

**Hackathon NASA Space Apps Challenge 2023**

**TEC DE MONTERREY SONORA NORTE**



## **Zoi: Beyond The Unreal**

### **Challenge**

**Habitable Exoplanets: Creating Worlds Beyond Our Own**

### **Team Name**

**UltraNova**

### **Team Members**

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SEDE TEC DE MONTERREY SONORA NORTE

**DETAILED DESCRIPTION**

**Project Title:**

Zoi, Beyond Unreal

**Logo:**



**Challenge:**

The challenge, called “Habitable Exoplanets: Creating Worlds Beyond Our Own”, consists of researching exoplanets and designing our own habitable world. For the Jupiter level of this challenge, our team created a detailed three-dimensional rendering of a habitable exoplanet, along with a passage about what life would be like there. Our mission as a team is to design and envision what life and ecosystems in these exoplanets would be like, and what NASA’s view from the Habitable Worlds Observatory would be like.

**Short description of the challenge, ¿How do we solve it?**

The universe is still a mystery for humans, for thousands of years our predecessors have looked at the stars and wondered what could be out there. In the last 60 years our knowledge about the universe has increased at an incredible rate, but there are still hundreds of questions yet to be answered. The main focus of this challenge is to portray an image of what we imagine a life-sustaining exoplanet could look like based on what we know so far about other planets and astrological conditions. With this challenge, we will envision what it would be like to explore one of these planets and be able to experience the wonders of nature.

Our approach for this challenge is to create a 3D rendering of our exoplanet to give every user the opportunity to visit another planet that can sustain life. The user will be able to visit several different locations to experience the natural attractions our exoplanet has to offer. The user will live a beyond unreal experience, something in the boundary between science and fiction.

## **Background**

An exoplanet is defined as any planet outside the solar system, they come in all shapes and sizes, ranging from rocky to gas giants. All the exoplanets are made by elements in our periodic table, however they are contained in different proportions as earth. All of these differences can lead to conditions such as glass rain, toxic atmospheres, and all kinds of environments. Exoplanets have been primarily discovered by the Kepler Space Telescope, and with the help of some indirect methods of detecting the presence of a planet, scientists are able to estimate their size and mass. With this kind of data, scientists can estimate temperatures, light levels, and the color of the sky. Since when they were first discovered in the 90s, thousands of exoplanets have been identified, most in a relatively small area of our galaxy (NASA, n.d.). As diverse and varied the exoplanets are, we still haven't been able to confirm life in any of them, however there are still millions of more exoplanets to discover and more information to learn about the ones we have already found. In the ever-expanding universe, the chance of Earth being the only planet capable of hosting life is incredibly small, so we must keep our eyes and minds open.

## **Justification**

The curiosity for what lies beyond our skies has fuelled humanity for thousands of years. From mythology to astronomy, people have observed the night sky since the dawn of time to look at stars light-years away. Thanks to the advances of science, humanity has been able to learn more about them and have a better understanding of what exactly exists above our heads. With the help of powerful telescopes we have been able to discover planets, stars, satellites, asteroids, and galaxies.

The main objective of this challenge is to provide a perspective or point of view on how an exoplanet could sustain life and how it might look like. Our project consists of providing the user the unique experience of exploring the surface of a different planet. The user will be able to move around exoplanet *Zoi* and enjoy the natural beauty of our exoplanet in a first person point of view. The views will showcase some of the planet *Zoi*'s unique features, like its indigo toned sky, caused by its type k star. The user will be able to explore some of *Zoi*'s biomes, including its tropical forest, the volcanic ranges, and frozen polar regions.

- The polar zones are cold and frigid, with -90°C temperatures, nitrogen vapor waterfalls and large glaciers.
- The volcanic zones have thermal waters, dark and rich soil because of volcanic activity, and snowy mountain and volcano tops because of their elevation.
- Tropical zones are made up of several small islands with beaches, with wet and humid weather.

NASA is a pioneer in the research of exoplanets. To make its information more easily accessible, NASA has created an online exoplanet exploration site, called Exoplanet Travel Bureau, where users can see a 360° visualization of the landscape from an exoplanet. This simulation is limited to a few exoplanets and includes some stars, exoplanets and information tags. Our project, along with showcasing an exoplanet with a biosphere, will provide the user a first-person perspective as well as the ability to walk and move around the exoplanet's environments. This unique simulator implements high quality 3D rendering for a detailed view of the amazing natural phenomena present in *Zoi*.

## **Objectives**

Our team's main focus is to use NASA's publicly available information about exoplanets and earth to help us create a scientifically accurate model. We created a planet with all the necessary requirements for it to be habitable and realistic. Our objective was to develop a fully rendered 3D model that is accessible and navigable to provide the user with an immersive experience designed to portray a planet capable of sustaining life.

### **Delimitation**

Because our main objective is to develop a realistic exoplanet capable of sustaining life, we researched what a planet needs to sustain life and make it habitable, which includes elements present in the atmosphere, being in the goldilocks area of the star they orbit, the planet's mass and density, the sky and climate, amount of water, the influence of other celestial bodies, as well as the abundance of Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorus and Sulfur. We combined all of these factors and conditions into a planet and made sure to include everything needed to sustain life.

### **Theoretical Support**

The exoplanet is called Zoi, named after the Greek word for life. It is found within the goldilocks zone of its solar system, slightly leaning towards the outer edge of this zone. Zoi orbits an orange dwarf star also known as a type k, named Asteria after the word star in Greek. This star is both smaller and colder than our Sun, which translates into Zoi having an overall colder environment than Earth, with temperatures frequently reaching -80°C in its poles. A large portion of the planet's surface is covered by water, further decreasing the planet's temperature. The exoplanet's atmosphere is rich in nitrogen reaching a concentration of 90 PPM, it is thicker and denser than Earth's, which has allowed water to remain within the planet and allows for the greenhouse effect to maintain the exoplanet's temperature at a livable temperature, another factor is magma's distribution, since there are areas where magma is concentrated underneath the surface, volcanic eruptions, thermal waters and geothermal energy are incredibly common. Because of a combination of the star and the atmosphere's qualities, the sky will be a light blue closing on violet. Similarly, because of the chemical composition of the soil and the volcanic activity, the planet's surface will be colored as its indigo oceans and jade vegetation, combined with volcanic zones being long stretches of black soil and the frigid poles like white, frozen deserts. The planet has very prominent geothermal activity, further stabilizing its temperature, but making it have numerous active volcanic mountain ranges. Because of its exposure to Asteria, the climate near the equator is tropical in nature, with high humidity and lush vegetation. Relative to the Moon, Zoi's natural satellite, Filiá, is bigger, and its effect on Zoi's oceans make tides and waves bigger. Filiá has ice and nitrogen rings, a narrow and hazy band surrounding it when seen from Zoi's surface. The plants will absorb high quantities of nickel and iron, letting the plants have thick stems and leaves, a reduced growth, and tolerance to drought and contamination.

### **References:**

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