QArm Lab Procedure
Image Acquisiton

Setup

1. It is recommended that you run this lab individually.
2. Place the QArm in its resting position. You will not have to turn ON power for the QArm for this lab.
3. Connect your computer to the Intel Realsense camera on the QArm using the provided USB C – USB A cable via the camera port on the back of the QArm base.
4. Launch MATLAB and browse to the working directory for Lab 9 – Image Acquisiton.

Image Acquisition and Color Spaces

1. Open the Simulink model ImageAcquisitionAndColorSpaces.slx (Figure 1). You will use this model to learn about capturing and understanding camera data.

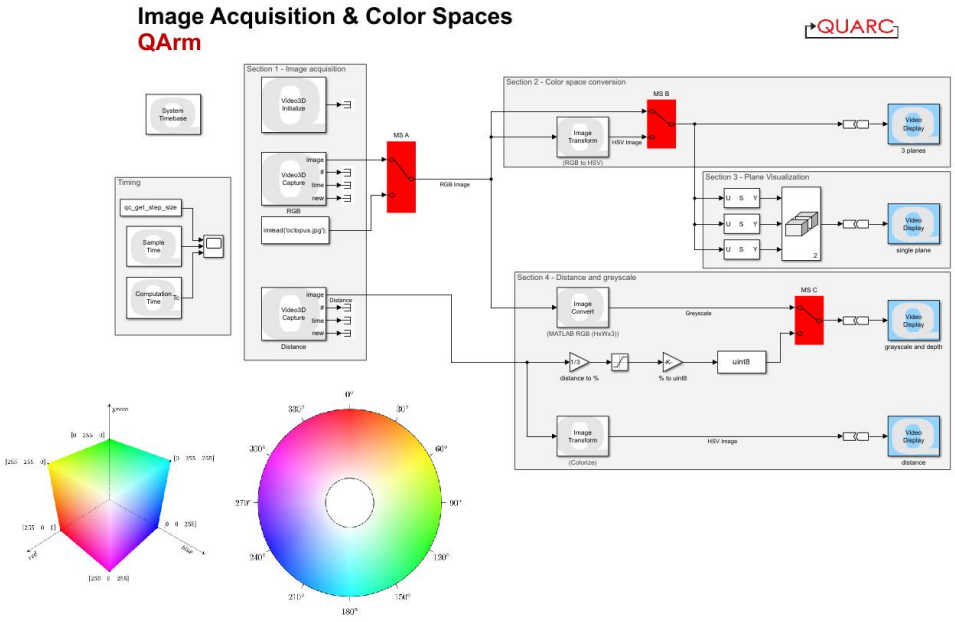

Figure 1. Image Acquisition Simulink model.

2. Prior to running the model, open the model's Configuration Parameters and verify that they are configured as follows:
    i. Solver type: Fixed-step
    ii. Solver: ode4 (Runge-Kutta)
    iii. Fixed-step size (fundamental sample time): 1/30 Hz
3. Make sure the Manual Switches, highlighted in red are all in the up position.
4. Section 1 focuses on image acquisition. To capture video from a 3D camera, we use the **Video 3D Initialize** and the **Video 3D Capture** blocks. Click on the **Video 3D Capture** block and note the type of

data (Stream Type), the resolution and the output format. These can all be modified depending on your specific needs, but leave them unaltered for this lab.

5. Section 2 demonstrates the difference between RGB and HSV views. Run the model and open the the **Video Display** on the top rightmost side of the model (labelled 3 planes) highlighted in light blue in the model.

6. Observe how the 3 planes **Video Display** window shows on the top the x and y position of your mouse, as well as the value in each pixel in the RGB color space.

7. Section 3 focuses on visualizing each plane independently. The single plane **Video Display** window will show you the individual planes simultaneously. Place objects of varying color in front of the camera and monitor their pixel intensities in the 3 planes.

8. Switch Manual Switch A (MS A). The 3 planes **Video Display** should show a picture of an octopus on top of a box. There's two red boxes drawn on top of it, one over sticky notes on the left side and one over a tool in the right side. By moving your mouse inside the area within the red boxes, note the RGB and the HSV values in the display's name at the top. Also note the values for the sticky notes where there is a shadow and where light is hitting it directly.

9. Switch Manual Switch A (MS A) back up to show video data and Manual Switch B (MS B) down. This displays an HSV image in the 3 planes **Video Display**. This view might look unnerving, because HSV images are better visualized as individual planes.

10. Open the single plane **Video Display** and observe how colored objects appear the same in the hue plane despite the lighting conditions.

11. Observe the third plane (value) in the single plane **Video Display**. What does this plane represent?

12. Close the first two video displays.

Distance and greyscale

13. The second **Video 3D Capture** in section 1 captures the depth information. Go to section 4 in the simulink model. The Image Convert block converts the RGB image to grayscale. With MS C up, open the grayscale **Video Displays** highlighted in light blue. How does this compare to the Value plane in the single plane **Video Display**?

14. Flip MS C down. This demonstrates one way of visualizing depth data in meters as an image. What is the significance of the 1/3 gain, the 255 gain, as well as the uint8 conversion?

15. Double click on the Image Transform (Colorize). This block will add color to the distance video feed for the distances defined in the parameters. The minimum and maximum pixel value are values in meters.

16. Open the distance **Video Display**. As you move an object closer and further away from the camera it will change colors. Change the maximum pixel value to 5, 8, 12 etc. What does this do?

17. Stop the simulation, change the colorization theme in the image transform (colorize) block and start it again. Try different color mappings for depth.

18. Stop the model and close MATLAB.