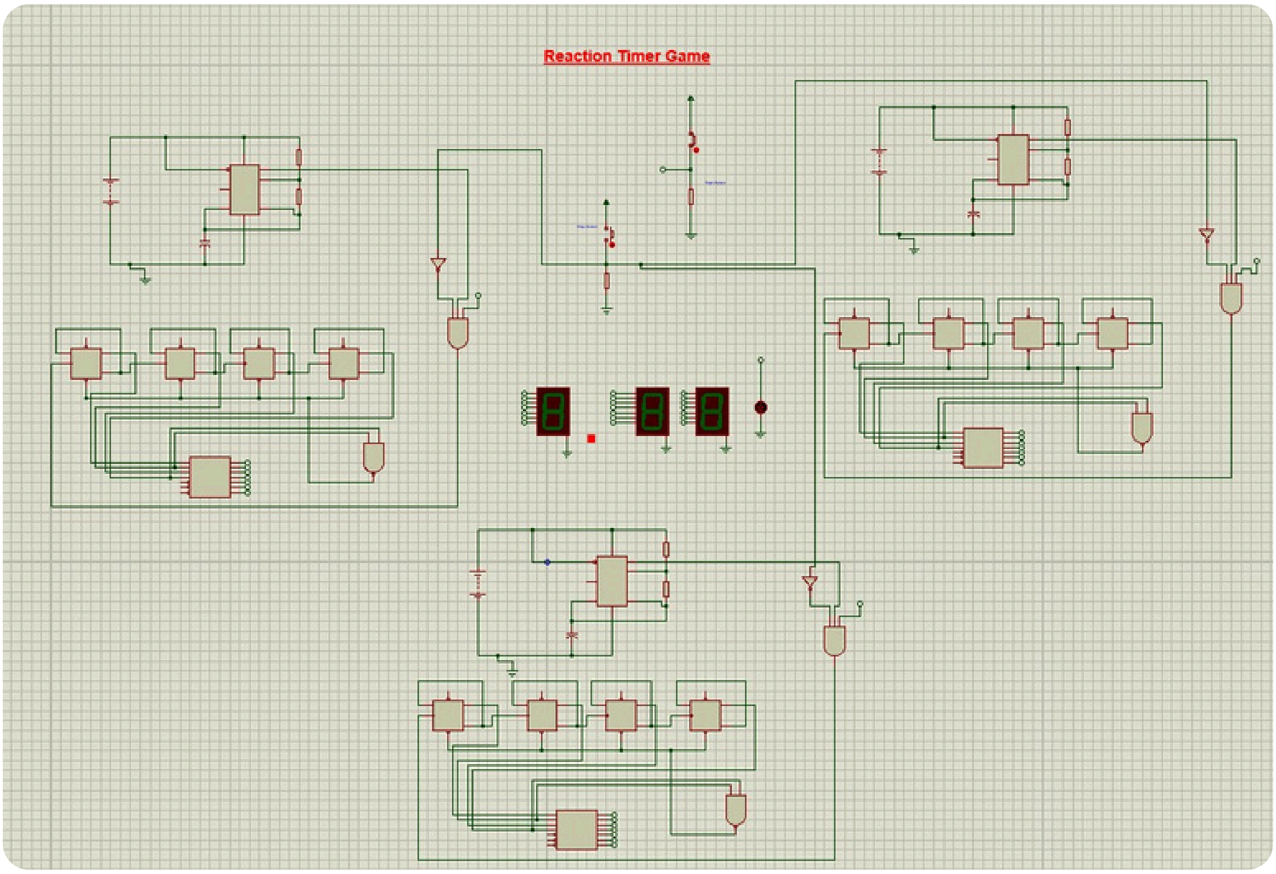
(3)

Results

The AND gate acts as a control logic: when it goes HIGH, it sends a pulse to the counter and turns ON the LED at the same time, indicating the system is active



FINAL CIRCUIT



It is a circuit that when the LED lights up, the player quickly presses the button to stop the timer, and the screen displays the delay from the time the timer starts until the player clicks the button.