ChronoFlex: Adaptive FPGA Timekeeper

Git_hub_Link: https://github.com/vardhan3003/Digital_Watch_on_FPGA

1.INTRODUCTION

This project entails the design and implementation of a digital watch on a Basys board using Verilog. The watch operates in three primary modes: Real-Time Clock (RTC), Edit Mode,Timer Mode Stop watch. The RTC mode displays the current time in a 24-hour format, updating seconds, minutes, and hours in real-time. The following sections provide a detailed overview of the functionality, and implementation of the digital watch.

2.STATES OF OPERATION

The design is composed of three states:

2.1 Real-Time Clock (RTC):

This state functions as a standard clock, displaying the current time in a 24-hour format. The time is updated every second, incrementing the seconds, minutes, and hours accordingly. This mode is the default mode of the watch.

2.2 Edit Mode:

In this state, users can manually set the time. The edit_shift input allows users to switch between setting hours and minutes, and the inc input increments the selected value. The display shows the current selection by blinking the digits being edited.

2.3 Timer Mode:

The timer state enables the watch to function as a countdown timer. Users can set the duration using edit_shift and inc inputs. The start_stop input starts or stops the countdown. The display updates to show the remaining time. The maximum duration that can be set is 59 minutes and 59 seconds.

2.3 Stop_Watch Mode:

In this mode, the watch functions as a stopwatch with a maximum time of 59 minutes and 59 seconds. In the stop state, the display blinks, and users can reset the time to 00:00. The stopwatch can be started and stopped using the start_stop input, providing intuitive control over its operation. When the stopwatch is running, the time increments normally. Upon reaching the maximum time, the stopwatch transitions to the stop state.

3.CONSTRAINTS OF THE BOARD

3.1 Push Buttons

reset: Resets all time values (hours, minutes, seconds) to 0 in the edit mode and the (minutes and seconds) to 0 in the timer mode.
mode: Cycles through clock, edit, and timer states.
edit_shift: Toggles editing position (hours/minutes) in edit mode and (minutes/seconds) in timer mode.
inc: Increments selected time unit (hours/minutes) in edit mode and (minutes/seconds) in timer mode.
start_stop: Starts or stops the timer in timer mode.

3.2 LEDs

mode_value: Displays the current mode on seven-segment display (mode_value[2:0]).

3.3 Seven-Segment Display

- **Real-Time Clock Mode**: Displays the current hours and minutes.
- **Edit Mode**: Displays the hours and minutes being set, with the selected time unit blinking.
- **Timer Mode**: Displays minutes and seconds for the countdown timer, with the selected time unit blinking in the stop state when adjusting the desired time.
- **Stop Watch Mode**: Displays the elapsed minutes and seconds, incrementing in real time during operation, with the display blinking in the stop state.

4.OUTPUT ON THE BASYS BOARD

Drive_link:
https://drive.google.com/file/d/1KSYFOlF2eukS_ucFTA1CtGmatqqZGWZI/view