

Vanier College

420-204-RE

Section: 00001

Gravity and Orbits - User Guide

Integrative Project in Computer Science and Mathematics

Members' Names:

Steven Hua

Obaidah Kanjou Agha

Fang-Yan Lin

Angela Huynh

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Introduction:

Welcome to this user guide manual of the Gravity and Orbits simulator application.

This application was created in the frame of a 3-4 month long time period that consists of a JavaFX program that implements scientific concepts into a user-friendly, interactive, and easy-to-use application.

There are many aspects to this application. They will be discussed at length in this document.

To use this application, there are no external sources needed. One does not require any previous experience in coding nor need to know any programming language. However, basic English language skills are needed, as well as familiarity with different mathematical and physics concepts such as velocity, mass, time, and so on.

Program Description:

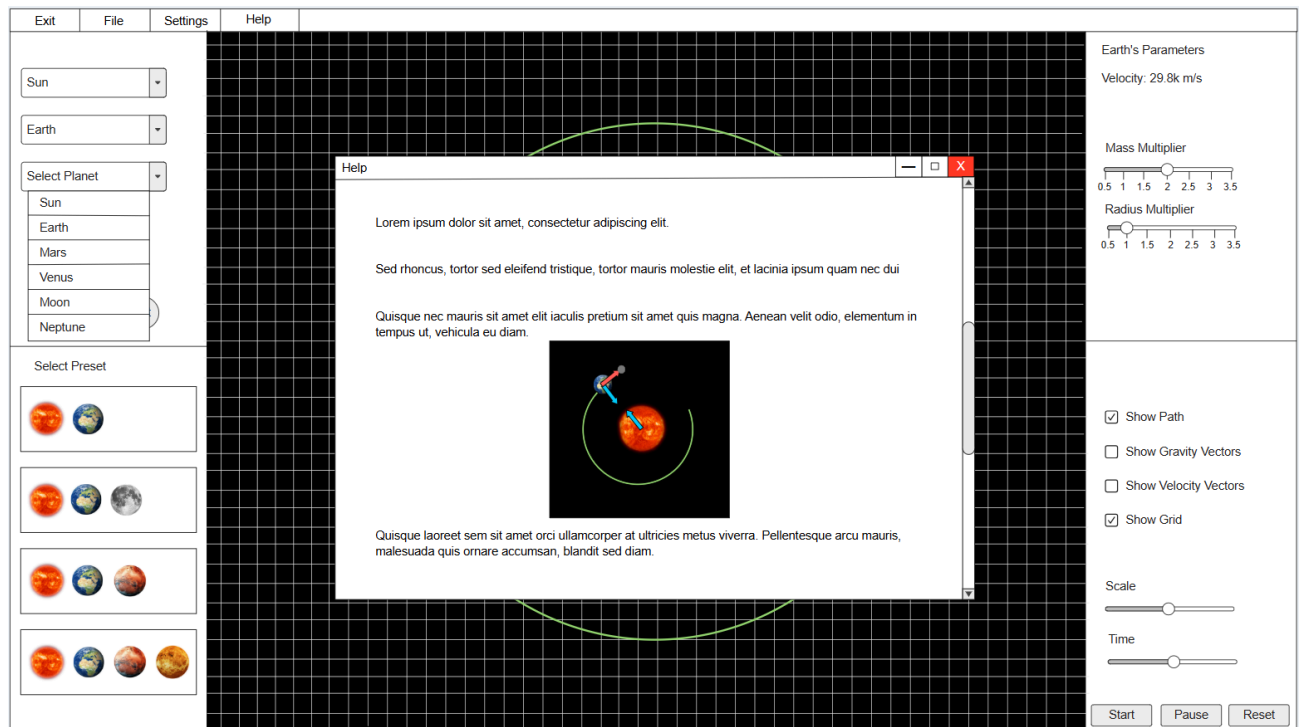
This program is a simulator that provides the user with a visualization of how planets in orbit interact with one another in terms of gravitational forces.

The user is able to select from a range of options to modify parameters associated with each planet choice and observe changes in the motion of the planets.

The program is a JavaFX application built with Maven and includes JUnit testing as well. There were no external libraries or plugins used in the development of the program, besides JUnit libraries.

The application includes multiple menus and menu bars, buttons for enacting functionalities, and panes to display information as needed.

Here is a mockup of how the user interface looks like:



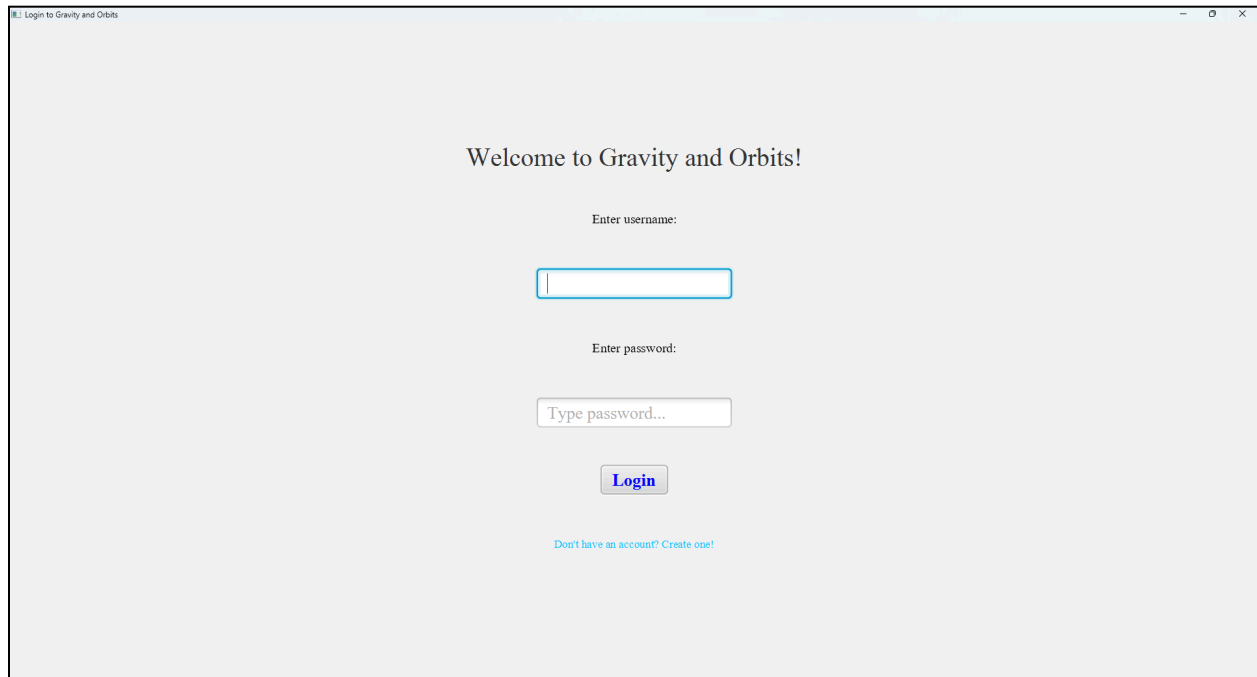
Program Features:

This application contains many features that perform different functionalities. They include the following:

- A menu bar with menus “Exit, Settings, and Help”. Each of these menus opens a drop-down menu that shows options related to the selected menu. The “Exit” menu displays an exit button, upon confirmation of which the application closes. The “Settings” menu allows the user to change the theme to dark or light, or change the displayed language, according to preference. Finally, the “Help” menu displays a window which briefly explains the functionality of the application.
- A left-side menu, with the options of selecting a planet (which opens a window so that the user could input the mass, radius, and velocity values), adding it to the center of the screen, or selecting a preset of planets that are already defined.
- The center screen, where the animation takes place.
- The right-side menu, where the user could view or change the parameters that he/she set for the planets, checkboxes for showing vectors, showing grid lines, or showing the path drawn by the planets, modifying time at which animation plays, as well as starting, stopping, and resetting the animation.

How to Run the Application:

First of all, the user needs to sign in to the application. He must create an account if he doesn't have one, and then login.



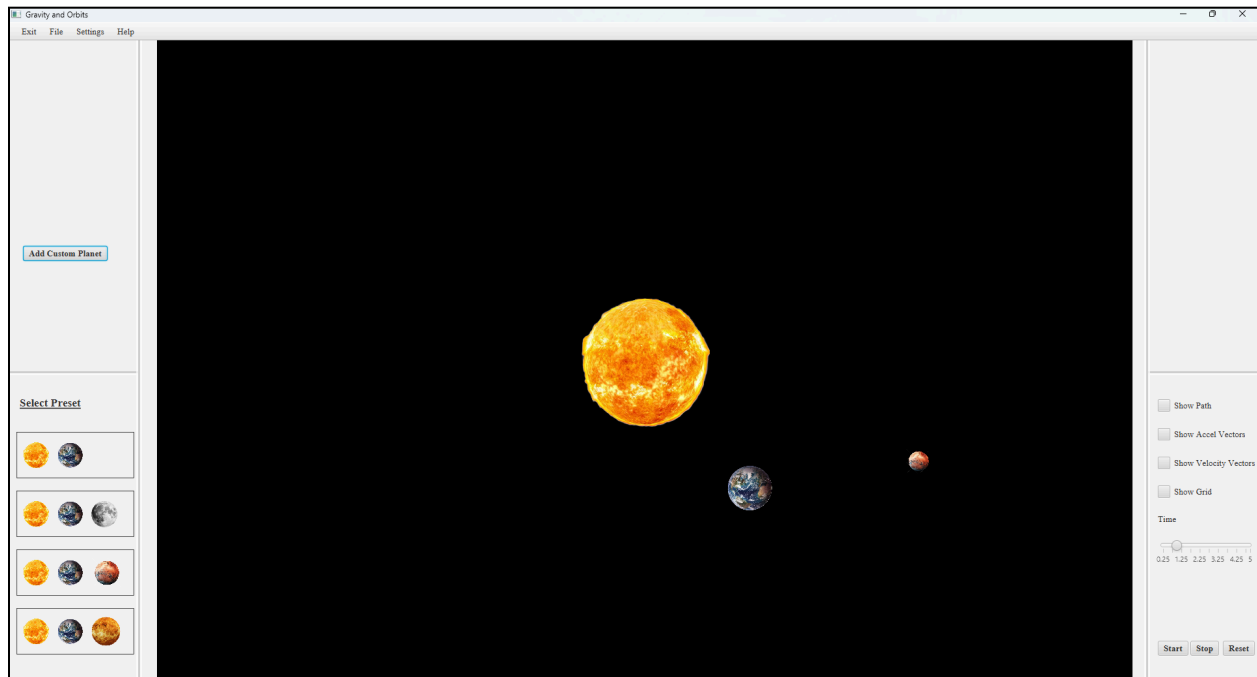
The screenshot shows a web browser window titled "Login to Gravity and Orbits". The page has a light gray background. At the top center, it says "Welcome to Gravity and Orbits!". Below this, there are two input fields: "Enter username:" and "Enter password:". The password field has a placeholder text "Type password...". Below the password field is a blue "Login" button. At the bottom, there is a link that says "Don't have an account? Create one!" in blue text.

In order to be able to properly run the application and benefit fully from the experience it provides, the user needs to first select a planet. This can be done with the help of the “Add custom planet” button on the top-left grid.

After entering the planet's parameters, the user would have to click on the black area of the screen and will thus be able to see the planet appear as selected. If the user enters a wrong value format, then the user can rest assured that the application will detect that mistake and won't apply those values.

In order to pause the simulation, the user would simply have to click on “Stop” in the bottom-right corner of the screen. To resume the animation, then he should click on “Start” right beside the “Stop” button. If he wishes to

reset the entire planet setup, then he must click on “Reset” beside the previously mentioned buttons.



Alternatively, the user may choose one of the pre-defined planet presets that are available at his/her disposal. They can be seen in the bottom-left corner of the screen.

Conclusion:

In conclusion, the Gravity and Orbits application offers the user an opportunity to view the gravitational forces of planets playing in front of him/her, allowing for better comprehension of these often difficult-to-grasp concepts.

After having gone through this guide, you have successfully:

- Learned how to add planets and modify their associated parameters
- Learned how to run the application as intended in order to benefit the most out of it.
- Interactively visualized the physics concepts associated with gravity and planet motion.
- Deepened your understanding of gravitational forces and how the mathematical parameters play into these forces.

In case you may have any questions, concerns, or suggestions, please do not hesitate to contact the members of the team that developed this program.

We wish you a wonderful experience using our application!