Project Interim Report Simon Walker, CSc 473/586A

Proposal:

The project that I wish to propose is a physics-based simulation of large interacting bodies and possibly having a trajectory guided ship which is also under the effects of these bodies. In other words, this is called a N-body simulation which will be simulating the force of gravity of celestial objects. I have been attempting this through OpenGL but I have not been able to put in the time that I would have liked due to my other courses so I might be moving to do this in Unity which is more streamlined. I will start with the dynamics of few-body systems like earth and the moon in order to get things ready for larger planets. Especially since there is so much information already available about our planet and the moon. Each object will have a mass and the distance between other objects within a certain distance. This is so that when the gravity will be effecting the object we can use the gravity equation, g = G \* Mass / distance to center of Mass ^2, where G is equal to 6.673 \* 10 ^-11 N \* m^2 / kg ^2 and distance to center of Mass is the distance from an object to the center of mass of another object. In other terms I will be calculating the gravity wells of these objects and how they affect the things around them.

Related Works:

“N-body simulations of planetary formation” by C. Beauge and S. J. Aarseth, is a paper that specifically talks about the formation of the solar system and how using a N-system they were able to accurately recreate the last stage of the formation of planets. This paper sues a lot of equations about the gravitational affect that large objects have on smaller ones.

<http://adsabs.harvard.edu/full/1990MNRAS.245...30B>

“N-body simulations (gravitational)” by Michele Trenti and Piet Hut, is a paper that is focused specifically on N-body simulations that deal with particles interacting gravitationally. This paper talks specifically about highlighting the main methods for these simulations which should help my search in chossing the best method for what I hope to achieve.

<http://www.scholarpedia.org/article/N-body_simulations#Direct_methods>

Challenges, completed work, and remaining plan:

I was able to do a good amount of research, finding multiple projects that others have done to code a full functioning solar system. Since I am focusing mostly on the gravitational side of things I will most likely be using them as visual guidelines than anything. I was able to briefly start on making the planetary system, trying to have a simulation of a moon under the effects of gravity from a planet but I have not been successfully yet. Hopefully I will be able to modify this code in order to get a moon accurately revolving around a planet under the effects of gravity.

Since it took me this long to get that to work, I believe moving to Unity will be beneficial as there is more information and tutorials for using Unity than there is for OpenGL and that would make finding the answers to simple problems easier. Because I have just started my code, I will need to move my Plan on by removing anything that makes the project look sleek. My current idea is to get multiple different sized dots that affect each other on a 2d plane rather than try to make something on a 3d plane with planet looking objects.

From here I will need to figure out how to deal with scaling, finding efficient ways to compute all these numbers, and determining what integrator to use. Since there is only a month left it will be difficult balancing the rush to get this done alongside my other work. I hope that I will at least have a skeleton so that if I am unable to complete this in this course then I could at least try to finish it at the end.