

# SpaceVR: Virtual Reality Space Science Outreach Experience

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Figure 1: A prospective student exploring the Sun within SpaceVR using the Oculus Quest.

## ABSTRACT

Teaching people about Space concepts is challenging with traditional text book and teaching methods. It is hard to encourage prospective students with these traditional methods as they lack engagement and interactivity. We have developed SpaceVR which is a VR application that provides high school students with an engaging outreach experience about Space Science. The application uses real images of the sun from NASA’s solar dynamics observatory satellite to create an interactive digital Sun for students to explore. The project investigates if adding gamification elements will increase student engagement with Space Science outreach efforts.

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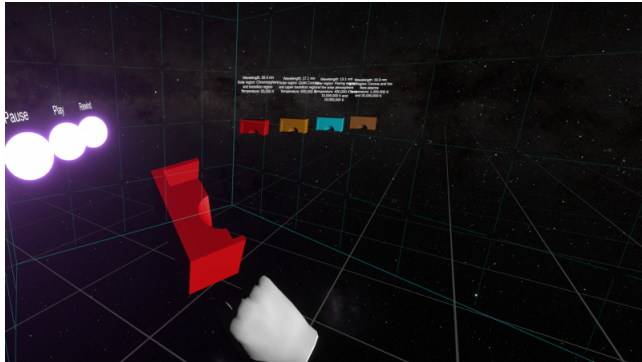
## 1 INTRODUCTION

VR experiences exist on a spectrum ranging from purely entertainment through to training and education. Many VR applications exist along this spectrum such as Valve’s VR game “The Lab” [7], Christchurch Airport’s VR training application [1], and “The Body VR” that teaches students about the biology of human beings [4]. Somewhere in the middle of this spectrum lies VR experiences for engagement and outreach. These experiences are not aimed to train their players in a new field but try to interest them in a topic they have not been exposed to before. *SpaceVR* (Figure 1) aims to position itself in the middle of this spectrum by providing an engaging outreach experience around Space Science targeted at high school

students. Engaging high school students in Space Science can help inspire students to pursue a career in STEM subjects.

## 2 SPACEVR

SpaceVR (Figures 1 and 2) is a VR experience that can be used to engage high school students with the basics of Space Science, in particular, the Sun and Solar Phenomena [6]. There are many resources that teachers can use to teach Space Science, but SpaceVR



(a) Solar filter goggles.



(b) Holding Control Item.



(c) Selecting Solar Event.

**Figure 2: SpaceVR – interaction controls, showing filtering, controlling items and selecting specific solar events.**

aims to create an alternative approach to interest students in learning about Space Science giving them the skills required to help solve major issues facing humanity. Previous research has shown that getting students interested in STEM can be facilitated with VR engagement tools [3]. There are two aspects to explore for this research project. One aspect is investigating if scientific data can be integrated into the SpaceVR application to provide a more engaging experience using data from NASA’s Solar Dynamics Observatory (SDO) satellite [5]. Without scientific data, the Sun is visualized by a designer’s interpretation. The other aspect of the project is investigating if the addition of gamification elements [2], especially narrative, increases the engagement of the experience. SpaceVR has been developed with the Unity Game Engine and Oculus Quests.

Figure 2 shows the high level interaction capabilities of SpaceVR including: data filtering by physical interaction, simulation control by throwable user interface elements, and dynamic solar event selection. Figure 2(a) shows the 3D interactive user interface elements that are used to choose the wavelength in the electromagnetic spectrum the Sun is visualized in. By raising the solar filter to the user’s face, the user can then select which part of the electromagnetic spectrum of the Sun is displayed. Different wavelengths highlight details in different parts of the solar atmosphere. Figure 2(b) shows a control item being thrown at the virtual Sun. The pause control allows for inspection of individual solar images by pausing the simulation. Players can also directly interact with the virtual Sun by reaching out and rotating it with their hands. The simulation automatically adjusts to player movement, adjusting which image of the Sun is shown based on their position. This feature provides a convincing effect that the player is really walking around the Sun. Figure 2(c) shows the event selection interface. SpaceVR has 13 different solar events that can be viewed, ranging from solar flares to coronal mass ejections [6]. This allows interesting phenomena to be shown and for students to learn what happened during these solar events.

In summary interactive VR experiences such as SpaceVR can help students learn about STEM subjects in particular Space Science by providing a more engaging experience than traditional tools with the hope that VR will encourage students to study some of the big issues facing humanity such as climate change. Our future work involves evaluating our tool with prospective students during a series of outreach events on our university campus, and to add more planet experiences to create a more comprehensive application exploring the Solar System and beyond.

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