LOGIC GATES PROJECT: STOPWATCH

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Fundamentals of Computer Engineering

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EXUTIVE SUMMARY

The IC555 is utilized to generate a continuous square wave signal in astable mode, allowing control over the frequency and duty cycle. The first IC4026 counter receives this clock signal and counts from 0 to 9, displaying the corresponding number on a seven-segment display. Once it reaches 9, it resets back to 0 and triggers the second IC4026 counter. The second counter functions in the same manner, determining the appropriate segments to illuminate on the second seven-segment display. This setup creates a two-digit display that can count from 0 to 99 before looping back to 0.

This stopwatch circuit was developed by a team using their knowledge from a logic gates course. It employs the IC4026, IC555 timer, and a 2-digit seven-segment display. The circuit allows for counting from 0 to 99, with each count lighting up the corresponding LEDs. Additionally, a switch button is included for resetting the count back to 0.

Background:

An integral part of logic circuits that offers timing and synchronization capabilities is a stopwatch, which is sometimes known as a timer or stopwatch. In digital systems, it is essential for managing the data and signal flow. A stopwatch measures and divides time into discrete periods, enabling accurate timing management in a variety of applications such as managing the flow of instructions via a microprocessor or arranging events in a digital system.

Logic gates, such as AND, OR, and NOT gates, which operate using binary signals (0s and 1s), are fundamental building blocks of digital logic. Complex circuits that perform particular functions are created when these gates are joined in various ways. However, logic frequently requires exact timing to guarantee proper functioning and synchronization among many components.

A stop clock usually comprises of a few clock signals, which are periodic, regular signals that serve as the time of the circuit reference. A sequence of discrete time periods are represented by the clock signal's pulses, which have a defined frequency. The interval separating each clock pulse, sometimes referred to as the clock period, is known as a clock cycle, clock tick, or clock pulse. Stop the oscillating circuit, that can be constructed using different electronic parts like quartz crystals or RC (resistor-capacitor) networks, is frequently used to produce the clock signal.
The stopwatch circuit's resolution and speed are dependent on the frequency of the clock signal. Higher clock frequencies offer finer time resolution, but precise signal processing need quicker electronics.

The stopwatch regulates the timing of several processes inside the logic circuit using the clock signal. It can decide when data should be sampled, when calculations should be run, or when signals should be sent from a single part to a different one, for instance. The stop clock makes sure that instructions are followed correctly and protects the integrity of the data in the system's memory by synchronising the timing of these processes.

The stop clock may have extra capabilities in more advanced digital systems, including programmability, numerous clock domains, and the capacity to create various clock frequencies for certain components. These capabilities make it possible for the system to perform sophisticated functions including pipelining, multi-cycle processes, and synchronous communication between system components.

Overall, a stop clock is a vital component in digital logic circuits, providing precise timing control and synchronization. It allows digital systems to operate reliably, ensuring the correct execution of operations and maintaining the integrity of data. With its ability to divide time into discrete intervals, the stop clock forms the foundation for the proper functioning of various digital applications, ranging from microprocessors and microcontrollers to complex digital systems and communication networks.

History of stop clock & its development:

Its starting point may be found in the creation of digital logic circuits and the advancement of electronic timekeeping apparatuses. Let's examine the brief histories of these essential components:

Digital Logic Circuits:

The development of integrated circuits and the advent of the transistor in the middle of the 20th century set the groundwork for digital logic. Transistors made it possible to build electronic switches that could regulate the flow of electrical current, which served as the foundation for digital logic gates.

Introduction of Flip-Flops:

Flip-flops as a concept were first launched in the late 1950s. One bit of information (0 or 1) may be stored in a flip-flop, a fundamental memory component in digital circuits. It has two stable states that are sometimes referred to as "set" and "reset," and these states may be managed by outside signals

Development of Counters:

Sequential logic called counters may count or keep track of the number of events or clock pulses. Binary counters and decade counters, among other forms of counters, were invented in the 1960s. These counters employed flip-flops and combinational logic to build circuits that could increase or decrease the count in response to clock signals.

Integration with Timekeeping Devices:

The integration of digital logic and counters with timekeeping devices became conceivable with the development of these technologies. Stop clocks that were mechanical or electronic were often utilised in the beginning. However, the introduction of electronic components and digital

Logic enabled the development of more reliable and precise electronic stop clocks.Stop clocks are still commonly used today for a variety of purposes, including as maintaining time for everyday activities, scientific research, and industrial operations. The creation of extremely accurate and adaptable stop clocks with a variety of functions is the result of the ongoing improvements in digital technology.

METHODOLOGY

Components of stop clock:

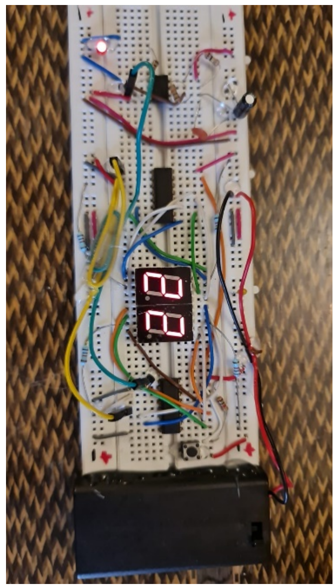
1) 2-digit 7-segment cathode
2) Push buttons
3) 3 (10k resistor)
4) 1 (100k resistor)
5) Capacitor
6) Bread board
7) (4026) IC
8) IC 555 timer
9) Jumper wires
10) 9v battery
11) Led

The IC555 is used to create a continuous square wave signal in astable mode. By adjusting the values of the resistors and capacitors connected to the IC555, you may change the frequency and duty cycle of this signal. The first IC4026 counter's clock input (CLK) is coupled with the output of the IC555. A 7-segment decimal counter with an integrated decoder and driver is called the IC4026. After counting from 0 to 9, it returns to 0. The second IC4026 counter's inputs (CLK, UP/DN, ENP, and ENT) are linked to the outputs (Q0-Q3) of the first IC4026 counter, which is receiving the clock signal from the IC555. A 7-segment display is linked to each IC4026 counter. By lighting up various segments, a seven-segment display, a popular form of electronic display, may display letters and numeric digits (0–9). The seven-segment display's inputs (A-G) are linked to each output of the IC4026 to regulate which segments are lighted for each digit.

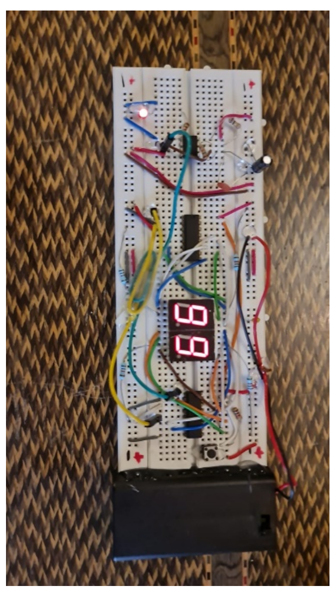
The IC555 produces a continuous square wave signal that serves as a clock for the first IC4026 counter when the circuit is turned on. The counter counts up from 0 to 9, activating the matching segments on the initial seven-segment display at each count to display the number. After reaching 9, the first counter resets to 0 and concurrently advances the second IC4026 counter. The second counter operates in a similar manner, selecting the right number to be displayed on each segment of the second seven-segment display.

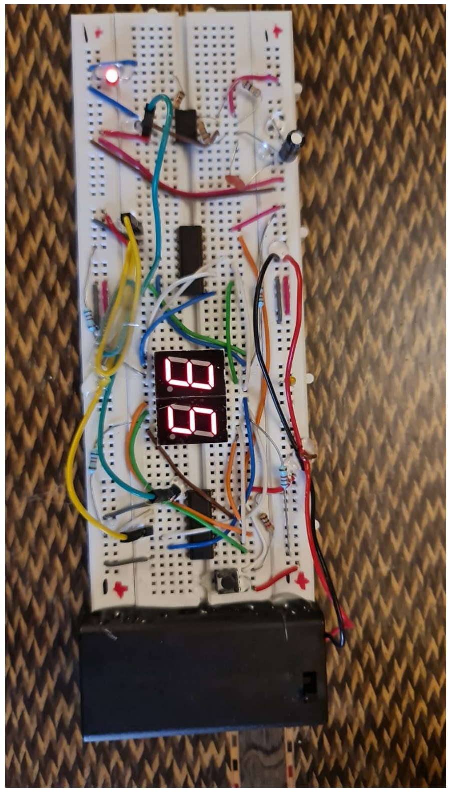
RESULT AND DISCUSSION

This picture is representing the outcome of the project after connecting it to the power supply



This picture is representing the greatest digit that can reaches which is 99 after that it will repeat again from a zero.





Conclusion

Finally we implemented the stopwatch circuit by the work of our team we use the knowledge that we have taken during the logic gates course. The 2-digit seven segment was used, ic4026 and ic 555 timer that gives out stop watch that can counts from digit 0 up to 99 and then repeat back in a loop with each count the led give us light. The switch button represent the reset option to start from 0 digit.

Future Work for Stop Clocks:

- Enhanced Precision: Future stop clocks will focus on improving accuracy in time measurement, ensuring more precise timing for various applications.
- Wireless Connectivity: Stop clocks will incorporate wireless capabilities for synchronization with other devices, enabling easy coordination and data sharing.
- Energy Efficiency: Stop clocks will be designed to optimize power consumption, prolonging battery life and reducing the need for frequent battery replacement.

These future advancements aim to improve the accuracy, convenience, and user experience of stop clocks, making them more reliable and user-friendly tools for time measurement.

References:

1) Digital Design and Computer Architecture by David Money Harris and Sarah L. Harris: This book provides a comprehensive introduction to digital logic design and covers various aspects of digital circuits, including timing and synchronization.

2) Digital Systems Engineering by William J. Dally and John W. Poulton: This book explores the design and implementation of digital systems, covering topics such as timing, clocking, and synchronization in detail.

3) Digital Electronics: Principles and Applications by Roger L. Tokheim: This textbook covers the fundamentals of digital electronics, including topics related to timing, clock signals, and synchronous circuits.