

Report on the BCD Digital Clock

Overview

This digital timekeeping system is designed to display seconds, minutes, and hours. It uses an external oscillator, counters, flip-flops, and logic gates to count time. Originally, the circuit was set up to count up to 30 hours. However, through modifications to the reset and gating of the last hour digit, the circuit now properly resets both hour flip-flops at 24 hours, ensuring a standard 24-hour format. Three toggle switches allow manual time setting for seconds, minutes, and hours, while an additional switch controls certain gate functions.

Circuit Operation

External Oscillator and Clock Generation

- **External Oscillator:**

An external oscillator—using a resistor and capacitor—generates a stable 2 Hz clock signal that serves as the time base for the entire circuit.

Seconds Counting

- **First Digit (Units):**

A CD4518 dual BCD counter counts the seconds using the 2 Hz clock pulses.

- **Second Digit (Tens):**

The tens digit is driven by the transition of the first digit:

- When the first digit reaches 9, the negative edge transition triggers the tens counter.
- An AND gate monitors the output; its high output on the positive edge initiates a reset of the counter that reached its maximum, while the subsequent low edge triggers the next stage.

Minutes and Hours Counting

- **Minutes Counting:**

When the seconds counter resets after reaching 60 seconds, a dedicated flip-flop increments the minute counter.

- **Hours Counting (Updated):**

The hour counting stage originally counted up to 30 hours. With the recent modification, the reset circuitry for the last hour digit has been updated:

- The reset now triggers both hour flip-flops simultaneously when the count reaches 24.
- This change eliminates the need for an extra gate that was previously used, ensuring that the circuit properly resets to 0 hours after 23.

Logic Components and Their Roles

- **Logic Gates (AND, OR, Inverters):**

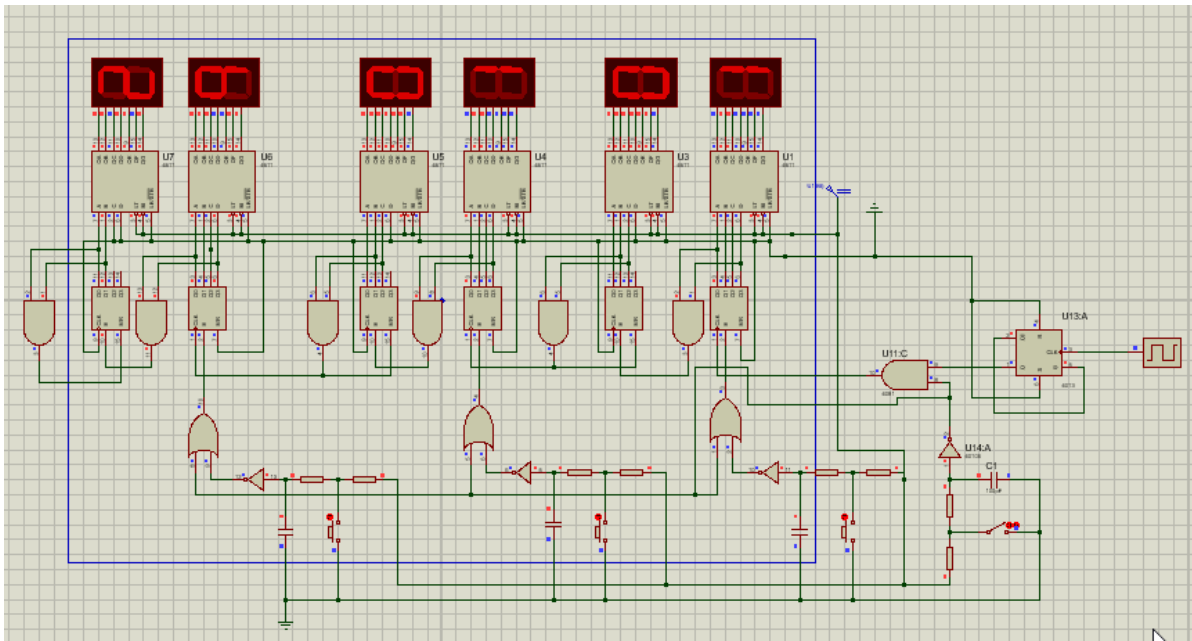
- **AND Gates:** Monitor specific outputs to detect when a counter reaches its maximum (e.g., 9 for seconds and 6 for minutes) and trigger the reset or the next counter stage.
- **Inverters:** Ensure the proper edge transitions for triggering and resetting, as seen in the hex inverter (CD4069) section.

- **Time-Setting Mechanism:**

Three toggle switches allow the user to adjust seconds, minutes, and hours. An additional control switch temporarily disables certain gate functions during the time-setting mode.

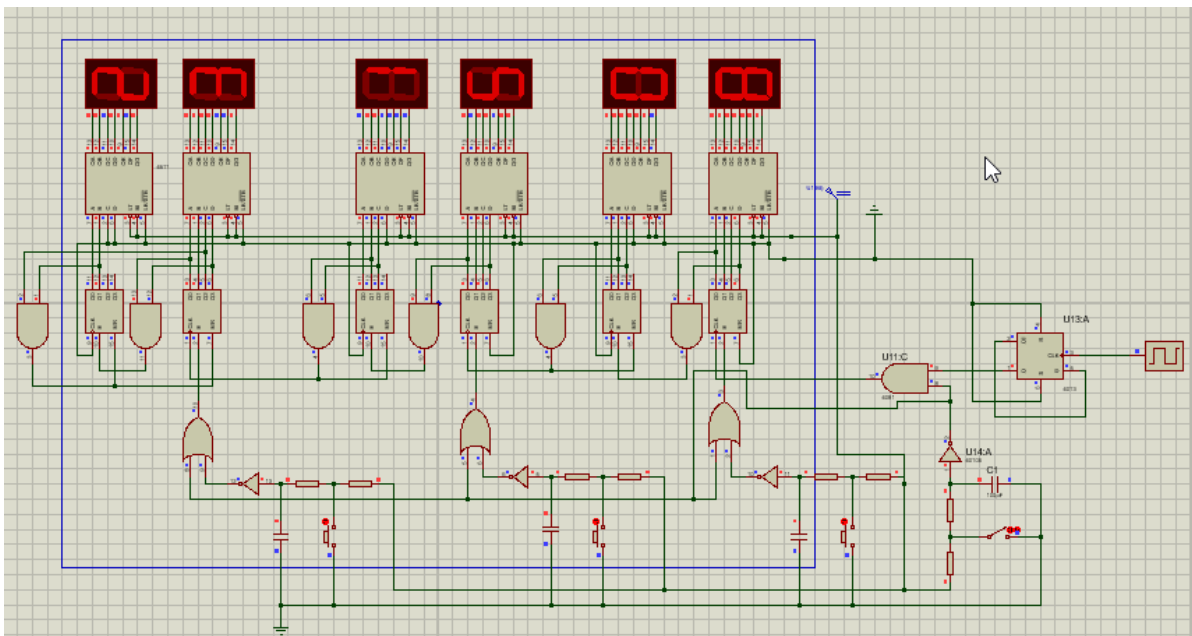
Visual Documentation

- **Figure 1: Previous Schematic Version**



This image illustrates the original hour counting configuration where the circuit counted up to 30 hours.

- **Figure 2: Updated Schematic Version**



This image shows the updated design where the reset and gating modifications ensure that the hour counter resets at 24 hours.

Conclusion

The updated timekeeping circuit employs an external oscillator, counter ICs, flip-flops, and logic gates to provide accurate time measurement. By modifying the reset circuitry for the hour counter, the design now correctly adheres to the 24-hour standard, resolving the previous 30-hour counting issue. The system's time-setting functionality further adds to its versatility, making it a robust design for digital time display applications.

