AE-6102: Parallel Scientific Computing and Visualization

Project Abstract

Title

Visualization of a planetary system

Participants

- Apurva Kulkarni (180010011)
- Nakul Randad (180010047)

Abstract

Visualization of the planetary system (especially the Solar System) has always been a fascinating thing. We plan to showcase the dynamic motions of the planets which are bounded by the gravitational field of a star (the Sun) and analyse the effects of changes in gravitational potential hence made. With a focus on the Earth, the Sun and the Moon, we further intend to investigate the Lagrange points of these two-body systems (and three-body system if possible). The model built as a part of the project would be capable to simulate the motion of a foreign object in the planetary system. Such a model will not only help people understand the way planets move, but may also inspire them to reimagine the solar system in a whole new way.

Outline

We plan to create a 3D, interactive visualization of the solar system. The visualization will have options for viewing the motion of the Sun and planets, the Earth and the moon and will also allow the addition of arbitrary bodies and observe their interactions. In terms of visualization, we plan to have options for visualizing the motion of the planetary bodies, and a mode to visualize the gravitational potential for observing the different stationary points that form in space. We will be using Mayavi for 3D visualizations and TraitsUI for the user interface. The UI will have options to toggle between the different modes and conditions. The code will be written in an optimized manner and we will try to include automation in the code.

Deliverables

A GitHub repository for the project would be created with its source code. This would consist of:

- The simulation model with the physics of the planetary system.
- A visualization tool with a custom user interface.
- Animations and pictures to demonstrate the capabilities of the tools developed.

Timeline

1. We would start with collecting the required parameters for all the planetary bodies that we plan to simulate.
2. The next step would be to code the physics of the model
3. A 3D visualization tool (Mayavi) would then be used to visualize relevant scenarios, objects and states
4. Custom user interface tools will be added to the visualization tool
5. Fine-tuning of all of the components would be performed.

Task 1 and task 2 (partially) will be done pre-endsems and the remainder of task 2 along with further tasks would be performed post-endsems.