Final Project Report

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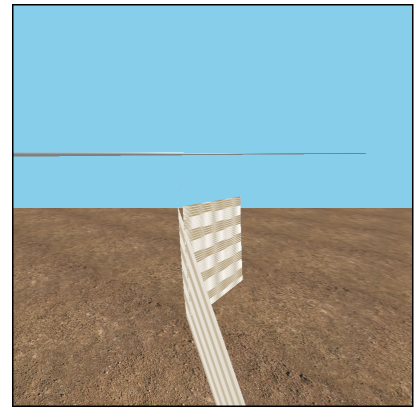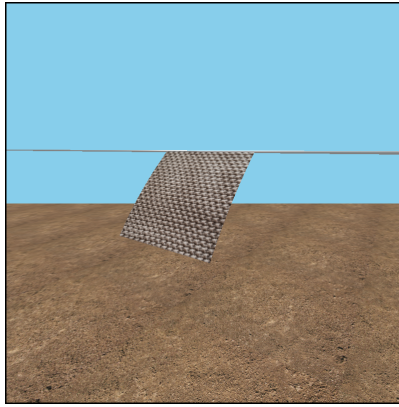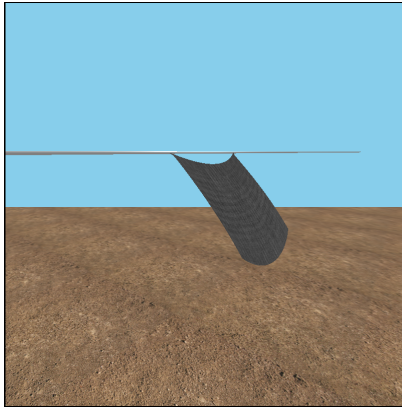Rohil Verma - rbv299
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Background

We decided to do cloth simulation for this project using ThreeJS and WebGL as the platform. In our original research, we found that there were two ways that we could have approached the project: mass-spring systems and position-based dynamics. While mass-spring systems are easier to implement, we found that position-based dynamics are much better at doing collisions and tearing than mass-spring systems. The way that mass-spring systems work is that they treat a cloth as a bunch of particles. These particles keep the same distance next to their adjacent distances(rigid body cloth simulation). To move the cloth, a force is applied to each of the particles and, if the particles move away from their adjacent particles, a spring force is applied to bring the particles back. On the other hand, position-based dynamics involves having particles but keeping the distance between these particles the same using constraints and a Gauss-Seidel solver to make sure all of the constraints are met as much as possible. Position-based dynamics allow us to have more constraints than just distance constraints, which makes it more accurate in how it represents cloth.

What We Accomplished

We have created a 3D cloth simulation using a simulation method called Position Based Dynamics (PBD). Using this method, the cloth interacts with gravity and the wind. The cloth can also be pinned at either the two corner points or along the entire side of the pole we have extended infinitely through the scene. The cloth is also textured based off of three default choices we have imported and can be chosen by the user through the GUI. We have used Three.js's orbital controls to let the user swivel the camera and zoom in and out. We attempted to implement tearing of the cloth, but we couldn't figure out exactly how to separate the mesh when splitting (i.e. the cloth texture loos like it just stretched).

Images

Tearing Attempt

References
https://matthias-research.github.io/pages/publications/posBasedDyn.pdf
https://www.ics.uci.edu/~shz/courses/cs114/docs/proj3/index.html
https://users.cs.utah.edu/~ladislav/liu13fast/liu13fast.html
https://carmencincotti.com/2022-08-01/the-pbd-simulation-loop/