ELC 5396 Project Report 4

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Summary/Implementation

For this project the goal was to design and implement the experiment 16.8.1 inclination sensing from the book. This code utilizes the SPI module to interact with the on board accelerometer to determine the orientation of the board. We tested at 4 different orientations of the board, 0, 90, 180, and 270 degrees which will be indicated with 4 different LEDs. First, the SPI module was implemented into the vivado code in slot9, adding the necessary connections to the top of the mmio sys vanilla file. Next, the top level vanilla file was updated to include these connections and the module instantiation of mmio sys vanilla was also updated to reflect this change. Finally, the generate function was updated to include up to slot9 and append 0's to the other unused slots. The bitstream was generated for the vivado code and exported to vitis. In vitis, the needed cpp files were added for the SPI and the g sensor function was used from the book, which is included in the main sampler test cpp file. This code utilizes the accelerometer to obtain the force of gravity on 3 axis, x, y, and z. The UART then takes these values and output them to the serial terminal in a readable format. Using this output, we can determine the range of x values for 0, 90, 180, and 270 degree orientations. A simple series of 4 if statements checks the values of x and determines if the range is consistent with any of the degree orientations, and turns on the LED associated with the orientation. LED 10(0 degrees), LED 9(90 degrees), LED 8(180 degrees), LED 7(270 degrees). The if statement will also turn off the unused LEDs so there is no overlap. This code all runs within a while statement so that it is always running.

Code

Testing

Testing was done by hold the board upright, treating this as 0 degrees. Turning the board to the right by 90 degrees was then of course the 90 degree orientation. This same method was used for 180 and 270 degrees and, to confirm the board was working, the LED each lit up at the appropriate time, indicating that the code was doing exactly what was expected.

Video and Github

Video Demo
Github