CS223 Digital Design
Project
Section 4

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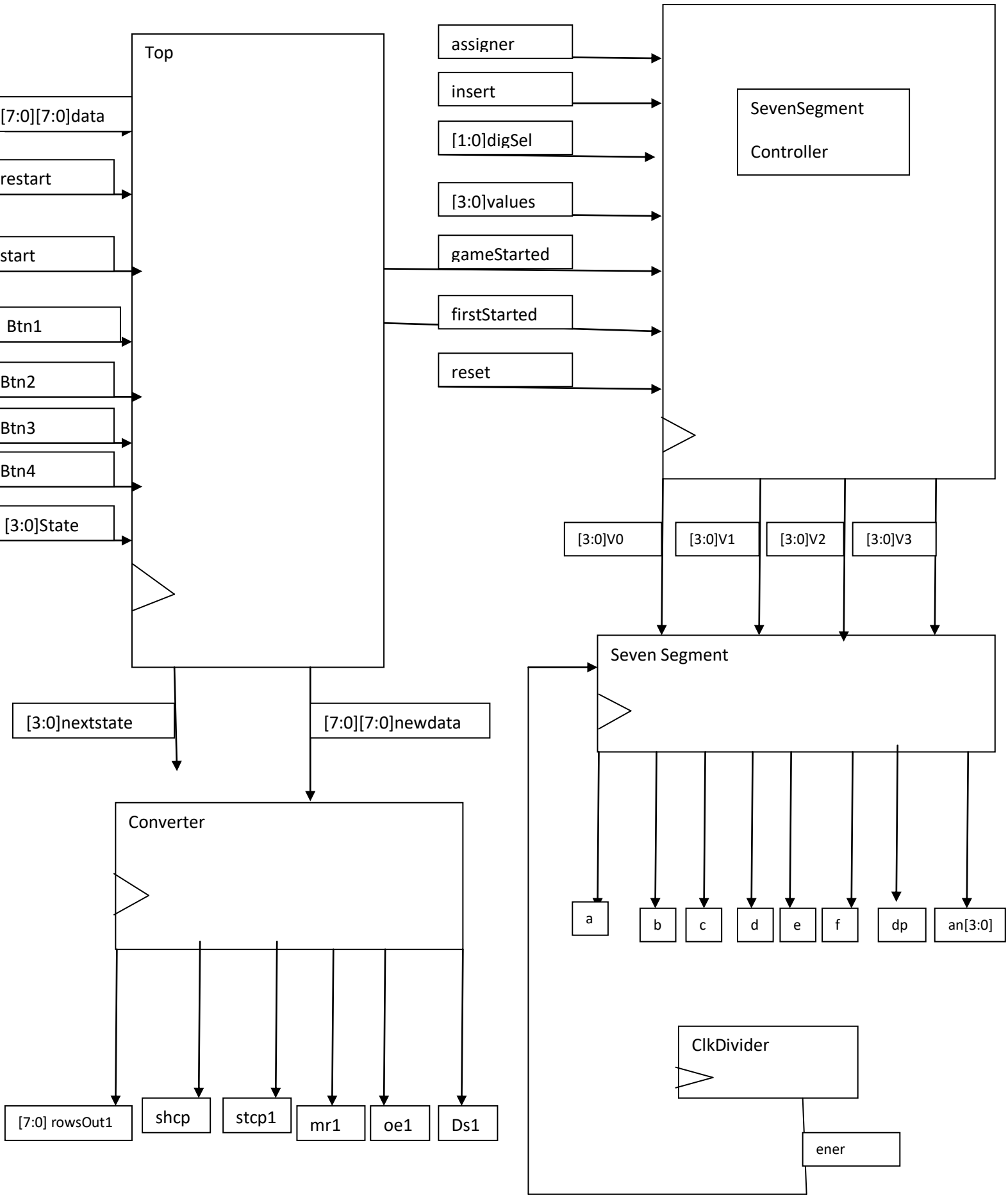
2.INTRODUCTION

All the parts of the projects correctly. This project is about a game where player tries to make all leds go off on a betiboard. Player decides the initial state of the leds by providing 16 x 4 bits of inputs via seven segment. Then players tries to turn all of them off based on some specific rules. I used HLSM in part3 and edited the seven segment module,part1 and part2 are coded without any special trick as in Lab 5.

3.BLOCK DIAGRAM(following page)


Top
[7:0][7:0]data
restart
start
Btn1
Btn2
Btn3
Btn4
[3:0]State
assigner
insert
[1:0]digSel
[3:0]values
gameStarted
firstStarted
reset
SevenSegment
Controller
[3:0]V0
[3:0]V1
[3:0]V2
[3:0]V3
Seven Segment
a
b
c
d
e
f
dp
an[3:0]
[3:0]nextstate
[7:0][7:0]newdata
Converter
[7:0] rowsOut1
shcp
stcp1
mr1
oe1
Ds1
ClkDivider
ener

4.DETAILED EXPLANATION

4.1 HLSM

My HLSM has a wait state. In wait state it assigns data to newdata. It changes state when any of the cell buttons is pressed, and it changes state on reset,restart and start. For instance when button1 is pressed the nexstate is S1. State S1 changes the data based on the rules. The module block top is responsible for HLSM operation, so detailed explanation can be seen there,in the block modules part.

4.2 BLOCK MODULES

Converter: This module is provided to us. It takes a [7:0][7:0] input,as a row based array, total 64 bits,then assigns it to 8 x 8 matrix led. For instance, if array[0][0] is 1 and array [0][1] is 0, first column of first row of the matrix will be on,and second column of the first row will be off.

Seven Segment: A module to display the input values as digits of the seven segment of Basys3. I applied minor changes to it. Fırst I changed the input size, to be able to represent numbers between 9 to 15 as well. Then I changed the corresponding 7 bit sseg_LEDS to show 9,A,B,C,D,E,F. I made digit value to 5 bits to create blinking operation. When the ener, the signal comes from the clock signal becomes one, the digit val becomes 5'b11111 and no sseg_LEDS is assigned to zero, which makes it to show nothing. Note that it is not blinking during the game, ener output of clkDiv is only considered when the data is 0 and gameStarted.

Seven Segment Controller:

User selects the digit with [1:0] digSel, sets the value with the switches in to [3:0] values, assign that value to the selected digit by using the assigner switch. If user decides to store the current seven segment 16 bit value,user pushes the switch button. After pushing it 4 times, the 64 bit data is ready to start the game. If gameStarted, the values on 7 seven segment becomes zero, and increments by one with each button press. The values that are mentionted are [3:0] v0,v1,v2,v3.

ClkDivider:

Used for blink operation. Divides the clock. It's output is used if all the leds are off, and if the gameStarted. On these conditions, the seven segment's input is changed to make the digit val 5'b1111 in every positive edge, which makes sevensegment to turn off in every positive edge of the divided clk.

Top:

The part HLSM operations take place. States changes upon button pushes. It changes state when any of the cell buttons is pressed, and it changes state on reset,restart and start. For instance when button1 is pressed the nexstate is S1. State S1 finds all the leds that are labeled with 1, than apply the rules to them, chaning the leds. The other “button state”s do the same thing, for different buttons. The way of changing the leds is changing the newdata, which used by the 8 x 8 led matrix. The state triggered with reset button assigns sevseg inputs,sevseg outputs, data, pressCounter and others to 0. The restarts state assigns data to it’s initial state, and assigns pressCounter to 0.

5.Conclusion

All the parts of the project work correctly. Part3 is implemented with an HLSM. Part1 and part2 is implemented with the knowledge from Lab5. Top module is responsible for HLSM operations,converter converts the data to leds in the 8 x 8 matrix,seven segment controller decides the inputs of the seven segment based on some data given by the top module and the user. Seven segment module takes these data and shows it on the seven segment of the BASYS3. ClkDivider is used to divide the clock, and is used make seven segment module blink. First, I tried to edit the data directly, without using HLSM. This way took a lot of time, and very hard to implement. After I decided to use HLSM, I did not face any serious problem.

6.References&Appendix

I used no sources.