COSC422 Assignment 2
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Purpose

This assignment purpose is to get the student to learn and understand how to use Assimp library to render skeletal animation using the model and motion data from a file eg. BVH/ DirectX. In this assignment, the student is required to complete two tasks: creating skeleton animation using BVH file and creating skeleton animation using a rigged character model.

Description of background

Scene 1
The background consists of floor and a maze. The floor is created using gl quads (createFloor function). The maze is created by having many walls. Each wall is created using glutSolidCube function in different scales (createWall function).

Scene 2
The background consists of land, rolling rocks, and gate to Brisca home. The land is created using gl quads (createFloor function). The rolling rocks are made using glutSolidDodecahedron function (createRock function) and the gate is created using glutSolidCube function (createWall function).

Description of animation sequence34

Scene 1
The animation I used is a skeleton jumping back and forth. The scene showed Trista being trapped inside the maze. It tried to find the exit by jumping to the other side (see Figure 1) but sadly some of the exit were too narrow so it had to go back to the previous path (see Figure 2). See full story of Trista 1 in Appendix.

Scene 2
The animation I used is bison running in place. The scene shows Brisca running on the land, trying to escape from rolling rocks which fell from the earthquake (see Figure 3). Brisca was almost got run over by the rock but luckily the gate to its home was strong enough to stop the rock just in time (see Figure 4).

Main functions

updateNodes() - Task 1 and 2
This function is called regularly(e.g. Every 9 second) to adjust node position and node rotation according to the motion data from the given file e.g. BVH file. Most steps are taken from lecture 9. The tick is calculated using time which is obtained by glutGet(GLUT_ELAPSED_TIME) function and ticks per second of the scene animation. I divided time by 1000 to convert from milliseconds to seconds. The glutGet function gets the

time since the application starts so I have to use modulus by the duration of the scene animation to get the tick within the range.

The lecture note uses tick for both position key and rotation key. However, sometimes, there might be one rotation key and many position keys. This is a special case and is handled by checking if the array size is 1. If it is then the first index is used to find rotation instead of the tick. The position key is handled the same way.

For Task 2, there's non-uniform frames. The tick is changed to be a fixed number. The lecture note shows a way to perform interpolation for rotation but not interpolation for position. I use the following formula (Formula 1) to perform linear interpolation for position.

$$v0 * (1.0 - step) + v1 * step$$

Formula 1: Linear interpolation formula

display() - Task 1 and 2
In Task 1, this function contains code for adjusting camera to look at the character's root node to ensure that the character root node stays within the field of view. aiMatrix4x4t has function DecomposeNoScaling to decompose the vector used for the node.

updateMeshes() - Task 2
This function is called regularly (as often as updateNodes function) to adjust vertices and normals. Most steps are taken from lecture 9. Vert array stores all vertices of every meshes. To identify different meshes, an offset is used. After the program finished processing all the bones in a mesh, I increment offset by number of vertices that the current mesh has.

moveBison() - Task 2
Increase x position for bison and rock variable and increase the angle of the rock variable if the bison still hasn't pass the gate. The speed of the rock increases before bison reaches the gate.

Other functions

update() - Task 1 and 2
A timer function which is used to call updateNodes and updateMeshes function.

render() - Task 1 and 2
A function which is used to render the model.

Keyboard inputs

2 - Rotate the scene, 3 - Move camera position further from character (X direction)
4 - Move camera position close to the character (X direction)
5 - Move camera position upwards (Y direction)
6 - Move camera position downwards (Y direction)

7 - Move camera position in Z direction
8 - Move camera position in Z direction
S - Stop/Continue the animation

Screenshots

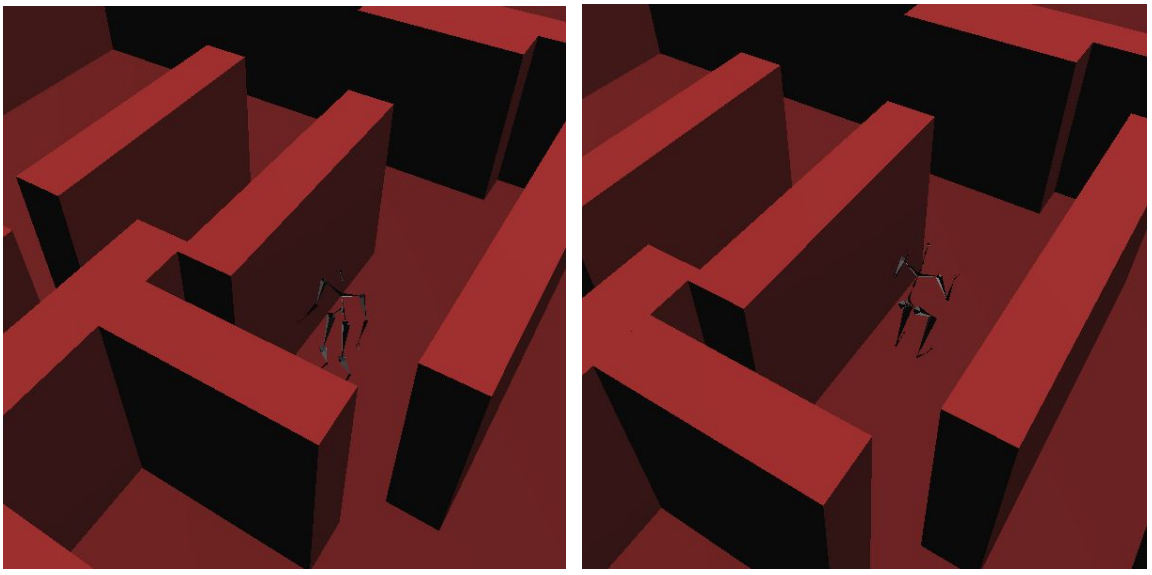

Figure 1 and 2: shows Trista trying to find exit in a maze(left) and Trista trying to jump back to where it was before(right)

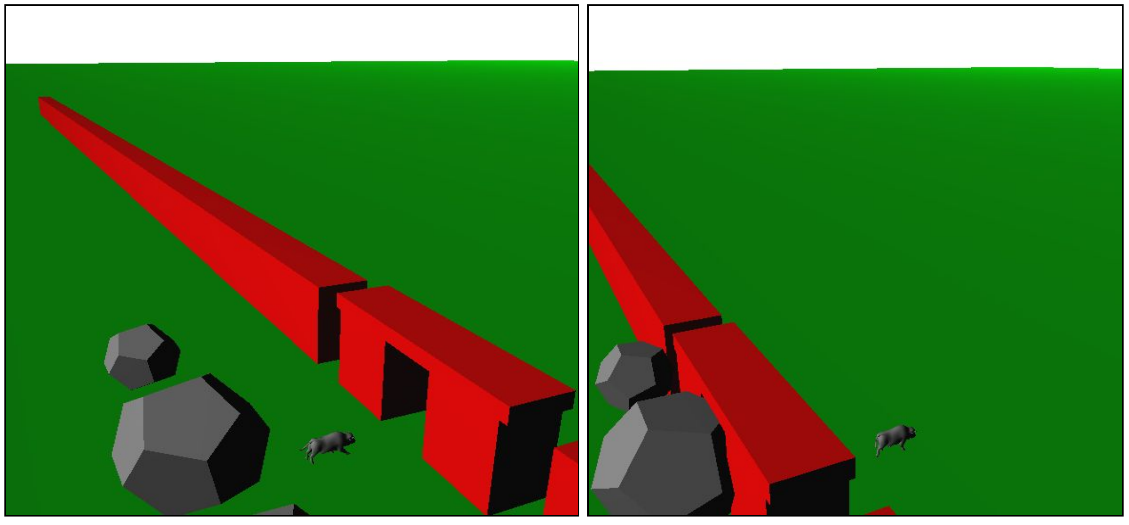

Figure 3 and 4: shows Brisca escape from rolling rocks before(left) and after(right) it entered the gate

Acknowledgements

I would like to acknowledge my classmates Hamish Christeller and Regan Gully who helped explain some steps used to implement Task 1 and Task 2 in the lecture note to me.

Reference

Linear interpolation formula
http://graphics.wikia.com/wiki/Linear_interpolation

Appendix

Scene 1
Once upon a time, there was an alien called Trista. Trista could jump like a frog but due to its heavy weight, its jump is rather slow. Trista was bored so it went out for a hop in a maze. The maze was well-known as a place where no one has ever make it back but for some reason, that day Trista did not care. The scene showed Trista being trapped inside the maze. It tried to find the exit by jumping to the other side but sadly some of the exit were too narrow so it had to go back to the previous path. Trista did not have a very good memory so it kept going back to the way there was no exit. At the end, Trista did not make it back and was trapped there forever. Since then, this tale has been passed on to the next generation of Trista tribe.

Scene 2
Brsica is a young bison. In one afternoon, Brisca was hungry so it sneaked out from its home to go for a hunt. Normally, young bison was not allowed to leave home unless it was supervised by an older bison however Brisca ignored that. While it was wandering around the rock mountain, earthquake suddenly happened. Earthquake caused some of the rocks to fall from the mountain. The scene shows Brisca running on the land, trying to escape from rolling rocks which fell from the earthquake (see Figure 3). Brisca kept running as fast as it could to go back home. It was almost got run over by the rock but luckily the gate to its home was strong enough to stop the rock just in time (see Figure 4). Brisca was exhausted and decided to stop running and took a rest. From that day onwards, Brisca was too afraid to come out again.