Assignment #1 Coding Report, CSC 2504

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February 11, 2014

1 Hierachical Object Design

The body part is desinged hierachicallly in the following kinematic tree. The transformation of each part (translation) is specified in the code relatively to its parent. For instance, the left upperarm's location is specified wrt the coordinate of left arm, rather than the world coordinate. The body is the only root of the tree, the location of which is set as (0, 0) at the world coordinate.

- Body
  - Lower Body
    - Left Leg
      - Circle
    - Right Leg
      - Circle
  - Left Arm
    - Left Upper Arm
      - Circle
    - Circle
      - Circle
  - Right Arm
    - Right Upper Arm
    - Circle
  - Neck
    - Head
      - Left Eye (Two Circles)
      - Right Eye (Two Circles)
    - Circle

2 Part Design

For each part, we need to specify its tranformations. The scaling parameters decide the size of the part, and the translation decide its location. However, since most parts are not rotated along its geometric center, we should conduct the transformation as follows:

- scale the object
- move the coordinate center to the rotation center by translating wrt the coordinate center of its parent node
- rotation with specified the rotation angle
- move to the center of the part by translating wrt the rotation center

Parameters of each part in animations is listed in Table 1. It is worth to note that, some paramters are not fixed, they are asked to be changed in each frame, so that an animation should be made. Therefore, we design two functions with current frame number as its independent variable. The length and angles updated along with l and θ respectively.

$$\theta = -\pi/4 \times \frac{\sin(N \times 0.1) + 1}{2} + \pi/4 \times \left(1 - \frac{\sin(N \times 0.1) + 1}{2}\right)$$

$$l = |\theta| \times \pi/180 \times 50 + 20$$

Name	Parent	Color	Translation	Size (Scaling)	Rotation center	Rotation angle
Body	-	green	(0,0)	30×50	-	-
Lower Body	Body	cyan	(0, -20)	50×10	-	-
Left Leg	Lower Body	red	(0, 25)	10×l	(-15, 0)	θ
Right Leg	Lower Body	red	(0, 25)	10×l	(15, 0)	θ
Left Arm	Body	red	(-25, 0)	10×50	(-25, 5)	θ
Right Arm	Body	red	(25, 0)	10×50	(25, 5)	θ
Neck	Body	yellow	(0, 15)	10×50	(0, 10)	θ
Left U-arm	Left Arm	pink	(25, 0)	10×l	(20, 0)	θ
Right U-arm	Right Arm	yellow	(25, 0)	10×l	(20, 0)	θ
Head	Neck	yellow	(0, 25)	25×50	-	-

Table 1.

3 GUI

I also implement a GUI to control all the 11 parameters individually. Each parameter has a max and min value, to avoid invalid input.