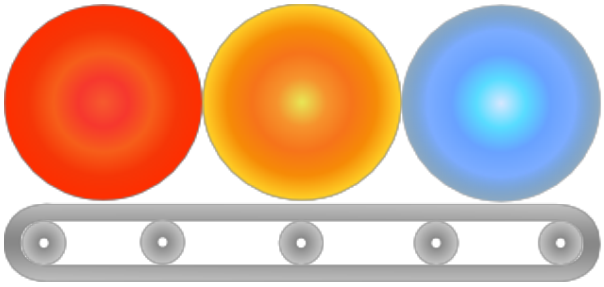
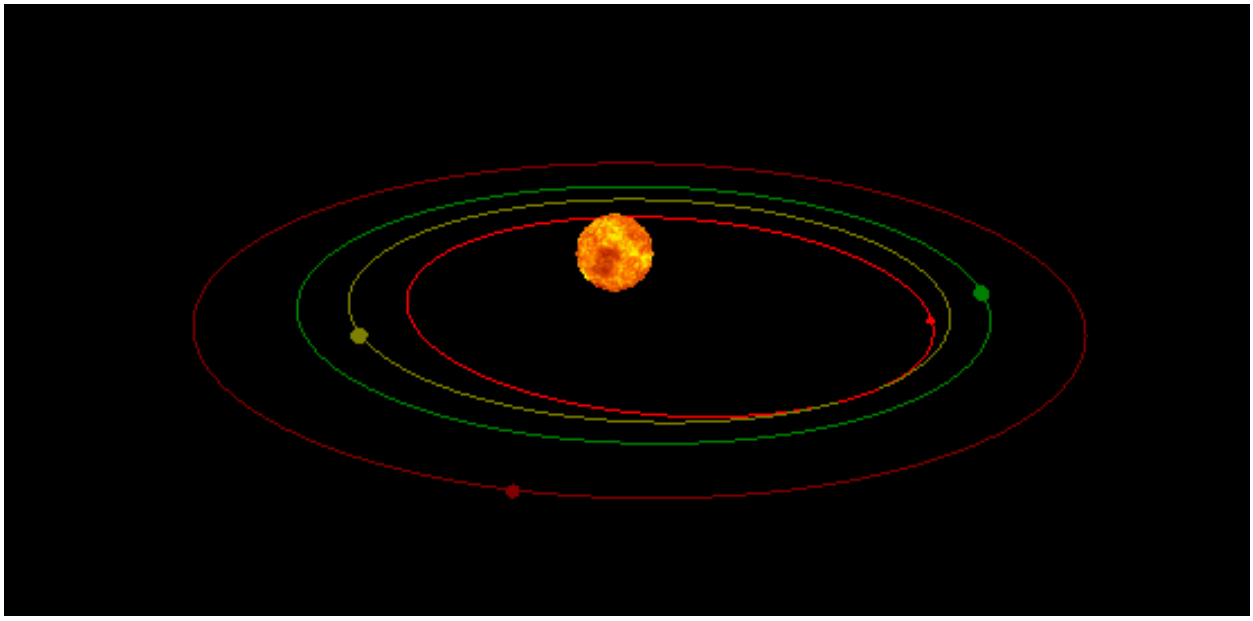


By A. Freitas, B. Lourenço, P. Gusmão and T. Ribeiro

Stellar System Management with Godlike Powers



Executive Summary

- Star Factory is a **Real Time Simulation** where players need to control the growth of a star in order to make stable Star Systems.

- The game is played on an top-down view of the system in **3D**, with the star and the planets all centered on the same plane.

- Players must feed the star with **Chemical Elements** from a limited pool, to affect its **Mass**, **Size** and **Temperature**.

- Players can feed the star a selected amount of elements or throw an asteroid. Throwing asteroids also costs elements. Each time the player uses a type of elements, **it may affect his pool of other elements.**

- The game consists of **multiple levels with different challenges** to master and different objectives to meet. Players get a score at the end of each level acording to how well they did and how many goals they achieved, such as achieving **Target Mass** for the Start, controlling the Star's **Temperature** and **Size** to induce planets on the system to support **Life** or ensuring as many planets as possible survive the growing pains of the Star by managing their orbits.

- Players can throw **asteroids** at the **planets** to adjust their **orbit**. Asteroids can vary in size and are made with the same elements the player must feed to the star. Planets can only sustain so much **impact** from asteroids (or other planets) before being **destroyed**.

- A **map of the diferent levels** that is shaped like a **galaxy** and lights up bit by bit as the player progresses through the levels.

Game Overview

High Concept

You have an entire galaxy that you want to populate with stable star systems. Use basic chemical elements like hidrogen, helium and more to build apropriate stars for each system. Control the growth of the star while keeping an eye on the planets to make sure nothing bad happens to them, such as coliding with another planet or falling into the star. And make sure you don't let your star get out of control and turn into a black hole!

Genre

Star Factory is a simulation puzzle game, where the player must complete the objectives of each level and acquire a high enough score in order to unlock the next level.

Hooks

The possibility of controlling the growth of the system's star, injecting chemicals that will cause changes in its composition, specifically changes in its size, mass and temperature. These changes will cause displacements in the orbits of the planets present in this star system.

Outstanding realistic 3D environments of the universe which allows the player a whole new vision of its creation.

Players can launch asteroids, the main objective of which is to change the current orbit of a planet. The player will have to set the speed at which the asteroid moves towards the chosen planet, this action can potentially save it or, if misused, destroy it.

Players can learn ,while playing ,about astrophysics as well as the life cycle of stars in an inadverted way.

Gameplay Highlights

- Planets can collide with each other, with potentially catastrophic ways.
- Semi-random occurrence of events, such as the appearance of a comet in collision course to a planet, meteorite rain and solar winds.
- When a planet is swallowed by the sun, its chemical composition is transfered to the star.
- You can manipulate chemical elements from the star in order to change its composition and properties.
- Each chemical element is contained in a reservoir, limiting the amount of each element you can use.
- The manipulation of the chemicals is controlled by sliders.
- The orbits of the planets are modified by changes in the mass of the star and by collisions of both planets and asteroids.
- The star burns chemical elements in real time , transforming them in other elements.
- You can inject heavier elements in star in order to get lighter elements. But this can make the star unstable.
- Is possible at any time to see if a planet has the ideal temperature to support life.
- You can choose the direction, speed and the target of an asteroid.

Online Highlights

The game includes a leaderboard with player scores for each level.

Technology Highlights

This game can be developed in native OpenGL, since most of the mechanics rely on the CPU and the graphic aspects are relatively simple.
However, engines such as Unity would provide many of the functionalities need to implement the gameplay. The game is viable in both 2D and 3D, although the best aproach is to treat the mechanics as 2D by setting the game in a plane while rendering it in 3D. Unity supports this, making it a worthwhile investment as it saves a lot in production time.

Art and Audio Highlights

On this topic, this game will require a high level of graphic design because one of the objectives is to give a sense of realism. This requires that the game contains “eye candy” graphics able to achieve this.

These graphics will be used in the art of each environment as well as in all elements present in it, like the planets, asteroids and other elements that appear throughout a level.

Regarding the audio, the game will contain collisions, explosions and other effects that need to be supplemented with audio and eventually will be an important piece to convey the impact of these effects to the player. Despite its importance is not necessary great development at this level because most of these audio effects can be replicate through other existing identical sounds.

Hardware

This game will be developed to run in PC and Smartphone. Having this in mind, we decided to develop a single version that it’s able to run in both platforms.

Production details

Current status

Currently, we have a functional prototype that covers most of the features proposed, having some of them which aren’t in a final state, but it’s still possible to get the idea how these features are going to work in the real game.

The game already starts inside a level where it’s possible to see all the information about the star, such as mass, temperature and the percentage of each chemical elements, the information about the level goal, three sliders that allow the player to manipulate each star’s chemical element, causing changes to the star, a temperature indicator that shows the Earth’s temperature and, finally, a level timer that informs how much time left the player has to achieve the objective. When this timer reaches zero, the level ends with failure, giving the possibility to restart the level.

Furthermore, the game has a 3D top-down view focusing the star of the system, in this case the Sun. The planets orbits are drawn while the planets do a translation motion around the star, but these orbits change everytime there is a change in the star's mass, through the manipulation of its chemical elements, and when there is a collision with another planet or asteroid. Each planet has an health indicator and it is decremented everytime there is a collision with another planet or asteroid. A planet is destroyed when it collides with the star of the system and when its health indicator reaches zero.

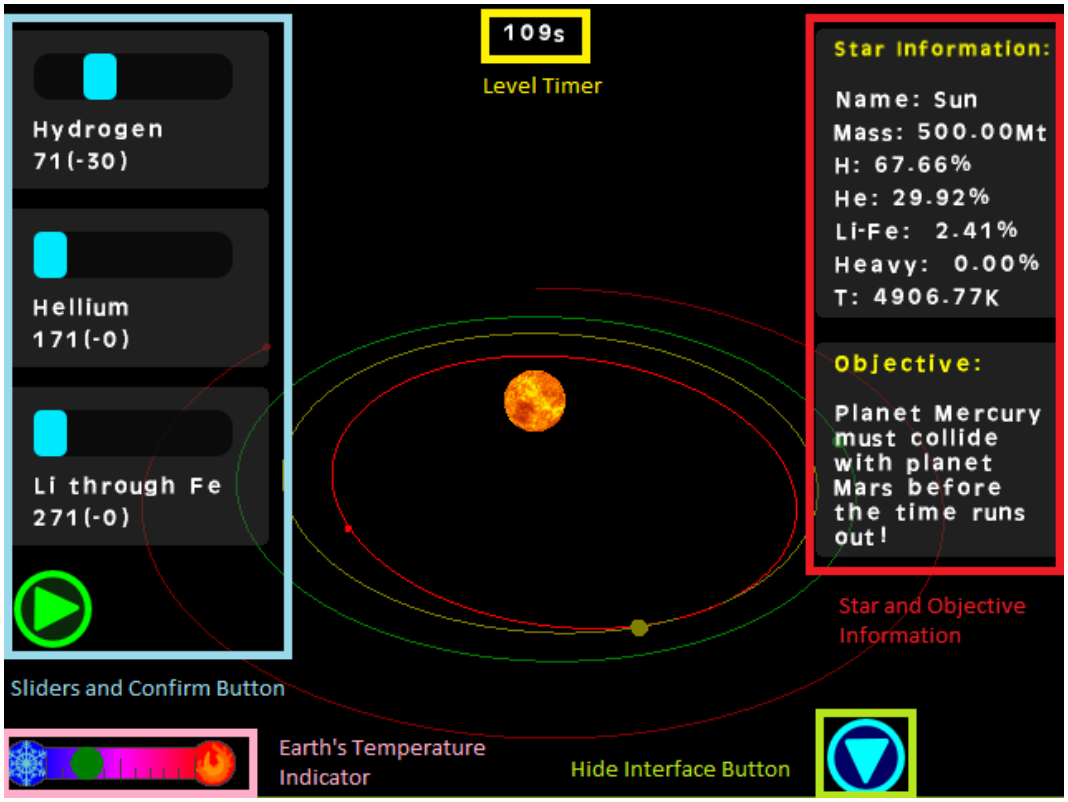


Fig. 1 - Starting screen of a level with brief explanation of the game's interface.

There is a button that hide all the interface of the game allowing the player to adjust the camera the way he feels more comfortable with, by rotating, zooming in or zoming out.

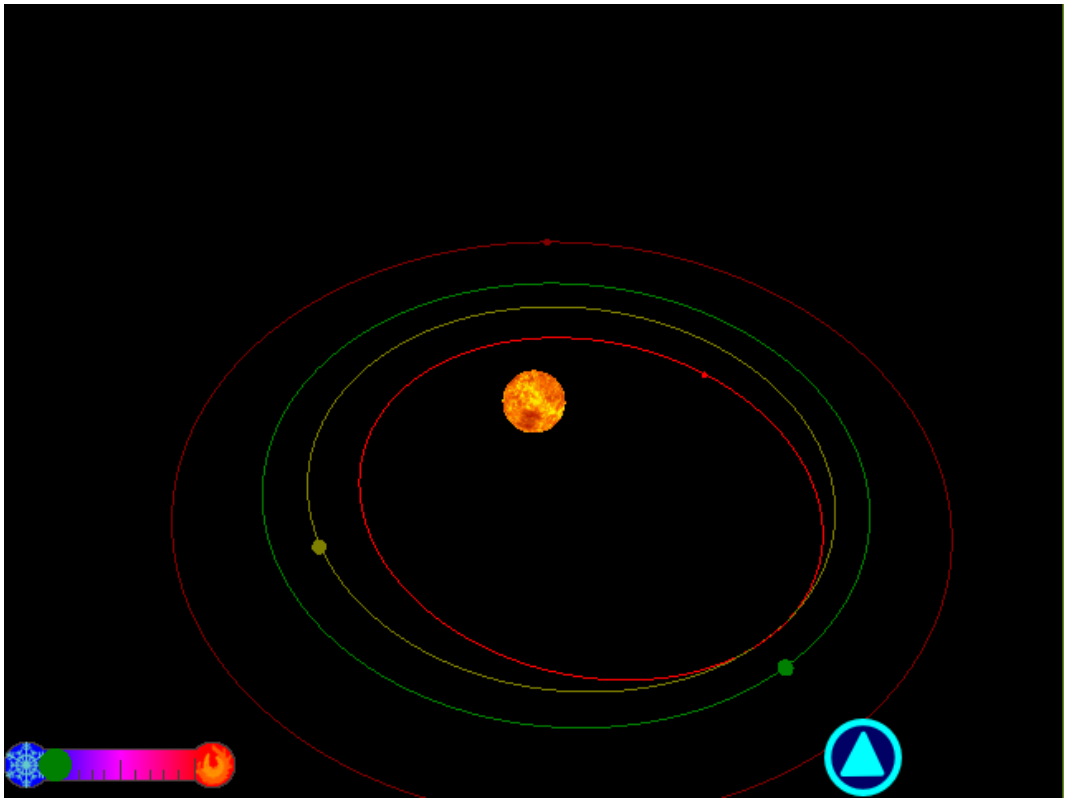


Fig. 2 - Visualization of the star system without aditional information.

The player can click any planet in the system, pausing the game and showing the clicked planet's information. In the planet's window, it's possible to see two different, the blue vector represents the velocity and the yellow vector represents the acceleration of the planet. Still in this window, the player can use the asteroid mechanism by clicking the planet and defining the velocity of an asteroid, which is represent by an orange vector. After defining this vector and there is at least a quantity of fifty on Li-Fe reservatoty, a red icon with a flaming asteroid will appear and by pressing this button the player will initiate the collision between the asteroid and the planet causing a change in the planet's orbit.

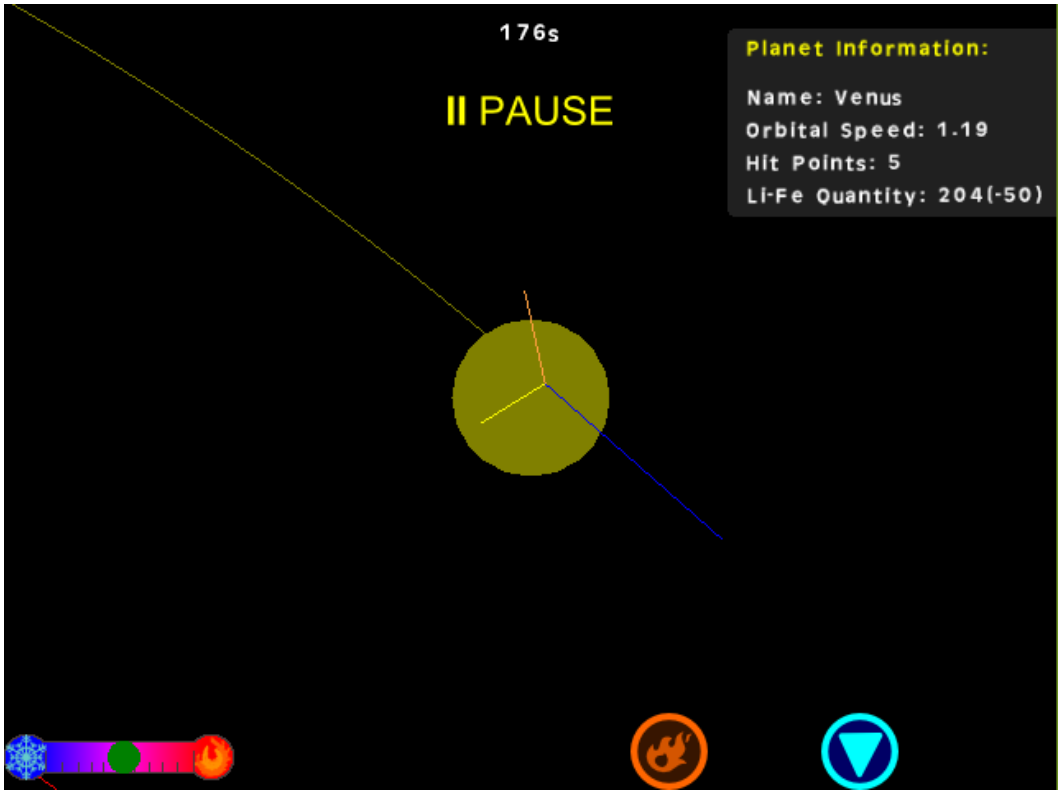


Fig. 3 - Environment visualized by the player after selecting a planet, exemplifying the use of the asteroid mechanism.

The level ends with success if the player achieves the objective and a new window appears with the player's total points. The level ends with failure, if the star explodes, if the player runs out of time or the player can't achieve the objective.

Development team

Alexandre Freitas is a student at Instituto Superior Técnico finishing his Master Degree (MSc) in Information Systems and Computer Engineering, majoring in Multimedia.

Bernardo Lourenço is a student at Instituto Superior Técnico finishing his Master Degree (MSc) in Information Systems and Computer Engineering, majoring in Multimedia. And currently employed by Accenture Technology Solutions as software analyst.

Pedro Gusmão is a student at Instituto Superior Técnico finishing his Master Degree (MSc) in Information Systems and Computer Engineering, majoring in Multimedia.

Tiago Ribeiro is a student at Instituto Superior Técnico finishing his Master Degree (MSc) in Information Systems and Computer Engineering, majoring in Multimedia.

Budget

We estimate that the game can be realized with 46500€. This value includes the work time of the developers, a license for Unity Pro (without Android Pro or iOS Pro, which would add an investment of 3000€) as well as the eventual purchase of graphical or audio assets. This value does not inclide advertising or marketing costs, which can be crucial to the success of the game

Schedule

We estimate that the game can be completed in 9 months.
The first 3 months would be used to develop the core mechanics of the game, creating the bulk of the gameplay.
The following 3 months would be dedicated to building several different levels to include in the game, as well as developing the graphical aspects.
Finally, in the last 3 months the final user testing would take place, in order to polish the whole game experience, both in mechanics as well as graphics. Any marketing of the game should also be done in this stage, in preperation for the release.

Depending on the reception of the game by the audience, as well as the available funds, it would be possible to continue developing aditional levels for the game after launch.

Competition

There are different types of games that are, to some degree, in competition with this game. On one hand, games where the player has a role in which his/her decisions will affect the whole environment around them, to some extent, what are considered God Games.

On the other hand, any game that has as a central theme space or the universe can be considered a competitor, because while the objectives and gameplay may differ, these

games end up overlapping by exploring the same theme. In particular games where the player interacts with planets and stars, and o some lesser extent games that include space travelling.

Then we still have another type of games with a similar frame to ours, where players play through various levels in order to progress while attempting to hit relatively high scores in them.

A few games with the characteristics mentioned above are:

- Planetoid 3D;
- Candy Crush;
- Angry Birds;
- Kerbal Space Program
- Solar Systems also Eat

Game world

Backstory

Dr Starimov, a brilliant inventor, was trying to create a shrinking ray. However, in his first experiment the ray malfunctioned badly and shrunk an entire galaxy, far far away. Dr Starimov was then able to contain the galaxy in a glass sphere, but the process upset the delicate balance of the complex system inside, essentially destrying everything.
Scientists all over the world now want to get their hands on Starimov's galaxy, in order to make all sorts of sordid experiments. But after Dr Starimov retired, before he accidentally destroyed the whole world, it was up to the player, Starimov's apprentice, to use the tools in his lab and rebuild the galaxy, while recording his/her findings in there.

Objective

The player is trying to rebuild the galaxy Dr Starimov destroyed, in order to mend his/her mentor's mistakes and eventually return the galaxy to it's rightful place in space.

Characters

Dr Starimov, the player's brilliant mentor, retired. Because of his scattered mind and erratic methods, he left only scraps of information about the star systems that the player wants to rebuild. In each level the player has access to a few tips and an outline for the goals of the level, as described in the notes that the doctor left.

Progression

The player starts by doing the tasks Dr Starimov left, following the instructions slowly. The farther the player gets in the game, the more he/she will discover about what actually happened that led to the professor's mistake and consequentially his retirement.