

KLE Technological University
Department of Electronics and Communication

Course Project Of ADLD on Digital Clock on FPGA

Team 13

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Chapter 1

Problem Statement

1.1 Problem Statement

To Implement Digital clock on FPGA

1.1.1 Objective

The primary goal of the digital clock project is to use the 7-segment display on the FPGA Board to digitally show the time. The run time is automatically displayed on the digital clock, but the time can be changed using the time set designated to the button on board. The 24-hour format of the planned digital clock is used. The format used to represent the time is hours:minutes:seconds. All Seven Segments of FPGA are not accessible at time,due to this we are simulating and verifying with LED's.

Chapter 2

Introduction

An alternative to the conventional analogue clock is a digital clock. On a watch, phone, or alarm clock, this kind of clock uses digits to display the time in a digital format. Before introducing kids to a digital clock, it's crucial that they have a basic understanding of the two forms, which can be in both 12 and 24-hour versions



Figure: Digital clock

Digital clocks also typically include additional features, such as the ability to set alarms, display the date and time in different formats, and provide other useful functions such as timers and stopwatches.

In a digital clock implemented on an FPGA, the timing logic is implemented using programmable logic blocks that can be configured to perform a variety of functions, such as counting, dividing, and generating clock signals. The clock signals are used to drive the display of the clock.

Overall, implementing a digital clock on an FPGA provides a flexible and customizable solution that can achieve precise timing and advanced clocking features.

Chapter 3

Architecture

Designing a clock circuit employing a combination of digital logic gates, counters, and other components is necessary for the implementation of a digital clock on an FPGA.

A clock signal will be supplied into the clock circuit, which will then use that signal to produce a string of pulses that represent the current time. After being supplied to a display controller, these pulses will be transformed into a format suitable for a digital display.

To design a full digital clock first we designed clocks of different frequencies for minutes , hours and seconds and maxing time clock can show is 23:59:59 so Using these clock, we implemented counter with following constrains:

- Second Unit-digit with clock of frequency $1/100$ MHz, that counts from 0-9
- Second Tenth-digit with clock of frequency $1/(10 \times 100)$ MHz, that counts from 0-5
- Minute Unit-digit with clock of frequency $1/(60 \times 100)$ MHz, that counts from 0-9
- Minute Tenth-digit with clock of frequency $1/(600 \times 100)$ MHz, that counts from 0-5
- Hour Unit-digit with clock of frequency $1/(3600 \times 100)$ MHz, that counts from 0-9
- Hour Tenth-digit with clock of frequency $1/(36000 \times 100)$ MHz, that counts from 0-2 (since the clock can only show up to 23 hours)

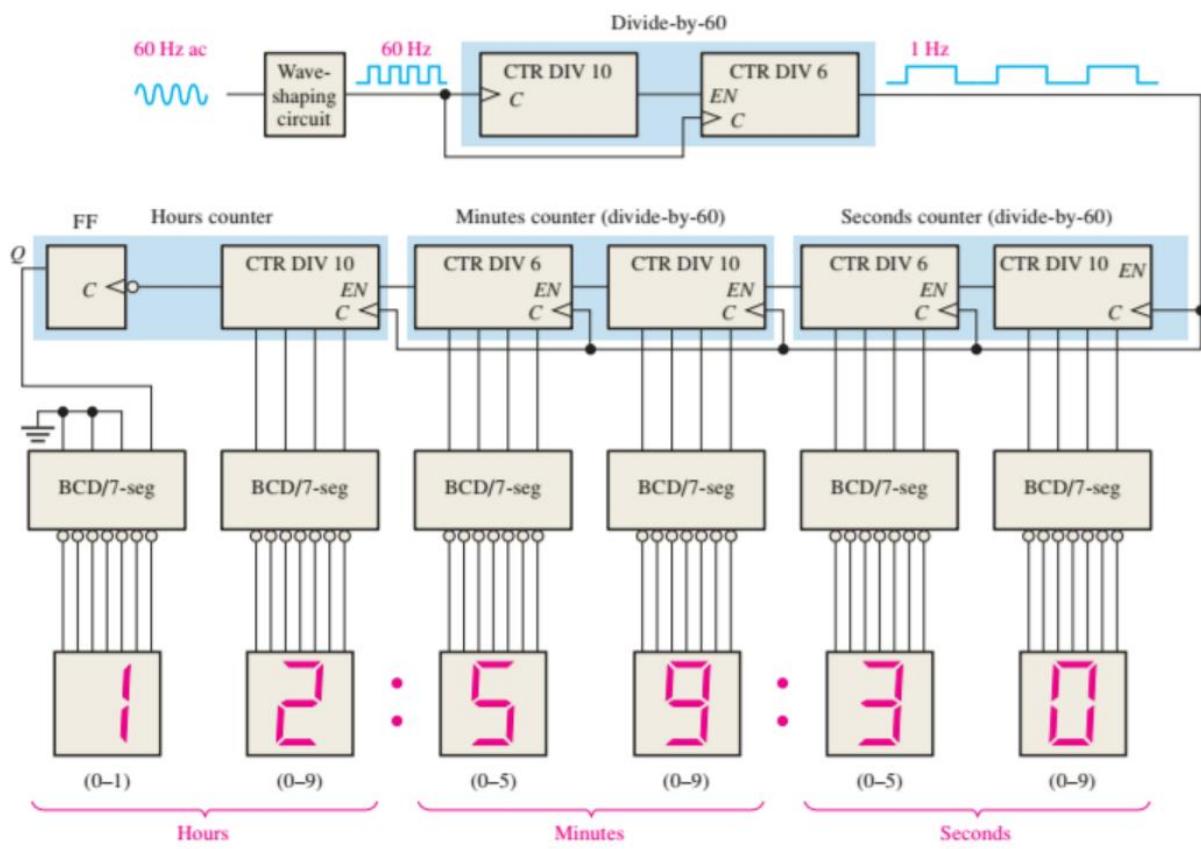


Figure 1: Architecture

Chapter 4

Results

4.1 Simulation Results

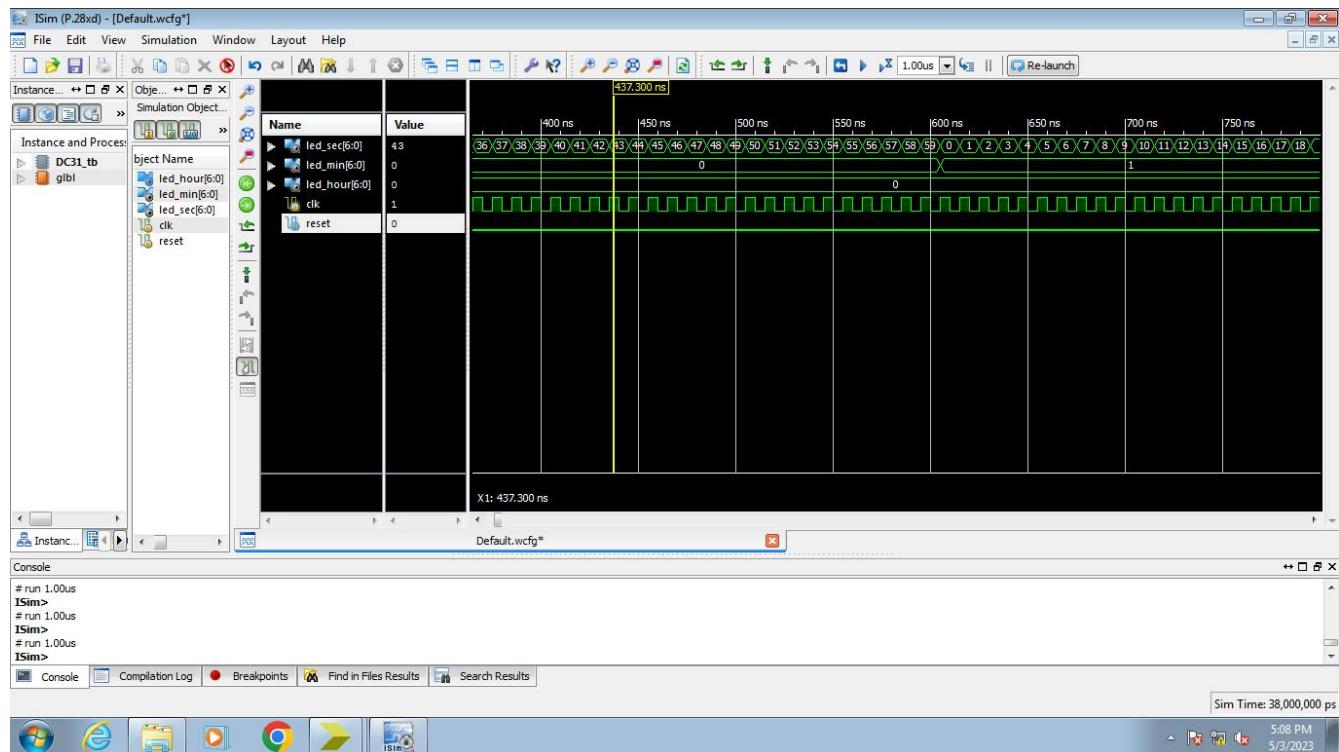


Figure 2: Waveform.

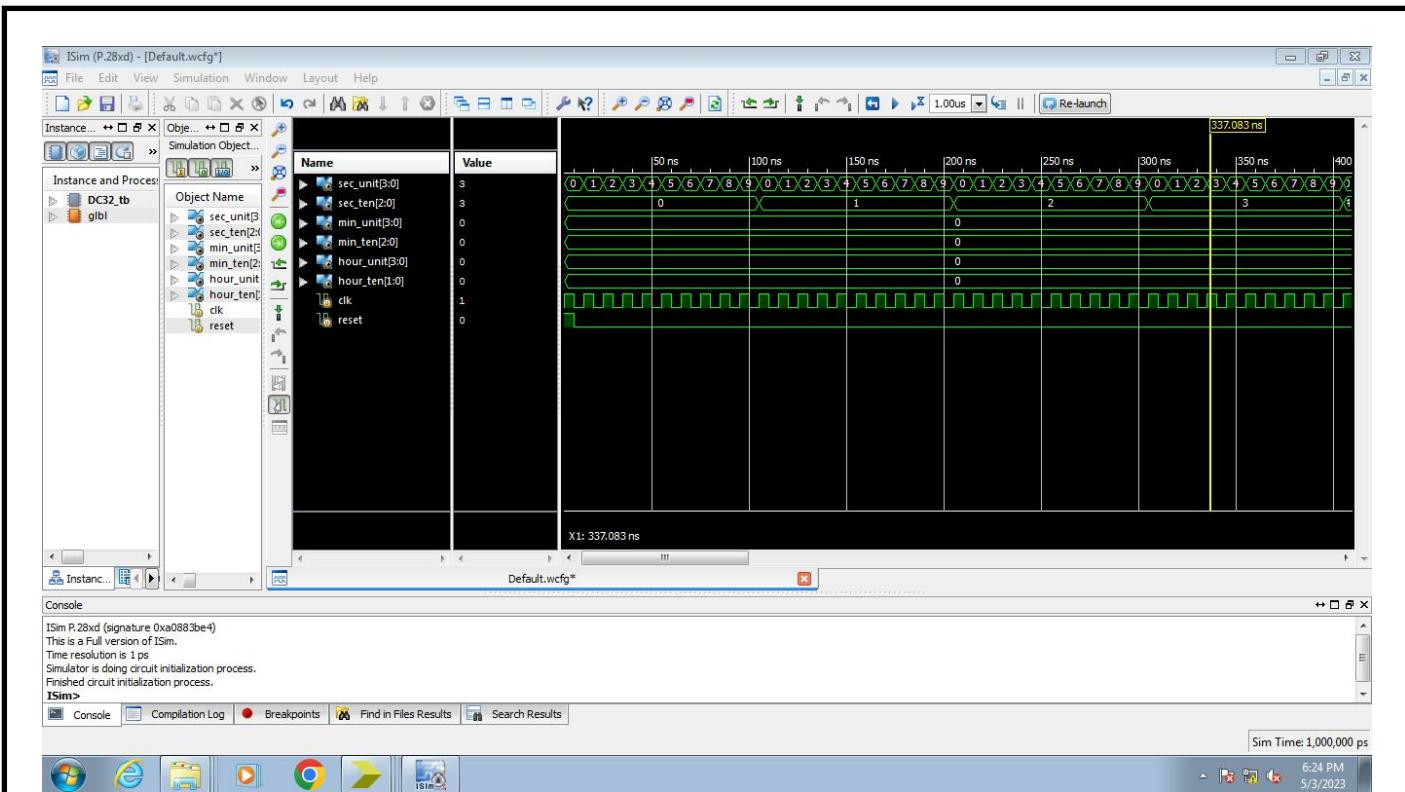


Figure 3: Sec-unit to sec-ten

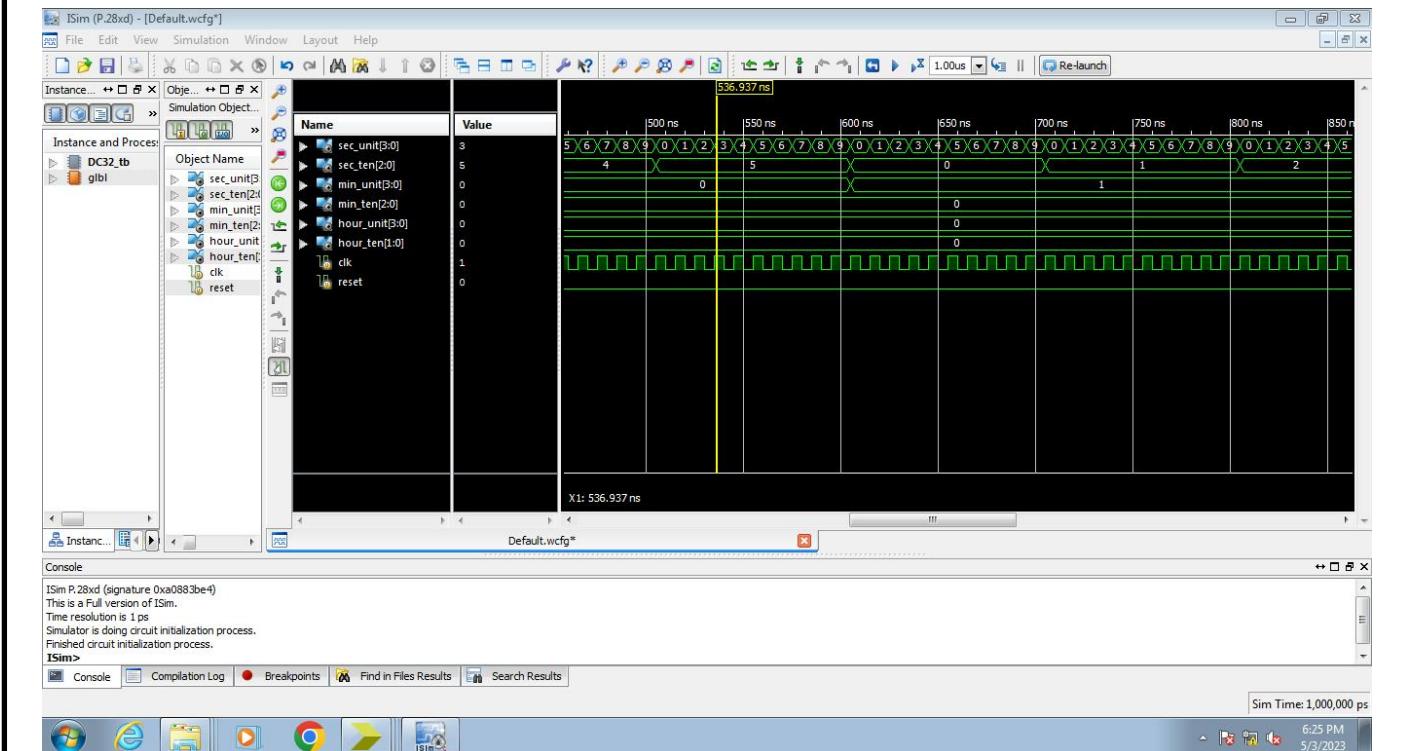


Figure 4: Sec-ten to min-unit

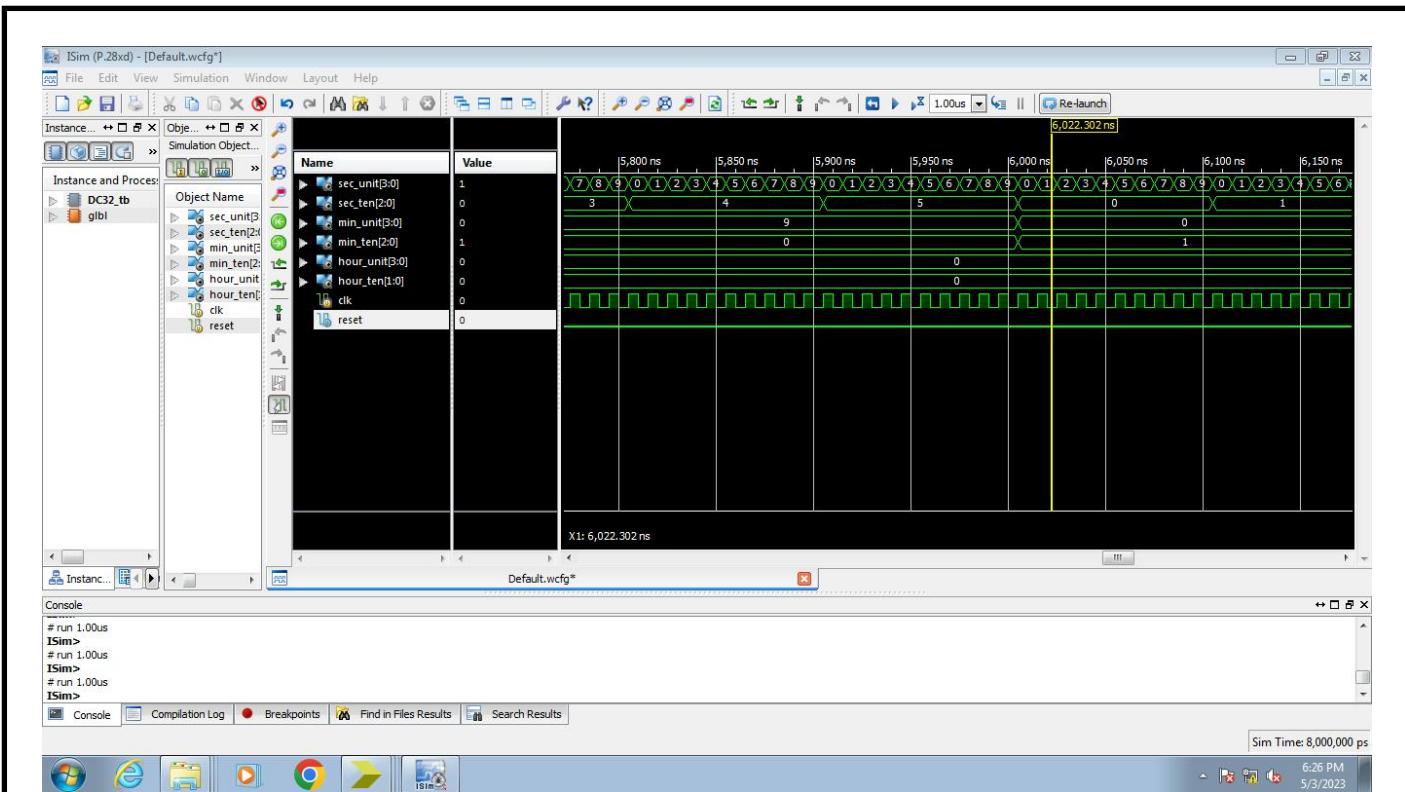


Figure 5:Min-unit to min-ten

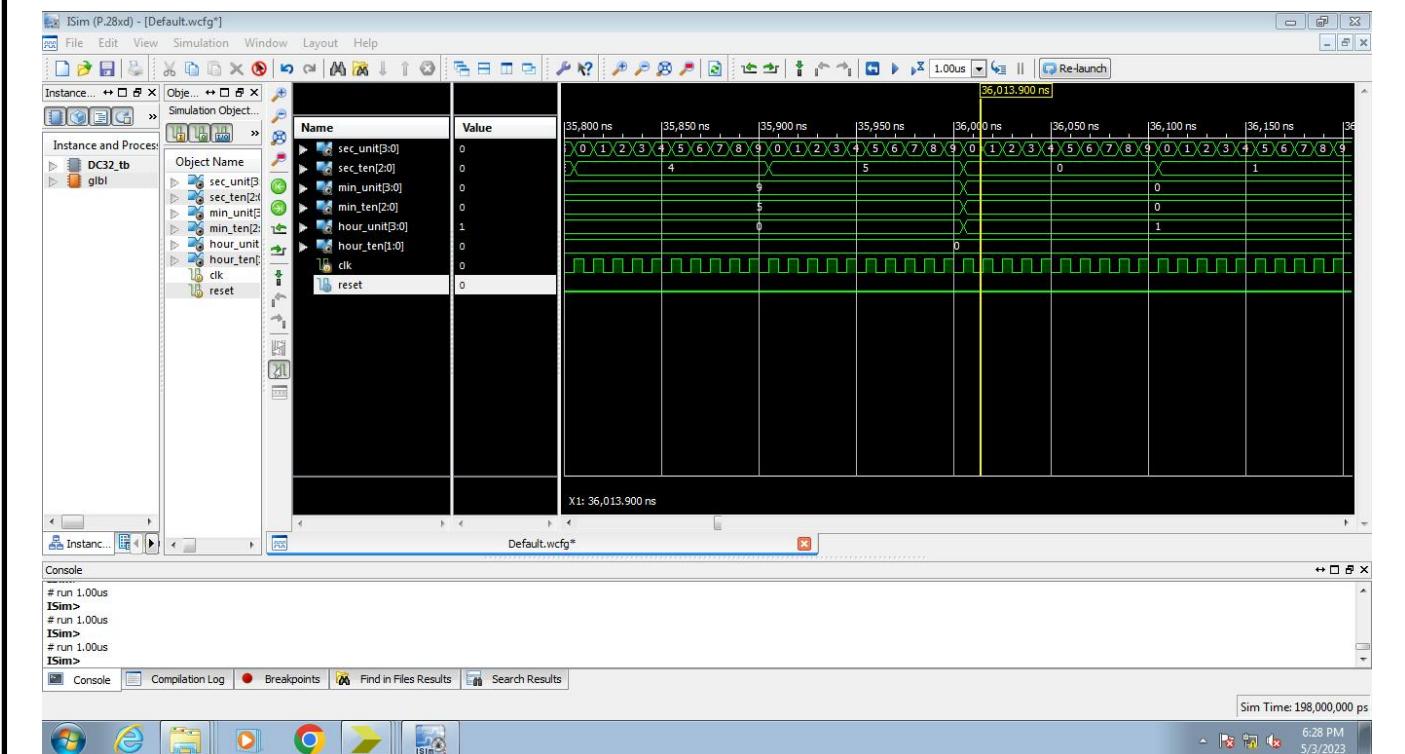


Figure 6: Min-ten to hour-unit

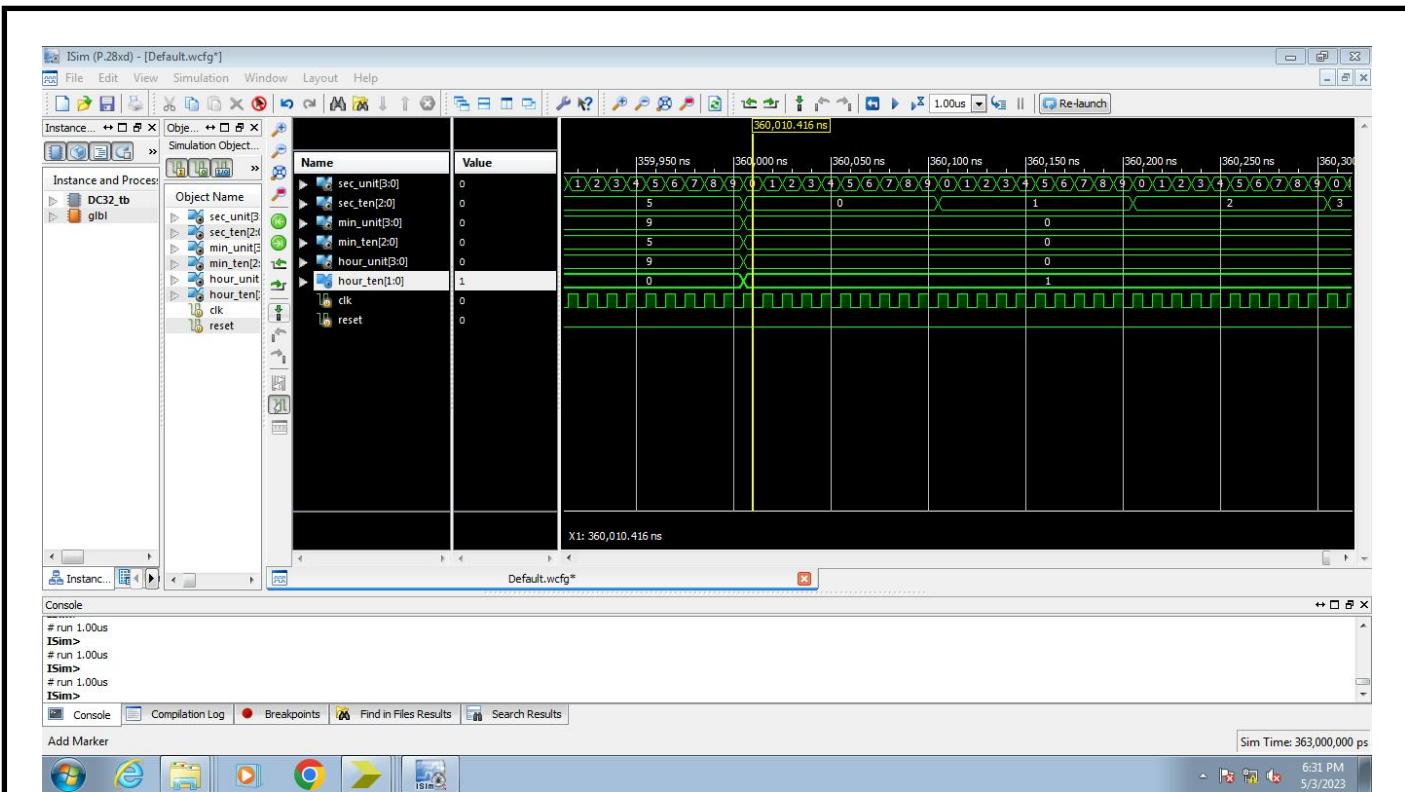


Figure 7: Hour-unit to hour-ten

4.2 Implementation Results

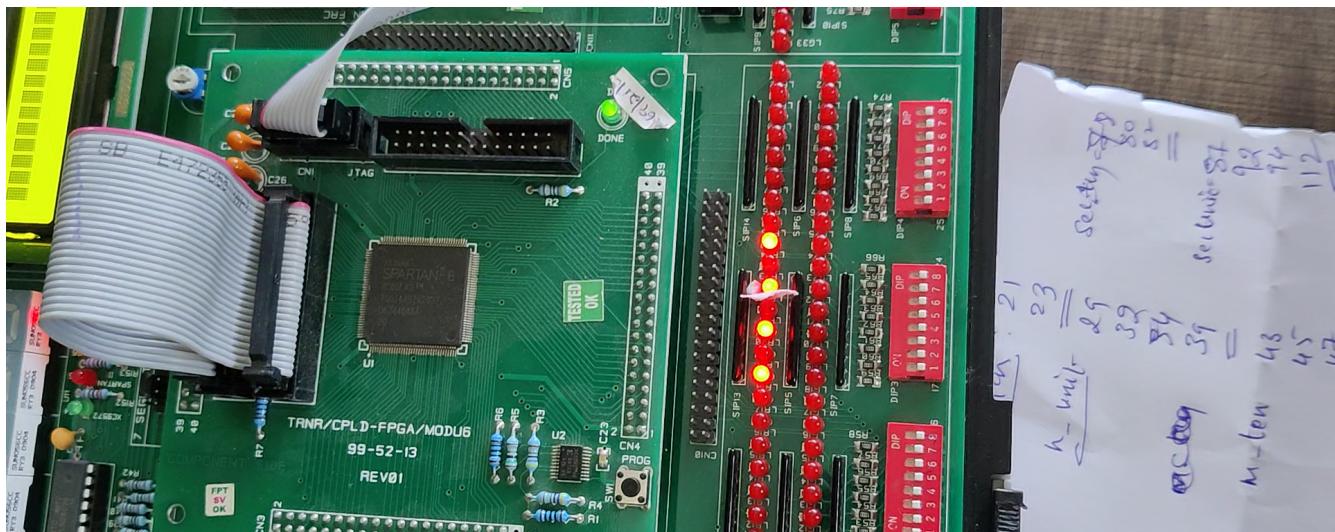


Figure 8: LED displaying

Chapter 5

Conclusion

The project successfully designed and implemented a full digital clock that displayed time up to 23:59:59 using different clock frequencies and counters for seconds, minutes, and hours. The clock consisted of six counters, each with its own clock frequency and count range. The use of different clock frequencies and counters ensured accurate and precise timekeeping. Overall, the project serves as a great example of digital clock design and can be useful for anyone interested in digital electronics.

There are several potential future scope areas for this digital clock project:

Addition of features: The clock could be enhanced with additional features such as alarm settings, time zone adjustment, or display customization options.

Integration with other systems: The clock could be integrated with other systems such as home automation or security systems to provide additional functionality and automation.

Use of wireless connectivity: The clock could be equipped with wireless connectivity options such as Bluetooth or Wi-Fi, which would allow it to synchronize with other devices and systems.

Optimization of power consumption: The clock's power consumption could be optimized by using low-power components or implementing sleep modes when the clock is not in use.