

# Report

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**Descriptive title: ProjectB:** walking robot and moving robot arm

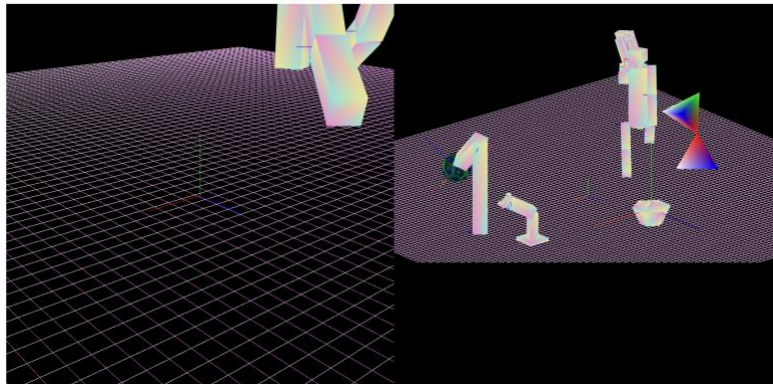
## User's Guide

### Instructions:

- Under the canvas there are five sections for user interactions:

- **Keyboard Section:**

- **Arrow key:** You can press the '-'>' key on the keyboard to turn the camera head to right. You can press '<-' key on the keyboard to turn the camera head to left. You can press 'up' key on keyboard to raise the camera head. You can press 'down' key on keyboard to lower the camera head.
- **WASD keys:** You can press 'w' key on keyboard to move the camera forward. You can press 's' key on keyboard to move the camera backward. You can press 'a' key on keyboard to move the camera to the left. You can press 'd' key on keyboard to move the camera to the right.  
**In an orthographic scene, objects will disappear if the camera moves beyond a certain distance.**



- **Mouse Drag Section:** You can drag the mouse to rotate the 3d object on the bottom right of this canvas. The rotation will not be affected by the camera's rotation and position.
- **User-adjustable joints of robot arm section:** You can change the angles of these four joints smoothly via the input boxes after the rotation stops. You could click the button to stop the rotation.

### Adjust angle 1(lower arm)

Angle 1:(-140 < x < +40 deg):

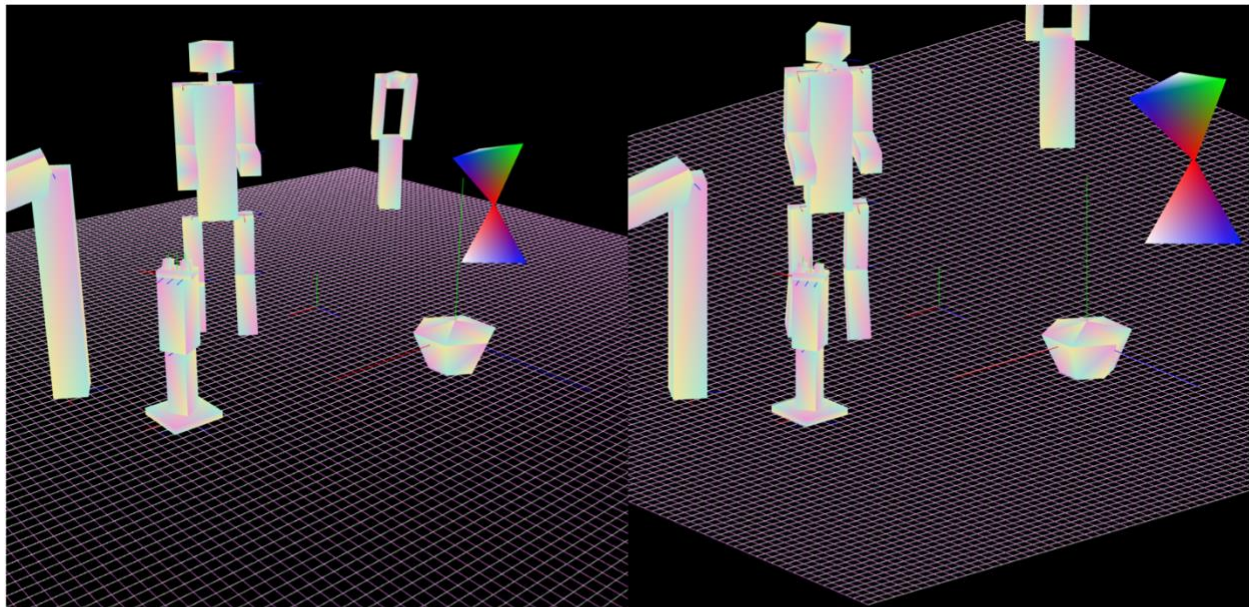
- **User adjustable asymmetric camera section:** You can change the number in the input boxes to change the 6 parameters individually. It is better to adjust the parameters by clicking the up and down arrows on the right of the input boxes

for far values. You can adjust other values by typing the number in the input boxes.

- **Switch Camera's View section:** You could click the box to switch the Perspective camera's view. When the box is checked, the camera will be attached to the moving robot arm's finger. When the box is not checked, the camera's position and look-at direction should be the same as the orthographic view.

## Results

This is what should be like on the screen:



-----Keyboard Section-----  
 You can press '>' key on keyboard to turn the camera head to right. You can press '<' key on keyboard to turn the camera head to left. You can press 'up' key on keyboard to raise the camera head. You can press 'down' key on keyboard to lower the camera head.  
 You can press 'w' key on keyboard to move the camera forward. You can press 's' key on keyboard to move the camera backward. You can press 'a' key on keyboard to move the camera to the left. You can press 'd' key on keyboard to move the camera to the right.

-----Mouse Drag Section-----  
 You could drag the object on the bottom right to rotate it. Mouse Drag totals (CVY x,y coords): 0,0  
 Current Quaternion: w = xi + yj + zk where (i,j,k) are 3-way imaginary numbers.  
 X=0, Y=0, Z=0, W=1.

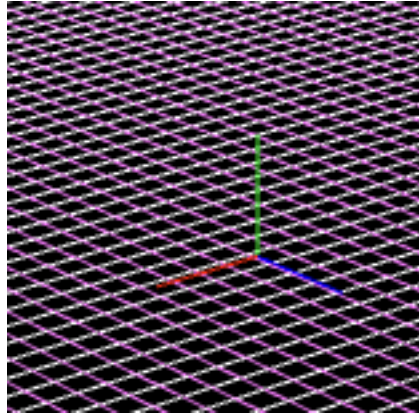
-----User adjustable joints of robot arm-----  
 Adjust the angle smoothly via the input boxes after the rotation stops. You could click the button to stop the rotation.  
 Adjust angle 1(lower arm) Angle 1 ON | 55.3 | Angle 2(upper arm) Angle 2 ON | 20.5 | Adjust angle 3(rotated panel) Angle 3 ON | 4.1 | Adjust angle 4(two fingers) Angle 4 ON | 15.3 |  
 Angle 1: (-140 < x < +40 deg) Angle 2: (-80 < x < +80 deg) Angle 3: (-90 < x < +90 deg) Angle 4: (-30 < x < +60 deg)

-----User adjustable asymmetric camera-----  
 It is better to adjust the parameters by clicking the up and down arrows on the right of the input boxes. When you resize the window, the parameters will adjust automatically depending on the canvas size and the values of near and far will be back to the default value 1 and 200.  
 Left: 21.55 Right: 21.55 Top: 20.91 Bottom: 20.91 Near: 1.00 Far: 200.00

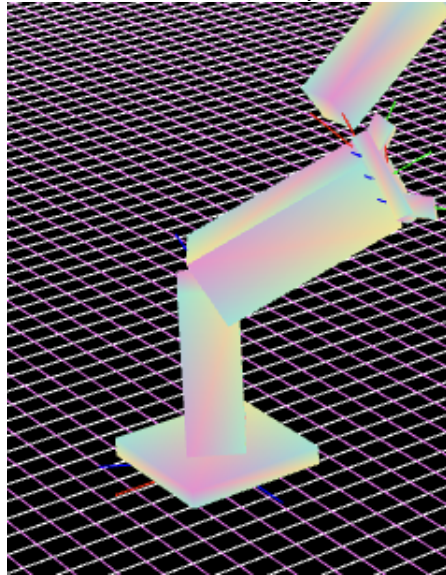
-----Switch Perspective Camera's View-----  
 Click the box to switch the camera's view. When the box is checked, the perspective camera will be attached to the moving robot arm's finger. ☐

There is a ground grid, every object is placed/ travelling on the ground grid here. The left scene is the perspective view, and the right scene is the orthographic view.

1. Coordinates: The green line is the y-axis, pointing to the up. The red line is the z-axis. The blue line is the x-axis.
  - a. This is the world coordinates in the middle:

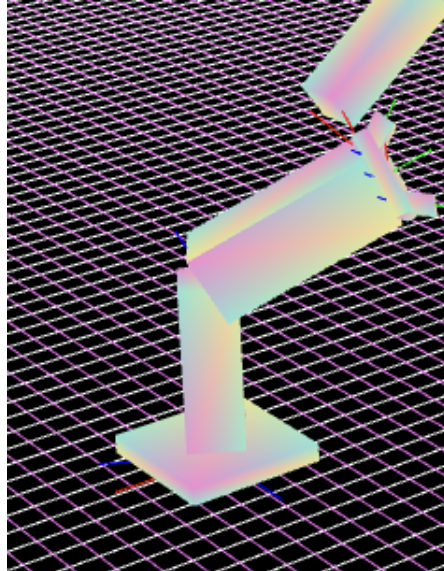


- b. This is the coordinate system for the jointed object:



2. Object:
  - a. 3 flexing sequential joints:  
There are 4 angles controlling the rotation of this assembly. The lower arm, upper arm, rotating panel on the top and the two fingers.





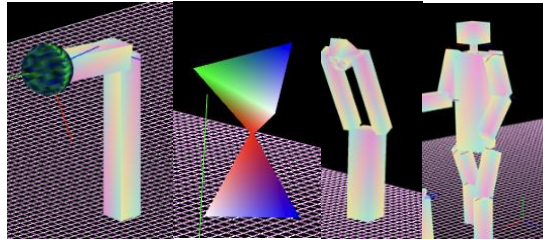
Adjust the angle smoothly via the input boxes after the rotation stops.

**Adjust angle 1(lower arm)**

Angle 1:(-140 < x < +40 deg):

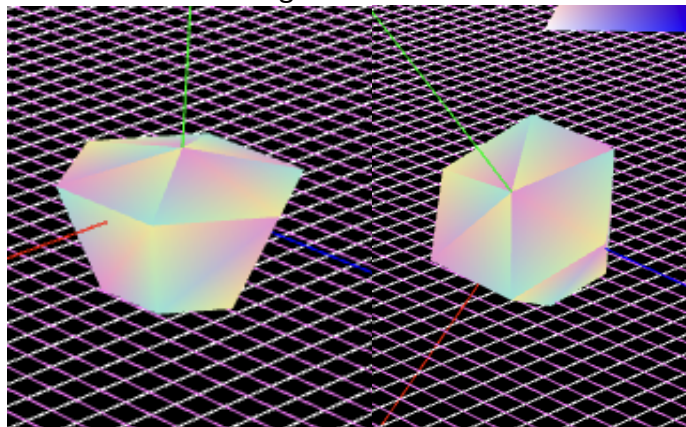
The adjusted angle can not exceed the min/max value of this angle.

- b. 4 jointed assemblies:



- c. The 3D object:

You can rotate it using mouse.



The rotation information will be displaced under this canvas.

-----Mouse Drag Section -----

You could **drag** the object on the bottom right to rotate it. **Mouse Drag totals (CVV x,y coords): -0.03021, -0.28571**

Current Quaternion:  $w + xi + yj + zk$  where (i,j,k) are 3-way imaginary numbers:

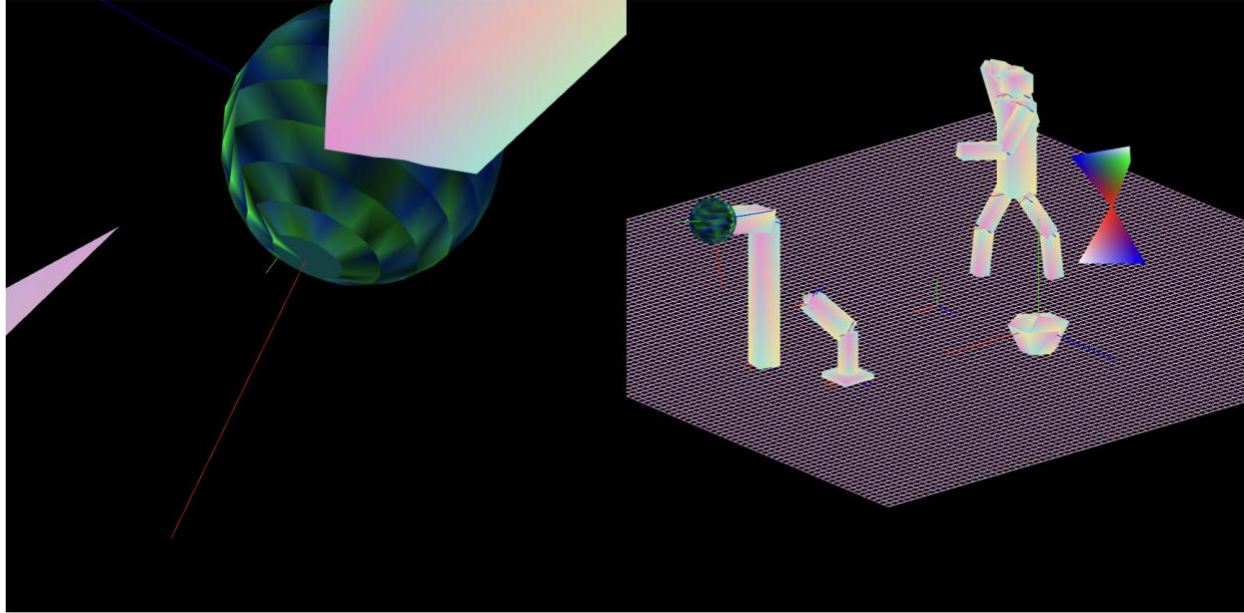
X=0.36545i Y=-0.03625j Z=-0.00227k W=0.93012 length=1.00000

3. Switch Perspective Camera's view:

a. When the box is checked

-----Switch Perspective Camera's View-----

Click the box to switch the camera's view. When the box is checked, the perspective camera will be attached to the moving robot arm's finger. ☒



When the box is not checked, the perspective camera's position and look-at direction should be the same as the orthographic camera's position and look-at direction even though the orthographic camera has rotated and changed its positions.

