Lab 6 Outline

If a coordinate or orientation value is not listed – it is assumed to be 0 or no changes are needed

Module 1. Building the Environment

Introduction

This lab will simulate a crane game, one you might see in an arcade (though much more consistent!). It will set-up the x and y coordinates of the crane by setting up prismatic joints that adjust the cranes position. We will adjust these positions through a UI element that slides the x and y axis into position. We will attach a gripper that will act as the main crane mechanism. We will then program the crane to descend, close the gripper, attach the object, then ascend back to the neutral position. We will then be able to adjust the x and y coordinates again, before opening the gripper and detaching the object from the crane to release the object in the desired position.

Goals:

Setup ceiling for crane to attach to

Setup basket for crane to release objects in

Setup a greppable, detectable object to be lifted

- Equipment -> Panes
- Add Glass pane – 2.0 x 2.0 – This will act as our ceiling
- Rotate Glass pane relative to world 270 degrees around x, 180 deg around z
- Enter coordinates
- **X: +5.0006e-02**
- **Y: +3.1626e-01**
- **Z: +9.0000e-01**
- Household
- Add largeBasket
- Adjust Basket_visible Geometry Proportions
- **X: .75**
- **Y: .75**
- **Z: 3.00**
- Apply Coordinates
- **X: -8.4996e-01**
- **Y: -5.5654e-01**
- **Z: +9.2500e-02**
- Add -> Primitive Shape -> Cuboid
- Double click Cuboid Icon -> Common

- Check Detectable Box
- ***Done!***

Module 2. Building the Crane

Introduction

Goals:

Build crane joints and aux shapes

Welcome to Robot Academy. In this module, we'll attach a crane to the ceiling we created. We'll also build the main control for the x, y axes, as well setup to control the z axis as well.

- Add -> Joint -> Prismatic
- Rename to x_joint
- Double click Prismatic_Joint
- Set Pos. Range **2m**
- Set Length **.05m**
- Show dynamic properties dialog
- Check Motor Enabled
- Check Control loop enabled
- Enter Coordinates
- **X: -8.9999e-01**
- **Y: -5.5871e-01**
- **Z: +8.7495e-01**
- Orient **90 degrees** around Beta, relative to World
- Attach it to the Pane
- Create Y Joint
- Copy & Paste x_joint
- Rename new joint to y_joint
- Set coordinates
- **X: -8.4999e-01**
- **Y: -6.0871e-01**
- **Z: +8.7495e-01**
- Orient -90 **degrees** Alpha, relative to Parent frame
- Add -> Primitive Shape -> Cuboid
- Modify Geometry
- Scale
- **X: .75**
- **Y: .75**
- **Z: .25**
- Enter Coordinates
- **X: -8.4999e-01**

- **Y: -5.5871e-01**
- **Z: +8.7495e-01**
- Attach Cuboid to y_joint
- Double Click Cuboid Icon
    - Show Dynamic Properties
        - Disable Body is Dynamic
- Create Z joint
    - Copy & Paste Y joint
    - Enter Coordinates
    - **X: -8.4996e-01**
    - **Y: -5.6092e-01**
    - **Z: +8.2480e-01**
    - Mouse rotate until **a: -180** degrees
    - Attach Z joint to Cuboid
- Components -> Grippers -> Barrett Hand (simplified)
    - Enter Coordinates
    - **X: -8.4996e-01**
    - **Y: -5.6096e-01**
    - **Z: +7.4978e-01**
    - Orient Alpha & Gamma **180** degree

Module 3. Crane Control – X & Y Axes

Goals:

Write Scripts to set joint position with sliders

- Script
    - Insert New Script
        - Non-Threaded Child Script
    - Click out and back in
    - Associated object -> x_joint
- *Create UI Controls*
    - *x = sim.getObjectHandle('x_joint')*
    - *y = sim.getObjectHandle('y_joint')*
    - *z = sim.getObjectHandle('z_joint')*
    -
    - *xml = '<ui title="Crane Control" closeable="false" resizeable="false" activate="false">'..*
        - *[[*
            - *<label text="X" style="* "/>*
            - *<hslider minimum="0" maximum="100" id="1"/>*
            - *<label text="Y" style="* "/>*
            - *<hslider minimum="0" maximum="100" id="2"/>*
            - *</ui>*
        - *]]*

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-
- *ui=simUI.create(xml)*
- *simUI.setSliderValue(ui,1,0)*
- *Position Change Callback Function*
- *function PosChange_callback(ui,id,newVal)*
- *pos=newVal/75*
- *axis=id*
- *end*
- *Add on-change event to sliders*
- *<hslider minimum="0" maximum="100" on-change="PosChange_callback" id="1"/>*
- *<hslider minimum="0" maximum="100" on-change="PosChange_callback" id="2"/>*
- *Set Joint Position*
- *if (axis == 1) then*
- *sim.setJointPosition(x, pos)*
- *end*
-
- *if (axis == 2) then*
- *sim.setJointPosition(y, pos)*
- *End*

Module 4. Crane Control – Drop, Grip, and Raise

Goals:

Create button to attempt to drop, grip, and raise an object

Create button to release an object

- *Open the gripper*
- *sim.setJointTargetPosition(rotJointHandles[1],-1)*
- *sim.setJointTargetPosition(rotJointHandles[2],-1*
- *Get relevant object handles*
- *attachPoint = sim.getObjectHandle('BarrettHand_attachPoint')*
- *attachSensor = sim.getObjectHandle('BarrettHand_attachProxSensor')*
- *cuboid = sim.getObjectHandle('Cuboid')*
- Configure z_joint
- Double Click Z_joint icon
- Show dynamic Properties
- Upper Velocity limit **.1 m/s**
- *Create Button to Drop Crane*
- *<button text="GO" on-click="Go" id="3"/>*
- *function Go(ui, id)*

```
        sim.setJointTargetPosition(z, .54)
    End
Send In Position Signal
    if(sim.getJointPosition(z) >= .54 ) then
      sim.setIntegerSignal('In_Position', 1)
   End
Attach object to gripper & close gripper
positionSignal = sim.getIntegerSignal('In_Position')

   if(positionSignal == 1) then
      if (sim.checkProximitySensor(attachSensor, cuboid)==1) then
         sim.setObjectParent(cuboid,attachPoint,true)
         attachedObject = true
      end
      positionSignal = 0
      closing = true
   End

    if closing then
      sim.setJointTargetVelocity(closingJointHandles[1],-0.02)
      sim.setJointTargetVelocity(closingJointHandles[2],-0.02)
      sim.setIntegerValue('Return', 1)
Return Z axis to 0
    returnSignal = sim.getIntegerSignal('Return')

   if (returnSignal == 1) then
      sim.setJointTargetPosition(z, 0)
      if ( sim.getJointPosition(z) <=.05) then
         sim.setIntegerSignal('Return', 0)
      end
   End
Add Release button & cb function
    <button text="RELEASE" on-click="Release" id="4"/>
    function Release(ui, id)
       sim.setIntegerSignal('Release', 1)
    End
Open fingers and detach object
    releaseSignal = sim.getIntegerSignal('Release')

```