Project: Visual-Servoing of XL-320 2-link Planar Manipulator

Preamble: Distributed computing (Figure A) demonstrated that a PC running Scilab can issue commands to the XL-320 via Master/Slave NXT Bricks. Build plans for a Lego Camera Tower was also introduced and mounts over the white Lego 32x32 baseplate. This results in a top view (Figure B left) of the XL-320 2-link planar manipulator and the upper-half of the baseplate (i.e. Quadrant 1 $+X, +Y$ and Quadrant 4 $+X, -Y$). Also, SSD tracking was demonstrated using Scilab's computer vision toolboxes (Figure B middle and right).

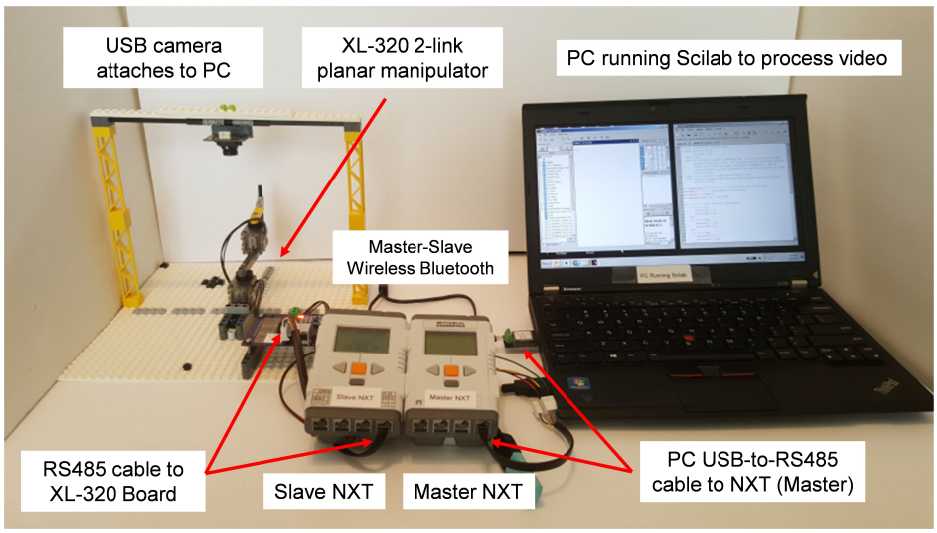

Figure A: Distributed Computing Setup

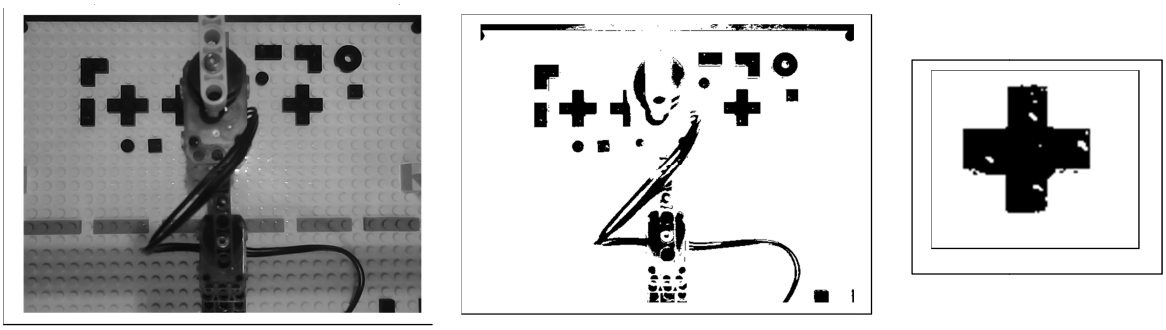

Figure B: View from Lego Camera Tower as greyscale image (left), thresholded frame (middle), and template cropped from thresholded frame (left).

Project Goal: Have the XL-320 2-link planar manipulator's end-effector hover over the center of a Lego Cross piece that is randomly mounted somewhere (but within the camera's FOV) on the white 32x32 Lego baseplate.

Methodology: Use Scilab to capture one thresholded frame, as a PNG file, from the USB camera's video using the Lego Camera Tower. Off-line, use that frame to create a template of the Lego Cross piece and save as a PNG file. Off-line, apply SSD in Scilab to yield task space coordinates of the Lego Cross piece. Run a Scilab program that sends that task space coordinate to the XL-320 2-link planar manipulator via Master and Slave NXT Bricks.

Deliverables: Complete the given template to document and demonstrate the following:

1. The focal length calculations and the resulting task space lengths (in cm) given image space lengths (pixels). Apply these calculations to the Lego Cross piece's location. Verify using a ruler. Provide annotated photos confirming the location (15-points).

2. Position the Lego Cross piece in 3 different locations to demonstrate success of the robot's end-effector hovering over those locations. Provide URLs to YouTube videos of these 3 demonstrations captured with a smart phone (25-points).

3. Provide all NXC and SCE source code with descriptive comments (10-points).