CSE260 PROJECT REPORT

Title: DIGITAL 24-HOUR CLOCK SYSTEM

GROUP NUMBER: 06

NAME AND ID

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Theory Section: 03

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☐ Introduction:

We four students, Md. Asif Rahman, Jannatul Ferdoush, Md. Imamul Mursalin Sujoy and Shafin Abrar Mufdi, have chosen a digital 24-hour clock system for our project. Here, firstly we will show the proposed model we have used in this project. Secondly, an experimental setup where we will explain what we need, what we have used in this project, and lastly, a circuit design that will show us how it will be made and its result. At last, we will conclude about what we have learned and what will be the overall solution of this project. Our objective for this project is to design a digital 24-hour clock system.

☐ Proposed Model /System:

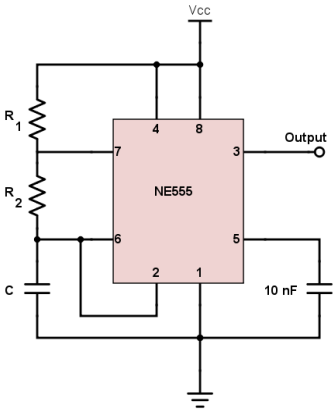
This experiment can be simulated by using proteus. First of all, we will consider a clock as a counter which counts 0-59 and 0-23. Whenever these values exceed it will just carry to its next higher designation(Seconds>Minutes> Hours). Now, We will focus on building a pulse generator circuit. This circuit will generate 1 hz per second. Then we have built a counter circuit which counts the pulse and displays it in the 7 segment display. When the second counter circuit counts up to 59, then that circuit will reset and another counter circuit will count minutes. It will count up to 59, after that it will get reset and another counter circuit will count the hour. For pulse generation we have used 555 timer IC, for the counter circuit we have used 4026 seven segment counter IC. For resetting the circuits we have used 7411(3 input AND gate) IC.

☐ Experimental Setup:

❖ Required Components and Equipments:

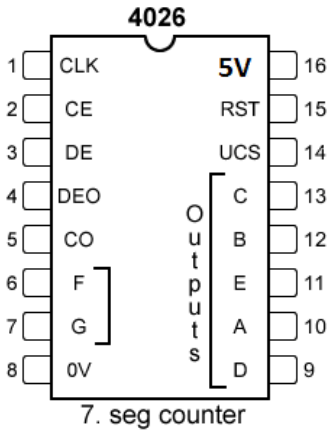
- 7 segment common cathode display (red) * 6
- 555 timer IC * 1
- 4026 IC * 6
- 7411 IC (Three input AND Gate) * 3

- Non electrolytic capacitor * 1
- Resistor * 17
- DC Power supply (9V) * 7
- Ground



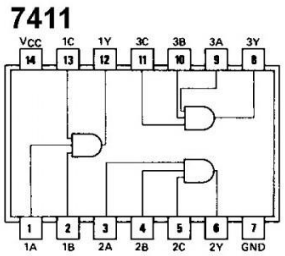
❖ **Explanation of components:**

The 555 IC is the base of the circuit of the digital 24-hour clock system which is a monostable multivibrator. This time of digital clock system is decided by the Resistor and Capacitor connected with 555 IC. The speed of the digital clock system can be controlled by the frequency of the capacitor connected with the 555 IC.



7. seg counter

Besides, the circuit of the digital 24-hour clock system consists of 6 common cathode seven-segment displays which can display 0 to 9. The displays are connected with 4026 IC which is a 16-pin CMOS seven-segment counter from the 4000 series. It counts clock pulses and returns the output in a form which can be displayed on a seven-segment display. One 4026 IC controls one seven-segment display.



There are also three 7411 ICs which are basically an AND Gate having three inputs and one output. This IC contains three AND Gates. This IC is used for resetting the (hour, minute and second) display to '00'.

❖ **Setup of the circuit:**

The setup of the circuit starts with the 555 timer IC where it is wired as a monostable Multivibrator. The 555 timer IC generates a clock pulse after a second and output of 555 is connected to pin 1 of 4026 IC which is a seven segment display decade counter which is used to drive a 7 segment display with input clock pulse. Here the clock pulse is obtained from the monostable multivibrator and fed into the pin 1 of the first 4026 IC. Pin 2 is usually grounded since giving a high signal to this pin will inhibit the input clock signal to pin 1 and pin 3 (Enable

Clock) is always taken High. The 555 timer IC is connected to the 9V DC power supply and 1.5 uF capacitor.

Initially, when the circuit is switched ON the 7 segments will indicate ‘00:00:00’ count and as soon as the negative trigger is given to 555 high pulse will be obtained from pin 3. The high pulse is fed to the first IC and therefore it increments its count with each clock, displaying 1 to 9 in its seven segment display. As soon as 10 counts are incremented by IC a high to low signal is obtained from its pin 5 which indicates the completion of ten increments.

The pin 5 is connected to the clock pin of the next 4026 IC. Therefore whenever 10 counts are completed by the 7 segment, the high to low signal at the pin 5 will feed a single clock pulse input to the second IC and therefore the corresponding 7 segment will be incremented one value. For a digital clock we must reset the second IC when it reaches number 6 because we want seconds to count upto "59" therefore we used IC 7411 (Three input AND Gate). In the same manner, the fourth IC will count from 0 to 6 and then the value in the fifth IC will be incremented by one. This is all about for seconds and minutes of clock. Now for hours we must reset the fifth and sixth IC when the number reaches “23” so we put one more three input AND gate.

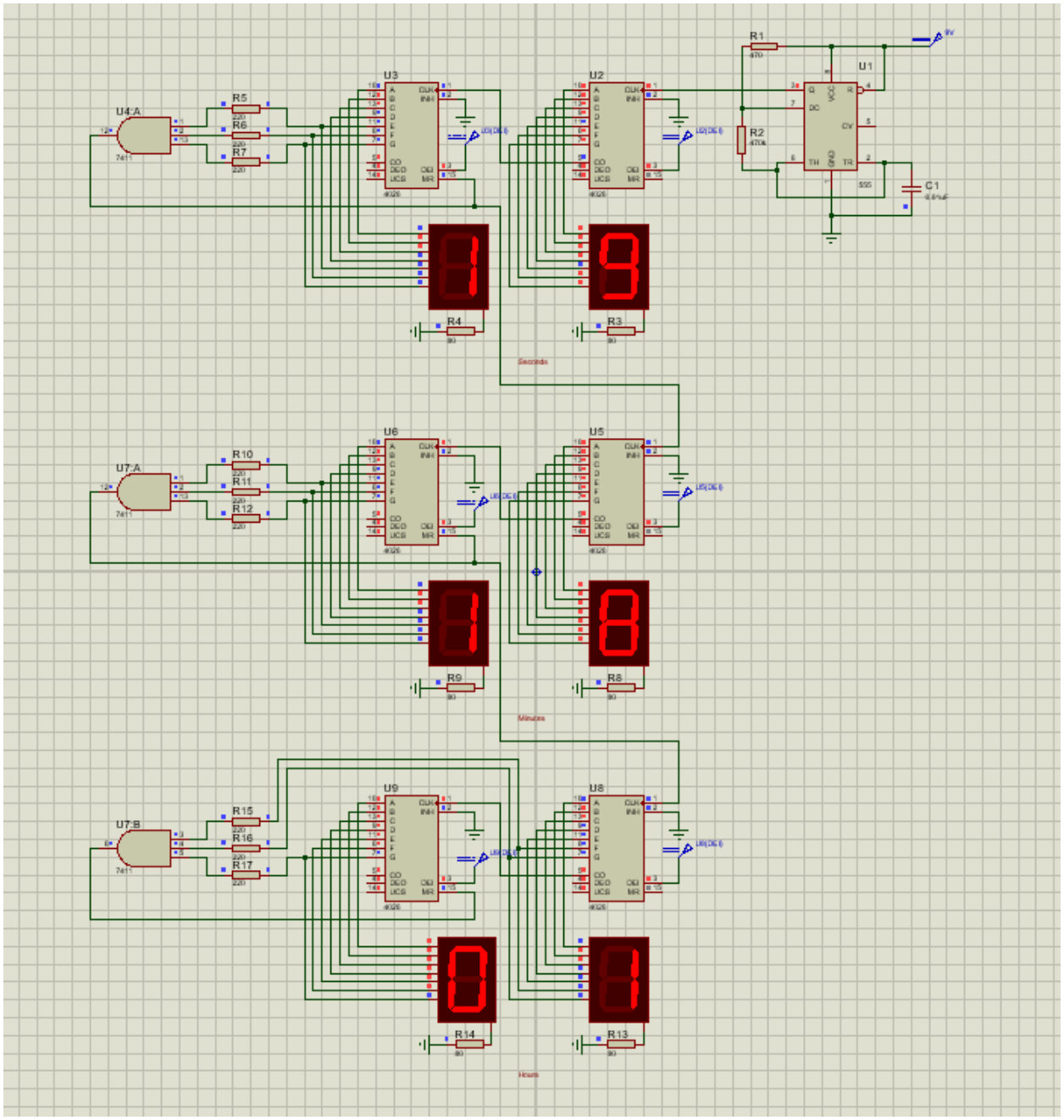


Figure: Circuit of 24-Hour Digital Clock System

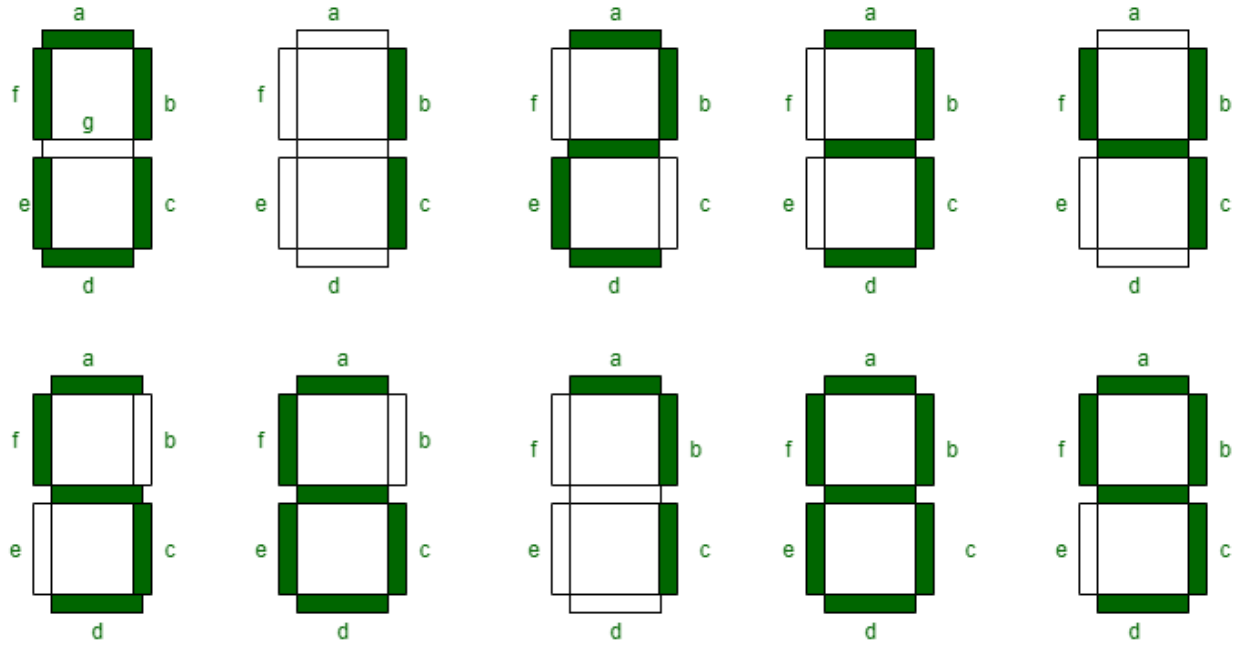
☐ Results and Analysis:

❖ Truth Table of 555 IC:

SR Flip-Flop Truth Table			
Inputs		Outputs	
S	R	Q	$\overline{Q}$
0	0	No Change	
0	1	0	1
1	0	1	0
1	1	Undefined	

There are four states of the flip flop and we need to know only two of them. Here in the table it can be seen that for set and reset inputs we get respective outputs. If the set pin receives a pulse and the reset pin receives a low level, the flip-flop stores the value one and sends high logic to the Q terminal. This state occurs until the reset pin receives a pulse while the set pin logic is low. This resets the flip-flop, causing the output Q to go low. This condition will last until the flip-flop is reset. The flip-flop saves one piece of data in this manner. Another thing to note is that Q and Q-bar are always in opposition.

❖ Truth table of 4026 IC:



Count	a	b	c	d	e	f	g
0	1	1	1	1	1	1	0
1	0	1	1	0	0	0	0
2	1	1	0	1	1	0	1
3	1	1	1	1	0	0	1
4	0	1	1	0	0	1	1
5	1	0	1	1	0	1	1
6	1	0	1	1	1	1	1
7	1	1	1	0	0	0	0
8	1	1	1	1	1	1	1
9	1	1	0	1	1	1	1

The 4026 IC works as an digital display driver of timer which shows the clock time by emitting the light. It contains counters and 7 segments decoded in one package. This emits lights in shapes of numbers to express the number. Suppose, to light 4 it needs to light up the f,g,b,c so this will receive voltages to light up those particular parts to express this number.

❖ **Truth Table of IC 7411(3 input AND Gates):**

Input			**Output**
A	**B**	**C**	**Y= A.B.C**

0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

7411 IC has three three-input AND gates. An AND gate is an electrical circuit that combines three signals so that the output is on if both signals are present. Logic AND Gates are available using digital circuits to produce the desired logical function is given a symbol whose shape represents the logical operation of the AND gate. The Boolean expression for the logic AND function is defined as which is a binary operation, AND gates can be cascaded together to form any number of individual inputs. However, commercially available AND gate IC's are only available in standard 2, 3, or 4-input packages. If additional inputs are required, then standard AND gates will need to be cascaded together to obtain the required input value, for example. In this 7411 IC Truth Table, the output of the 3 input AND gate is HIGH when all the 3 inputs are HIGH and it will be LOW for all other combinations of inputs.

☐ Conclusion:

There are several limitations of your project as limited circuits were used in building this. One of the limitations of using 555 IC is that the inaccuracy of timer setting as the 555 timer works with charging an external capacitor and voltage threshold so this is highly dependent on the circuit voltage and value of the capacitor as a result the exact accuracy is rare in this case.

In conclusion,the Design of the digital Clock was successfully carried out using synchronous counters and basic logic gates. The designed system was implemented using Proteus version 8.9. The Simulation result shows that the system functions as desired, where for every 60 second there is one minute and for every 60 minutes there is 1 hour, until the clock reaches 24 hours before it cycles back to 00 hour.