CS488 – Assignment 3

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Manual

Program Description

This program renders a puppet whos joints can be rotated to put the puppet in a variety of poses. It also lets you use a virtual trackball to manipulate the orientation and position of the puppet.

Controls

In Position/Orientation mode, use the left button to pan the view, the middle mouse button and vertical motion to zoom, and the right button to rotate the puppet using a virtual trackball.

In Joint mode, left click on limbs to toggle their selection (selected limbs will blink white), use the middle button with vertical motion to rotate selected joints about the x-axis, and use the right button with horizontal motion to rotate selected joints about the y-axis.

Menu Items

- Under the Application menu you'll find the several reset commands and the quit command. All shortcut keys are displayed beside the menu item.
- Under the Mode menu, you'll be able to switch between Position/Orientation ('P') and Joint Mode ('J').
- Under the Edit menu you can Undo ('U') and Redo ('R') changes to joint rotations.
- Under the Options menu you can toggle several view settings.

Changes to Scene Graph Data Structure

I added several recursive functions that traverse the scene graph and let nodes modify themselves based off of events. I could have implemented these by maintaining a list of joints, or a list of selected nodes, but decided it would be easier if everything just operated on a single tree.

I used an extra root node created in the program to hold position/orientation transformations.

Following are the specific changes I made to the given scene graph:

- Made walk_gl traverse graph, apply transformations when recursing on children, use name stack if picking, and draw primitives.
- Added traversing function “togglePick” that toggles the selected state of the node with matching id (if it's parent is a joint).
- Added traversing function “moveJoints” that rotates selected joints.
- Added traversing function “resetJoints”.
- Added undo and redo stacks to joint nodes.
- Added traversing function “saveJointUndoState” which is called after you complete a joint manipulation action. It saves state to the undo stack and clears the redo stack.
- Added traversing functions “undoJoints” and “redoJoints”.

Puppet Model Hierarchy

Here is a textual representation of my puppet's hierarchy. Generally I used joints in the main hierarchy centered at their pivot points and then sphere leaf nodes attached to those.

node(root)

- node(torso) → sphere
  - joint(shoulders) → sphere
    - joint(leftUpperArm) → sphere
      - joint(leftForearm) → sphere
        - joint(leftHand) → sphere
    - joint(neck) → sphere
      - joint(head) → sphere(head), sphere(left_eye), sphere(right_eye)
    - joint(rightUpperArm) (… same as left ...)
  - node(hips) → sphere
    - joint(leftThigh) → sphere
      - joint(leftCalf) → sphere
      - joint(leftFoot) → sphere
    - joint(rightThigh) (… same as left ...)

Assumptions

- When switching from Joint mode to Position/Orientation mode, I can leave joints selected so that you can continue manipulating them after switching back to Joint mode.
- I can make the primitives blink as an indicator of being selected.
- I can add an additional degree of freedom to each node for rotating about the y-axis (consistent with behavior of head but for other joints).