

ELECTRONIC DIGITAL CLOCK

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Abstract

In this project, electronic digital clock is designed and built. This circuit is developed by mainly using 555 timer IC, CD4033 counter IC, 7-segment display and LM7809 regulator IC. The digital clock can show hour, minute and second. The 555 timer is used in oscillator circuit as astable oscillator mode to provide the clock pulse waveform. Six counter ICs are used to count the time from second to hour. To increase the counting beyond 9, the carry out of first IC is connected to the clock input of second IC by cascading two CD 4033 IC. Six common cathode 7-segment displays are used to display the hour, minutes and seconds. In this digital clock, 9V power regulated power supply is constructed by using LM7809 regulator.

Keyword: 555 Timer IC, CD4033 counter IC, 7-segment display, hour, minutes, second

1.INTRODUCTION

A clock is an instrument for measuring time. In principle, it requires no more than some physical process which will proceed at a known rate, and a way to gauge how long that process has been continuing. There are different types and sizes of clocks.

Depending on the method of time display, clocks can be classified by four types. They are (i) analog clocks, (ii) digital clocks, (iii) auditory clocks (iv) textual clocks. Digital clocks display a numeric representation of time. Two numeric display formats are commonly used on digital clocks. They are: 24-hour notation with hours ranging 00 to 23 and 12 hour notation. Most digital clocks use an LCD or LED display.

This circuit consists of five portions. These are power supply portion, oscillator portion, second section,

minute section and hour section. This circuit is 12-hour notation. Its range is 00:00:00 to 11:59:59.

2.MAIN COMPONENTS

The main components and other components used in this project are as follows.

- 555 timer IC
- Common-cathode 7-segment display
- CD 4033 counter IC
- LM 7809 regulator IC
- Resistors
- Capacitors
- Diodes
- 12V Transformer

2.1. 555 Timer IC

The 555 timer IC is an integrated circuit used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip flop element. In this project, 555IC is used as oscillator to output the clock pulse waveform.

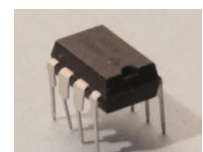
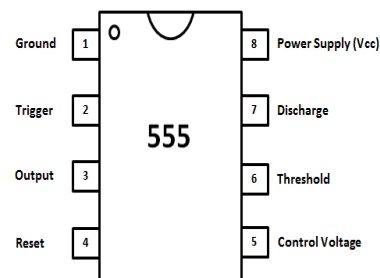


Figure 1. 555 Timer IC

2.2. CD 4033 Counter IC

CD 4033 is used in digital display. It converts the input into numeric display which can be seen on 7-segment

display with the help of LED's. It can be used in various applications like in 7-segment decimal display circuit, in clocks, timer etc. In this clock, six CD4033ICs are connected in series to output the counting time from second to hours.

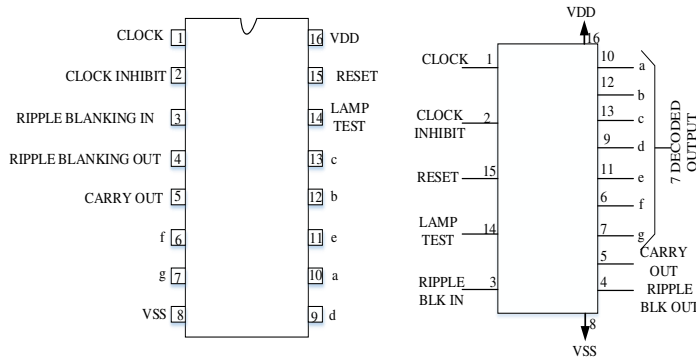


Figure 2. CD 4033 IC

2.3. Seven Segment Display

There are two types of LED 7-segment display called: Common Cathode (CC) and Common Anode (CA). Common cathode displays are used in this circuit to display the current time.

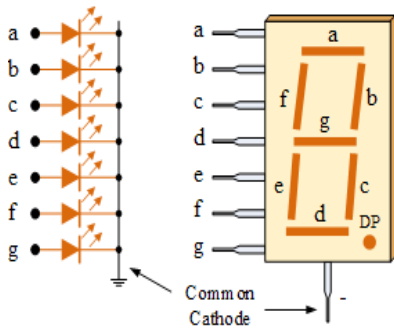
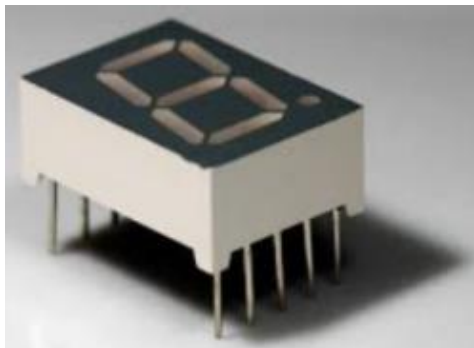


Figure 3. Common Cathode 7-Segment Display

3. OPERATION OF POWER SUPPLY

Every electronic circuit can operate with only DC voltage. This circuit contains power supply that converts AC voltage to DC voltage. For this project, a 9V regulated power supply is used for power supply. 9V battery can also be used instead of power supply circuit. LM7809, 3-Terminal 1A Positive 9 Voltage Regulator, is used to get the regulated power supply for the whole project.

Fig.4 is shown the circuit diagram of 9 V regulated power supply by using popular 7809 IC. The 7809 is a 9 Volt voltage regulator IC with features such as internal current limit, safe area protection, thermal protection etc. A 12 V transformer brings down the 230V mains, 1A bridge rectifier rectifies it and capacitor C1 filters it and 7809 regulates it to produce a steady 9V DC output.

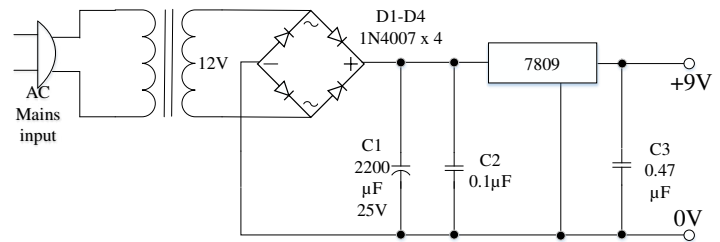


Figure 4. 9V Regulated Power Supply Circuit

4. OPERATION OF ELECTRONIC DIGITAL CLOCK

To provide the clock pulse waveform to 4033 IC, the 555 timer oscillator circuit is used.

The output frequency of the rectangular wave from oscillator can be calculated by the following equation.

$$f = 1.44 / \{(R1 + 2R2)C1\}$$

The value of R2 is the value of adjusting VR1.

for example, $R2 = VR1 = 68k$

$$f = 1.44 / \{(10 k + 2 \times 68k) \times 10 \mu F\} = 0.98 \text{ Hz}$$

If preset is used instead of R2, 1 Hz exactly can be obtained by adjusting forward and backward to VR1. From figure (5) to figure (7), express the complete digital clock that used IC CD 4033. The 1Hz clock signal is supplied from the clock input (T5) of the second section. The output pins (T3,T4) of the second section must be connected to the input pins (T3,T4) of the minute section. The output pins of the minute section must be connected to the input pins (T1,T2) of the hour section.

By making these steps, the complete 12-hour circuit results.

The second section counts up from 00 to 59 every positive edge triggered of the oscillator. The second section is designed to reset at 60 and to get carry output 1 from IC2. This carry output is provided to the clock pulse of minute section to start the count. Minute section is designed similarly to second section. The hour section is designed for counting up from 00 to 11 and resetting at 12.

After connecting with power supply completely, some digits will show on 7-segment display. Commonly, the three front displays will be OFF. For adjusting the time setting, two switches involve. MIN-SET switch is used to adjust minute. HOUR-SET switch is used to adjust hour alternatively.

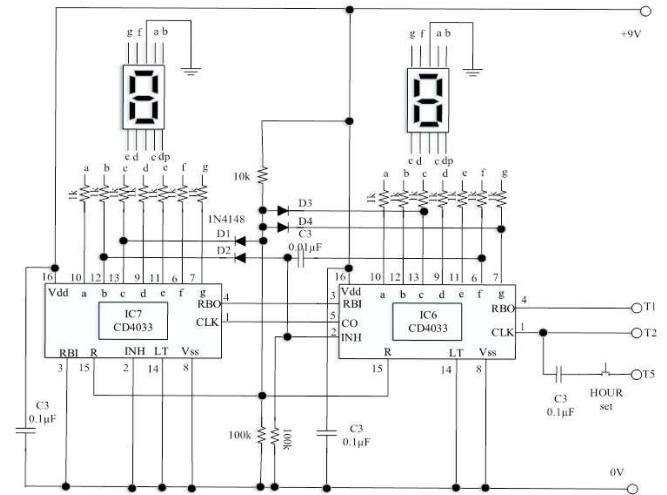


Figure 7. Circuit Diagram of Hour Section

5. TEST AND RESULTS OF DIGITAL CLOCK

After second section, minute section and hour section are step by step testing on project board, testing of overall circuit is get as shown in figure (8), figure (9) and figure (10).

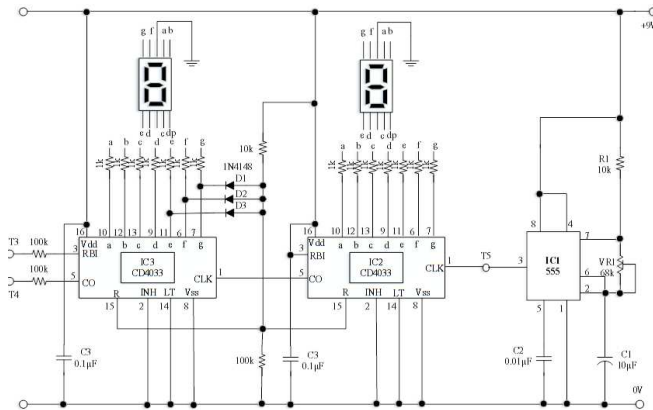


Figure 5. Circuit Diagram of Oscillator and Second Section

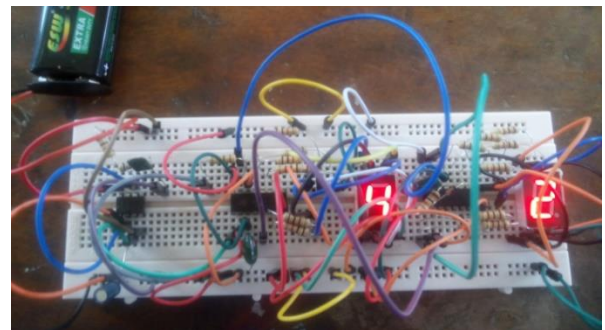


Figure 8. Testing of Oscillator and Second Section on Project Board

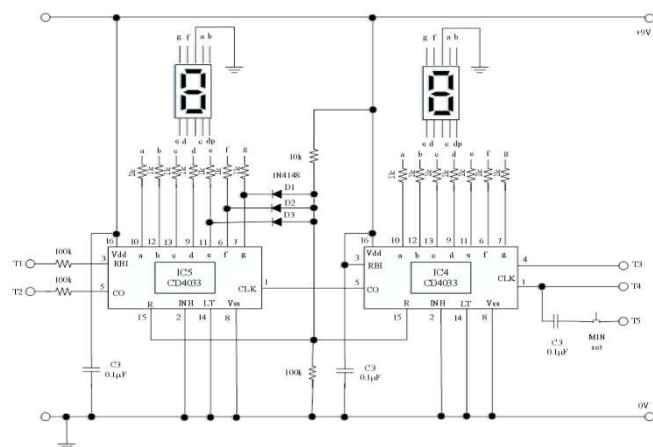


Figure 6. Circuit Diagram of Minute Section

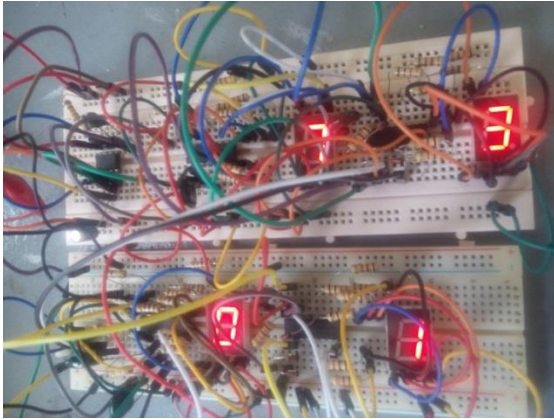


Figure 9. Testing of Second and Minute Section on Project Board

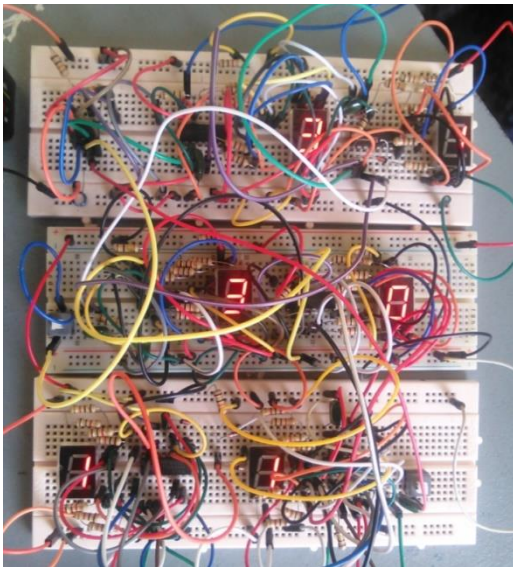


Figure 10. Testing of Overall Circuit on Project Board

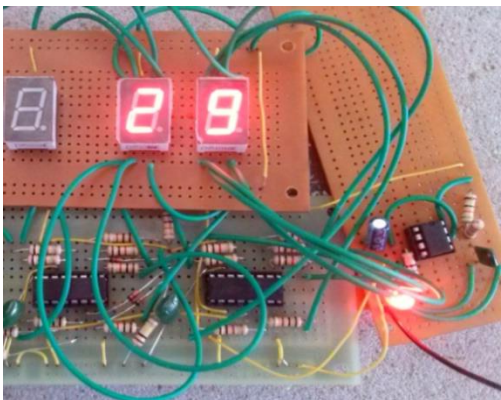


Figure 11. Testing of Second Section

The components are placed and soldered on the universal IC card and then testing photos are presented in figure (11), (12) and (13). The result of the complete electronic digital clock is shown in figure (14).

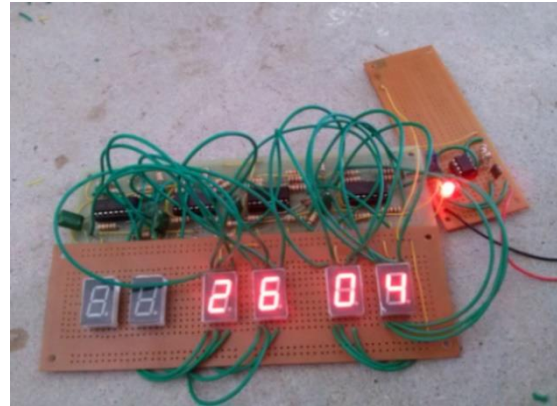


Figure 12. Testing of Second and Minute Section

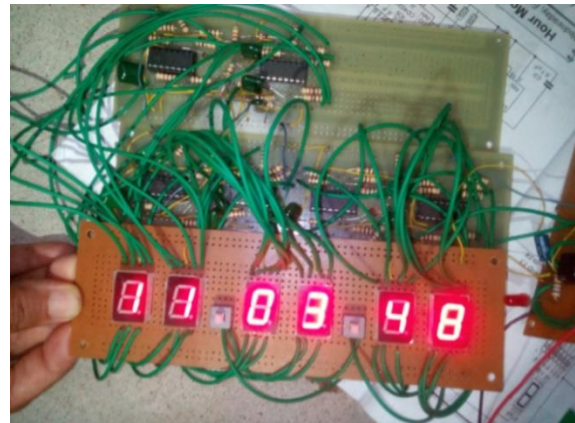


Figure 13. Testing of Overall Circuit

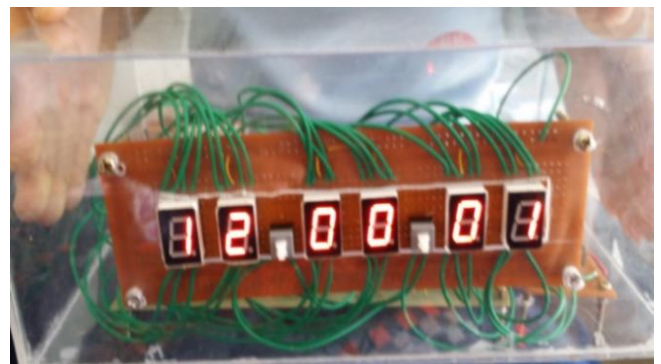


Figure 14. Output Result of Electronic Digital Clock

6.CONCLUSION AND DISCUSSIONS

In this project, the Digital Clock device is designed and constructed by using CD 4033 ICs, 555 Timer, switching diodes (1N4148), 7-Segment displays, Fixed Resistors and capacitors. The circuit is meant to provide the learners for understanding.

If the circuit is used, the 7-segment display of the second section will be lighted whenever the oscillator circuit used 555 timer IC is supplied by the power supply. Then the second section is used to drive the minute section. Step by step, drive the hour section by using the minute section.

In this digital clock circuit, CD 40110(Up-Down Counter) can be replaced in CD 4033(Up-Counter). To drive the common cathode seven segment display, combination of 7490 IC and 4511 IC can be used instead of 4033 IC. To get exactly 1 Hz signal input, the crystal oscillator circuit can be used instead of the 555 IC oscillator circuit.

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