ELEC 204

LAB PROJECT

ROCK-PAPER-SCISSORS

TOLGA SUMER

64534

Introduction

A [simultaneous](http://www.wikizero.biz/index.php?q=aHR0cHM6Ly9lbi53aWtpcGVkaWEub3JnL3dpa2kvU2ltdWx0YW5lb3VzX2dhbWU), [zero-sum game](http://www.wikizero.biz/index.php?q=aHR0cHM6Ly9lbi53aWtpcGVkaWEub3JnL3dpa2kvWmVyby1zdW1fZ2FtZQ), it has only two possible outcomes: a draw, or a win for one player and a loss for the other. In this version of Rock-Paper-Scissors, one of the players is the FPGA board itself.

Equipment & Software

• IBM compatible PC with Windows operating system,

• Xilinx ISE v14.7 & Prometheus software packages,  
• Prometheus FPGA board,  
• USB cable for programming.

Methodology

Rock, paper and scissors are assigned to three different switches. After we select our choice, we push the decision button to continue. After this button is pushed your decision and the random decision made by the FPGA is compared and whether you win, lose or it is a draw is decided. Also, there is a reset button which resets the game. The main goal of this game is to reach 5 points. If you reach 5 points before the FPGA, you win otherwise you lose. The code for the buttons are shown below:

if(button = '1') then

if output = "001" then

userScore <= userScore + 1;

elsif output = "100" then

FPGAScore <= FPGAScore + 1;

else

UserScore <= UserScore;

FPGAScore <= FPGAScore;

end if;

end if;

end if;

if resetButton = '1' then

userScore <= 0;

FPGAScore <= 0;

end if;

As told before, to determine the winner, user input and FPGA input is compared. The output from this comparison is a three-bit vector. If the output is “001”, then user scores. If the output is “010”, then it is a draw. If the output is “100”, then FPGA scores. The code is below:

if rps = "001" then

if random = 0 then

output <= "010";

elsif random = 1 then

output <= "001";

else

output <= "100" end if;

elsif rps = "010" then

if random = 0 then

output <= "100";

elsif random = 1 then

output <= "010";

else

output <= "001";

end if;

elsif rps = "100" then

if random = 0 then

output <= "001";

elsif random = 1 then

output <= "100";

else

output <= "010";

end if;

else

output <= "111";

end if;

Lastly, the score is represented on the seven-segment display. User score is shown in the right, and the FPGA score is shown on the left. The scores are separated with two dashes. If user reaches 5 points first, “Win” is displayed and if FPGA reaches 5 first, “Loss” is displayed.

The pin representation is shown below:

NET "MCLK" LOC = "P40";

NET "rps<0>" LOC = "P15";

NET "rps<1>" LOC = "P12";

NET "rps<2>" LOC = "P5";

NET "resetButton" LOC = "P34";

NET "button" LOC = "P35";

NET "led<0>" LOC = "P16" ;

NET "led<1>" LOC = "P13" ;

NET "led<2>" LOC = "P6" ;

NET "Anodes<0>" LOC = "P50" ;

NET "Anodes<1>" LOC = "P49" ;

NET "Anodes<2>" LOC = "P52" ;

NET "Anodes<3>" LOC = "P56" ;

NET "Anodes<4>" LOC = "P59" ;

NET "Anodes<5>" LOC = "P57" ;

NET "Anodes<6>" LOC = "P60" ;

NET "Anodes<7>" LOC = "P61" ;

NET "SevenSegment<0>" LOC = "P64" ;

NET "SevenSegment<1>" LOC = "P98" ;

NET "SevenSegment<2>" LOC = "P73" ;

NET "SevenSegment<3>" LOC = "P72" ;

NET "SevenSegment<4>" LOC = "P65" ;

NET "SevenSegment<5>" LOC = "P62" ;

NET "SevenSegment<6>" LOC = "P71" ;

Experimental Results

If rock (“100”) is selected and random number is 0 (scissors) then output is “001”, which implies that user wins.

If rock (“100”) is selected and random number is 1 (rock) then output is “010”, which implies draw.

If rock (“100”) is selected and random number is 2 (paper) then output is “100”, which implies that FPGA wins.

If paper (“010”) is selected and random number is 0 (scissors) then output is “100”, which implies that FPGA wins.

If paper (“010”) is selected and random number is 1 (rock) then output is “001”, which implies that user wins.

If paper (“010”) is selected and random number is 2 (paper) then output is “010”, which implies draw.

If scissors (“001”) is selected and random number is 0 (scissors) then output is “010”, which implies draw.

If scissors (“001”) is selected and random number is 1 (rock) then output is “100”, which implies that FPGA wins.

If scissors (“001”) is selected and random number is 2 (paper) then output is “001”, which implies that user wins.

Conclusion

Everything works as expected. However, there is a little bug. The clock sequence is very high, that’s why sometimes both user and FPGA gets a point. Other than this, the program is fully functional.