Palestine Technical College

Engineering Professions Department

EEE14357 - Final Project Report

Digital Clock

(Design and Implementation without Microcontrollers)

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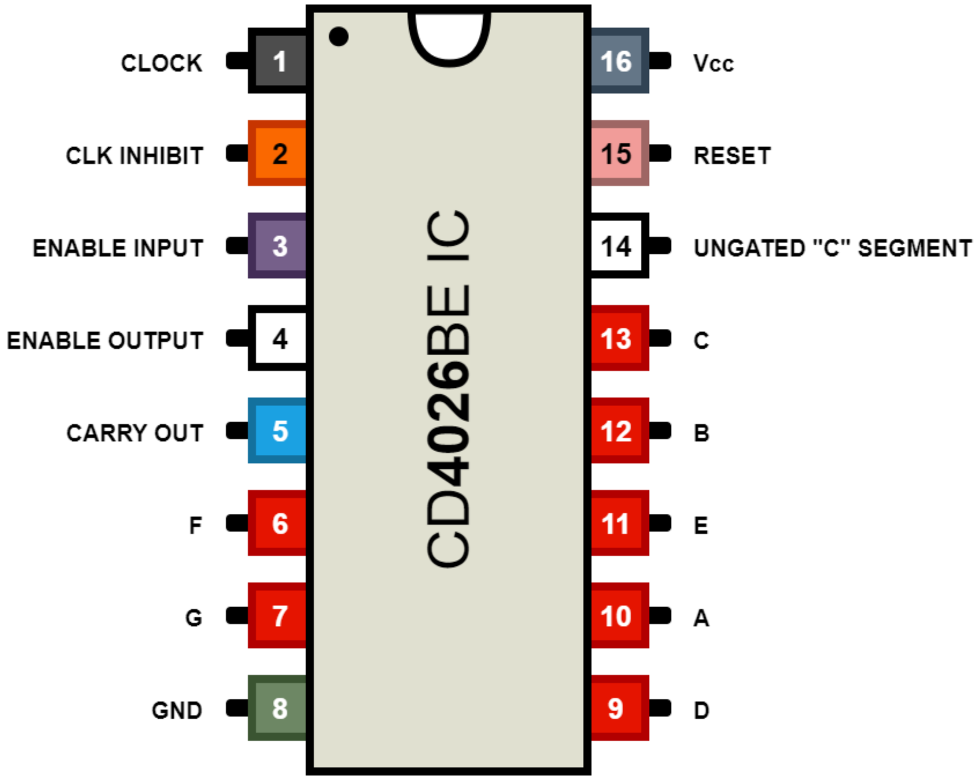
Introduction:

Digital clocks are widely used in various applications, providing accurate timekeeping and convenient display of it. While microcontrollers are commonly used in modern clock designs, this project aims to build a digital clock without their utilization.

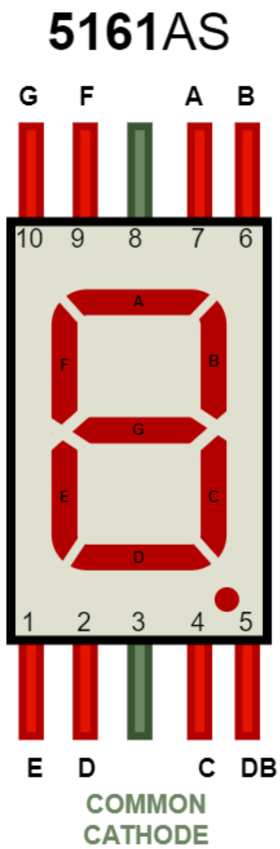
This report presents the design and implementation of a digital clock without the use of microcontrollers. The clock utilizes several integrated circuits, including the CD4026BE IC, 7-segment displays, NE555P timer, and SN74LS11N IC. The project focuses on creating a simple wired digital clock that can display seconds, minutes, and hours in a user-friendly manner. It also supports two buttons to adjust time.

Components Used:

- ***<u>CD4026BE IC:</u>*** The CD4026 IC performs the function of both a counter as well a 7-segment Driver. It can count from 0 to 9 and is often used in digital counters and clocks. (*6 used*)

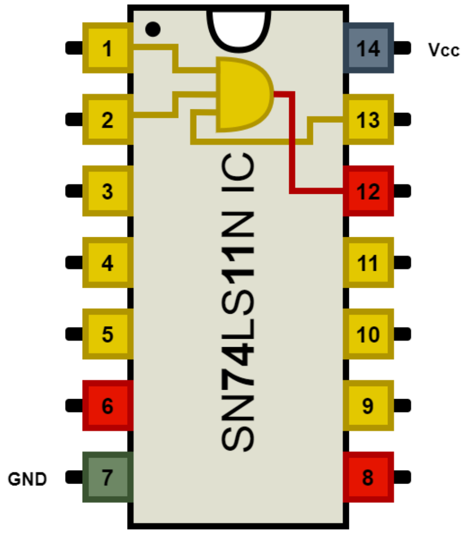


- ***5161AS(7-segment):*** The 7-segment displays are commonly used to visually represent numerical digits from 0 to 9. They consist of seven individual segments that can be illuminated selectively to display specific digits. (*6 used*)

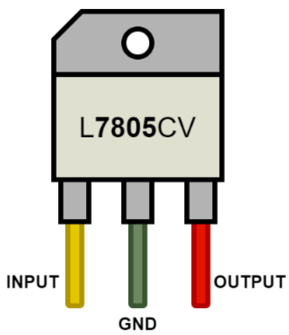


- ***NE555P Timer:*** The NE555P is a popular timer IC capable of providing accurate timing and pulse generation functions. In this project, it is employed for timekeeping and to synchronize the counting functionality of the CD4026BE. (*1 used*)

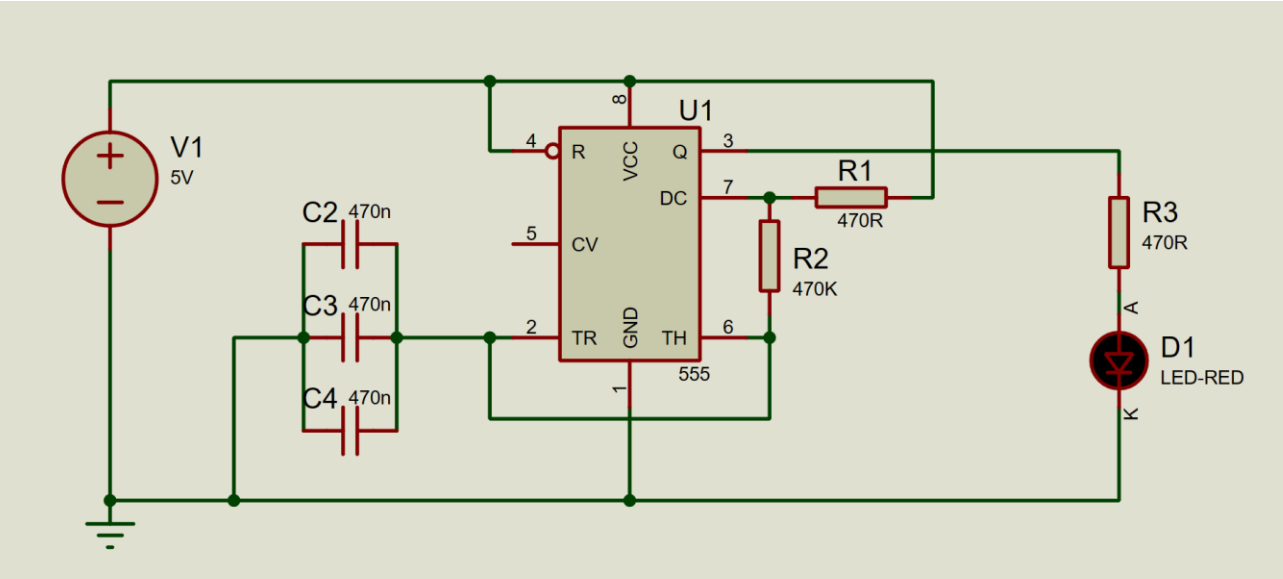
- ***SN74LS11N IC:*** The SN74LS11N is a triple-input positive-AND gate IC. It is used in this project for logical operations, particularly for resetting stages. (*1 used*)



- ***L7805CV IC:*** The L7805CV is a popular linear voltage regulator IC that delivers a steady 5V output from higher input voltages. It is widely used in electronics projects to ensure a stable power supply for various applications. (*1 used*)



Pulse Generation:



$$f = \frac{1.44}{C(R_1+2R_2)} = \frac{1.44}{3\times470\times10^{-9}(470+2\times470\times10^3)} = 1.085\ Hz$$

Circuit Design:

The **circuit design** involves connecting the components in a specific configuration to achieve the desired functionality.

Initially when the circuit is switched ON the 7-segments will indicate "00:00:00" count and as soon as the trigger was given to the NE555P timer, the clock starts counting up.

The **working of the circuit** starts with the NE555P timer provides a stable clock pulse after a second and this clock pulse (output of NE555P) is fed into the pin 1 of first CD4026BE IC, which is the central element responsible for counting and displaying the hours, minutes, and seconds via a set of 7-segment displays.
Pin 2 is usually grounded since giving high signal to this pin will inhibit the input clock signal to pin 1, and pin 3 is always taken High to enable the output pins (Out A to Out G).

Moreover, the **SN74LS11N** is used for logical operations and resetting stages.

The circuit consists of three similar stages: **SECONDS**, **MINUTES**, and **HOURS**. Each stage utilizes two CD4026BE ICs, part of the SN74LS11N IC, and two 7-segment displays.

The **SECONDS STAGE** receives clock pulses from the NE555P timer. It counts the pulses and increments the count by one on each clock cycle, displaying 1 to 9 in its first seven segment. As soon as 10 counts was incremented by CD4026BE IC a signal is obtained from its pin 5 which indicates the completion of ten increments.

The pin 5 was connected to the clock pin of the next 4026 IC. Therefore whenever 10 counts were completed by the 7 segment, the signal at pin 5 will feed a single clock pulse input to the next IC and therefore the corresponding 7 segment will be incremented one value.

When the count reaches 60, it resets back to 0 using the SN74LS11N IC. The output of the seconds stage is then passed on to the minutes stage.

The **MINUTES STAGE** is similar to the seconds stage as it also consists of two CD4026BE ICs, part of the SN74LS11N IC, and two 7-segment displays with the same circuitry. It receives the output from the seconds stage and increments the count by one for every 60 seconds. When the count reaches 60, it resets back to 0 using the SN74LS11N IC. The output of the minutes stage is then passed on to the hours stage.

The **HOURS STAGE**, similar to the previous stages, includes two CD4026BE ICs, part of the SN74LS11N IC, and two 7-segment displays. It receives the output from the minutes stage and increments the count by one for every 60 minutes. When the count reaches 24, it resets back to 0 using the SN74LS11N IC.

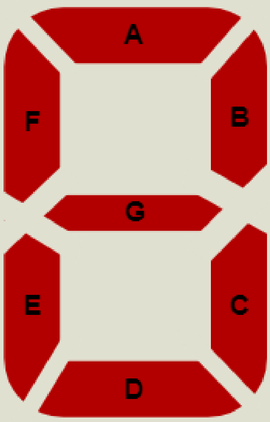
This multi-stage design allows for the accurate representation of time, with each stage resetting at the appropriate intervals (seconds at 60, minutes at 60, and hours at 24).

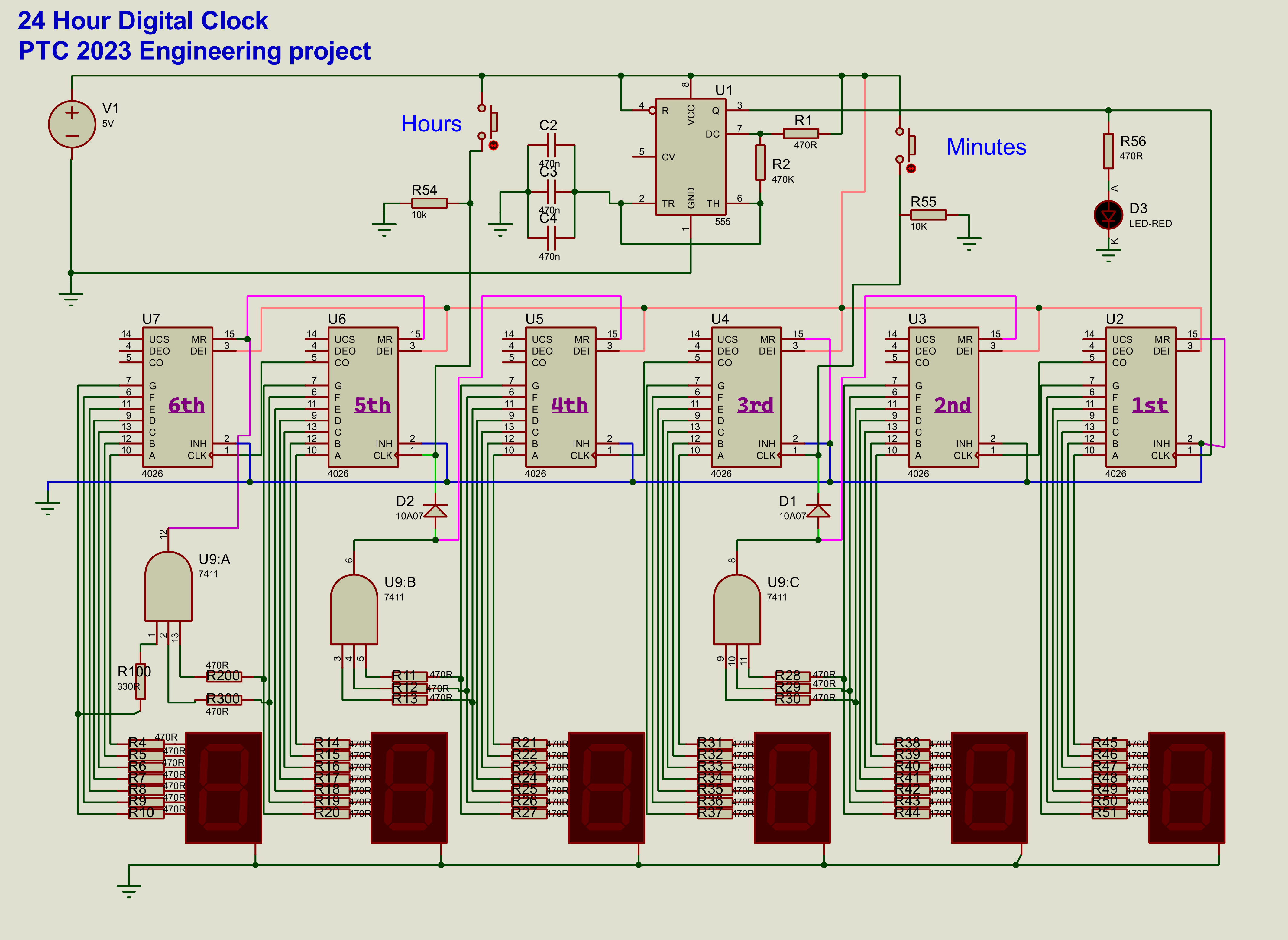
For a digital clock we must **reset** second IC (in **SECONDS**) when it reach to number 6 because we want seconds count up to "59" therefore we used IC 7411 (Three input AND Gate) on the (E,F, and G) pins.

In the same manner, fourth IC (in **MINUTES**) will count from 0 to 6 and then 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 fifth and sixth IC (in **HOURS**) when number reached to “24” so we put one more three input AND gate on the (F and G pins of the fifth IC) in addition to (G pin of the last IC) and reset both of these ICs together.

COUNT	A	B	C	D	E	F	G	CO
0	●	●	●	●	●	●		●
1		●	●					●
2	●	●		●	●		●	●
3	●	●	●	●			●	●
4		●	●			●	●	●
5	●		●	●		●	●	
6	●		●		●	●	●	
7	●	●	●	●				
8	●	●	●	●	●	●	●	
9	●	●	●	●		●	●	




24 Hour Digital Clock
PTC 2023 Engineering project
V1
5V
Hours
Minutes
R54
10k
C2
C3
C4
470n
U1
555
R
VCC
Q
DC
CV
TR
GND
TH
R1
470R
R2
470K
R55
10K
R56
470R
D3
LED-RED
U7
U6
U5
U4
U3
U2
4026
UCS
DEO
CO
MR
DEI
INH
CLK
6th
5th
4th
3rd
2nd
1st
D2
D1
10A07
U9:A
U9:B
U9:C
7411
R100
330R
R200
R300
470R