CSE 260 Final Project

Project Name - Stopwatch Counter

Submitted by -

Group 5

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Introduction :

Topic of our project is “ Stopwatch Counter ”. In this project we are going to present the functioning and digits counting method of the Stopwatch via proteus software. For this, our objective has been to establish the lookalike system via circuits, capacitors and battery.

Proposed Model :

To check if the system is working, there will be a switch for starting and stopping the function. Alongside there will be a reset button, so that we can start over again whenever we require. Meanwhile, a green LED light will be seen blinking, every second. All these functions are supposed to be working till the counter digit reaches 99 .

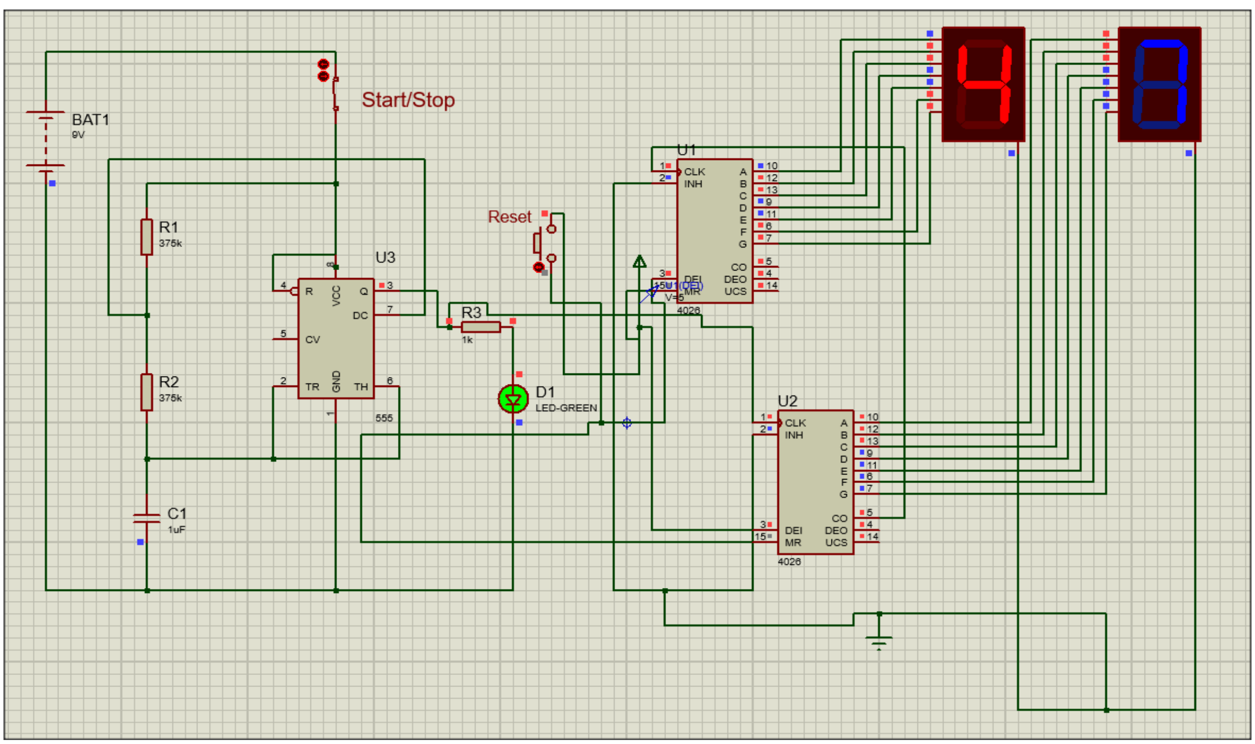
Function : After pressing the start button the periodical charges and discharges from capacitor causes flip-flop in 555 timer IC where an oscillating output comes. It goes through bottom IC 4026 (CLK Input), responsible for the right seven segment display. In display, the count increases by 1, each second. After reaching 9, a carry bit goes to top IC 4026, responsible for the left seven segment display. Then, the count increases by 1 and awaits for another carry. Following the loop, together the counting stops as digit 99.

Experimental Setup:

Component names :

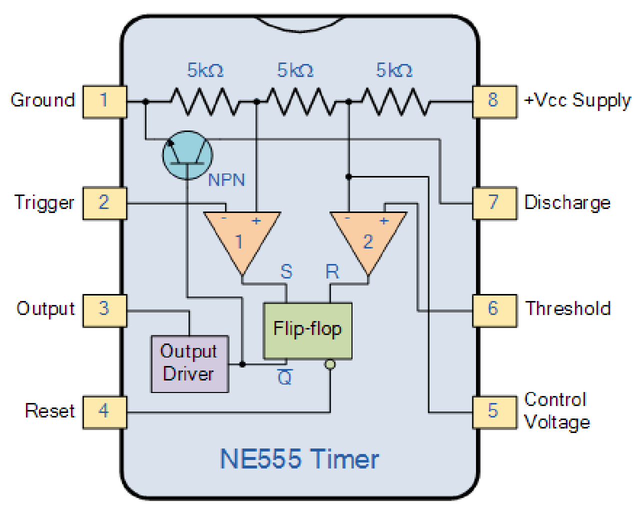
1. 555 timer IC
2. IC 4026
3. 7 Segment Display Common Cathode
4. 1uF Capacitor
5. Resistors (375k ohm, 1k ohm)
6. Battery 9V
7. LED green
8. Button
9. Switch
10. 5V Voltage Source
11. Power
12. Ground

Circuit Diagram:



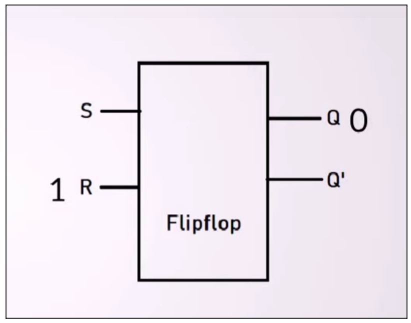
555 Timer IC:

The 555 timer is a monolithic integrated circuit that is used here as a clock generator. As it can produce accurate timing pulses (delays and oscillations) within an efficient duty cycle. The VCC pin supplies the voltage. There are three 5kΩ resistors connected together internally producing a voltage divider network between the supply voltage at pin 8 and ground at pin 1. The flip-flop function is controlled by the voltages at the Threshold, Trigger and Control Voltage pins. Also An SR flip-flop stores the state of the timer and is controlled by the two comparators. The reset pin is there to override whenever needed. The "Reset" pin overrides the other two inputs, thus the flip-flop (and therefore the entire timer) can be reset at any time.



Initially, the capacitor will be charged by the voltage source (9V) via the resistors. The IC's output will be high(1) while it's charging . When the capacitor voltage reaches 2/3 of the 9V source, the discharge pin is activated, and the capacitor begins to discharge through resistor, resulting in an output low(0). When the capacitor voltage falls below 1/3 of 9V, it begins to charge again and produces a high output. This cycle continues, causing the output pin to oscillate between low and high. The capacitance and resistance on the resistors will determine the length of one cycle. The clock pin of the top IC 4026 is then connected to this.

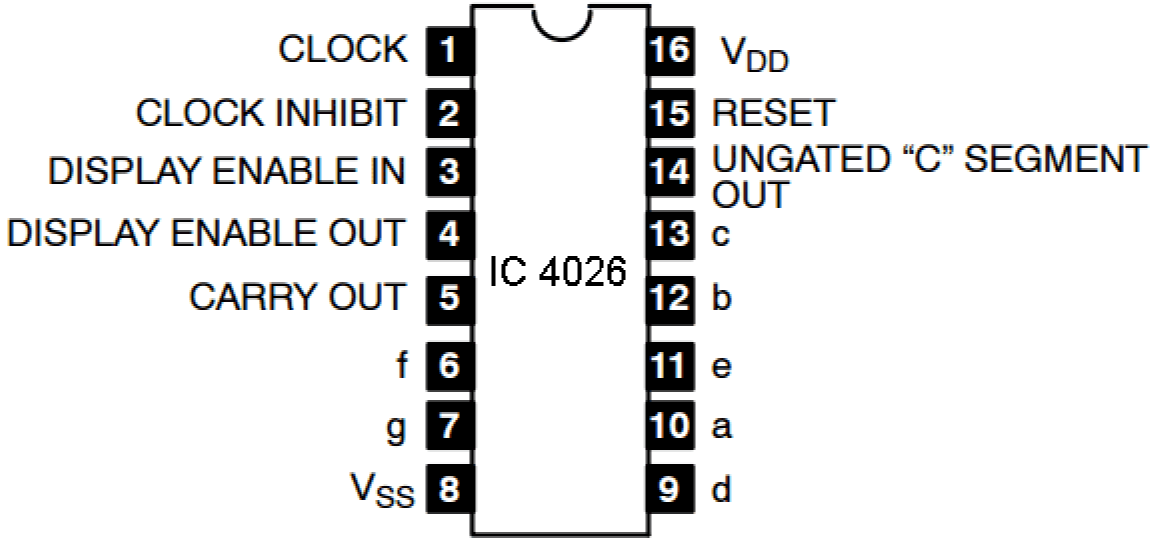
Furthermore, In bistable mode, the 555 timer acts as an SR flip-flop.



The trigger and reset inputs are held high via pull-up resistors while the threshold input is grounded. Thus configured, pulling the trigger momentarily to ground acts as a "set" and transitions the output pin to V_{CC} (high state). Pulling the reset input to ground acts as a "reset" and transitions the output pin to ground (low state).

IC 4026:

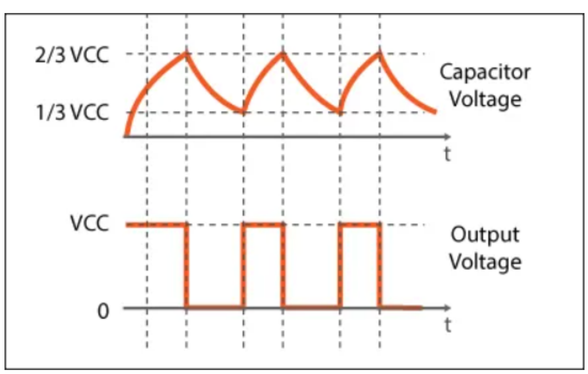
IC 4026 is a decade counter integrated circuit with 16 pins, that is used for 7 segment LED display for its counter functionalbility. The 1st pin is a genuine clock pin. Being connected to the ground(low), the 2nd pin is utilized to enable the clock pin and can stop the count whenever needed. Since, 7 segment LED display consumes a lot of power,the 3rd pin (DEI - Display Enable input) is connected to +5V(High). Considering high output, the 4th pin(DEO - Display Enable output) will be connected to the 2nd IC as a power source. The 5th pin is a carry out pin that generates a pulse at the count of 10 and fed into the 2nd IC. Except 8, the 6th to 13th decoded pins are connected to the 7 segment LED display. The ungated (UCS - Un-gated C-Segment) pin 14 is rarely used. The 15th pin is a reset pin and the 16th pin is VCC that provides power to the IC.



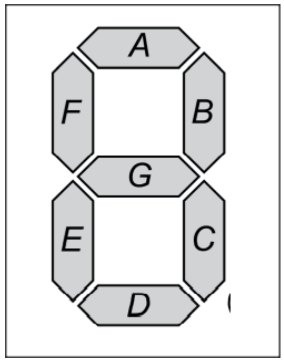
The Display Enable Output (DEO) pin 4, and Un-gated C-Segment (UCS) pin 14, are utilised in special divider circuits, and therefore not connected in our project.

Results and Analysis:

When the capacitor on the left charges and drains, the 555 timer's output pulse :



Whenever the output becomes 1, the IC4026 raises count by 1, managing every one of the Seven lights inside the 7-segment display to demonstrate those numbers (A,B,C,D,E,F,G).



Here is the truth table :

count					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

Here in the truth table we took the count until 9. After 9 the carry 1 bit will go to the next IC and will continue from 0 again in this IC. By doing this, the highest peak value that we will get from both of the 7 segment common Cathode.

Conclusion:

The end result of this project, a stopwatch counter will be efficient in terms of necessary time counting events, such as basketball, chess or even pop quiz. But compared with these regular events, it doesn't follow the ideal counter of 1min and takes over 60 seconds. However, this limitation is still effective in the perspective of our nation's defense system where an explosive charge needs more than 60 seconds of counting for a test. Moreover, an event occurring within 2 mins can be easily managed by our project " Stopwatch Counter" as it is saving 1 more bit space for a segment.