

Project 2

COORDINATE FRAMES & SIMPLE ANIMATIONS

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Purpose

The purpose of this program is to apply lighting and animation to our previous project. My previous project was a Star Wars scene with BB-8 droids, so this project continued off that by adding lighting to the scene and animating the droids.

Head Movement

The droid has a head movement that occurs automatically, or independently from the user's input. This movement is to simulate the droid constantly "looking around" the scene. This movement is generated by rotating the head about the z-axis back and forth. Each time the head changes direction, the time for the head to rotate is randomized, and it does not change direction again until that time has been reached. In addition, to have the head pause before it switches direction, the head only rotates during the middle 50% of the rotation time.

Body Movement

The body's movement was a bit more complicated, and was totally reliant on the user's input. Keyboard input allows the body to roll around the scene in the direction specified by the user, with the head remaining on top, so that the entire droid can smoothly move around. This movement is broken up into two parts: position changes and rotation. First, when a user wants the body to move in a specific direction, a translation is applied to the entire object in that direction. While a keyboard button is held, the object will continue moving in that direction. Directions can also be combined, to create a diagonal movement. Second, the body section of the droid will rotate in the direction of the movement. Since multiple rotations about an object's X and Y axes will not always result in rotations in the desired direction, matrix multiplication had to be done to account for this. To solve this, any time a direction is changed, a new vector which the object should be rotated around is created. This vector is created by creating a vector on the global axis and multiplying it by the inverse of the object's coordinate system. This new vector will allow the body to always roll in the direction that the user intended. Once again, this rotation along with the position changes create a rolling effect as seen in the Star Wars series.

Lighting and Shading

The lighting and shading aspect of this project was primarily modeled after Prof. Dulimarta's lighting example BlackBoard, but the structure of things had to be reorganized due to multiple objects needing shading, rather than just one torus. In order to achieve shading on all objects, I had to first generate the normal vectors within each basic object (Hemisphere, Ring, Cylinder, etc.). After normal vectors were correctly calculated, I included the references to the coefficient values within each object, so that before an object was drawn it could be adjusted to display correctly. This was mostly to set the ambient lighting, to give the object its color, but it was also useful when I wanted different coefficients for "sandy" objects. Lastly, I had to make sure that the normal vectors and lighting was adjustable, so that when an object moved, the lighting would adjust to the new angles of the object.

Screenshots

