A logo of a company

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California Polytechnic State University Pomona

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

# Verilog and FPGA Laboratory

ECE 3300L-01

LAB #9

Alarm Clock User Guide

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# 1. Functions of Input/Output Components

1. Eight 7-segment displays
   1. Left four used to display the alarm time
   2. Right four used to display the clock
2. Two RGB LEDs
   1. Lights up in a sequence when the alarm is triggered
3. Mono audio port for alarm sounds
   1. Plays sounds when the alarm is triggered
4. Halt/Display off switch
   1. When high, the alarm clock operates normally
   2. When low, stops the clock and shuts down all display and audio elements
5. Set alarm switch
   1. Switch high to set alarm and turn on the alarm LED
   2. Switch low to turn the alarm off or ignore alarm time
6. Clock reset button
   1. Long press to reset the clock time to “00.00”
7. Stop alarm button
   1. Long press to turn the alarm off
8. Select min/sec button
   1. Press to change the minute of alarm time
   2. Press again to change the second of alarm time
9. Alarm time control buttons
   1. Top button increases the alarm time by one
   2. Bottom button decreases the alarm time by one
10. Alarm LED
    1. Lights up when the alarm is active

# 2. Map of Interface

A green circuit board with black and white buttons

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9.a. Inc alarm time button

1.a. Alarm time display

10. Alarm LED

7. Stop alarm button

6. Clock reset button

9.b. Dec alarm time button

8. Select minute/sec button

5. Set alarm switch

4. Halt / Display off switch alarm LED

2. RGB LEDs

1.b. Clock display

3. Mono audio port

Figure 1: Map of all external I/O components

# 3. Start-up Procedure

* Remember to connect some type of speaker to Mono audio port (3.) before starting.
* Make sure that the two switches (5. and 4.) are off when starting the clock.
* Turn switch 4. (Halt switch) on to start the alarm clock.
* Switch 5. (Set alarm switch) can be turned on now or later after the alarm time has been set. (The second option recommended)

Note: if switch 5. and switch 4. are both on at start-up, the alarm will be activated since clock time “00.00” is equal to the default alarm time “00.00” at start-up.

# 4. Setting the Alarm

* Set the desired alarm time using buttons 8., 9.a., and 9.b.
* For example, to efficiently set the alarm to “05.50”, press the select button (8.) once to pick the minute alarm time, press the increase button (9.a.) 6 times to reach “06.00”, then press the select button (8.) again to select the second alarm time, press the decrease button (9.b.) 10 times to reach “05.50”.
* Make sure to turn switch 5. (Set alarm switch) on when the desired alarm time has been entered.

Note: When the **second** alarm time is decreased from “00.00”, it will go to “59.59” which will make setting longer alarm times easier. Similarly, when decreased from “02.00”, it will go to “01.59”. The same is true when increasing the alarm time. When increased from “01.59”, it will go to “02.00” and when increased from “59.59”, it will go to “00.00”. When the **minute** alarm time is decreased from “00.00”, it will go to “59.00” and back to “00.00” when increased.

# 5. Stopping the Alarm and Resetting the Clock

* The alarm will light up the RGB LEDs for a total of 10 seconds and play the alarm sound for 28 seconds (which is the full length of the sound as implemented)
* Due to the implementation of the alarm checking module, the RGB and audio will be activated one or two seconds after the set time.
* The alarm sounds and lights will automatically stop after their respective time limits are up
* To stop them manually, you can press the stop alarm button (7.) or turn off the set alarm switch (5.)

Note: Using switch (5.) to turn off the alarm will permanently turn it off, since the alarm is no longer set, and will not be repeated in an hour.

* After the alarm has stopped automatically or stopped using button 7., the alarm will be repeated in an hour.
* If you want to repeat the alarm at the same time, for example, using it as a 5 min timer, the clock reset button (6.) can be used to reset the main clock, thus, the alarm time will sound after the same amount time.

# A diagram of a computer Description automatically generated6. Technical implementation diagram

Figure 2: Verilog Implementation Block Diagram

**Diagram Number User Guide Name**

Ofswitch 4. Halt/Display off switch

set\_al 5. Set alarm switch

clkreset 6. Clock reset button

al\_stop 7. Stop alarm button

select 8. Select min/sec button

inc 9.a. Alarm time control buttons

dec 9.b. Alarm time control buttons