

Digital Clock

Team members:

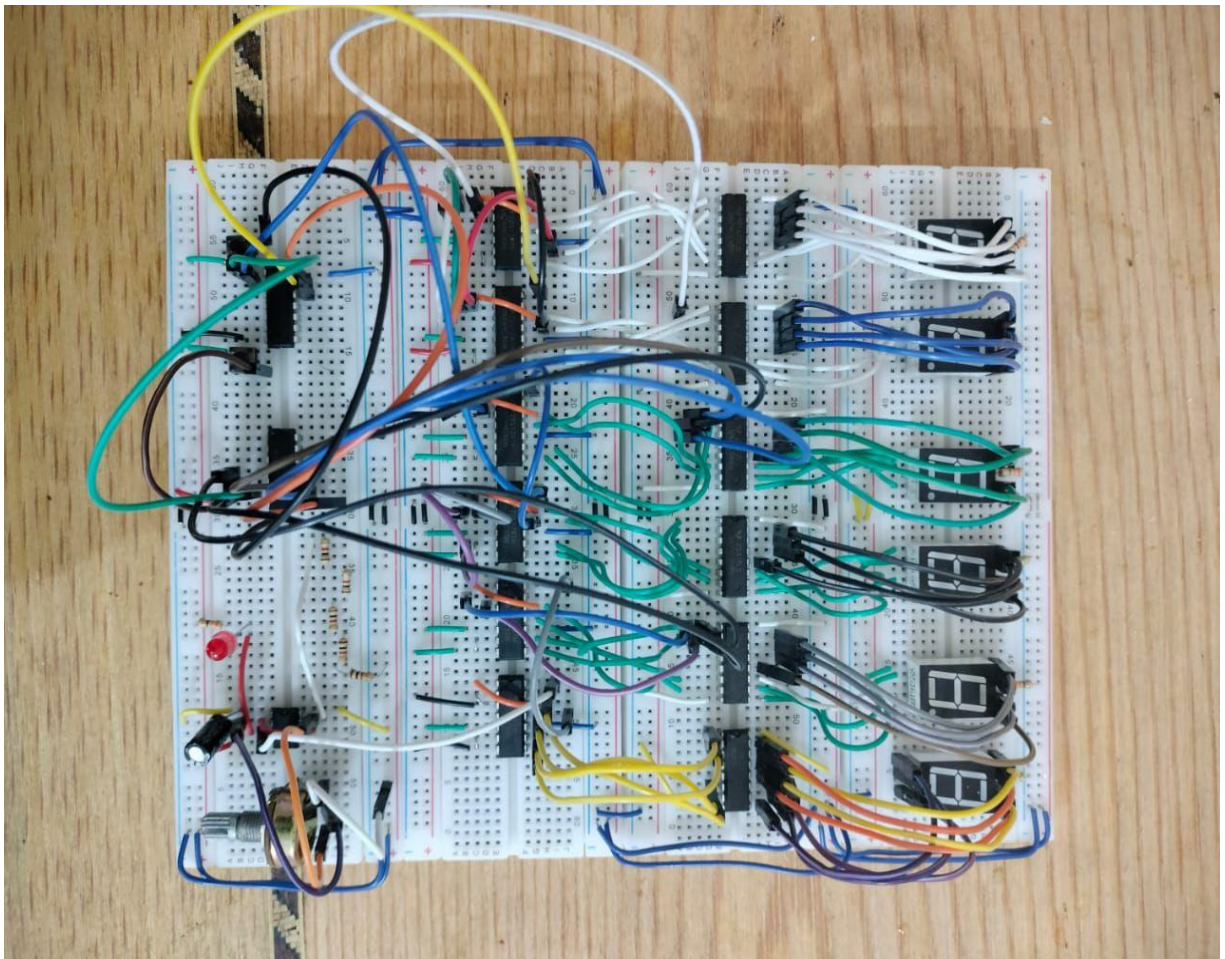
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Project without ic 4026



Introduction:

This project aims to design and implement a digital clock using integrated circuits (ICs) and basic electronic components. The clock is capable of displaying time (hours, minutes, and seconds) accurately, with the additional functionality of accelerating time counting using control buttons.

Tools and Components Used:

1. Pulse Generator - IC 555:

- a. Used to generate clock pulses.
- b. Connected to a variable resistor to control the speed of the pulses.

2. Fixed and Variable Resistors:

- a. To set appropriate voltage and current values for circuit operation.
- b. The variable resistor is used to adjust the pulse speed.

3. Counters:

- a. IC 7490:
 - i. A decade counter.
 - ii. Two counters are used for seconds: one counts from 0 to 9, and the other counts from 0 to 5.
 - iii. Two additional counters are used for minutes with the same configuration.

4. Logic Gates:

- a. AND and NOT Gates:
 - i. Used to coordinate the reset operation when the counting limits are reached.

5. Decoders:

- a. IC 7448:
 - i. Used to display output on 7-segment displays.

6. 7-Segment Displays:

- a. Used to visually display seconds, minutes, and hours.

7. Push Buttons:

- a. Used to accelerate the time counting when pressed.

Working Mechanism:

1. Generating Clock Pulses:

- a. Clock pulses are generated using IC 555, with their speed controlled by a variable resistor.
- b. Pressing the buttons accelerates the pulse generation, speeding up the time counting.

2. Counting Seconds:

- a. Seconds are divided into two parts using two IC 7490 counters:
 - i. The first counts from 0 to 9.
 - ii. The second counts from 0 to 5 and sends a signal to the minute counter upon completing a full cycle.

3. Counting Minutes:

- a. The same mechanism as seconds is used, with two additional IC 7490 counters.

4. Resetting:

- a. The reset operation is managed using an AND gate combined with a NOT gate to define the reset point.

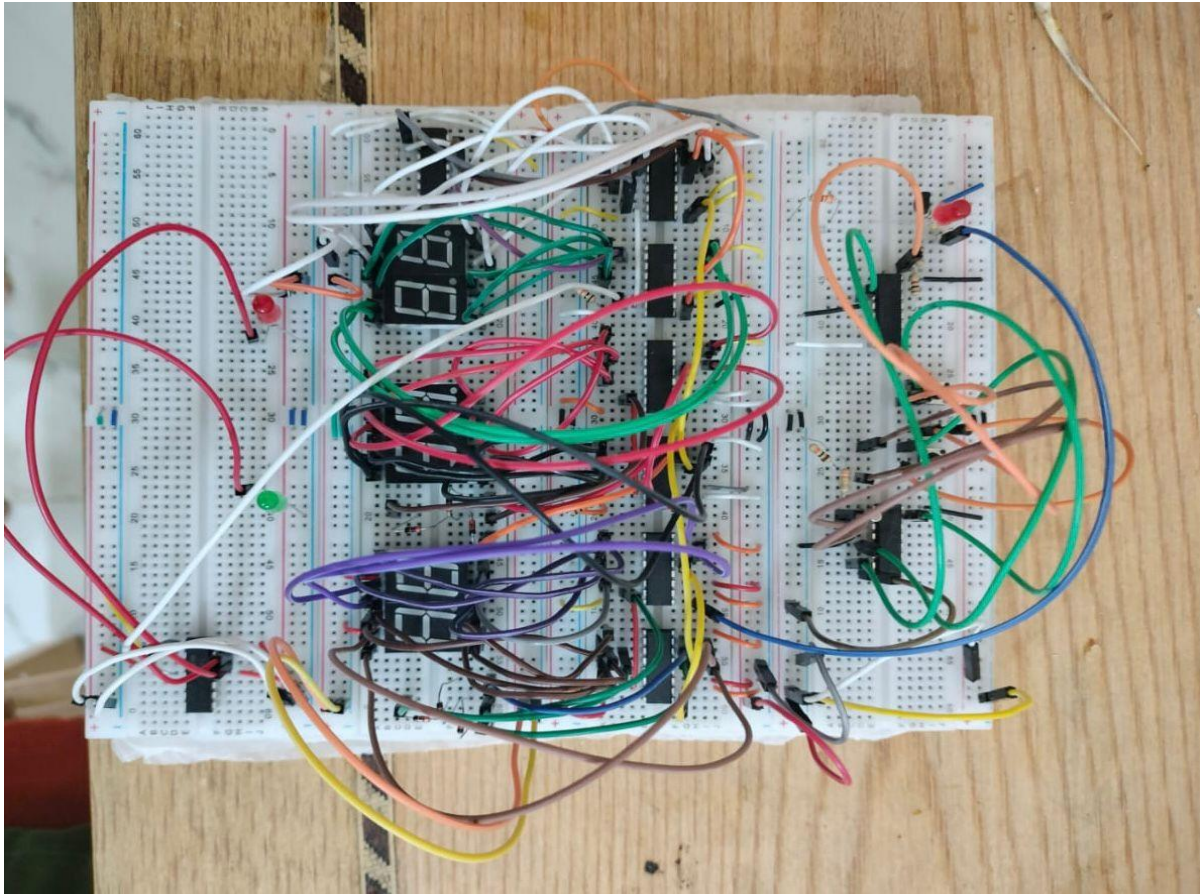
5. Displaying Time:

- a. Outputs from the counters are fed into IC 7448 decoders, which convert them into signals suitable for 7-segment displays.

6. Accelerating Time:

- a. When the push buttons are pressed, the pulse speed generated by IC 555 increases, causing the counters to operate faster and accelerate time counting.

Another project with 4026



Introduction:

This project is an enhanced version of a digital clock, incorporating additional functionalities such as AM/PM indication. It builds on the previously described project but uses IC 4026 to simplify the circuit by combining the counting and decoding functions. The clock displays seconds, minutes, and hours accurately, with an added feature to distinguish between AM and PM using a JK flip-flop.

Tools and Components Used:

1. Pulse Generator - Crystal Oscillator:

- a. Generates precise clock pulses to drive the IC 4026.

2. Integrated Circuits:

- a. IC 4026:
 - i. Combines the functionality of the decade counter (IC 7490) and the 7-segment decoder (IC 7448) from the previous project.
 - ii. Receives clock pulses and directly drives the 7-segment displays for seconds, minutes, and hours.
- b. JK Flip-Flop:
 - i. Used for AM/PM indication.
 - ii. Takes the reset signal from the hour counter every 12 hours and toggles its output to control two LEDs (one for AM and one for PM).

3. 7-Segment Displays:

- a. Used to visually display the time (seconds, minutes, and hours).

4. Logic Gates:

- a. NAND Gate:
 - i. Used to manage the reset functionality of the counters.

5. Push Buttons:

- a. Accelerates the clock pulses for testing or demonstration purposes.

6. LED Indicators:

- a. Two LEDs are used for AM and PM indication:
 - i. One LED lights up for AM, while the other remains off.
 - ii. They toggle states every 12 hours.

Working Mechanism:

1. Clock Pulse Generation:

- a. A crystal oscillator generates the clock pulses required to drive IC 4026.
- b. Push buttons can be used to accelerate the pulses, speeding up the counting process.

2. Counting and Displaying Time:

- a. IC 4026 serves dual functions:
 - i. Counts the incoming pulses for seconds, minutes, and hours.
 - ii. Decodes the count and drives the corresponding 7-segment displays directly.

3. Reset Operation:

- a. A NAND gate manages the reset process for the counters.
- b. For example, when the seconds counter reaches 60, it resets and increments the minute counter.

4. AM/PM Indication:

- a. The JK flip-flop toggles its state every 12 hours, triggered by the reset signal from the hour counter.
- b. The outputs Q and Q^- control two LEDs:
 - i. One LED lights up during AM hours.
 - ii. The other LED lights up during PM hours.

5. Time Display:

- a. The 7-segment displays show the counted values for seconds, minutes, and hours in real time.