# Dynamixel XL-320 Lego-Based 2-DOF Planar Manipulator

Preamble: Previous labs demonstrated using M2.5 fasteners to attach the Dynamixel XL-320 servo to Lego pieces. The XL-320's size, weight, power and accuracy are advantages over conventional Lego motors. Moreover, Lego bricks use a standard; stud-to-stud spacing is 8 mm. This consistent spacing allows one to gage positioning accuracy when calculating forward and inverse kinematics.

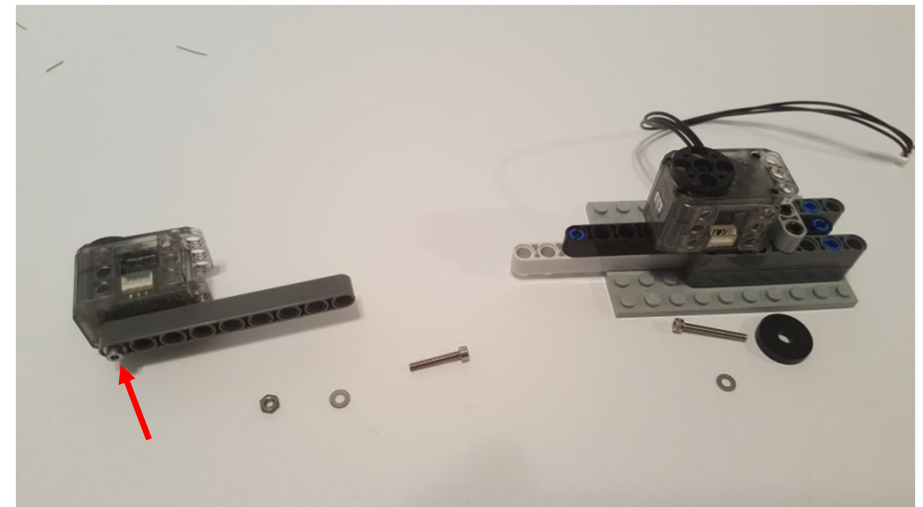**Objective:** Construct Lego-based 2-DOF Planar Manipulator using two XL-320 servos
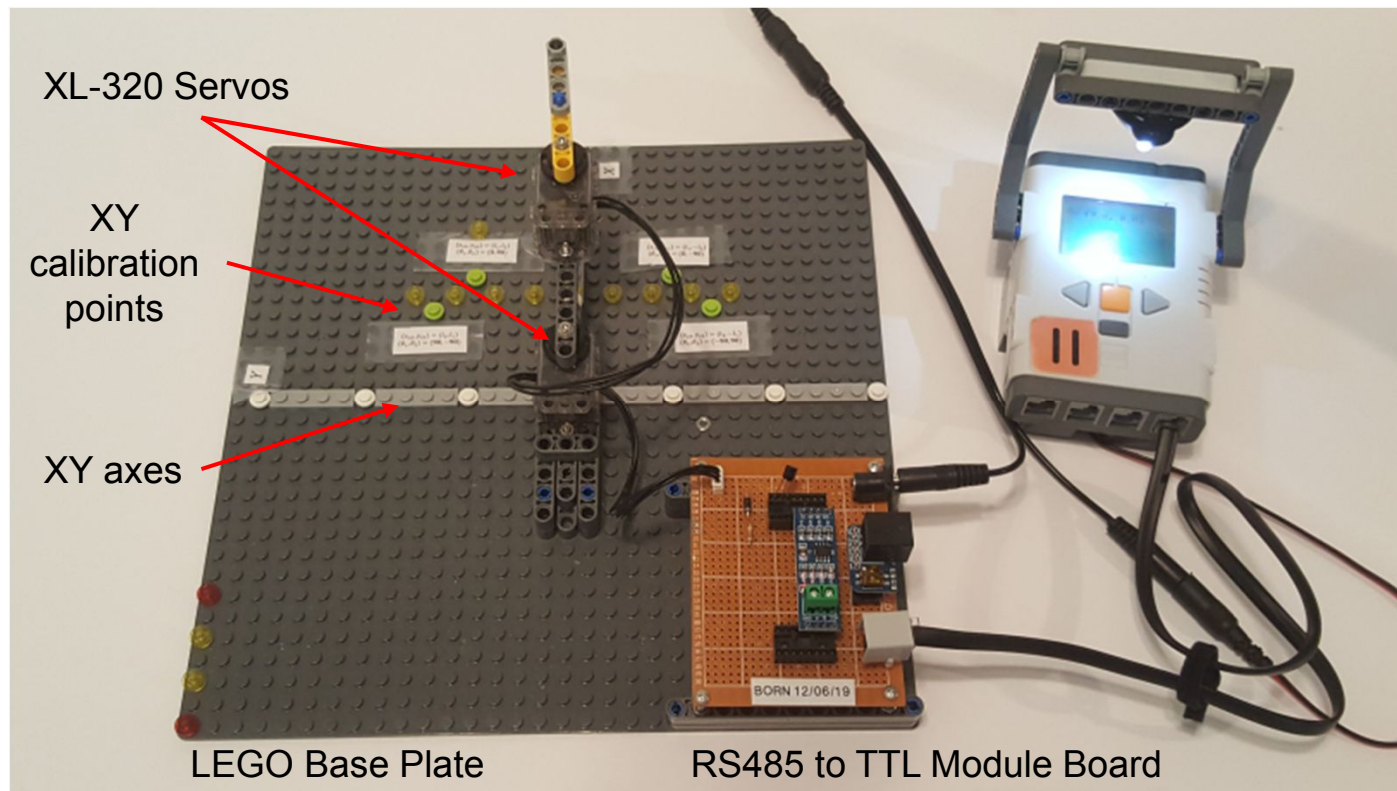
2-DOF Planar Manipulator using Legos and two XL-320 Servos
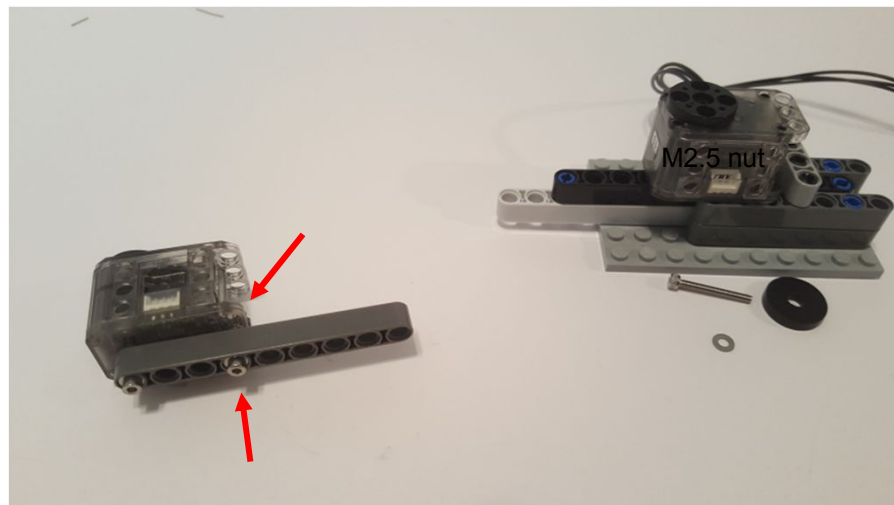
Step 1: Joint 1 to Joint 2 Link
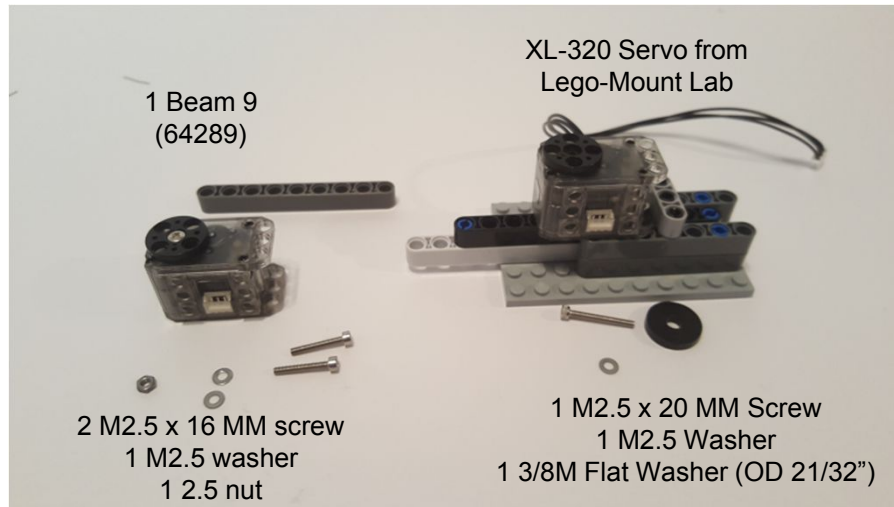
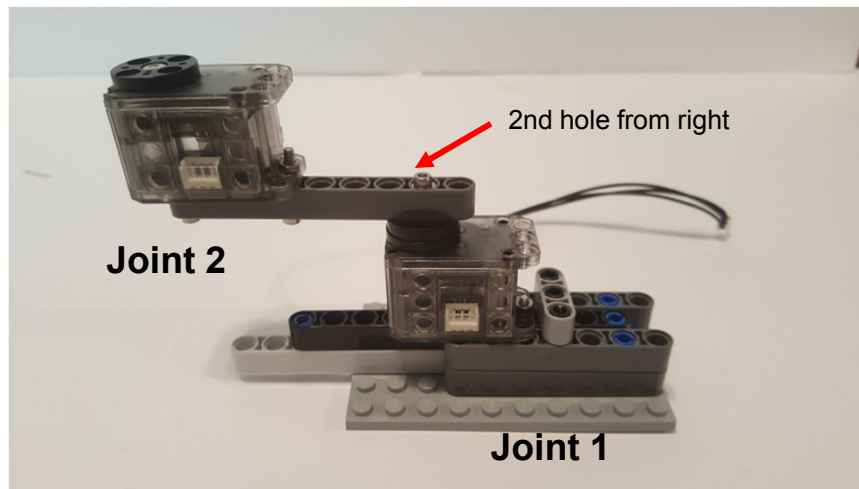1A: Lego-Mount Lab's XL-320 serves as base joint. Additional XL-320 will be second joint

1B: Secure M2.5 x 16 MM screw thru washer and Beam 9 and into XL-320's left mounting hole (red)

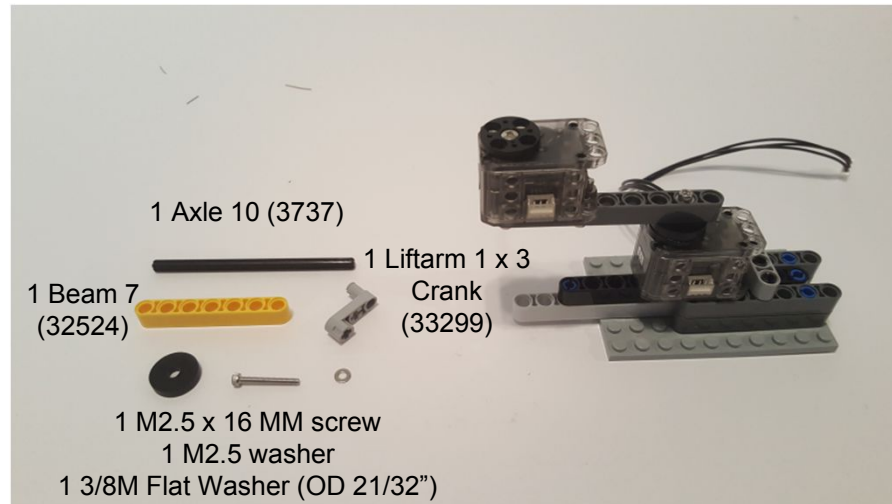1C: Secure M2.5 x 16 MM screw thru washer and Beam 9, and fasten M2.5 nut (see red arrows)

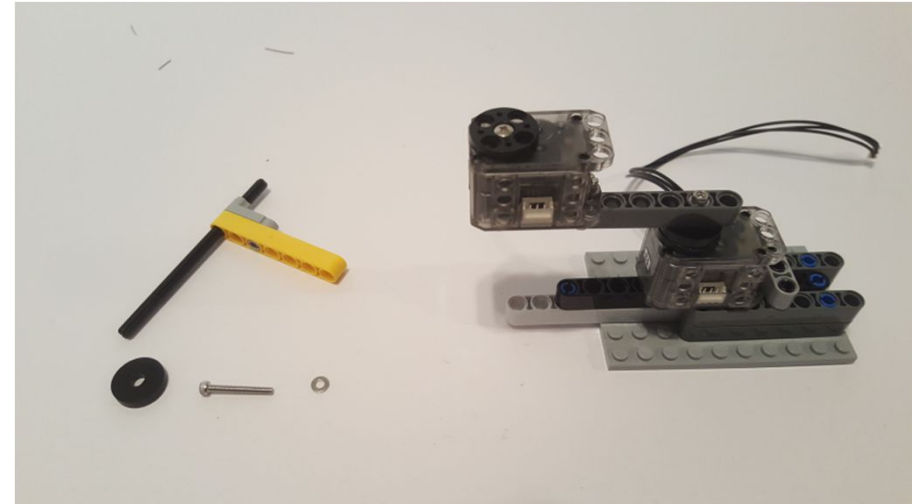Alternative view of Step 1C. Red circle shows fastened M2.5 nut

2nd hole from right

Joint 2

Joint 1

1D: Screw M2.5 x 20 MM into washer, Beam 9 and into Joint 1 horn

Step 2: Link 2

1 Axle 10 (3737)

1 Liftarm 1 x 3 Crank (33299)

1 Beam 7 (32524)
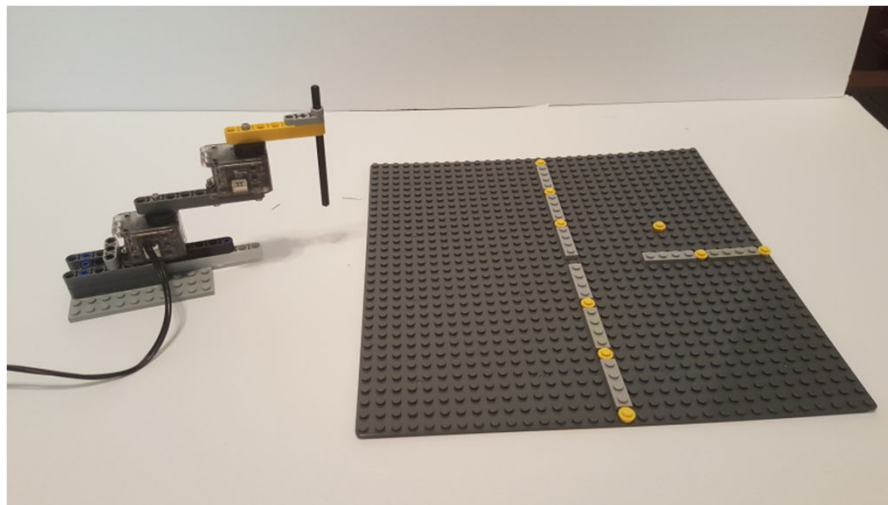
1 M2.5 x 16 MM screw
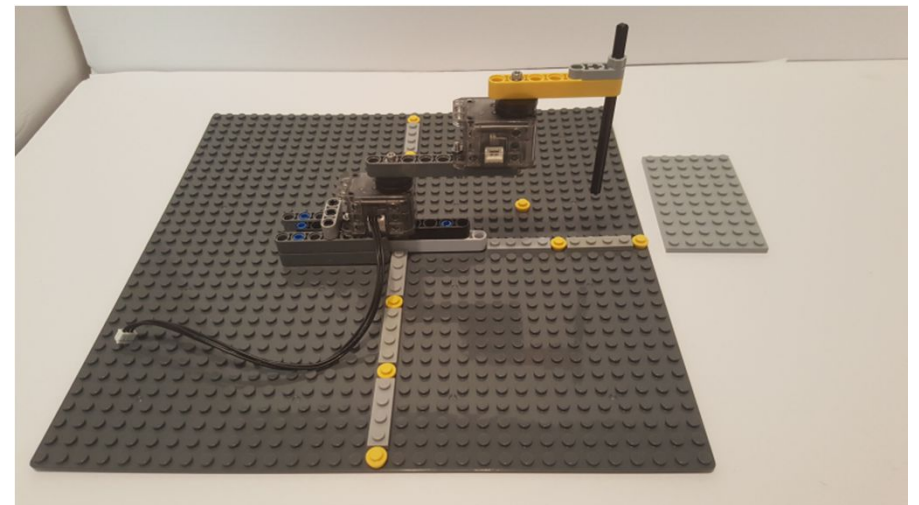1 M2.5 washer
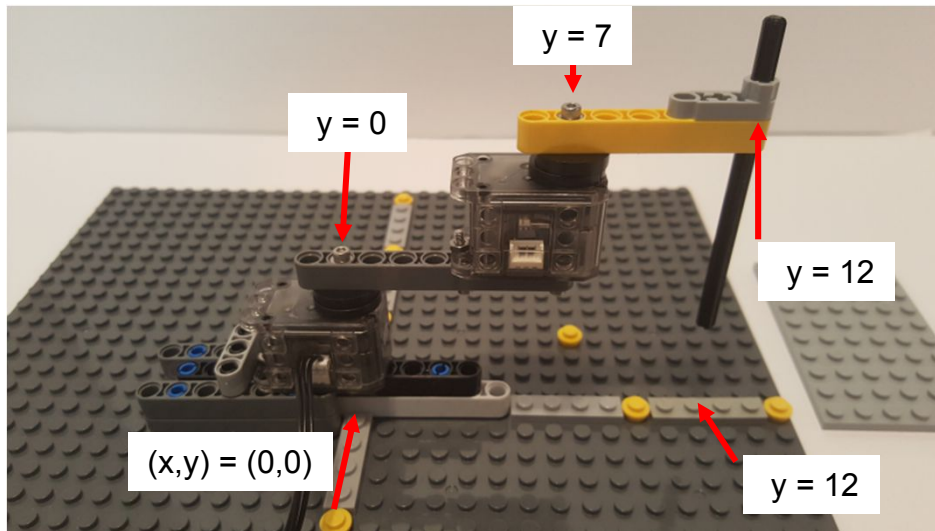1 3/8M Flat Washer (OD 21/32")

2A: Gather components
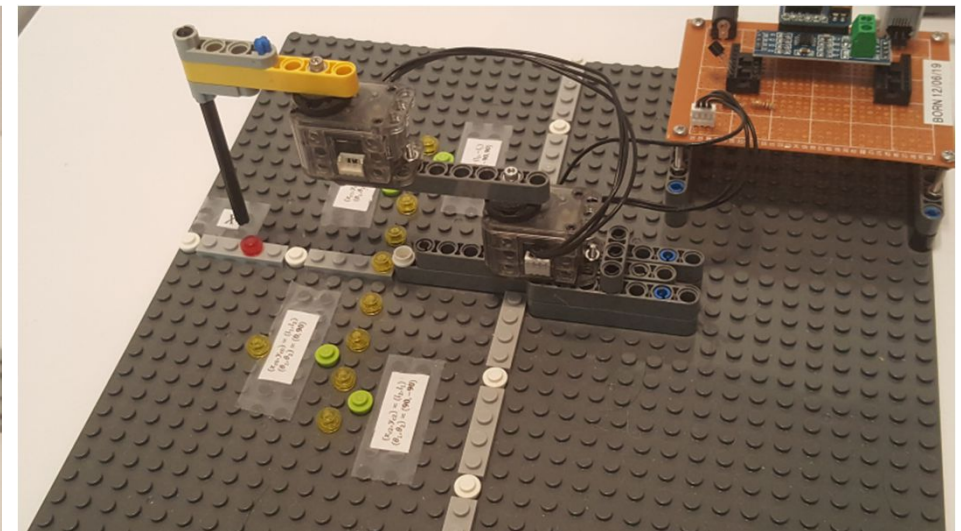

2B: Slide Axle 10 thru Beam 7 and Crank

2C:Secure M2.5 x 16 MM screw thru washer, flat washer and into 2nd XL-320's horn

2D:Secure resulting 2-DOF manipulator to 32 x 32 base plate. Create $\pm X$ and Y axes

y = 7

y = 0

y = 12

(x,y) = (0,0)

y = 12

2E: Note that end-effector (Axle 10) hovers over y=12 position when manipulator's two links are aligned with Y-axes

Alternative view: Red colored stud is the y=12 position and end-effector hovers over it.

Congratulations! Completed Lego-based 2-DOF XL-320 Manipulator