AMRITA SCHOOL OF ENGINEERING, BENGALURU

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B. TECH. III SEMESTER AY 2024-2025

23ECE281 DIGITAL ELECTRONICS LAB

SYSTEM DESIGN REPORT

JULY TO NOVEMBER 2024

TITLE OF THE SYSTEM DESIGN

Submitted by

Name	Registration Number	Signature with Date
Chebrolu Rishita	BL.EN.U4ECE23204	
Chandan Sai Pavan P	BL.EN.U4ECE23205	
D Rushikesh	BL.EN.U4ECE23207	
M V Sri Harsha	BL.EN.U4ECE23227	

BATCH NUMBER:

Faculty Signature with Date	
Comments (If any)	

AIM:

To implement the design of a Digital Clock.

COMPONENTS REQUIRED ALONG WITH THEIR SPECIFICATIONS:

S.No.	Component	quantity
1	4026 IC	6
2	7411 IC	1
3	NE555 Timer IC	1
4	MAN74A 7Segment Display	6
5	1 µF Capacitor	2
6	100 nF Capacitor	1
7	10 µF Capacitor	1
8	470 Ω Resistor	6
9	10 kΩ Resistor	2
10	1 kΩ Resistor	1
11	100 kΩ Resistor	1
12	10 kΩ Potentiometer	1
13	1N4148 Diode	5
14	Push Button Switch	2
15	PCB Board	1
16	Connecting Wires/Headers	As needed
17	IC Sockets	7

THEORY:

A digital clock is an electronic circuit that displays time in a numeric format using digital components like counters, logic gates, and 7-segment displays. It works by generating and counting electrical pulses to keep track of seconds, minutes, and hours.

555 Timer IC:
This generates a steady clock pulse (usually 1 Hz) .Each pulse increments the seconds counter by 1.

CD4026 Counter ICs :
These ICs are counters with 7-segment display drivers. Each one counts pulses up to 9 and resets to 0 on the next pulse, sending a carry-over pulse to the next counter.
There are six counters in total:
Two for seconds (units and tens).
Two for minutes (units and tens).
Two for hours (units and tens).

7-Segment Displays :
Each display is driven by a corresponding CD4026 IC to show a digit (0–9) for the seconds, minutes, and hours.

Resistors :
These are current-limiting resistors connected to each 7-segment display. They protect the LED segments in the displays by limiting the amount of current flowing through each segment.

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Push Buttons :
Used for manual time adjustment and resetting. One button likely resets the time to zero, while the other may be for incrementing hours or minutes during setting.

Diodes :
These diodes are included to isolate different parts of the circuit and prevent interference and allow the reset and set buttons to function without causing unintended changes in other parts.
They are also used to separate the logic signals between different types of components (TTL and CMOS) to protect sensitive parts and ensure stable operation.

7411 Triple 3-Input AND Gate :
This IC is used to create control logic for resetting and carry-over between counters. It ensures that counters reset correctly at their limits (e.g., 59 seconds rolls over to 00 and increments minutes).

Capacitors :
These are used for debouncing the push buttons and stabilizing the power supply to prevent noise or glitches from affecting the counters and display.

Power Supply :
Supplies power to all ICs, displays, and components in the circuit. The stable 5V ensures reliable operation of the digital components.

Each component works together to form a simple digital clock that counts time accurately and displays it in an easily readable format. The 555 timer generates a time base, the CD4026 ICs count and display time, while the additional components provide stability, user control, and protection.

LOGIC CIRCUIT:

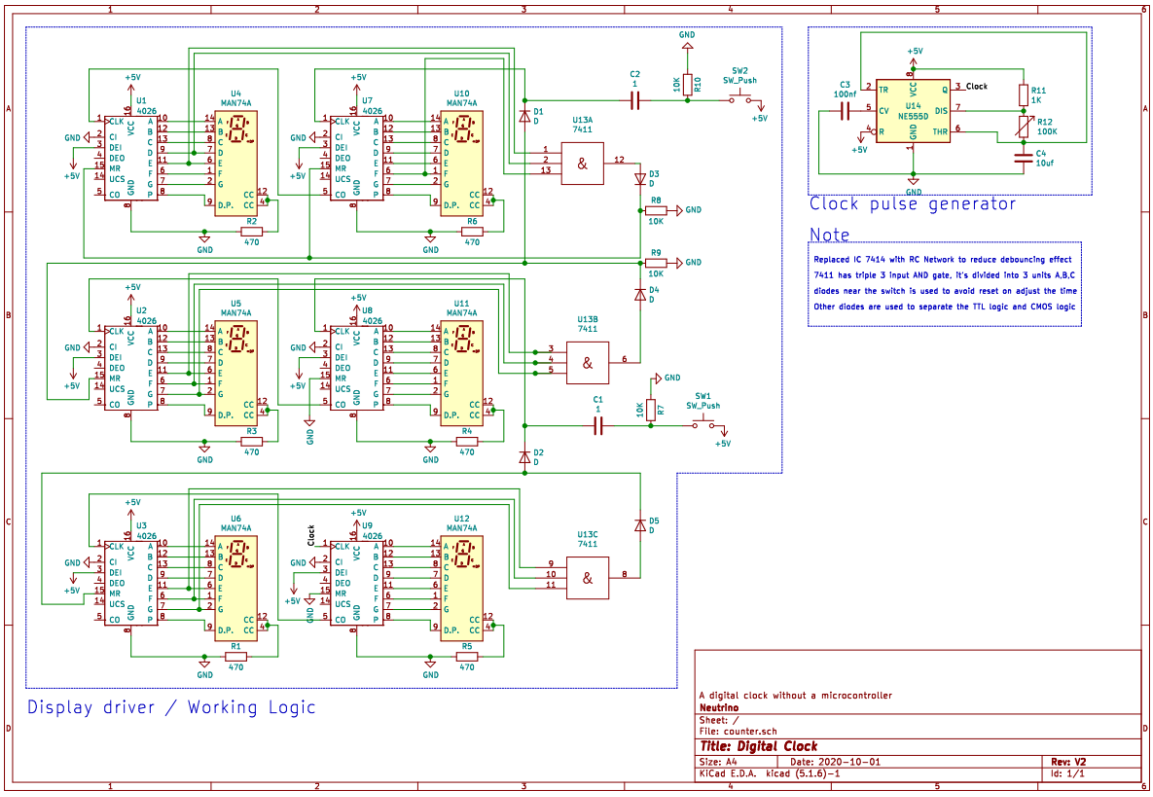

Fig 1: The Logic Circuit

SCREENSHOT OF THE WORKING HARDWARE FOR ALL THE REQUIRED FUNCTIONS:

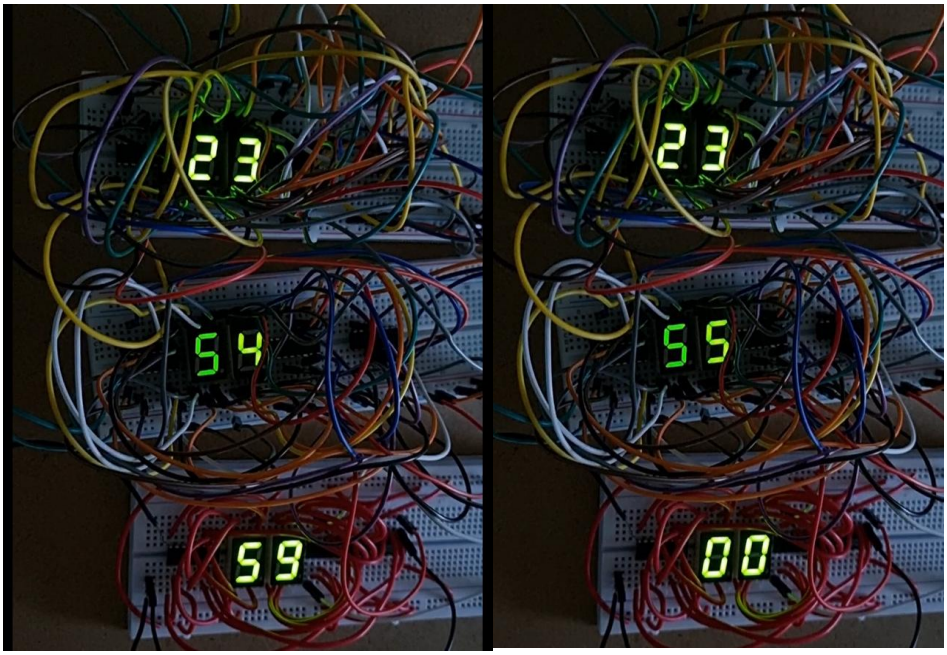

Fig 2 :The seconds segments displaying 00 after 59 while the minutes segment gets incremented simultaneously.

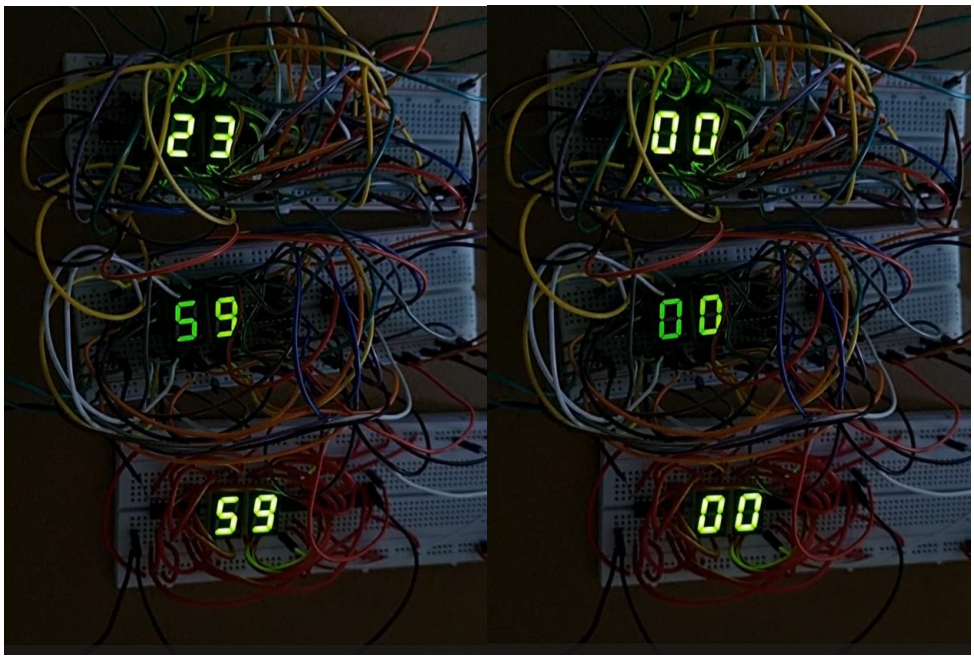

Fig 2 :The seconds and minutes segments displaying 00 after 59 while the hours segments display 00 after 23 .

RESULT:

The digital clock successfully displayed time in HH:MM:SS format on the common cathode 7-segment display. IC 4076 stored and shifted time data, while IC 7411 managed the counting logic. The 555 IC ensured accurate timing, and diodes and resistors provided the necessary protection**.**

CONCLUSION:

The digital clock project demonstrated the successful implementation of timekeeping using digital components. By integrating ICs, resistors, capacitors, and 7-segment displays, we created a functional clock capable of displaying time in HH:MM:SS format. The 555 Timer provided stable clock pulses, while the CD4026 ICs managed counting and display. Despite facing challenges with connectivity, power stability, and timing accuracy, we resolved these issues with effective circuit adjustments and careful PCB layout. This project reinforced our understanding of digital electronics and component integration for real-world applications.

ACTUAL COST REQUIRED:

PROBLEMS FACED DURING THE IMPLEMENTATION:

- Unstable Connections on the Breadboard: Loose connections caused intermittent or unstable clock signals, resulting in inconsistent display output.

- Power Supply Issues: Inconsistent power led to the clock resetting or displaying incorrect times.

- Clock Signal Inaccuracy: Time drift occurred due to inaccuracy in the oscillator or crystal, causing the clock to run too fast or too slow.

- Display Flickering or Brightness Issues: LEDs or 7-segment displays flickered, appeared dim, or didn’t turn on properly, often due to insufficient current or poor grounding.

- Incorrect Wiring or Component Placement: Misplaced components or incorrect wiring led to malfunctions and prevented the clock from starting.

PROBLEMS RESOLVED USING SOLUTIONS:

- Ensuring Stable Connections: Firmly secured all components and jumper wires, used shorter jumper wires, and double-checked connections against the schematic to improve stability.

- Using a Regulated Power Supply: Used a stable power source with voltage regulation, such as a 7805 regulator, and added capacitors on the PCB to smooth out any fluctuations.

- Fine-Tuning the Oscillator: Used a high-quality crystal oscillator with appropriately rated capacitors, and made adjustments on the PCB to improve timing accuracy.

- Optimizing Display Performance: Added current-limiting resistors, checked ground connections on the breadboard, and minimized ground trace length on the PCB layout to ensure proper brightness and stability.

- Double-Checking Wiring and Placement: Carefully checked wiring against the circuit diagram, labeled components on PCB design software, and verified connections before soldering.