

An Interactive Mars Experience Using WebXR Technologies

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Abstract

This project aims to create an immersive experience set on the planet of Mars using WebXR technologies. To achieve this data gathered from research conducted by outside parties will be used to simulate the geography with which users can interact alongside commanding a virtual replica of a Mars Rover. This experience will focus on using the WebXR API's ability to support virtual reality environments and will explore the potential benefits that virtual reality may have on education.

Declaration

I, Kyle Dick confirm that this work submitted for assessment is my own and is expressed in my own words. Any uses made within it of the works of other authors in any form (e.g., ideas, equations, figures, text, tables, programs) are properly acknowledged at any point of their use. A list of the references employed is included.

Signed: Kyle Dick

Date: DATE OF SUBMISSION.

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Introduction

This project aims to understand the benefits of an immersive virtual reality experience on an individual's ability to learn new concepts. To explore this a virtual reality environment based on the planet Mars will be developed that the user can explore and interact with, through these interactions the intent is for a greater understanding of the planet to develop within the user.

To measure the effect that this experience has on learning about the Mars environment a control group will also be involved who will be tasked with a traditional learning task, in this case it will be a document which contains facts about the planet which are present within the virtual environment. At the end of both the traditional experience and the virtual experience participants will be required to answer a questionnaire which tests their knowledge of the planet. The results of this quiz will be compared to investigate if the virtual environment proves to be a positive enhancement to learning.

Background

The idea of Virtual Reality Learning Environments (VRLE) is not a new concept and has been explored by other researchers in various industries. The most prominent use of VRLEs is within healthcare.

Requirements Analysis and Research Methodology

The project will be divided into several segments allocated to time periods.

The following “milestones” were used to plan the project timetable found later in the document.

Create a 3D environment which can be explored in virtual reality

The first milestone focuses on creating the basic foundations from which the rest of the project can be built upon.

This includes

- Object Loading
 - The act of loading in an asset for the explorable plane, this will initially be a flat simple geometry such as a long cuboid but in the final build will be a complex surface accurately representative of the martian surface.
- Lighting
 - Creating a lighting system where the origin can be manipulated.
 - This would simulate a day/night cycle for the environment.
- Mesh
 - Allow the user to be able to walk upon the plane and have their position transform accurate to the geometry of the mesh
- Interactive Elements

- This will include sourcing a physics engine for the project to handle the user manipulating 3d objects in the virtual space
- Examples of this in the final build would be the user's ability to pick up a rock from the surface and throw it where the trajectory is accurate to the martian environment.
- WebXR API integration
 - Connecting the user's perception to a camera object within the virtual space.
 - This will allow the user to move within the virtual space and should account for motion sickness and the ability to fall back on the monitor output.

The end goal of this step will produce a featureless 3D environment from which it could be molded into one accurate to the martian environment.

Developing the Learning Material and Questionnaire

Once the basic foundation of the virtual environment has been laid the next step is to develop the learning material. This refers to the facts about the Mars environment that the test groups will be asked about in the conclusion of their experiences.

The main objectives of this section includes:

- Compiling the research information that has been gathered on Mars into what will be included in the experiences.
- Creating an Information document which the control group will use to learn about Mars.
- Creating a questionnaire which both groups will complete after their respective experiences.

A concern in this area is that there are many different learning mediums. Reading a paper, watching a video and listening to a lecture are all very different experiences. As it stands right now this project only compares virtual reality with the 'Reading a paper' experience which isn't the most engaging. Perhaps look into developing different mediums for members of the control group.

Recreating Mars

This section of the project is focused on taking the foundation from the previous step and building upon it.

This includes

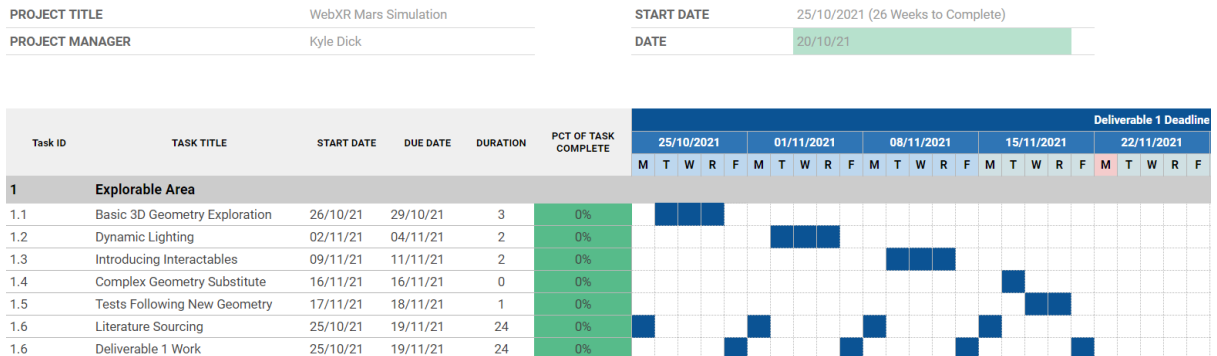
- Mapping martian texture to the terrain mesh
 - Sourcing accurate data that represents the different types of surfaces that can be found on the planet.
- Creating a skydome

Evaluation Strategy

Project Management

Project Timetable

Mars Gantt Chart



Risk Analysis

Consideration of Professional, Legal, Ethical and Social Issues

Due to this project working with the general public consideration needs to be taken in regards to their health and wellbeing throughout their experiences. Specifically when interacting with the virtual environment as the real environment is hidden so injury is a risk. Beside injury from accidents in the real world while operating a virtual reality headset, virtual reality sickness is also a factor that needs to be considered.

Participants will be able to terminate their involvement at any point within their experiences to avoid discomfort or injury.

The virtual reality environment may require the use of third party assets, due to this attention must be paid to copyrighted material. Any asset that is used must be kept in the public domain.

No software developed for this project will be for profit.

This project will more than likely involve handling data related to the participants and as such must comply with the Data Protection Act 2018¹

¹ "Data Protection Act 2018 - Legislation.gov.uk."

<https://www.legislation.gov.uk/ukpga/2018/12/contents/enacted>. Accessed 26 Oct. 2021.