AIN SHAMS UNIVERSITY FACULTY OF ENGINEERING
I-CREDIT HOURS ENGINEERING PROGRAMS COMMUNICATION SYSTEM ENGINEERING

CSE222: Digital Logic Design

12-Hour Digital Clock

Summited to:

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Introduction:

This project involves the design and implementation of a 12-hour digital clock using sequential and combinational logic circuits. The clock displays time in the **HH:MM:SS AM/PM** format and provides essential functionalities such as **time setting, resetting**, and **AM/PM indication**. At the heart of the design, we used the **7490 decade counter IC**, which enables accurate counting for each digit in seconds, minutes, and hours.

The design is modular: separate stages were created for seconds, minutes, and hour counting by cascading multiple 7490 ICs, with additional logic to manage digit rollovers (e.g., 59 → 00) and toggle the AM/PM state. Seven-segment displays are used to show the time clearly, driven by BCD to 7-segment decoder circuits. The system also includes user input controls to allow manual time adjustments.

To drive the entire sequential circuit, we needed a **stable and consistent clock pulse**. For this, we designed a **555 timer circuit in astable mode** to generate a continuous square wave signal with a frequency of approximately **1 Hz**. This causes the LED (in the standalone test) to blink once per second, and in our final circuit, it acts as the clock signal that increments the seconds counter.

The 555 timer's output period was set using the equation:

$$T=0.693\times C1\times(R1+2R2)$$

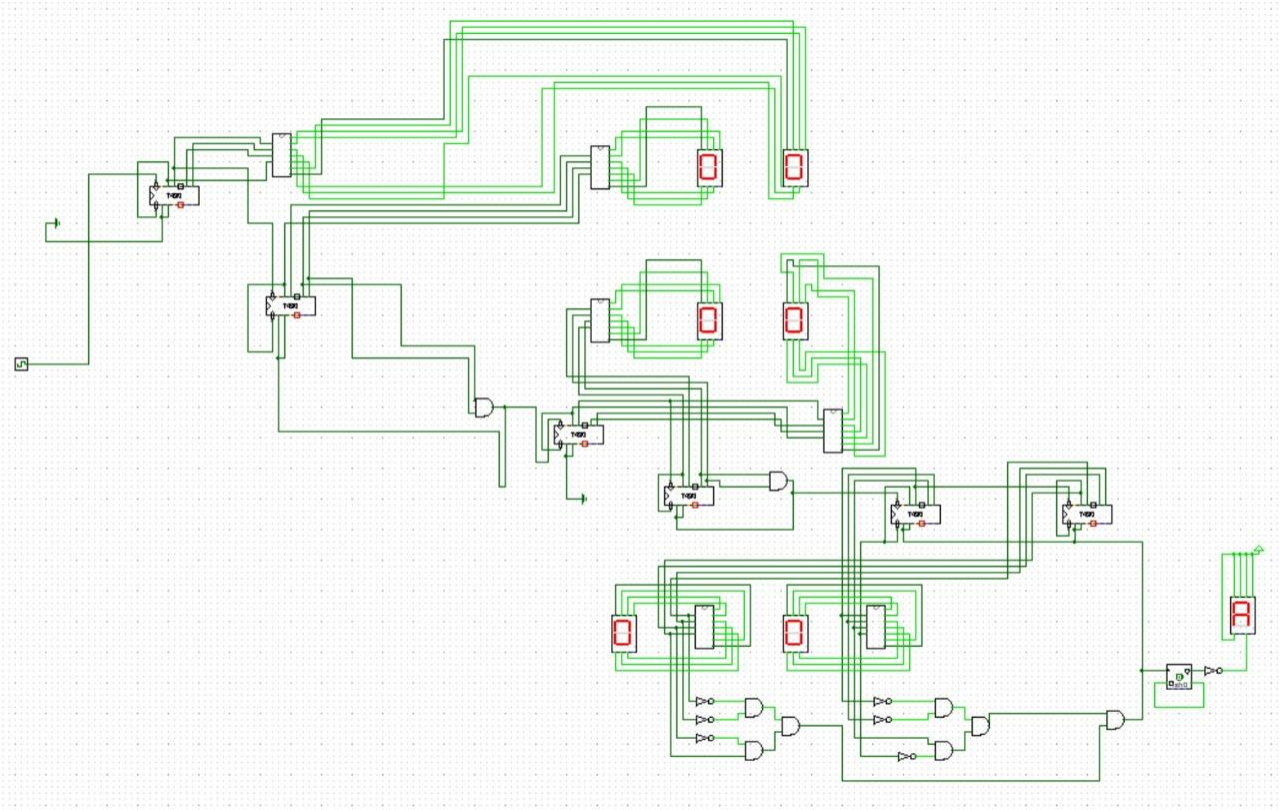
With selected component values:

- **C1** = 1000 µF
- **R1** = 443 Ω
- **R2** = 500 Ω

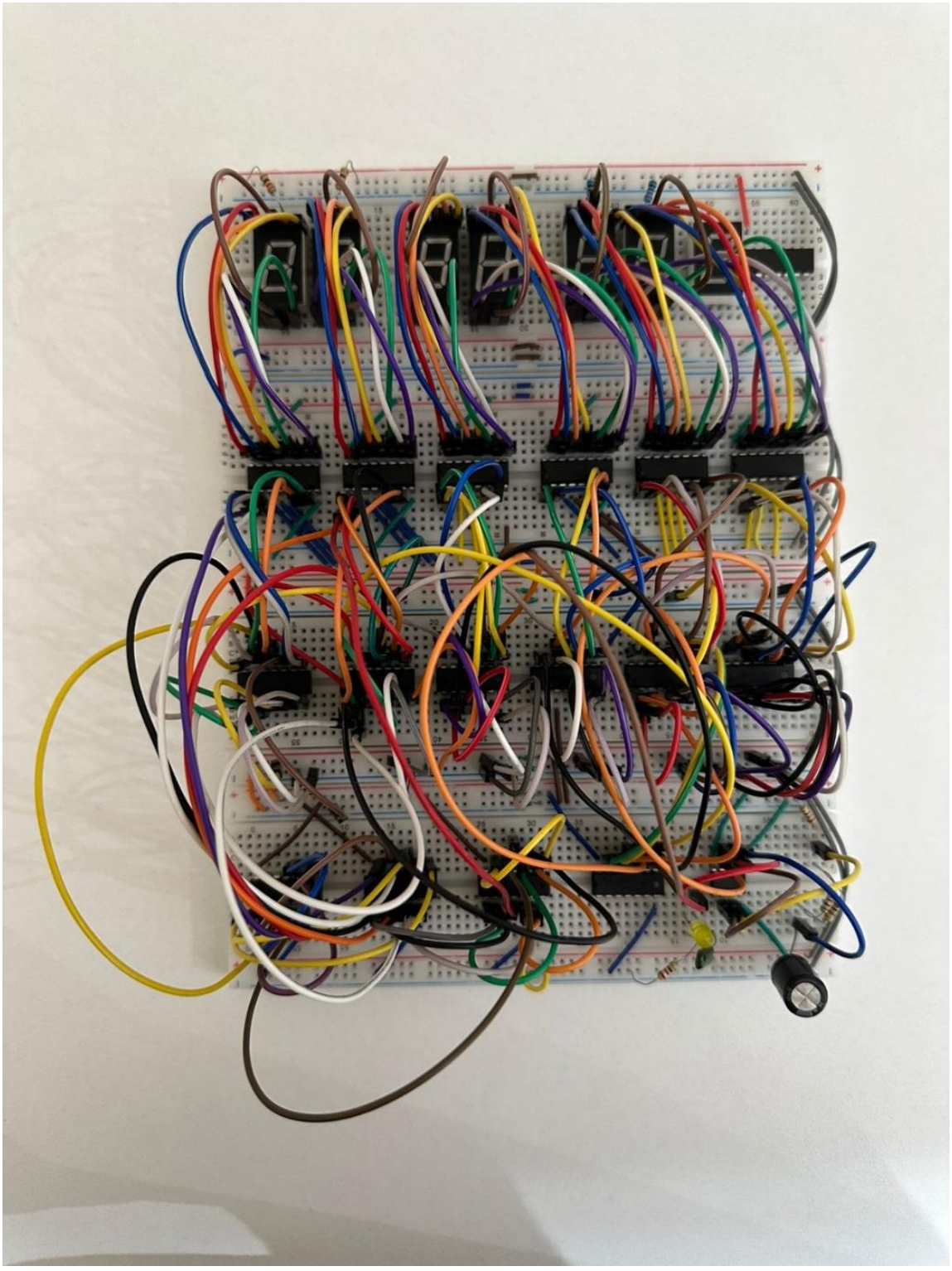
This produced an approximate period of **1 second**, ensuring the timing was suitable for real-time clock operation. The resulting output was then fed into the 7490-based counter stages, making the 555 timer a crucial part of the overall system.

In conclusion, this project demonstrates the integration of fundamental digital electronics components—including **7490 counters**, **logic gates**, **seven-segment displays**, and a **555 timer pulse generator**—to construct a fully functional and interactive 12-hour digital clock.

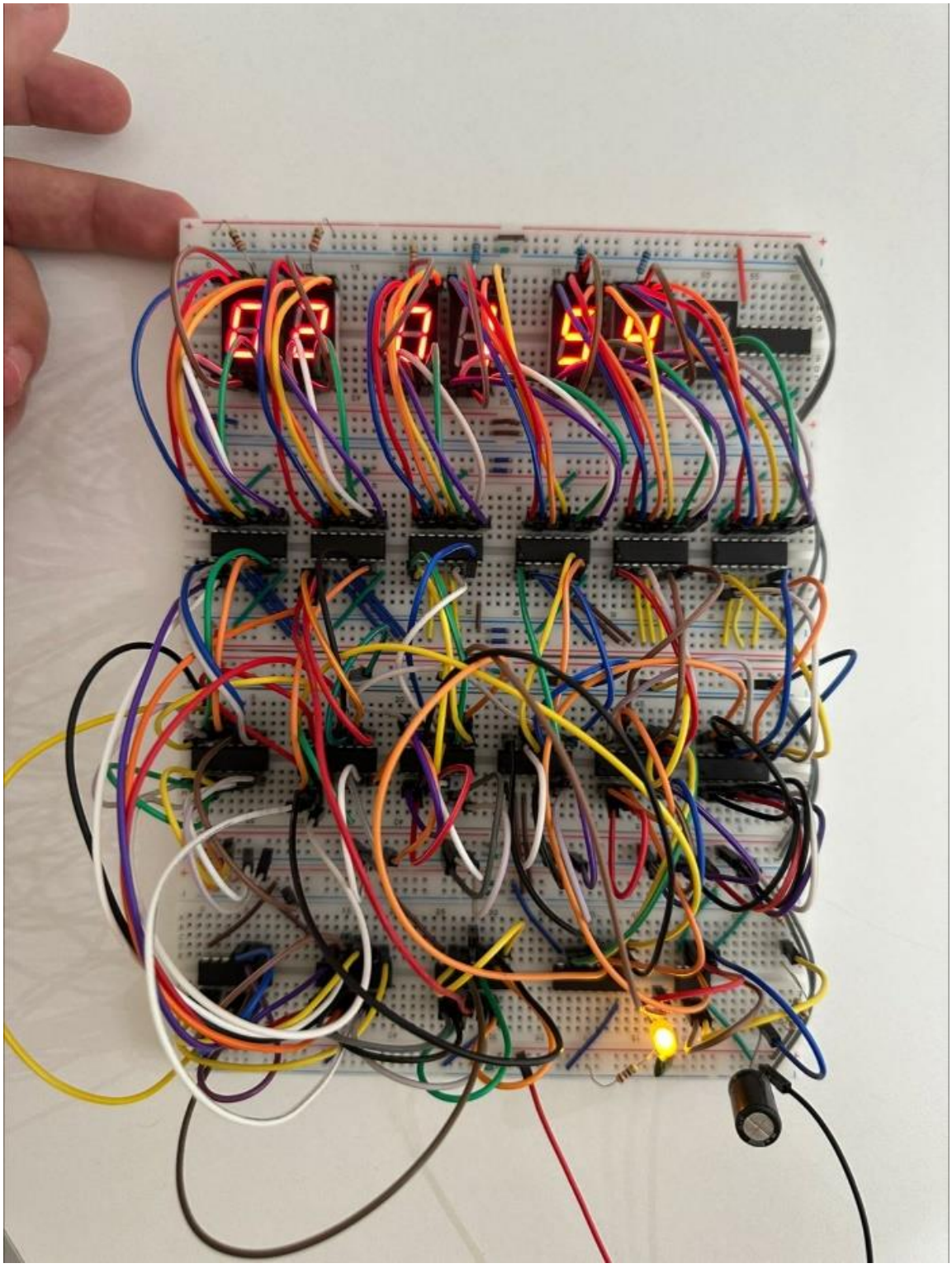
12 hours Circuit Simulation:



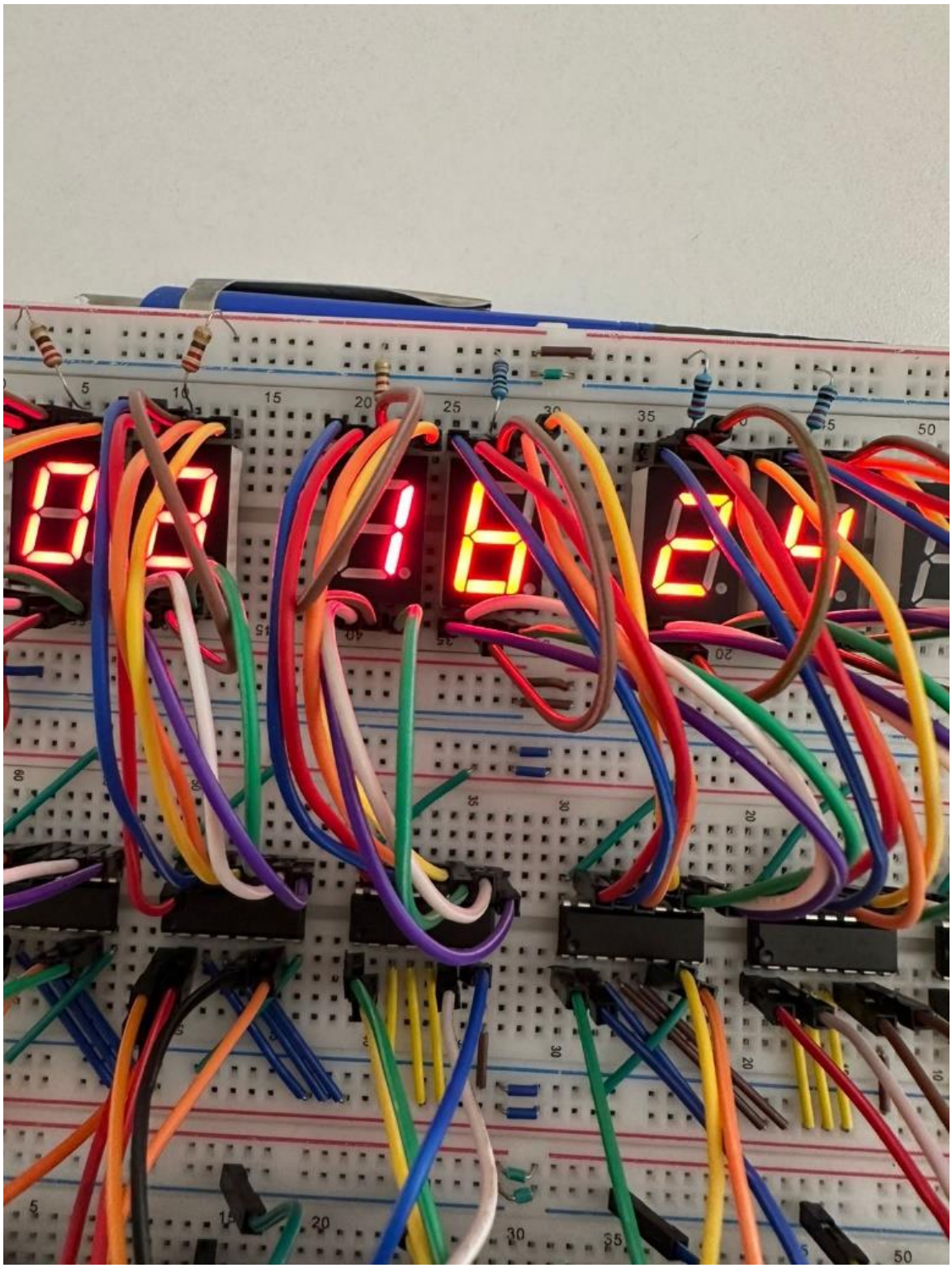
12 hours Implementation Hardware:



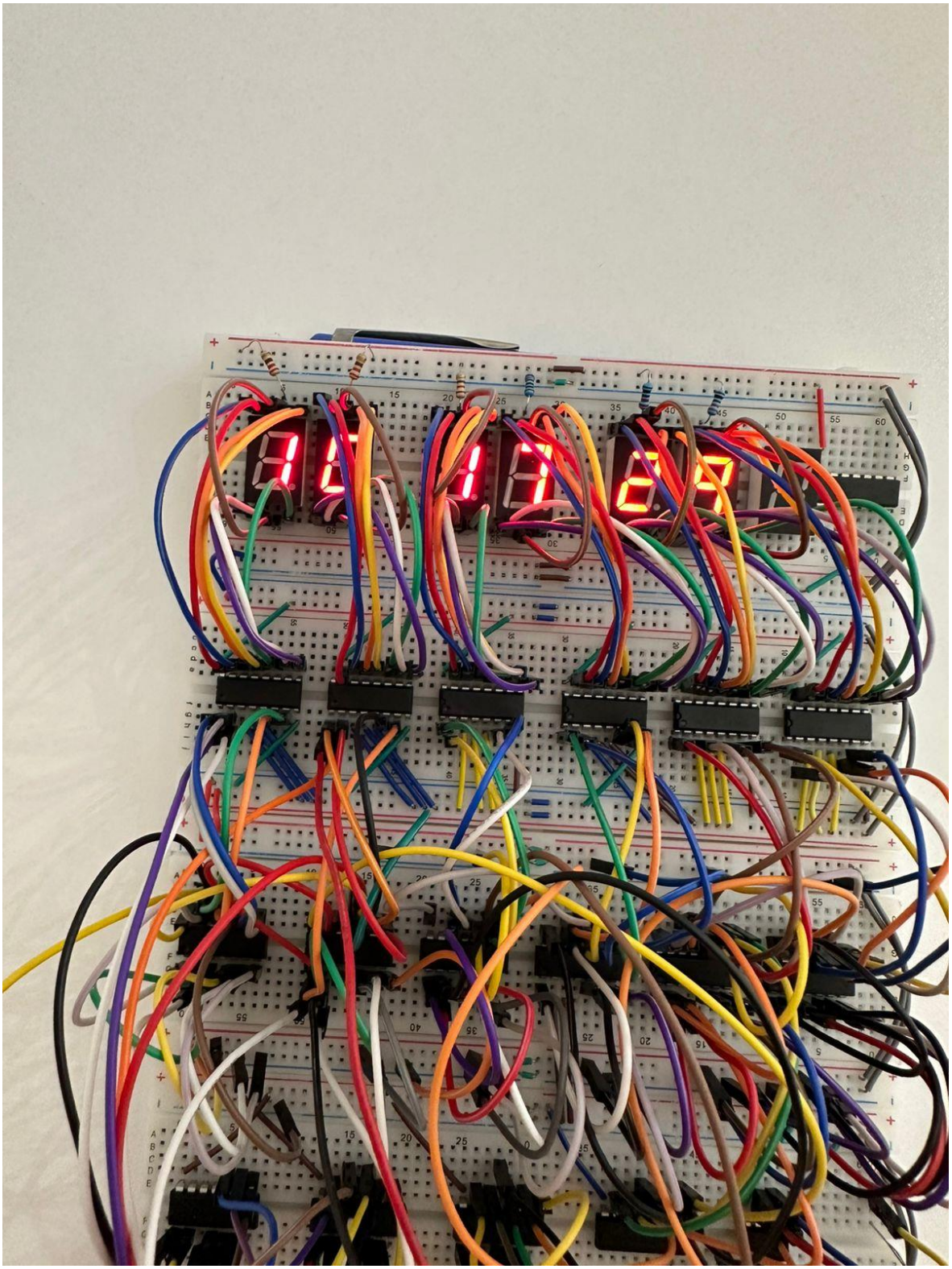
Case in range of 2 hours (Hardware):

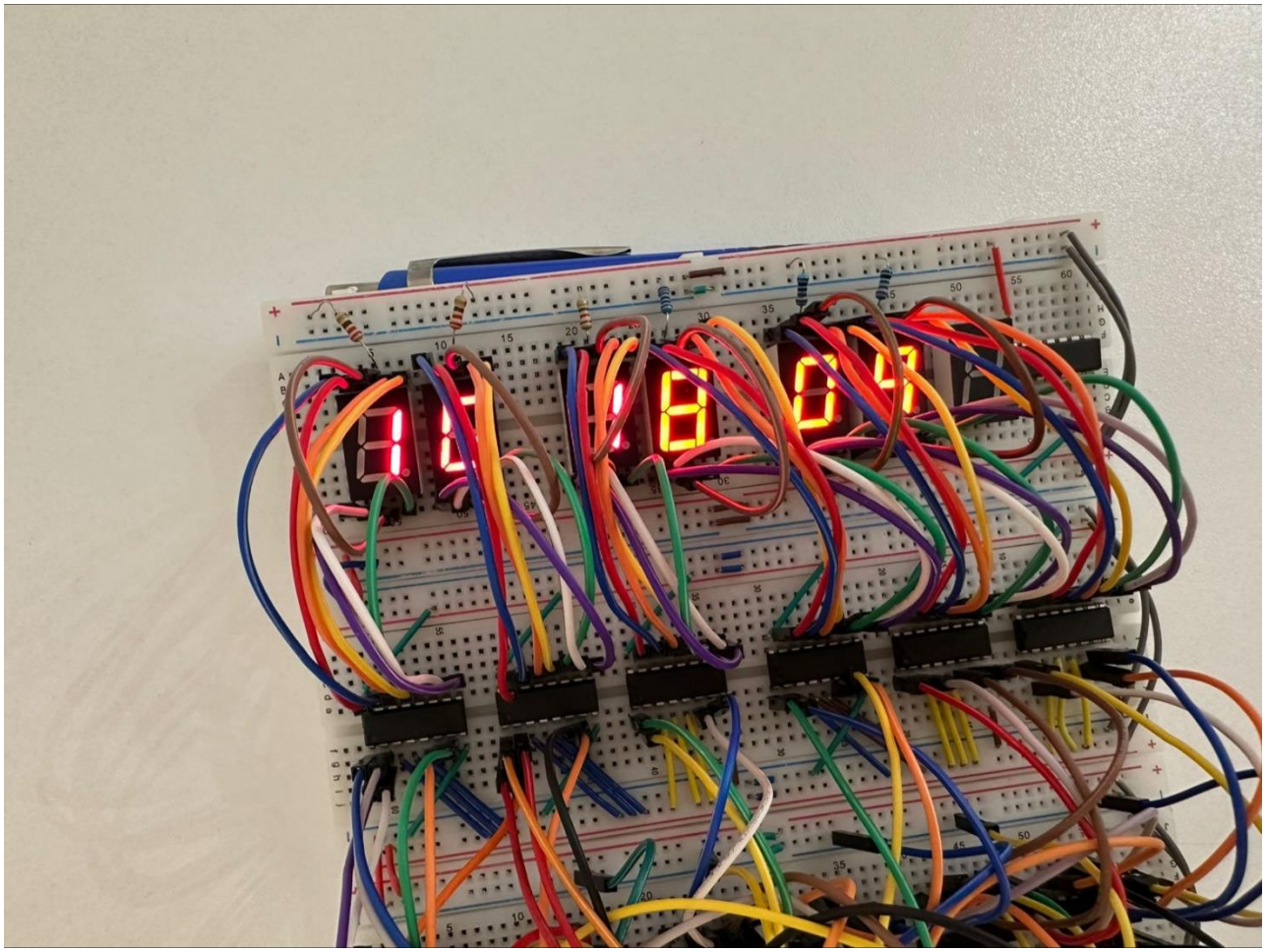


Case in range of 8 hours (Hardware):

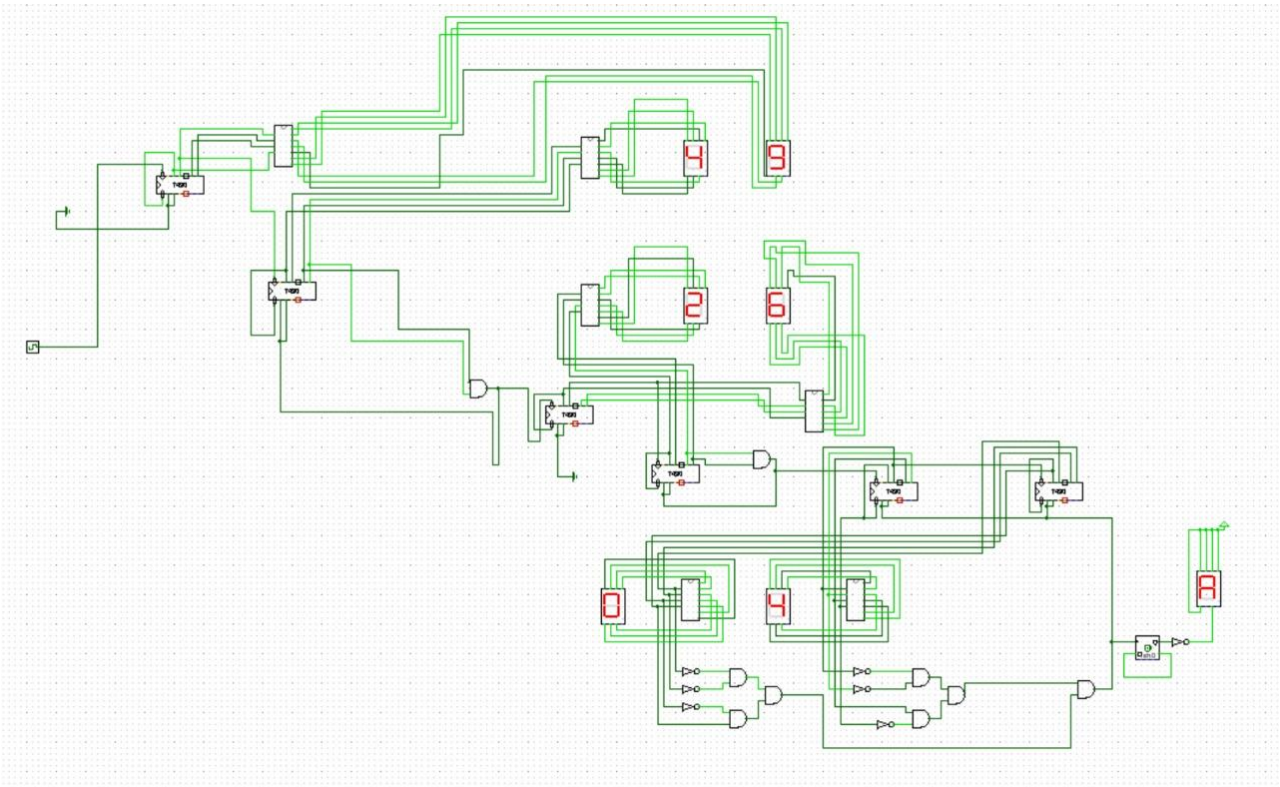


Case in range of 10 hours (Hardware):





Case in range of 4 hours AM (Simulation):



Case in range of 12 hours PM (Simulation):