Physics and Astronomy
VR software Development Research Project

Astronomy Simulation Project

Blender and Unreal Engine Documentation
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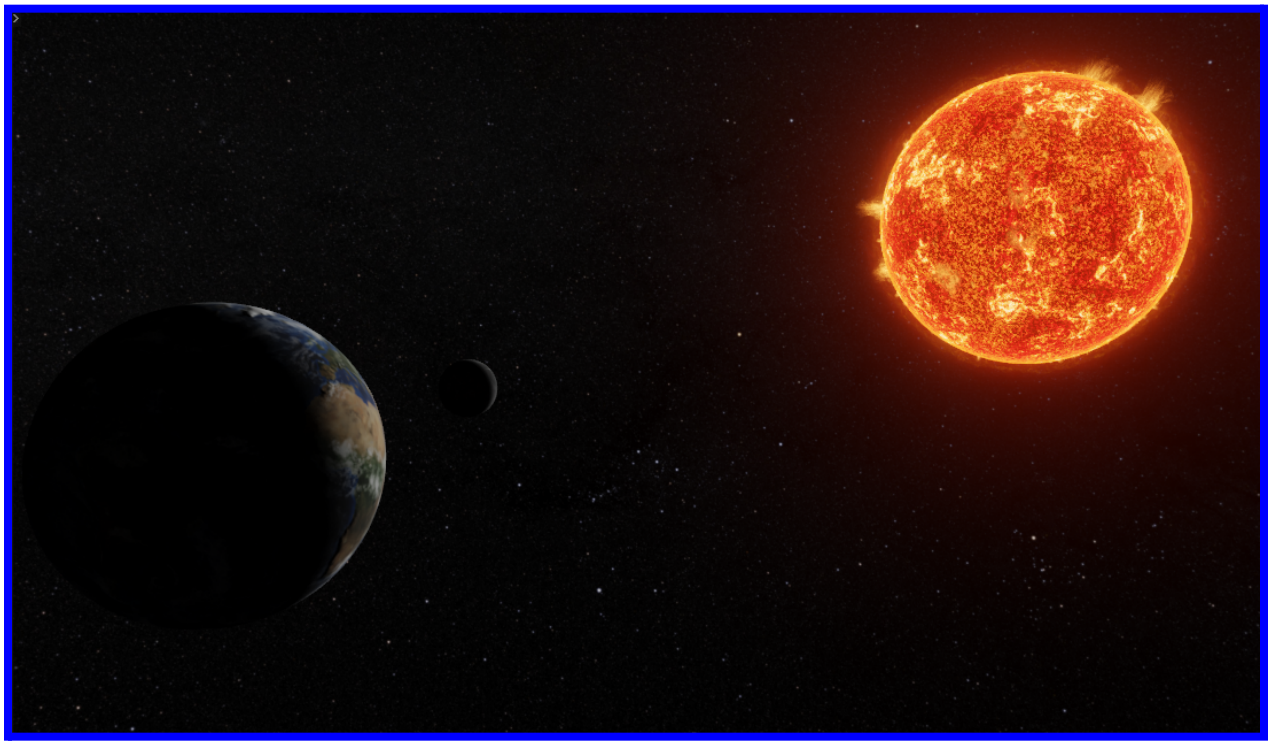

Image Above Rendered in Blender 3.6.2 Eevee Render Engine*

OVERVIEW

The Purpose of this project is to create an accurate solar system simulation that can be integrated into astronomy courses for visualizing astronomical concepts

GOALS

1. Determine which software is better suited for the development of this Project
2. Attempt to create a planetary simulation of the Solar System

BLENDER 3.0 SYSTEM SPECIFICATIONS

64-bit quad-core CPU with SSE2 Support

8 GB RAM

Full HD Display

Mouse, TrackPad, or Pen & Tablet,

Graphics Card with 2GB RAM, OpenGL 4.3

Less than 10 years old (generalizing)

UNREAL ENGINE 5.2.1 SYSTEM SPECIFICATIONS

Intel i5 core processor 5th generation and above

256 GB Storage SSD or Hard Drive

8 GB RAM

NVIDIA GeForce GTX 1650

Hard Drive to save file on a source other than the computer

Blender 3D hardware requirements: What you need to get started with Blender. CG Cookie. (n.d.). https://cgcookie.com/posts/blender-3d-hardware-requirements-what-you-need-to-get-started-with-blender

SOFTWARE COMPARISON

Blender

Blender is a robust 3D software package which is a free and open-source one for creating VR content. It includes Blender 2.80, the latest version, which is user-friendly and integrated with quality-level features. This programme enables developers to create virtual solid reality apps,

high-quality animation content and visual effects. Blender is the ideal software development tool for game creators as it makes product testing and exporting simple.

Unreal Engine

The potent Unreal Engine offers a full set of developer and supporting VR tools. Gaming, film, architecture, automotive and transportation, broadcasting, and AR/VR simulation benefit greatly from the Unreal Engine. Innovative aesthetics, a rich entertainment experience, and immersive virtual worlds can all be created without restrictions.

BLENDER SOLAR SYSTEM DOCUMENTATION

1. Download any version of Blender following version 3.6.2
2. Open and Save a new project file using the file menu
3. Download the official Earth, Moon, and Sun models from NASA. Make sure the file format is .gltf
4. Save the planets in a folder in your file explorer where you will remember it.
5. Import all three models into your 3D space using the import option menu.
6. If done correctly, all of the 3D objects should be spawned where the world cursor is which is directly in the middle of the 3D space. In order to properly select each planet to move individually, you can use the Outliner tab located on the top right of your screen to easily select which object you want to manipulate.
7. The Outliner window allows you to rename objects. If the NASA files that you import do not already have names, rename the objects by clicking on that object on the Outliner Window and double click and type to rename.
8. Next hold “shift + A” to open the Add Menu and hover over the “Curves” tab. Next click the “circle” option. If done correctly this will spawn a circle into your 3D space
9. You can easily manipulate the size of the circle by selecting it with “left mouse button” and holding down the “S” hotkey. For reference, to scale objects in 3D space, you must press “S” and move your mouse to manipulate the sizing. To rotate an object, you must press the “R” hotkey and move your mouse accordingly. Lastly, to move an object or transform/translate an object in 3D space, you must press “G” and move your mouse accordingly. For the purposes of this project we will be restricting transformation of objects to the X and Y axis. To restrict movement to the X and Y axis, click the object you want to move and hold “shift Z” and move your mouse accordingly.
10. Use the Scale Hotkey to increase the size of the circle and ensure that the circle lays flat relative to the X and Y axis

11. Next spawn another circle and scale it so that it is bigger than the first circle and ensure it lays flat.
12. Next you will select the Earth Model in the 3D space and then navigate to the Properties Window where you will find the object constraints tab. On this tab you will select a constraint called “Follow Path”
13. Afterwards a new menu will open and you will click the “Target button” and move your cursor to either the 3D space or the Outliner window to select the first circle.
14. Congratulations! Now next you will animate this sequence
15. UNFINISHED (will add next steps soon)

UNREAL ENGINE SOLAR SYSTEM DOCUMENTATION

1. Download and install Unreal Engine 5.2.1
2. Documentation for Unreal EngineSetting up the Solar System (Mainly focused on the Sun, Earth and Moon)
3. Create a project in 3rd person
4. Click File, New Level, and set it to empty open-world
5. Click Window, Env. light mixer, create atmospheric light 1 and set intensity to 5
6. Create a new visual effect with PostProcessVolume and check the box for Infinite extent (Unbounded)
7. To create the sun
8. You can either import an already-made sun, import a premade model from Blender, or create your own
9. Add a mesh UV sphere
10. Increase segments to 128, rings to 64, and dimensions to (20, 20, 20) meters (X, Y, Z)
11. Right-click and show smooth
12. Scale the sun by 695,500 and set the location to 0
13. Set the y rotation to 7 - 7.25 degrees
14. Now the sun is scaled correctly with an accurate tilt
15. In order to make it more realistic you can add a slight wobble to the sun (a barycenter) due to the large planets exerting a gravitational force on the sun
16. Note: The barycenter of the sun does not follow a single circular or elliptical orbit due to the orbits of the other planets
17. Could have time to add solar radiation that shows in the simulation

18. There is a website called Solar Textures that we will use and it allows you to download unique textures to use for planets and stars
19. Apply the textures to the sphere to make the mesh sphere look like the sun
20. To create the Earth repeat the same steps to create a UV Mesh Sphere and add textures from Solar Textures
21. Place the earth in the correct position (still in progress)
22. Select the Earth model and in details and in the Details panel, set the Earth to have the Sun as its parent. This ensures that Earth orbits the Sun.
23. Could add a potential Day-Night cycle
24. Having a moving system is very heavy on the system, there is constant lagging, stutters, and crashes
25. Repeat the same steps for the moon and set earth as its parent
26. Can further be optimized by the blueprints
27. CONTINUED...