I pledge my honor that I have abided
by the Stevens Honor System.
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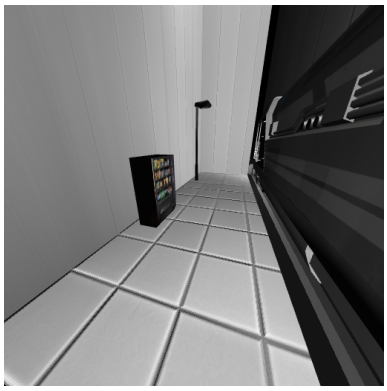
Jose de la Cruz

Final Project Report

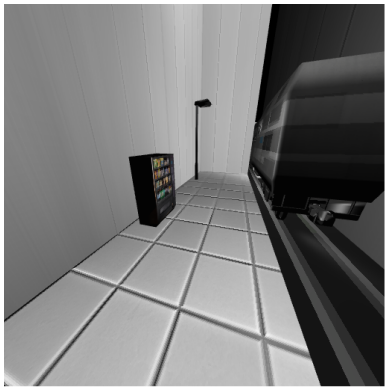
Outcome

For our project, we have created an interactive diorama of a subway station. In our scene, the vending machine, lamp, and train are interactable and clicking on them will cause unique animations for each.

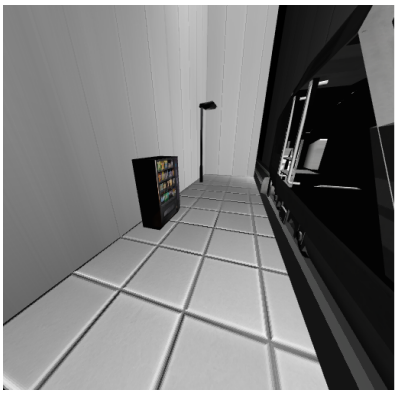
The train animation has the train naturally accelerate and leave the scene, then reenter the scene and smoothly come to a stop. The lamp animation turns on the lamp. The vending machine animation triggers a can to fall out of the vending machine and roll across the floor, then fall onto the tracks. All of these animations can be replayed after they complete by clicking on the objects again. The following images illustrate the rendering of the subway station and the animations that are possible:



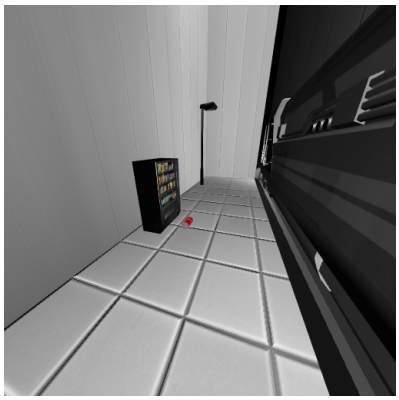
Completed scene on load



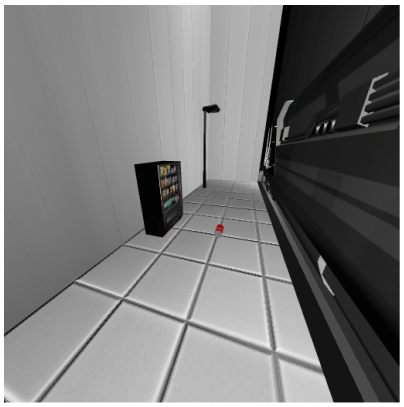
Start of train animation



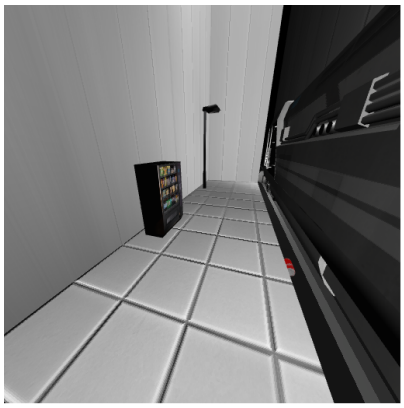
Train pulling back in



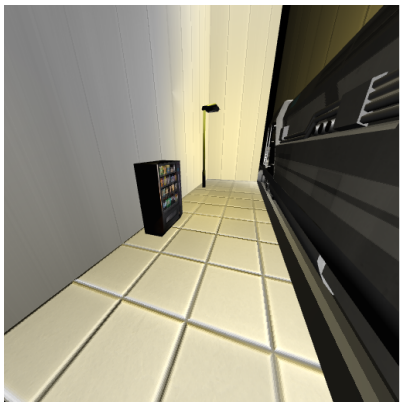
Start of can animation

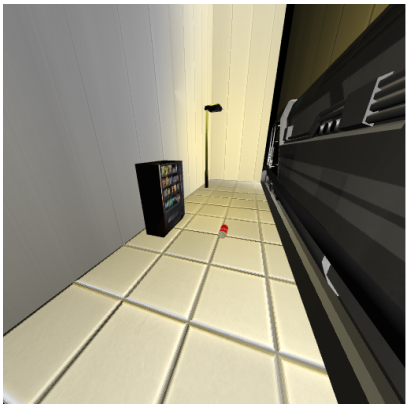


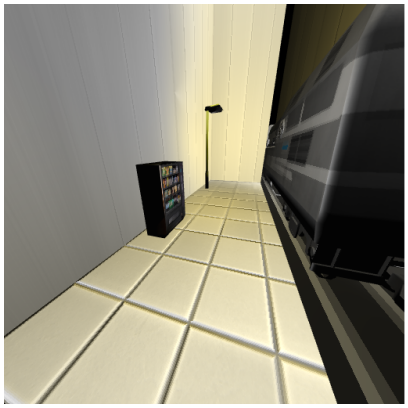
Midway through can animation



Can falling into tracks


Lamp animation in static scene


Can animation in lamp light


Train animation in lamp light

Techniques

Assets

The subway station asset was made in Blender since it was a simple, but specific, structure we needed for the project. The texture for the subway station was found on cc0textures which provided both a texture and a normal map. The rest of the objects and their textures, the vending machine, can, train, and lamp, were found on TurboSquid.

Animations

The train animation is just a simple translation of the train on the z axis, but with the train's z position over time being increased and decreased parabolically when the train speeds up to depart, and slows down to a stop.

The lamp animation adds a new, much yellower, light source to the scene which is added to the shader for each object.

At the start of the vending machine animation, the can is at a high point in space, out of the scene. When the vending machine is clicked, it causes the can object to be teleported to the "vending machine flap," then it falls out, rolls across the floor, and falls onto the track. The can movement is achieved by translating and rotating the can at different points in its animation. After the can falls, it is teleported back to a high point in space.

After each of these animations is complete, it can be triggered again by clicking on the objects again. Clicking on the objects is handled by bounding boxes that approximate the area of the object. These bounding boxes change a boolean in the code, which triggers the animations.

Lighting and Texturing

All the objects are shaded using the Phong Reflection Model, which was tweaked per object to make each object look appropriate in the scene. The models were all imported as OBJ files with their UV coordinates, which were used, along with their textures, to create the diffuse albedos for each object.

There are three different light sources in the scene: one light source above the scene, one light source originating from the camera, and one light source that is provided by the lamp when it is turned on. The light source above the scene and the light coming from the camera are both colorless; the lamp's light source is tinted to be a warm yellow.

Normal Mapping

The floor of the subway station is normal mapped to give it a bumpy, tiled appearance. To achieve the appropriate look with normal mapping, we had to learn how to send two different textures to the subway station's fragment shader. The normals for each fragment were determined using the fragment's interpolated UV coordinates and the provided normal map. To make the floor's normals generally point in the y direction the bump map's y and z coordinates were swapped.

Roles and Responsibilities of Teammates

Breanna primarily worked on the modeling of the subway station and acquiring the other models and textures we used in our subway station. She also performed edits on the objects in Blender as necessary to make sure they appeared appropriately in the scene and were in the correct file format. She placed the objects initially in the scene, and has done edits on the texturing, lighting, and animations as needed throughout the process.

Jose primarily worked on the shaders for the program. He completed the initial texturing of objects, including the normal mapping on the floor of the station, implemented the initial lighting in the scene, and set up the appropriate camera angle for the scene. He also implemented the initial animations for the project.

Both of us worked together on cleaning up the texturing, lighting, and animations, and on writing the reports for the project.