

EE/CprE/SE 491 WEEKLY REPORT 8

03/27/2024 – 04/02/2024

Group number: 6

Project title: Video Pipeline for Machine Vision

Client: JR Spidell

Advisor: Dr. Philip Jones

Team Members/Role: Deniz Tazegul (Video Stream to FPGA), Liam Janda (VDMA to DDRM), Taylor Johnson (DDRM to Display), Ritwesh Kumar (Video Stream to FPGA)

o Weekly Summary

This week, the team began to get comfortable with the Ultra96-v2 board. The team reserved a locker in the senior design lab so everyone could have easy access to the components. The team met with the new faculty advisor and received feedback to start working with the Ultra-96. In addition, the team met with the client and discussed the pipeline block diagram in more detail.

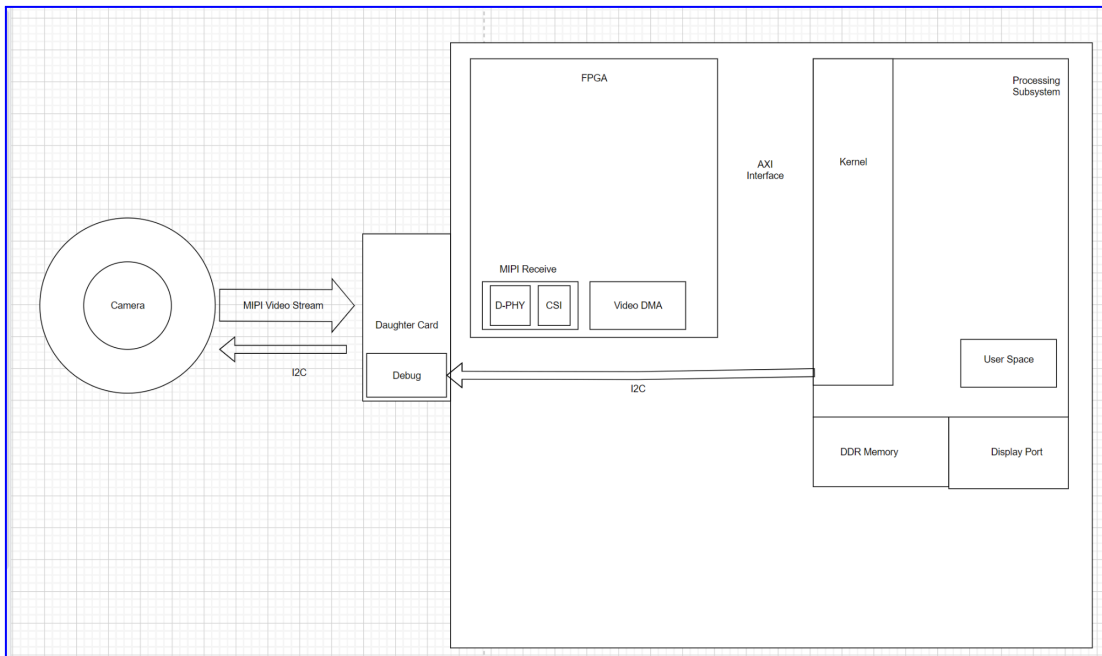
o Past week accomplishments

- Deniz: Learned how to get started on Ultra96 board, during set up, there were some issues with the Non-PYNQ SD card, so progress was limited. The terminal could not find the “shutdown” or “devmem” commands, so it could not execute them. Spent some time trying to debug those issues, but the OS crashed and created new errors, so it is now unable to boot. Spent some more time trying to debug those issues but was unsuccessful so far.
- Liam: Met with everyone and taught them how to use the board in person, including setting up hardware, booting up the device, accessing the terminal through Tera Term, and accessing the Jupyter Notebook server through a web browser. Liam reserved a locker in the Senior Design lab so everyone has access to the components. Met with Taylor to begin to decode and understand the VDMA and TPG, and find potential issues with them.
- Taylor: Met with Liam to learn how to properly set-up the Ultra96 FPGA and use the PYNQ SD card. Taylor and Liam reviewed the incomplete TPG_VDMA code from a past team. Looked into the overlays for each component to understand how they are connected. The VDMA still throws an error when attempting to read a frame. I believe this could be due to timing and when we are trying to read. Taylor also created a general block diagram after the team meeting with the client to easily see how data moves through the system. Taylor also reviewed itX files in the git repository to understand how an image could be loaded to the display. Learned that the past team was trying to use cv2 and an

image show function because of the data array structure that is expected by the display. However, none of the itX files successfully load an image to the display.

- Ritwesh: Talked with the client to learn why the team switched image sensors. Condensed his slides in the team's components slideshow into two smaller slideshows for PYNQ API and the old image sensor (the OV5647 sensor) to learn the previous team's implementation. He reviewed the previous team's presentation of the video pipeline to prepare for work with the Ultra-96. Ritwesh also modified the IMX219 driver file after looking at the team's input and output spreadsheet for agreed-upon I/O settings. He created a block diagram for the OV5647 image sensor.

- Group: The team has started to work on the Ultra96 board. There are some existing issues that are slowing progress on getting the previous team's code to start. The team has also started meeting with our new advisor, Dr. Jones, getting him up to speed on the project.



Video Pipeline Block Diagram

o Pending issues

- Deniz: Need a new Linux image from the client to get the previous team's code running.
- Liam: None
- Taylor: None.
- Ritwesh: Learning how to work with the Ultra-96.

o **Individual contributions**

<u>NAME</u>	<u>Individual Contributions</u>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Deniz	Working on debugging non-PYNQ ultra96	7	50
Liam	Teaching Ultra96-v2, working on VDMA, reserved locker	7	56
Taylor	Learned to use Ultra96, digging into the TPG_VDMA PYNQ code to try to properly read a frame produced by the TPG, created a simplified diagram tracing the flow of data through the pipeline, reviewed the itX code files in Git.	6	46
Ritwesh	Discussed the reason for using different sensors with the client, created new slideshows to decompose the team's components presentation, and learned more about different functions of the OV5647 image sensor to help with running the previous team's code	8	59

o **Plans for the upcoming week**

- Deniz: Continue to debug Ultra96, create block diagram for MIPI controller
- Liam: Continue to look at the PYNQ code with Taylor. Create a backup image of the PYNQ OS and receive the non-PYNQ OS image from JR.
- Taylor: The focus for the upcoming week will be on loading an image onto the PYNQ SD card and having it display to the monitor.
- Ritwesh: Read one register value of a known value to establish communication with an image sensor (OV5647 or IMX219) or other components on the Ultra-96 using I2C.

Action Item	Task Owner	Expected Date
Learn how to communicate with the camera by running the prior team's code (Be able to send & configure the camera using I2C using the code from before)	Ritwesh	4/14/2024
Run the existing code on the hardware and observe how the registers are updating for MIPI controllers	Deniz	4/14/2024
Load an image to an SD card and get the image to display on a monitor using the FPGA	Taylor	4/14/2024
Map each section's inputs and outputs to determine appropriate data widths across sections/roles.	All	4/1/2024
Create back-up of PYNQ SD card	Liam	4/7/2024

o **Summary of weekly advisor meeting**

The team met with the new faculty advisor for the first time. The advisor gave the team feedback on ways of approaching the project. Based on these insights, the team created a document with notes on tasks to work on before the next meeting, including questions the team could ask the client for more information.