Executive Summary – Chris porter

Technical Contributions

I wrote test code for the GPIO in SoftConsole. This code displays the inputs from GPIO INPUT pins in the Putty terminal and sets GPIO OUTPUT pins. I also helped Jonah troubleshoot code for the LCD Screen, and I helped Spencer with the UART module in Libero. We found a module in one of the user guides that recommended a generic RX/TX module for setting up LVDS UART. There is a module for MIPI communication that sets up low voltage differential signals for the generic RX/TX module, but more research would be needed to get it working.

I tested peripherals on the FPGA, specifically GPIO, SPI, and I2C. GPIO is mostly working, but I would recommend using 2 GPIO Cores, one for input and one for output. We did not have a working application for SPI and I2C to test receiving data from a device.

Future Suggestions

I would suggest re-doing the PCB using better Signal and Power Integrity practices. Also, consider the FMC Connections on the FPGA, and make sure they all work for the task they are set to do.

If LVDS is needed on the UART, the generic RX/TX module can output LVDS signals, but requires a lot more inputs/setup to get it working. This is done by selecting the MIPI option in the generic RX/TX module. I would also consider setting up a device or connections on the PCB to test the LVDS UART signaling.

This project was difficult to get started on, considering we only had one license for Libero, and due to COVID-19 Pandemic, we had limited access to the computer that had the license. If this project were to be worked on again at BYU-I, I would first focus on making sure you have access to the computer, as well as ADMIN access, which needs to be set up by Tier 2 IT and Brother Smith at BYU-I. It should be noted that Libero cannot synthesize a project if you are connected to the computer using Remote Access.

As for PCB Peripherals, the LCD is finicky. NASA has a library set up to communicate with it. The timing is especially important during the initialization of the LCD screen. I would also set up a device (Arduino that outputs 3.3V, MSP432, Rasberry Pi, anything that outputs 3.3V) to test I2C and SPI to test the receiving functionality of SPI and I2C, then use that to communicate with the sensors on the PCB.

More important would be to get the Testbench working, and to test different RISC-V architectures on the FPGA. The testbench that we were looking at using was Dhrystone.

Timetable

Week	Time (hours)	Work Done
Week 1	10	• Leadership • Mission Statement • Schedule

		• Research
Week 2	8.16	• Leadership • Meetings • Learn Softconsole & Libero – Install Software • Check Schematic and PCB Layout for Accuracy
Week 3	13	• Leadership • Meetings • Learn Softconsole & Libero – read PolarFire Tutorial • UART – Researched LVDS for Libero
Week 4	8.75	• Leadership • Meetings • LCD – Read Datasheet for LCD and SoftConsole Code from W20
Week 5 – 6	14.6	• Leadership • Meetings • Learn SoftConsole & Libero – Access to Computer, Zac showed us how to get Libero working. • LCD – Discovered LCD needs GPIO pins working
Week 7	13	• Leadership • Meetings • Learn SoftConsole & Libero – research Libero for peripheral addresses • LCD • GPIO Test – Write code
Week 8	13	• Leadership • Meetings • GPIO Test – Write code
Week 9	15.75	• Leadership • Meetings • GPIO Test • LVDS UART – UART module working, but not LVDS
Week 10	14.25	• Leadership • Meetings • GPIO Test – Output working. Input code fixed. • LVDS UART – Research devices to test LVDS UART Communication • LCD Test • Test Peripherals – Tested GPIO, SPI, and I2C
Week 11	15	• Leadership

		• Meetings • LVDS UART • LCD Test – Screen turns on. Nothing displayed. Chip Select, clock, and data is sending. • Test Peripherals – Tested GPIO, SPI, and I2C • CPU Testbench – looked through Dhrystone code.
Week 12	12.5	• Leadership • Meetings • LVDS UART – Found MIPI module that can send Low Voltage Differential Signals, but needs a lot more research. • Test Peripherals – Tested GPIO. SPI/I2C receive not tested due to no working applications for devices to test them with.
Week 13	6	• Meetings • Presentation • Documentation – Executive Summary, Final Report, etc.
Total	143	

Team Contributions

As team leader, I tried to keep the group focused on what was most important to accomplish. I set up and coordinated meetings, and would lead discussions about our progress and timeline.

Report Contribution

I updated GPIO, I2C, and SPI sections in the final report.