Inspiring Excellence

Course code: CSE260

Course title: Digital Logic Design

Project Related Work

Project Title:Digital Clock Using 7 Segment Display

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Introduction:

Our group chose to create a digital clock due to the widespread use of digital clocks in daily life. We want to create a digital clock in order to learn how to construct one and to gain a better understanding of how they work. We know that 60 seconds equals 1 minute and 60 minutes equals 1 hour in the metric system. As a result, the minute segment is derived from the second segment, and the hour segment is obtained from the minute segment. Each minute and second part is meant to display a count from 00 to 59, after which it resets to 00, while the hour section displays a count from 00 to 24 hours, after which it resets to 00. In the second portion, the minute segment increases its count by one for each cycle from 00 to 59. Similarly, for each minute cycle from 00 to 59, the hour segment adds one to its count. As a result, when 23 hours, 59 minutes, and 59 seconds, passes, each sector was reset to zero, resulting in the display 00.00.00, often referred to as the Othhour. Without further discussion , let us jump straight into our project, focusing on various aspects according to the modules.

Proposed Model:

The project has four primary segments - the second section, the minute section, and the hour section.

In the second section, we have used two ICs that constantly generate all ‘second’ values at the frequency of 1 Hz. A Drive IC and a seven-segment display have been used to display the counts. The anode type in both integrated circuits is the same.

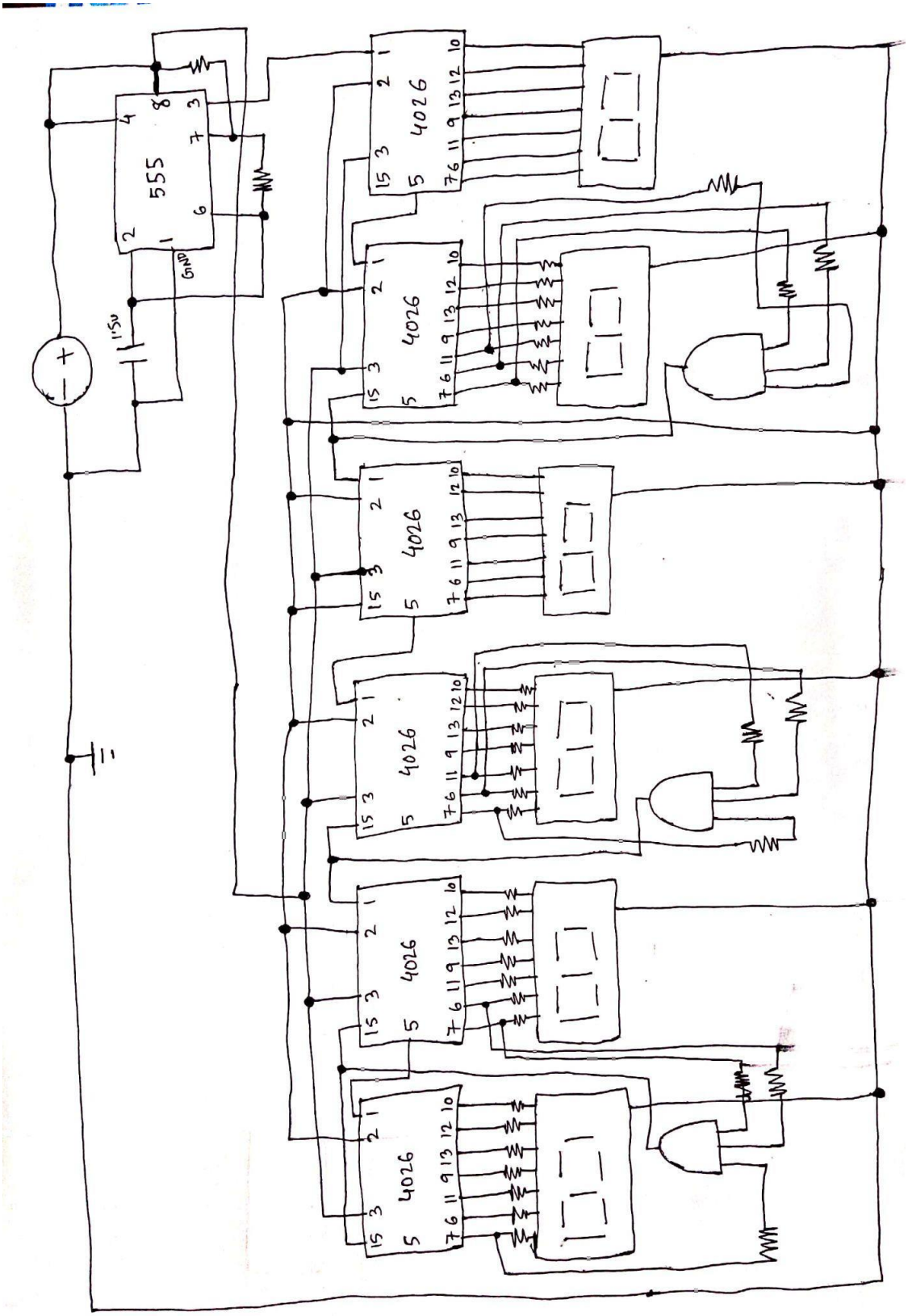
In the minute segment, we basically recreated the same circuit as the second segment but the count frequency here is lesser - 1 pulse per minute

The hour component ticks once an hour and the timer automatically goes back to 00:00:00 after hitting 11:59:59.

Required Components and Equipment:

- 7SEG-COM-CATHODE
- 555 IC
- 4026 IC
- 7411 AND GATE
- CAPACITOR - C1206C183J2RACTU
- RESISTOR - METALFILM470R
- VSOURCE

Experimental Setup:



Results & Analysis:

Truth Table For Seven Segment Display

A	**B**	**C**	**D**	**a**	**b**	**c**	**d**	**e**	**f**	**g**
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	0	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1
1	0	1	0	**X**	**X**	**X**	**X**	**X**	**X**	**X**
1	0	1	1	**X**	**X**	**X**	**X**	**X**	**X**	**X**
1	1	0	0	**X**	**X**	**X**	**X**	**X**	**X**	**X**
1	1	0	1	**X**	**X**	**X**	**X**	**X**	**X**	**X**
1	1	1	0	**X**	**X**	**X**	**X**	**X**	**X**	**X**
1	1	1	1	**X**	**X**	**X**	**X**	**X**	**X**	**X**

The seven segment display has seven LED like structures inside them which emit light when in high state, i.e. has the output 1. However, these displays cannot display numbers greater than 9 and thus, for the above truth table the rest of the number outputs, from 10-15, ‘don’t care’ values are used to represent that those values cannot exist. As the clock impulses are received from the 4026 IC, the corresponding lights are turned on which resemble the numbers.

As for the clock impulses, from the beginning, the 555 timer IC works as an astable multivibrator which means it has two states available, 1 and 0. Using the pin number 2 and 6, trigger and threshold pins and with the help of capacitors and resistors, 1 and 0 outputs can be generated which are like square wavefronts passed on to the rightmost 4026 IC. The charging and

discharging of the capacitors, allows the 555 timer to provide 1s and 0s, both as outputs. These varying outputs allow the circuit to create the 'seconds gap' In the 4026 IC, the clock pulses are taken as inputs. Multiple 4026 ICs are used, 6 in our project, to show the hour, minute and second count. When the clock impulse is 1, the display number is increased by one and when the number reaches 9, an output of 1 is cascaded to the next 4026 IC. The ICs are connected from their pin number 5 to the next IC for the cascading effect. The time gap remains constant in this way and hence a digital clock is made. Lastly, during the simulation, the clock worked in the way initially hypothesized as during the simulation, if looked upon the terminals of the seven segment displays, the outputs match with the truth table found above.

Conclusion:

Due to the presence of multiple oscillating and counting integrated circuits in the project, along with various other electrical components such as transistors, capacitors and resistors, at times, it got strenuous to connect the great number of wires accurately with the corresponding components. Moreover, the frequency of the digital clock can be altered wishfully using pin number 5 of the 555 timer and hence, the time period of the 555 timer IC, can be changed although it needs to be considered that the resistance in the circuit is not too low as it may create a short circuit which will then hinder the oscillations. Furthermore, as the clock impulses are spontaneous, this digital clock cannot be manually set to a certain value which means after stopping the simulation, the values will be reset and thus the whole counting will start from the beginning.

In a nutshell, in order to build a digital clock, the structure followed above is convenient for beginners due to the ease of understanding of the two different ICs involved and the seven segment display as only the knowledge of the working principles of these components are required to make this entire circuit.