**Wild Swans Mini Project Documentation**

1. Marker detection scheme

Marker detection is done with OpenCV. First, the picamera is opened and calibrated to a specific framerate and white balance. This camera then repeatedly captures an image and does processing on that image. The first step is the filtercolor(frame) function which filters the image to have only a specific color using the hsv colorspace and a bit mask. The image the goes through the cleanimg(img) function that uses a 5x5 kernel with the open transformation to get rid of any noise in the image. The next step is findpos(img) function which thresholds the image in grayscale and then uses canny edge detection to get the outline of the remaining objects. From here the largest contour leftover is found so only the largest object in the frame is used for x, y coordinates. Finally, the x, y coordinates and the width and height of the image are used to find what quadrant the image is in in the findquad() function.

1. A short document (perhaps using the publish function of the Matlab editor) that includes  
   • Your control design and design method.  
   • The open loop step response (both simulated and experimental), and the closed loop step response (both  
   simulated and experimental), with a discussion of the results.
2. The Arduino code that implements the controller. Include also a Simulink block diagram that shows your feedback control loop, and label each line/arrow in the block diagram with the variable in the Arduino code that is associated with this signal. Include comments in the Arduino code that specify the units of these variables.
3. <https://github.com/JohnRipple/SEED>

The github should be public. If you have a problem viewing it send me an email at jripple@mines.edu