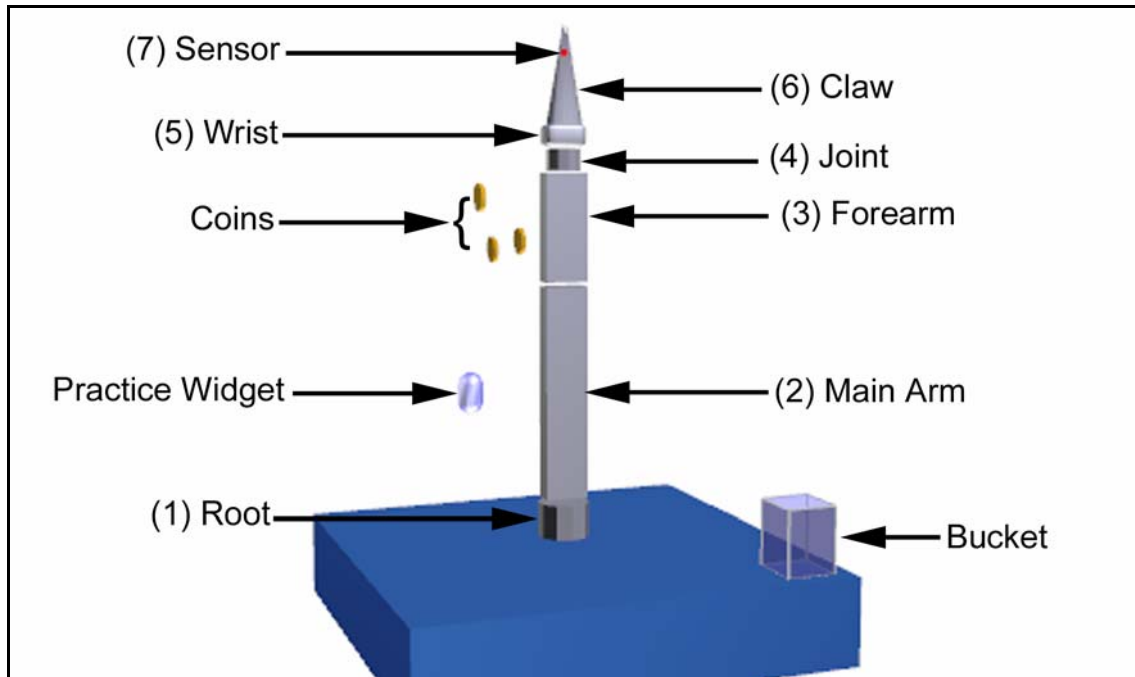


PDF 3-D Fully Interactive Robot Arm Game

This document demonstrates a PDF 3D Annotation of a Robot Arm game. The Robot Arm game is fully interactive. Each section of the Robot Arm is controlled directly by the user. The Robot Arm has the ability to pick up and move other objects in the 3D Annotation. These other objects are a set of coins randomly dispersed about the model and can be dropped into a bucket. The user can also change the dimensions of each section of the Robot Arm to their own preference.

The 3D Robot Arm model consists of 7 parts (Figure 1). Each part rotates on either the X or Z axis in concert with the other parts. Direction of rotation and speed are controlled from keystrokes applied to the 3D Annotation. Note that the keyboard focus must be on the 3D Annotation for the Robot Arm model to receive the keystrokes.



(Figure 1 - Robot Arm Parts)

1. **Root:** Rotates entire arm 360°:
“a” and “s” keys control direction of rotation.
2. **Main Arm:** Restricted to 270° of rotation
“z” and “x” keys control direction of rotation.
3. **Forearm:** Restricted to 270° of rotation
“<” and “>” keys control direction of rotation.
4. **Joint:** Rotates entire arm 360°:
“Left Arrow” and “Right Arrow” keys control direction of rotation.
Also controlled with the “i” and “o” keys.
5. **Wrist:** Restricted to 270° of rotation
“Up Arrow” and “Down Arrow” keys control direction of rotation.
Also controlled with the “k” and “j” keys.
6. **Claw:** Consists of two parts that open and close.
Toggle open/close with the “space bar”
7. **Sensor:** Does not rotate. This part is the catch position. An object can only be picked up when the sensor is inside it.

Playing the 3D Robot Arm Game

Open the Robot Arm claw by pressing the space bar. Then, using the Arm Controls, maneuver the Sensor (the red cube) as close as possible to the coin until its appearance changes. At this point it can be grabbed by the claw. Press the space bar to toggle the claw closed. The object is now captured and can be moved by the arm.

Next, maneuver the Robot Arm until the object is inside the boundaries of the Bucket. Press the spacebar to release it. If the coin was positioned properly inside the Bucket, a clinking noise will sound and it will disappear.

Counters to the left of the 3D Annotation keep track of the number of objects dropped into the Bucket and the number still in play. When no more objects are in play the Timer is stopped.

Reset with the “Reset Coins” button at the bottom of the page. They can also be shuffled before or during play by pressing either the “b” key or the “Shuffle Coins” button.

Timing the Play

The Robot Arm Game page includes a timer. Simply click the “Start Timer” button to begin the count up timer. Click on the same button to stop the timer. The timer counts up until either all the Objects have been placed in the bucket or the maximum time is reached.

Changing the Speed of Robot Arm Movement

The speed of the Robot Arm determines the accuracy of the Arm movement. The slower the Arm, the easier it is to position accurately. Arm speed can be changed on the fly with number keys “1”, “2”, and “3”, where the speeds are slow (1), medium (2), and fast (3).

Robot Arm Position Presets

It is helpful to be able to move the Arm to a specific location with a single keystroke. This is especially useful for placing objects in the Bucket.

The Preset keys are the numbers “4” thru “0”. Position “0” is fixed to the initial position of the Arm as it is shown in Figure 1. Positions “4” thru “8” are programmable by the user. To program a preset position do the following.

1. Maneuver the Arm into the desired position (such as placing a coin in the Bucket)
2. Press **Shift + (Number Key)**. For example, to use the “4” key as the preset position, press **Shift+4**.
3. To move the Arm into the preset position, simply press the associated number key.

Changing the Number of Coins

There can be from 1 to 10 objects in play. To set the number in play:

1. Click the cursor on an empty area of the 3D Annotation so no model parts are selected.
2. Click the “Properties” toolbar button on the tool bar for the 3D Annotation to display the Model Properties dialog (Figure 2). This button has the word “Properties” on it. There is no button image.



(Figure 2 – Model Properties Dialog)

3. Enter the number of objects to be used in play and press ok.

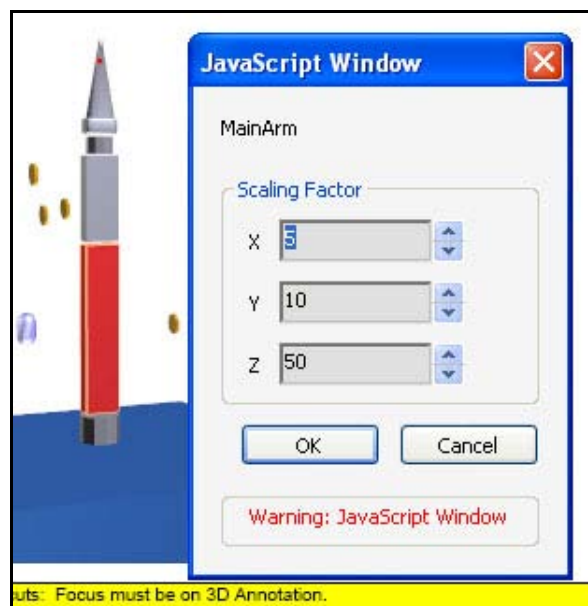
They will either appear or disappear and will be shuffled.

The “Reverse Claw Open State” check box is for correcting a possible miss in switching the state of the Claw, due to timing irregularities when system performance is low.

Changing the Size of an Arm Section

Each section of the Robot Arm can be rescaled to any size, making it longer, shorter, fatter, or thinner.

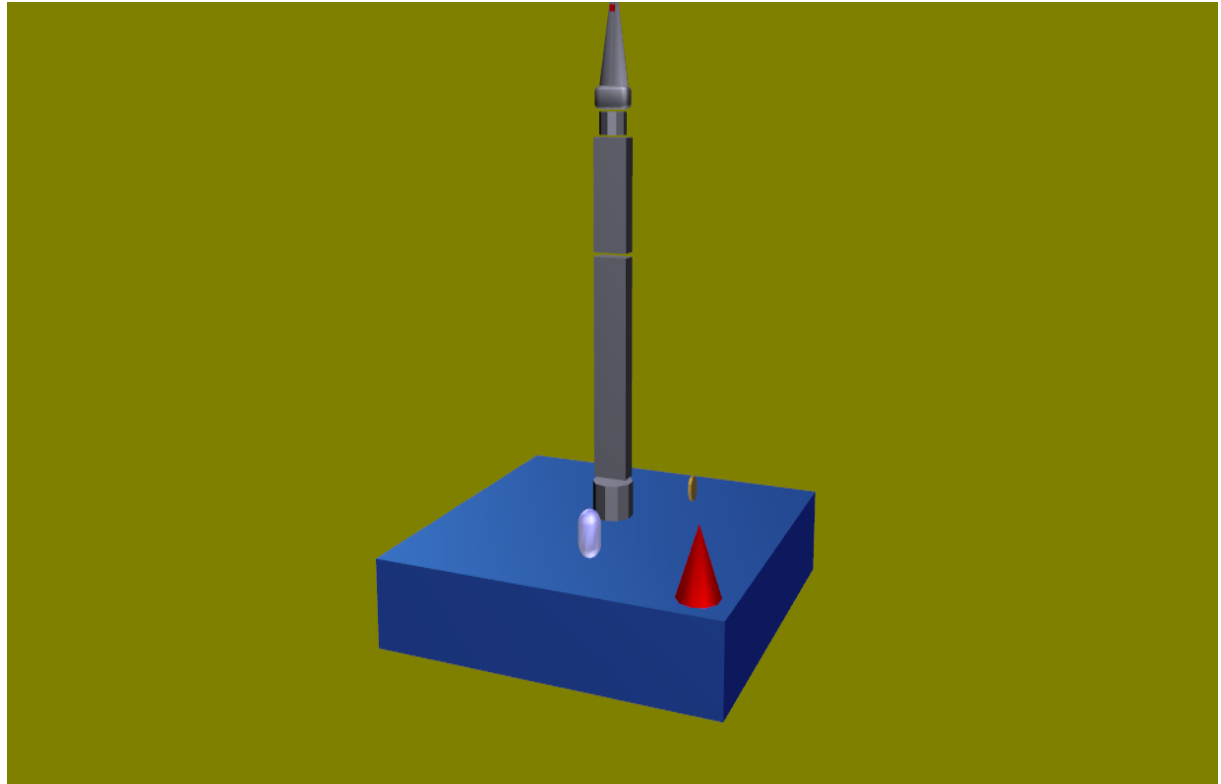
1. Click on an Arm Section with the cursor. The action highlights and selects the Arm Section.
2. Click on the “Properties” toolbar button on the tool bar for the 3D Annotation. This button simply has the word “Properties” on it. There is no button image.
3. This displays the Arm Section Properties dialog (Figure 3).



(Figure 3 – Arm Section Properties Dialog)

4. Enter new x, y, and z dimensions for the Arm Section and press “OK”. The section’s length is the “z” dimension.

This process can be done at any time during, after, or before playing the Robot Arm Game.



Keyboard Shortcuts: Focus must be on 3D Annotation.

Rotate - "a" and "s"

MainArm - "z" and "x"

ForeArm - ",", and "."

Joint - "Left Arrow" and "Right Arrow" Or "i" and "o"

Wrist - "Up Arrow" and "Down Arrow" Or "k" and "l"

Claw - "Space Bar"

Speed- "1", "2," "3"

Preset Position - Numbers 4-9, To program Preset usee shift+"number"