National Administration of
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SPACE-APP CHALLENGE

Twinkle, twinkle, little star

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SPACE APP CHALLENGE

CHALLENGE:WINKLE, WINKLE, LITTLE STAR

EQUIPMENT:SAROS GUAJAÜI

Looking at the sky on a clear night we can see the sky with stars, they change colors and brightness, it seems that, even being so distant, they are very alive. But some of these phenomena are atmospheric, much of the brightness variability of a star is due to other factors such as if it is in a double system, there are exoplanets around or even under some characteristics of the star.

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SAROS GUAHAÜI. BUILD YOUR STAR

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ABSTRACT

The following work has**objective**expose a possible solution to the challenge posed by NASA,*shine, shine little star*, whose purpose is to develop a tool to help people learn about stellar variability. The project is**justified**by identifying that people have little or no knowledge about the reasons for the change in brightness of a star.

For this, a video game called Saros Guahaüi has been made. Arm your Star, where the user, through**methods**deductive students will understand the behavior of the variables that allow us to identify the change in brightness of a star, and develop concepts such as light curve or stellar evolution. Finally achieved that he has a development experience that allows him to identify the reasons for the change in brightness of a star and its apparent impact on the human eye.

Keywords: Education, Star Variability, Stellar Evolution, Light Curves, Python.

ABSTRACT

KEYWORDS

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INTRODUCTION

From NASA, the international event SAPCE APP CHALLENGE is conceived, which aims to submit challenges developed by different NASA experts to groups and institutions worldwide, so that students can develop them and provide solutions that contribute to knowledge.

Our group called SAROS GUAHAÜI has participated in the Twinkle, Twinkle Little Stars challenge, in order to teach about the dynamics of stars and their brightness variations.

There are many factors that alter the brightness of a star as a function of time, the most common of these is that of the earth's atmosphere, since we can identify changes on this star with respect to its brightness and color, creating the effect that they are twinkling, however, this factor does not directly affect the star, but rather the observer's perspective. There are other types of stellar dynamics that directly affect its brightness.

For example, a star can be affected by its distance or its age, which for stars with advanced ages can mean its death. Currently there is a scale of values given to the apparent brightness of a celestial body "On the magnitude scale, a very bright star has a magnitude of 1, and the faintest that can be seen with the naked eye is given a magnitude of 6, with binoculars it is possible to see up to magnitude 10 and with the Hubble Space Telescope it is possible to see magnitudes of up to 30" (Torres & Fierro, 2009).

Most of the stars are variable, some, for example, have periods of time where their brightness changes with respect to hours or days, and others, on the contrary, depend on interaction with other celestial bodies. The**problematic**What we have identified is that there is a lack of knowledge and information in an easy and agile way, so that people can understand the dynamics of star brightness variation, and how we can come to appreciate these changes. The**issue**It is based on the construction of a tool that allows us to understand in a simple way all the dynamics that exist behind the variation in the brightness of stars.

Given the above, it**justifies**the elaboration of a game, as an educational tool, that allows its user to understand the different existing types of stellar variability, being a training and informative tool that supports the learning process and becomes the product of the international event Space App Challenge as a tool .

The**objective**arises from the same challenge, since it is exposed as the creation of a tool to help people learn about stellar variability, and we propose a solution through a video game that supplies characteristics of **specific objectives**of the challenge as: a) providing fun and educational experiences b)

help understand that the stars in the sky are constantly changing c) devise or design learning models that improve the user experience.

The**methodology**that allows us to achieve the previously stated objectives is based on using primary and secondary sources of information such as data from NASA, ESA, the Kepler mission, the Mikulski Archive for Space Telescopes, among other sources such as research books and academic articles, compiling the information for the construction of the theoretical framework on the conditions for the variability of the stars and take real data from missions that have accurately detected these variabilities. To use cases that exist in real life represented in the video game.

This document is divided into three parts, in the first part you will find a theoretical framework of information and reference from which the research was based to carry out the development, in the second part you will find information about the event, the research group and its concept. for the creation, and in the third and last part you will find information on the design and functionality of the game.

THEORETICAL FRAMEWORK

VARIABLE STARS

They are a type of star whose luminosity is not constant, their luminosity changes are often given by internal factors of the star, however there are also some variable stars whose variation is defined by celestial bodies that interact with it, this implies that the stars variables are going to represent a fairly large group since I will have as many categories as possible variations. (Astropedia, nd)

Among them we are going to delve into some of the main ones among them: pulsating variable stars, rotational variable stars, cataclysmic variable stars, eclipsing binary variable stars (García, 2012)

PULSING STARS

They are stars that have a change in the dimensions of their outer layers which causes them to have changes in their temperature, therefore in their luminosity it is a variant

CATACLYSMIC STARS

The vast majority are binary stars or that belong to a system where their energy interacts and causes that in slight cuts of time there is a light variation due to the same interaction of their system.

ECLIPSING BINARY STARS

They are a pair of stars that have a stable system, in which each one orbits the other, in order to understand the light variation of this pair of stars, we need to have the earth as the observation point and realize those "eclipses" that you have when there is a collinearity of the stars with our planet

SPACE APP CHALLENGE

The Space App Challenge is a hackathon organized by NASA and other space agencies, and brings together thousands of people around the world using open data. For this year, 22 challenges have been carried out, among which issues of astrophysics, climate, diversity, programming, space exploration, among others, are addressed.

The challenge we have developed is called*shine, shine, little star*and consists of developing a tool that shows people how active and dynamic the stars are, through the analysis of light curves, using strategies that provide a fun and educational experience.

SAROS GUAHAÜI

That is why we have created the SAROS Guahaüi group, the concept has been built in the following way, the members of the group are part of a research hotbed called SAROS, the research hotbed is part of the mathematics program of the Sergio Arboleda University in Bogotá , and being members of this group we recognize in their name, on the other hand, the concept of Guahaüi comes from the Muisca language[6]and it means Deer, there is a cosmogonic representation of the Guahaüi and ASASAC explains it, on the website "El Cielo para los Muiscas" in the following way:

> The deer or guahaüi in the Muisca language represents the heart of the sky embodied on Earth, this being keeps in its memory the information of the universe, of each star, in its eyes you will find the legacy of hundreds of years of observation of the firmament. (ASASAC, undated)

And this is where the relationship between the name of the group and the objectives of the selected challenge is found. Well, our goal as a group is to transmit the information of each star, and how these are so dynamic and changing in their own environment.

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[6]It is an Amerindian indigenous people that has inhabited the Cundiboyacense plateau and the department of Santander, in the center of the current Republic of Colombia, since approximately the 6th century BC (Wikipedia, sf)

LOGO SAROS GUAJAGÜI

The logo has been designed based on the GUAHAÜI concept, as a new constellation of variable stars.

SAROS GUAJAHÜI – THE GAME

https://youtu.be/9NMLCaEcQQY

DESCRIPTION

The game works as follows, when you start the App you will be able to see the constellation of the Deer, this constellation is not yet visible, because you will have to build variable stars to identify it, the first thing you must do is design a star, and you will find a menu with three selection options. Create, map and exit.

TO CREATE

In the create option you can have a star, and enter parameters to modify conditions of mass, age and size. Under these parameters you can modify your star, the game by default shows you a light curve graph (This graph corresponds to a variable star). And a star without major changes or variations in its behavior. By making adjustments to the variables you will find the light curve to which the example corresponds.

MAP

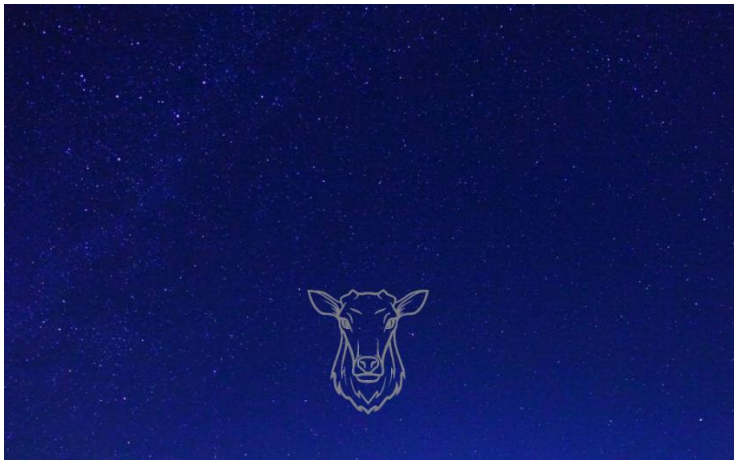
Once your first star is unlocked, you can see the first star of your deer constellation reflected, now you will enter the Map option, in this option you will find the stars that you are unlocking, the deer horns correspond to the progress of the game and the constellations that you are creating.

LEAVE

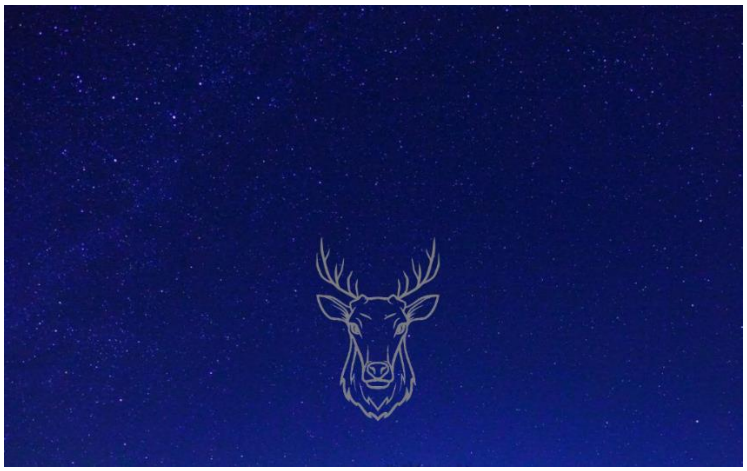
Finally we find the option to Exit will end the game

GAME PROGRESS

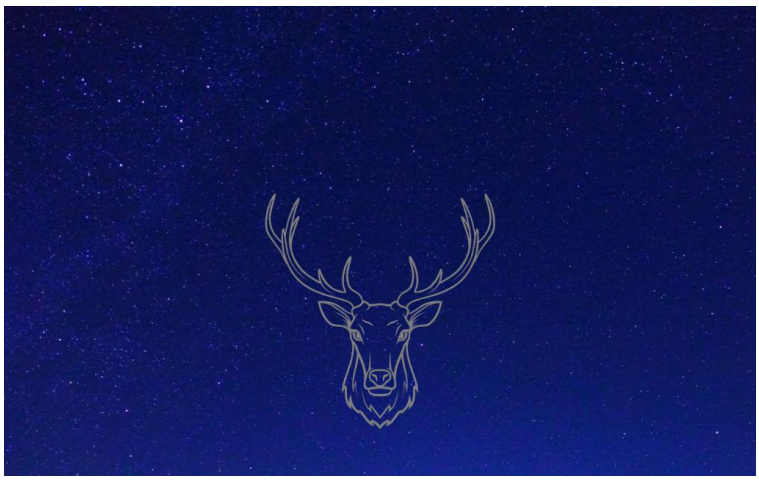
At the start of the game, the deer constellation will not have horns, as these will appear as the game progresses.



Starting the Game



Advanced level



Expert level

The program has been developed in Python

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