



## EE/CprE/SE 4920 BI-WEEKLY REPORT 5

11/01/2024 - 11/14/2024

**Group number:** 6

**Project title:** Video Pipeline for Machine Vision

**Client:** JR Spidell

**Advisor:** Dr. Phillip Jones

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

### o Bi-weekly Summary

The team has started working on a custom configuration code that takes in five parameters of framerate, height, width, top left x coordinate, and top left y coordinate of a rectangular window sent by the IMX219. The maximum resolution and framerate attainable by the IMX219 limits how these parameters are computed. The code will be shared with the next Senior Design team to work on integrating the video pipeline with eye-tracking machine-learning algorithms implemented for the full project.

### o Past two week's accomplishments

- **Deniz:** Worked to create initialization code for Mipi block in C instead of Python. Came across memory access and kernel permission issues, including segmentation faults and crashing the board. After debugging, he was able to read from and write to the register values using shell commands and C code using memory mapping and the devmem command.
- **Liam:** Worked with Ritwesh to create a more effective way of measuring fps by reading the packet count register in the CSI-2 block. Each packet contains a line of the frame, so by measuring the number of packets over a given time and dividing by the frame height, the team can get the fps by only reading a register twice, instead of constantly reading the frame received register.
- **Taylor:** Worked with Ritwesh to update the camera's custom configuration code. Created a function that sets the IMX219 registers based on a desired framerate, top left x and y coordinates of the desired bounding box, as well as height and width. Examined how framerate is measured within the current

version of the code and compared two frame rates taken at two different points in the pipeline: one before software processing and one after software applies a filter. Will need to do further investigation to ensure the framerate measured after software processing is what is expected. Currently for 1920x1080 at 30fps the frame rate measured about 24fps before software processing and 2.5fps after software processing.

- **Ritwesh:** Worked with Taylor on a custom configuration for the IMX219 that takes in five parameters of framerate, height, width, and x and y coordinates of the top left corner of a rectangular box sent by the IMX219. This code allows for ease of custom configuring a rectangular box that can help the next Senior Design team track a user's eyes along with machine-learning algorithms to help a user with limited mobility, who is confined to a motorized wheelchair, with navigation.

o Pending issues

- **Deniz:** None
- **Liam:** None
- **Taylor:** None.
- **Ritwesh:** None.

o Individual contributions

| Name    | Individual Contributions  | Hours this week | Cumulative Hours |
|---------|---|-----------------|------------------|
| Deniz   | Read and write registers in C, Poster work  | 15              | 63               |
| Liam    | Fps counter for pipeline  | 8.5             | 61.5             |
| Taylor  | Worked with Ritwesh to create code for a custom camera configuration based on five input parameters to determine how to set the IMX219 registers. Began examining how frame rate is measured. | 12              | 60               |
| Ritwesh | Worked with Taylor to create a custom configuration code given five parameters  | 12              | 75               |

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|--|---|--|--|
|  | of framerate, top left x and y coordinate, height, and width of a rectangular box sent by the IMX219. |  |  |
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o **Plans for the upcoming two weeks**

- **Deniz:** Create initialization code for MIPI, VDMA, and IMX219 using C code, measure FPS more accurately using C
- **Liam:** Help Ritwesh and Taylor with the custom camera configuration code and implement it into the team’s cleaned-up code.
- **Taylor:** Finish writing the custom camera configuration function by adding error checks for maximum framerate based on the requested parameters input into the function. Continue to examine frame rate by testing how long it takes for the software function to process a set amount of frames.
- **Ritwesh:** Work with the team to add checks to make sure the maximum framerate of the IMX219 at a given setting is used if a request is made for a framerate above the maximum calculated value. Work on a general code for the IMX219 integration time to ensure the amount of light taken in by the sensor results in an image that is as close to the expected visual output as possible.

| Action Item  | Task Owner | Expected Date |
|--|------------|---------------|
| Ensure that the IMX219 custom code defaults to the maximum calculated framerate if the requested framerate is above the maximum calculated framerate.  | All        | 11/28         |
| Ensure that the amount of light taken in by the sensor (the integration time) results in an image as close to the expected visual output as possible across different resolution and framerate settings. | All        | 11/28         |
| Measure framerate of the RAW8 data sent from the IMX219 and compare this with the framerate of the RGB data after the color transformation between RAW8 to RGB.  | All        | 11/28         |

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|--|-----|-------|
| Work on reading and writing to IMX219, MIPI D-PHY, CSI-2, or VDMA registers using C. | All | 11/28 |
|--|-----|-------|

o **Summary of weekly advisor meeting**

During the team's advisor meeting, the team received feedback on the poster that they had been working on for the end of the semester. Specifically, the advisor mentioned that the team should classify the requirements as functional versus non-functional instead of constraints versus non-constraints. The advisor also gave a suggestion to measure framerate of the RAW8 data sent by the IMX219 for comparison with the RGB data after the color transformation from RAW8 to RGB. This could help the team understand how the color transformation affects the framerate measurement.