Project Proposal of *Space Panther*

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# Platform

Both team members will be using C/C++ and windows in this project. Platform will be Android.

# Summary of the project including the open source APIs used and links to those APIs

## Synopsis (MVP)

This is a N-body physics based celestial body simulator allowing the user to create, observe, and explore a galaxy composed of simple spherical bodies. Orbital data will be entered from dialogs and textboxes. Galaxies can be saved and loaded.

## API Usage

Framework and UI: Unreal Engine 4, <https://www.unrealengine.com>

Linear Algebra: Eigen, <https://eigen.tuxfamily.org/>

Physics: boost::odeint, <http://headmyshoulder.github.io/odeint-v2/index.html>

Relational DataBase: MySQL

# User stories

1: As an astronomy hobbyist, I want to see a galaxy from different angles to get a better sense of its depth. My condition of satisfaction is that I do not need to wait longer than few minutes for the simulation to be rendered and the rendition of the galaxy must allow for views from multiple perspectives/points of view. If simulation takes longer than few minutes, I must have a message suggesting to lower number of planets or try again repeatedly till the rendition is produced.

When user pushes the rotation joystick, the camera should turn towards the expected direction.

When the camera is pointing directly up at 90 degree, it ignore further directions to look up. Similarly, there is a limit at 90 degrees down.

The camera can rotate full 360 degrees left-right with no limits.

When the user pushes the translation joystick, the camera should move towards the expected direction.

When the user pushes abort button, the simulation should stop.

2: as a student, I want to be able to choose any number of planets for the galaxy and enter their coordinates, mass, and velocity for simulation so that I could have a better visual understanding of physically accurate relative position of the planets in my n-bodied galaxy.

Condition of satisfaction and acceptance testing:

I must be able to choose the number of planets that I want to be simulated, must be able to enter their mass:

After the prompt to enter the number of bodies that the user would like to implement if the user enters any positive whole number not equal to zero the second prompt will ask to enter the information for the 1st body and the entry in the database will be made in the table planets with the ids generated for each planet. If the user enters any negative, zero or non decimal number, the prompt will be repeated to enter the any whole number except zero. This error message will appear till the acceptable input is given.

If I entered negative numbers for the mass or coordinates that are the same for the previous body (unless it is the entry for the first planet than coordinates are expected right away) I should be prompted to enter the information again explaining that negative or zero values are not permitted for the mass and velocity and the same coordinates could not be given for 2 or more planets .If I continue using the same information without correcting, the message will repeat till correct information is given.

I must be able to add one or more planets’ information to the previous simulation right away or later if I need/want to. After I entered the information and got my simulation, I will have a choice to add more planets for the simulation. In this case the previous scenarios will apply to the number of the planets I want to add and their numerical information. After I ad entered the information and got the simulation, the entries will be made in the database reflecting the data entered but will not be committed unless I saved the configuration at the end.

3: as a user, I would like to be able to save my galaxy’s information I had entered (such as each planet’s weight, velocity and coordinates) before termination of the app so that I could reuse this galaxy’s information again without entering the data again. Condition of satisfaction: before I terminate the application, I need to be prompted to save my work if I want to.

When the user quits the application, a prompt to save is popped up.

When the user saves a galaxy, the prompt should allow inputting an identifier. Then, a database will be updated to save current galaxy state. If for some reason the connection to the database was not possible, the error message will notify the user that it is not possible to save the state at this time.

If the identifier already exists, a prompt asks the user whether to overwrite.

If overwrite, then the existing entry in the database will be updated. Otherwise, the user can input another identifier.

4: as a user, I would like to be able to use my previous work so that I could continue my work/study. Condition of satisfaction: I need to be able to start the last simulation I had done from where I had left off if I need to/ want to from a previously saved information. If my previous work could not be loaded or I forgot to save it, I should get the message saying that it is not possible.

When the user chooses to load, a prompt shows all identified galaxies in a database. The user can then choose a galaxy to load.

If an invalid identifier is used, a warning will tell the user to input a valid name.

When a galaxy is loaded, data is read from database and the simulator is updated to continue from the state.