

EE/CprE/SE 491 WEEKLY REPORT 5

2/28/2024 – 3/5/2024

Group number: 6

Project title: Video Pipeline for Machine Vision

Client &/Advisor: JR Spidell / Mohammad Tayeb Al Qaseer

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

o Weekly Summary

The team this week is getting close to being able to run the existing code on the hardware setup. The team's collective knowledge of the components seems to be close to a point where we can begin updating the previous team's code. After discussing with the client at the weekly meeting, the team has a clear idea of an intended user for this project. While there are many use cases for a computer vision system, one that the client is passionate about is a way to track eye movement for individuals who have difficulty with gross and fine motor skills. Tracking their eyes can be used in conjunction with other computer technologies to relay information, such as speech or wheelchair controls, in situations where individuals are unable to do so on their own.

o Past week accomplishments

- Deniz: This week Deniz kept reading on the MIPI controllers to find any other registers to monitor or component parts that are needed to understand to properly set up the project. Deniz also read up a bit more on the IMX image sensor to see how that component would connect to the MIPI controller being used. Deniz also read up on the previous code being used to monitor the register values of the MIPI controller, as the next step is getting the code to run on the hardware, and that code will be useful in ensuring the correct setup of the image sensor to the MIPI controller and the FPGA board.
- Liam: Liam met 1 on 1 with JR for a short intro to the Ultra96 board. Met with the class Professor to discuss new possible advisors. Nick recommended contacting Dr.

Jones as an advisor. Learned about the daughter board and its interface. Liam also looked into frame buffer code from previous team.

- Taylor: Reviewed the IPs involved in the DisplayPort, the wiring of components to get a better understanding of how the pixel data is being moved, how the DisplayPort will work with the VDMA, and completed slides for the team's component presentation. Taylor began looking through the PYNQ library and possible Linux boot for the Ultra96.

- Ritwesh: Created slides for both components and code covering the OV5647 and IMX219 image sensors. Ritwesh also included information about PYNQ libraries that can be used that are compatible with the Ultra-96 board such as MMIO and AXI GPIO in place of MRAA which is not compatible with PYNQ (which was used by the previous team). He tried to focus on inputs and outputs as they relate to the I2C interface between the ARM processor, MUX on the Ultra-96 board, IMX219 image sensor, and other components that can use I2C (i.e. the IMU chip on the daughter card). When the hardware is available, it will be important to verify that the Python code can use I2C with or without the camera, which is why Ritwesh looked into the details of these components and how to use PYNQ-compatible code to write to the appropriate I2C port and configure the IMX219 sensor.

- Group: The team met with the professor regarding a potential new advisor. On their suggestion, we have sent an email to Dr. Phillip Jones regarding him advising us for this project.

o **Pending issues** *(If applicable: Were there any unexpected complications? Please elaborate.)*

- Deniz: Currently waiting on hardware setup to run previous team's code
- Liam: Currently waiting on cables in order to access the Ultra96-v2 OS and software.
- Taylor: Waiting on hardware to load an image from SD card.
- Ritwesh: Waiting on hardware to be set up before running test code from the previous team.

o **Individual contributions**

<u>NAME</u>	<u>Individual Contributions</u> <i>(Quick list of contributions. This should be short.)</i>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Deniz	Read MIPI controller datasheet, read IMX datasheet, reviewed monitoring	6	31

	code		
Liam	1 on 1 with JR, Learned about the daughter board interface. Looked into frame buffer code.	6	33
Taylor	Reviewed DisplayPort data sheets for various components, updated team's component slides, and began review of PYNQ libraries, and how to port Linux to the FPGA.	6	31
Ritwesh	<ul style="list-style-type: none"> - Created component and code detail slides for the IMX219 image sensor - Understand why new implementation is needed for PYNQ-compatible code due to the Ultra-96 hardware the team will use - Found how similar the IMX219 with OV5647 image sensors are - Began work on the IMX219 Driver file and learned how MMIO and AXI GPIO can be used instead of MRAA for writing PYNQ-compatible code 	10	36

o **Plans for the upcoming week** *(Please describe duties for the upcoming week for each member. What is(are) the task(s)?, Who will contribute to it? Be as concise as possible.)*

- Deniz: Prep to run monitoring code on software, consult with client to determine what all that means
- Liam: Begin to use the Ultra96-v2 board and get used to the OS and used software. Liam will finish learning about the previous team's frame buffer code and begin to figure out how the VDMA will replace it.
- Taylor: Will be reviewing PYNQ libraries to get a better idea of which functions can be used to access the DDR and allocate memory for the display.

- Ritwesh: Add more details to the components slideshow if needed for the IMX219 image sensor in particular. When hardware is available, try to run the previous team's code to read one register value to ensure communication is established both in software and hardware. For the future, begin working on the IMX219 driver file by reviewing PYNQ libraries and how they are implemented in code.

Action Item	Task Owner	Expected Date
Finish reviewing project code	All	3/3/24
Set-up the hardware and connect to wifi	Liam	3/24/24
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	4/14/24
Run the existing code on the hardware and observe how the registers are updating for MIPI controllers	Deniz	4/14/24
Load an image to an SD card and get the image to display on a monitor using the FPGA	Taylor	4/14/2024
Fill out register presentation	All	3/10/24

o Summary of weekly advisor meeting

There was no advisor meeting this week, but on the recommendation of the course professors we have sent an email to Dr. Phillip Jones to set up a meeting and discuss whether he could help advise us for this new project.