Final Project Proposal: Navigating the Cosmos - Pathfinding Among the Stars

Context and Personal Relevance

The vast expanse of space, with its myriad stars and galaxies, has always been a source of fascination and wonder. Our project aims to simulate the navigation of a spaceship through this celestial maze, using pathfinding algorithms to chart the most efficient course between stars.

This subject holds a deep personal significance for each member of our team, driven by a shared passion for space exploration and computer science.

For Pengcheng Ding, the cosmos has always been a canvas of imagination and inspiration, stemming from childhood nights spent stargazing. This project serves as a bridge between those nights and Pengcheng Ding's current pursuits in computer science, combining personal passion with academic interest.

Ji Chen's interest lies in the intersection of technology and exploration. Having followed the advancements in space technology and exploration missions, he sees this project as an opportunity to contribute conceptually to the field he admires, applying his skills in algorithm design to solve complex navigational challenges.

Yichen Wang, on the other hand, is fascinated by the mathematical beauty underlying celestial mechanics and algorithmic logic. For Wang, this project is a means to explore the practical applications of theoretical concepts learned in class, particularly in algorithms and data structures, within the captivating context of space navigation.

Scope of the Project

Our project aims to simulate space navigation through a network of stars, employing and comparing various pathfinding algorithms to determine the most efficient routes.

By creating a scalable model of the galaxy as a graph, where stars are nodes connected by edges representing possible travel paths, we can simulate the navigational challenges a spaceship might face.

What We Will Explore:

Implementation and comparative analysis of multiple pathfinding algorithms, including but not limited to A*, Dijkstra's, and Greedy Search.

The impact of gravitational wells or other astrophysical phenomena on algorithm performance and path selection. (optional)

Algorithmic efficiency and accuracy in various spatial configurations and under different navigational constraints.

What We Will Not Explore:

The engineering and design specifics of spacecraft.

In-depth astrophysics beyond the necessary elements for pathfinding simulation.

Real-time or onboard navigation systems for actual space missions.

Plans of Action

Thus far, we have:

- Conducted a preliminary review of pathfinding algorithms and their applications in various fields.
- Identified the path finding algorithm as our primary focus, due to its efficiency and applicability to a wide range of scenarios.

Moving forward, our plans for the next 3 weeks include:

- **Week 1:** Finalize our research on the path finding algorithm and start developing the simulation environment. We aim to complete the basic setup, including star system modeling.
- **Week 2:** Implement the path finding algorithm within our simulation. Begin testing with simple star configurations to ensure accuracy and efficiency.
- **Week 3:** Introduce complexities such as gravitational forces and test with more complex configurations. Start optimization and refinement of the algorithm to handle these added challenges.

Your Data

SIMBAD (the Set of Identifications, Measurements, and Bibliography for Astronomical Data) is an astronomical database that provides comprehensive information on objects beyond the Solar System. Managed by the Centre de Données astronomiques de Strasbourg (CDS) in France, it is a critical resource for astronomers worldwide, offering data on stars, galaxies, exoplanets, and more. Users can search for objects by name, coordinates, and various other criteria, accessing a wealth of information including spectral data, proper motions, and bibliographic references.

For more detailed information or to conduct a search in the database, the SIMBAD website can be accessed at:

http://simbad.u-strasbg.fr/simbad/