

## Space Exploration and Education using Virtual Reality

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### ABSTRACT

Traditional methods of learning in the form of books and chalks are now-a-days being taken over by the e-Learning methods. For more understandability and memory power, Visual representation of any subject plays an important role. Thus, instead of teaching the subject capturing the information about space and the space objects traditionally, an environment is created in this product to enhance the feel of the overall theory which would end up grabbing more attention of the students increasing their grasping power. The simulation is made under the technology famously known as “Virtual Reality”, which helps one create an immersive environment. The environment allows one to move around in the space as well as open up the details about any specific planet. The external elements needing are a VR Headset and a Pointer. Also, VR compatible devices might prove necessary.

**Keywords :** Environment, Simulation, Virtual Reality, Space Exploration, VR Headset

### I. INTRODUCTION

The **definition of virtual reality** comes, naturally, from the definitions for both ‘virtual’ and ‘reality’. The definition of ‘virtual’ is near and reality is what we experience as human beings. So the term ‘virtual reality’ basically means ‘near-reality’. This could, of course, mean anything but it usually refers to a specific type of reality emulation. The world is known to humanity senses and perception systems. Basically a human being is having five senses: taste, touch, smell, sight and hearing. These are, however only most obvious sense organs. The truth is that humans have many more senses than this, such as a sense of balance for example. These other sensory inputs, plus some special processing of sensory information by our brains ensures that we have a rich flow of information from the environment to human minds. Everything that we know about our reality comes by way of our senses. In other words, our entire experience of reality is simply a combination

of sensory information and our brains sense-making mechanisms for that information. It stands to reason then, that if you can present your senses with made-up information; your perception of reality would also change in response to it. You would be presented with a version of reality that isn’t really there, but from your perspective it would be perceived as real. Something we would refer to as a *virtual reality*. Although it is an era of technological advancements and growth, Traditional methods are seen when it comes on the educational platform. That is, we still depend on books for theoretical knowledge, when it is scientifically proven that humans tend to understand things more clearly when learnt through visual means. Thus, masses are seen preferring online material for grasping concepts faster. What if there was a way that students could learn their favorite subjects through immersive extensible visualized platform? That’s what we want to achieve through our project, where we will be creating such an astronomical representation of solar system that will

enable you to visually and immersive experience space, and not only that, you can travel to every planet and actually feel what the atmosphere of that planet is like along with all the astrophysical projections of the same. The purpose is to create a Virtual Reality based simulation app with the intention of replacing the traditional learning methods with a more interactive and immersive way. Additional benefits are that Virtual reality helps better understanding of some complex problems through visual immersion which will revolutionize the learning experience of the school going students. This product will be targeted at the educational institutes for providing the product to school going students at a very reasonable cost. This will surely revolutionize the education system.

## II. RELATED WORK

The structure of any simulated environment depends upon two things:

### Objectives:

The overall environment must have an objective when it comes to a learning part. For example, a person in this very simulation tends to move on to the planets and explore the various portions it has. Also, the overall system is viewable making it easier for the user to explore through it and examine the planetary objects.

### Reality of the environment:

This portion also counts as a key portion of any environment. For example, the visual feel of the planets and their terrains in this very product is meant to be very real and dynamic. The overall structure of the planets is made as much as possible to be a replica of the real one. As it is an environment in Virtual "Reality", it is ought to be real enough.

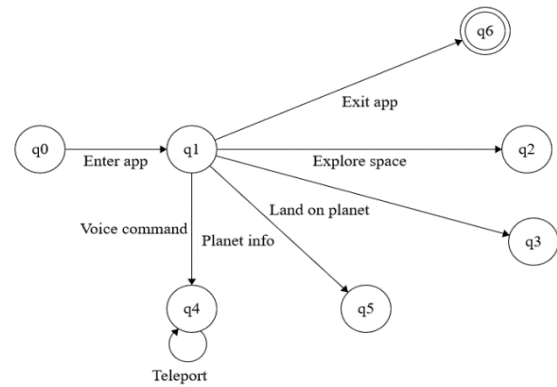


Fig 1: Mathematical Model

There are overall 4 major modules which are as follows:

### 1. Space Exploration:

User can explore whole solar system and all the celestial bodies within it. The responses are based on controller input provided by user. The only requirement for space exploration is user based input from the controller

### 2. Planet Exploration

User can explore each planet individually and experience their environmental conditions, gravity etc.

The responses are based on controller input provided by user.

The only requirement for space exploration is user based input from the controller.

### 3. Planet Information:

User can obtain general information of each planet from a dialogue box which pops up on the screen. The only requirement for space exploration is user based input from the controller. The responses are based on controller input provided by user.

4. Voice Recognition:

User can explore whole solar system and all the celestial bodies using voice recognition model. The responses are based on a controller button to activate the voice recognition. The only requirement is a microphone.

**III. SOFTWARE TESTING**

SR.NO	TEST CASE	DESIRED OUTPUT	ACTUAL OUTPUT
1	Select begin option from main menu using selection tool	Loading screen must appear and the experience should start	Loading screen appears and the experience starts
2	Planet selection to explore the inner cores of the planet using selection tool	The planet core must be visible with respective labels.	Planet cores opens up through animation with respective labels.
3	Textual information of respective planet using selection tool (right half click).	And information panel must appear containing the information respectively.	And information panel appears containing the information respectively.
4	Landing on the planet by selecting the explore button on the	The user must land on the selected planet.	The user lands on the selected planet.

	information panel		
5	Perceiving gravity through jump on the planet.	The player should jump after clicking the right side of the touchpad.	The player jumps after clicking the right side of the touchpad.
6	Teleportation function through voice recognition	The teleportation panel must appear after saying the word "teleport"	The teleportation panel appears after saying the word "teleport"
7	Returning back to the space from the respective planet by looking into the sky and selecting the option.	The user must return back to the space .	The user returns back to space.

Table 1: Test cases

**IV. TEST RESULTS**

The testing of the aforementioned cases was performed and results were as following.

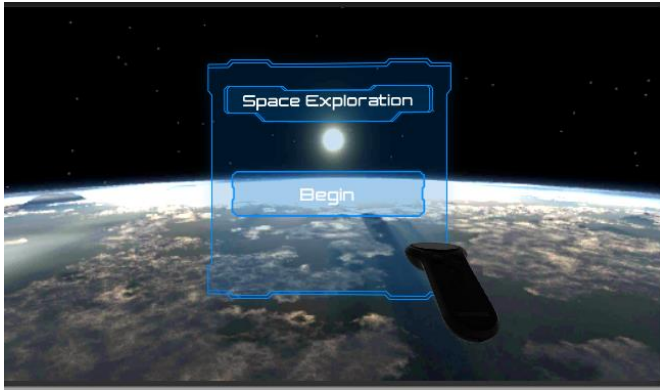


Fig 2: Inception of the Environment

a) The very initial stage of the simulation captures a Menu asking for the exploration to start. It provides the option of initiating the simulation. Also, from the first portion of the app itself the user has to use the touchpad.

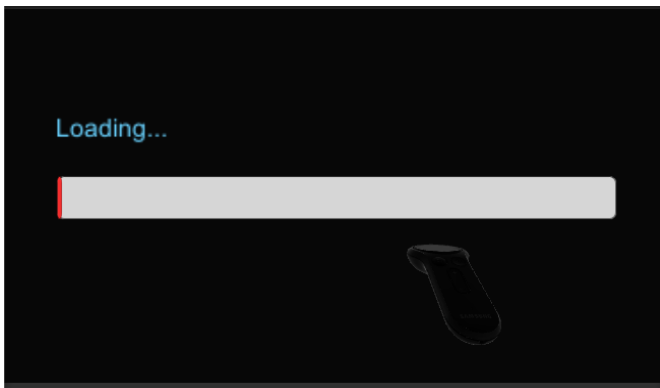


Fig 3: Loading Screen

b) The earlier stage is followed by a loading screen which inputs all the data necessary for the simulation to start. Basically just like loading a game, it takes tad bit less amount of time. It does not feel like a glitch nor does it make the user lose interest in the simulation. The loading bar is clearly visible and makes a good image of the application in the users' minds.

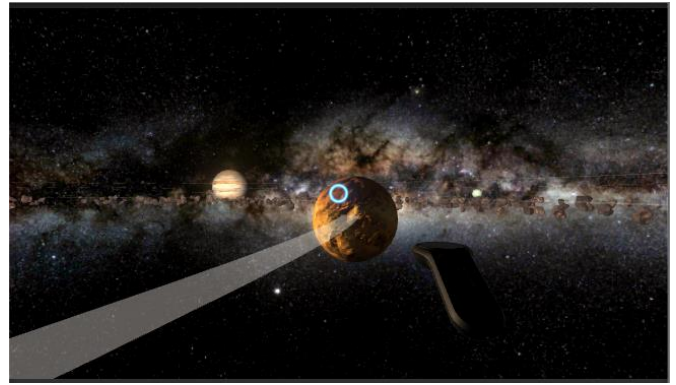


Fig 4: Simulated Space Environment

c) The user then is immersed into the environment. The environment has a clear space feel to it, along with the very minute details of each planet. As the user moves around, the planets' details start to become even clear and visible. Also, the planets are not stationary, they keep on revolving around in their orbits. The immersive feel of the environment is kept intact.



Fig 5: Explore Tab

d) When the user hovers over a planet, the following option panel opens up which provides the user a chance to explore the planet.

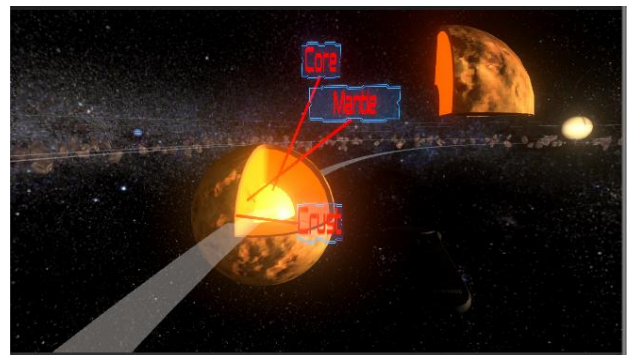


Fig 6: Detailing of the planets

e) The details of each and every planet are visible once the EXPLORE tab is selected. The details are to the point and informative. No exaggeration is seen. Also, liveliness of the parts of the planet make it interesting for the user to view the details.



Fig 7: Terrains

f) The user may even enter the terrain of the planet by moving into the planet. The terrains are built good enough to understand the environment present at the planet. The right side the touchpad makes the user jump into the planet and view the terrain. For example, the terrain of EARTH is likely to be real. Provides a good view of the environment and all the important terrain aspects of the planet.

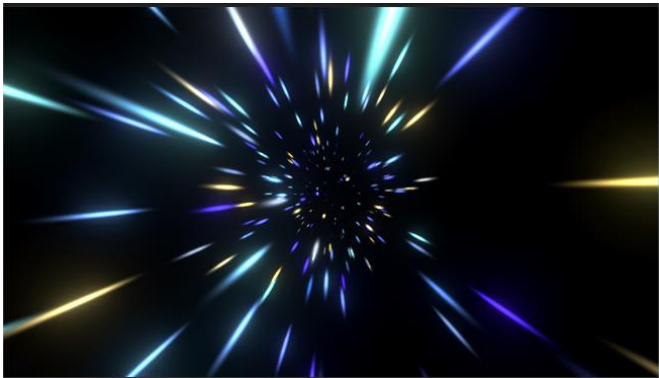


Fig 8: Teleporting simulation

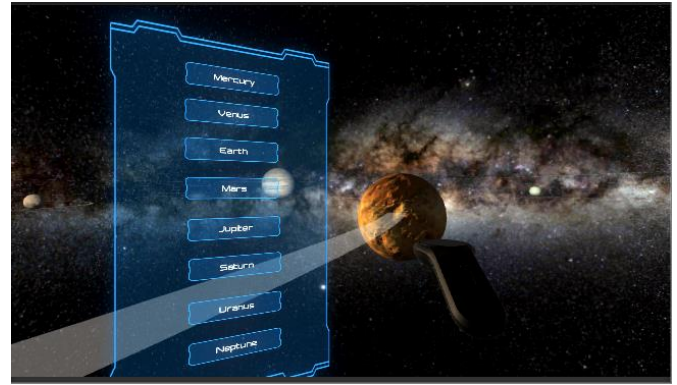


Fig 9: Teleport Tab

g) The user doesn't need to move and hover through the system always if any planet is far away. The user may select the TELEPORATION tab and by the voice command "Teleport" the user will be able to reach the planet of choice. This tab is efficient as the time consumed while travelling to other planets across the system is saved. Also, the animation while teleporting gives a space feel. It does not just make a planet appear in front of the user but makes the user feel like actual teleportation is being performed. It also plays a key role in the simulation.

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