Digital Clock with Presetted Alarm:

Semester Project: Digital Logic Design

Course: BSCS-A/B

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A wise person said, “Time is money”. Time is essential to our daily lives. Since the beginning of history, people have been using various ways to measure time. Some of the ancient ways of measuring time includes clocks such as the Sundial, Hourglass, and the candle clock etc. With the dawn of the computer age, things are revolutionized and everything that we see around us, is digital. With our semester project of digital logic design, we decided to create our own digital clock which has an additional functionality to ring alarm every time when the seconds counter reaches 10 seconds.

Abstract

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# Chapter 1: Introduction

### Overview of Project

This project is about creating a digital clock that rings a buzzer after 10 seconds.

We have created this project using the concepts of digital logic design that we have studied so far. We used some ICs along with some gates as well as Displays to view our output. The overview of this project shall be divided into three major parts:

**Inputs:**

The inputs of the 555 timer are Ra, Rb, and C to make it work in astable mode.

Then we set these values according to our minimum unit of time which is one second.

**Outputs:**

The output of 555 timer is a square waveform with the frequency of 1hz. The square waveform output of 555 is connected to pin 1 of IC 4026 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 was obtained from the monostable multivibrator and fed into the pin 1 of first IC 4026. Pin 2 was usually grounded since giving high signal to this pin will inhibit the input clock signal to pin 1 and pin 3(Enable Clock) is always taken High.

**Processing:**

Initially when the circuit is switched ON the 7 segments will indicate "00:00:00" count and as soon as the negative trigger was given to 555 high pulse will be obtained from pin 3. The high pulse is fed to first IC and therefore it increments its count with each clock, displaying 1 to 9 in its seven segment. As soon as 10 counts was incremented by IC a high to low signal was 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 was 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 second IC when it reach to number 6 because we want seconds count up to "59", therefore we used IC 7411 (Three input AND Gate). In the same manner fourth IC 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 minute of clock. Now for hours we must reset fifth and sixth IC when number reached to “23” so we put one more three input AND gate.

*Alarm Functionality:* In order for the alarm buzzer to generate sound after every 10 seconds, we connect the respective Hex code for “1” at the second counter and connect the wires with a two input AND gate. We also connect the rest of the hex inputs to a NOT gate. Furthermore, we connect the AND gate to the buzzer to generate sound.

### Block Diagram of Complete System (without using ICs, just use simple blocks)

4. Output

1. Timer.

2. Decoder

3. Control

**Figure 1: Block Diagram**

### 1. Clear Work Division

Clearly describe the work of each member with the help of block diagram if possible. Or give a new figure illustrating work division.

Due to the unavailability of Ahsan (200901025) after he gave the idea about the project, Asad Abbas (200901024) on creating the inputs, then processing it and outputs as well as simulations. Sameer Ahmad (200901103) also contributed to the project

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**Figure 2: Work Division**

# Chapter 2: Design

### Problem Statement

Time is a very important aspect of our lives, in order to measure it digitally, we are supposed to create a circuit of digital clock, which involves the fundamental concepts we covered in digital logic design. We also have to add the functionality of alarm buzzer that beeps after a specific interval of time.

### Truth Table / State Diagram

The Truth Table for the Hex decoder is as follows: (Due to the large nature of truth table, it was made on another file and got pasted here)

A picture containing graphical user interface

Description automatically generated

A picture containing application

Description automatically generated

Table

Description automatically generated with medium confidence

This will continue in the same pattern.SA

### State Table If Applicable

Here is the state table created for the buzzer in our digital clock.

Diagram

Description automatically generated.

### Simplification of Functions / K-Maps & Equations

Give the K-maps in a standard table format. Again do not copy-paste it. Use consistent font. Edit equations using a standard format.

Equation for Hex Decoder:

f(a, b, c, d, e, f, g) = a'b'cd'e'f'g' + a'bc'd'e'f'g'

Table

Description automatically generated

### Complete Logic Diagram

The complete logic diagram shall be displayed on the images below:

Picture 1: Chart

Description automatically generated

This picture gives the overall view of the circuit

Picture 2:

Schematic

Description automatically generated with medium confidence

This picture gives the view of the added alarm functionality.

### Simulation

The screenshots of the simulation at different instances are as follows:

Pic 1: Timer just started at 1 second.

Diagram, schematic

Description automatically generated

Pic 2: Buzzer started buzzing right after the timer reached 10 seconds. As we can see, the first input of the buzzer went changed color from blue to red which means its generating noise.

Diagram, schematic

Description automatically generated

Pic 3: The buzzer continues to buzz from 10 till 19 seconds.

Diagram, schematic

Description automatically generated

Pic 4: The buzzer again stopped generating noise when the timer exceeded 19 seconds, as we can see the first input of the buzzer changed its color back to blue.

Diagram, schematic

Description automatically generated

Pic 5: The buzzer started alarm again and will continue for the next 10 seconds. This process will keep on repeating every minute after 10 seconds. (Notice the color of the first input of buzzer gets red every time it rings)

Diagram, schematic

Description automatically generated

Pic 6: Overall Working of digital clock in simulation. The clock will reset after 24 hours to 00:00:00.

Chart, box and whisker chart

Description automatically generated

### Detailed Schematic of Design and its Description

* 1. Draw the schematics of your design using Proteus or otherwise. Using the Pin numbering, IC numbers. Give the numbers of ICs used as well. List all the components like resistors, diodes etc.

Diagram, schematic

Description automatically generated

Diagram

Description automatically generated

### Details of ICs used

* + - **1. IC Number 555 Timer**

#### Function Table

Mention any formulas in case of ICs like 555 timer.

Table

Description automatically generated

The formula for the frequency is:

Diagram

Description automatically generated with low confidence

We shall use this formula to compute time in seconds.

#### Schematic

Diagram, schematic

Description automatically generated

* + - **2. IC Number 4026**
    - ***Function Table***

***Chart, histogram

Description automatically generated***

* + - ***Schematic***

A picture containing text, device, thermometer

Description automatically generated

* + - **3. IC Number 4026**
    - ***Function Table*** Table

      Description automatically generated with medium confidence***SchematicShape

      Description automatically generated***

### Details of Other Components used like diodes, transistors, resistors etc.

1. Resistors: (39 Placed) 
2. Capacitor (1 placed) 
3. DC-Operated Buzzer (1 placed) Icon

   Description automatically generated
4. 7 Segment Common Cathode (6 Placed) A picture containing rectangle

   Description automatically generated
5. V-Source and Ground (1 placed) Icon

   Description automatically generatedChart, timeline

   Description automatically generated
   1. **Simulation Issues / Results/ Observations**

Some of the issues faced during simulation were the lag issues due to large circuit made on Proteus. Moreover the 3 input AND gate was not causing the buzzer to ring for some unknown reason, therefore we used multiple 2 input AND gate along with a NOT gate

# Chapter 3: Project Applications

Some of the project applications are as follow:

• We can use this in alarm clocks.

• Microwaves to adjust time.

• Timer

• Explosives

• Multi Display clocks

• Auditory clocks

# Chapter 4: Future Recommendations

The future recommendations for this project include the functionality to set time given by the user, also the ability to set the alarm at a particular time. This project can be enhanced into something more complex by adding more electronics into it.

# References / Bibliography

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