Earth Science Virtual Reality Field Trip Lab Software

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Abstract

The objective of this research project is to develop an efficient, realistic, and immersive Virtual Reality (VR) experience for Earth and Environmental Sciences (EAES) students at Douglas College to practice geological mapping techniques in a virtual setting. The VR experience will simulate a geological mapping lab and allow students to practice the process of mapping geological features of an environment in a virtual setting prior to an off-campus field-trip.

Introduction

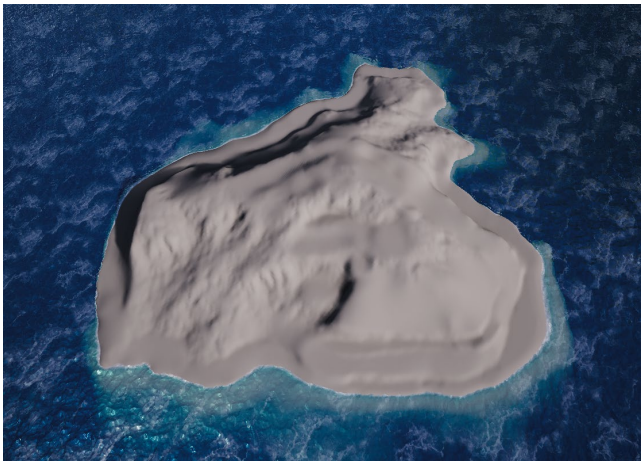
In this research project, we are developing an educational Virtual Reality (VR) experience for EAES students at Douglas College. The aim of this project is to develop an efficient, realistic, and immersive VR experience that can improve the learning experience of EAES students.This report includes the implementation details of the VR experience, future extensions, and user manual.

Requirements

- VR-Ready Laptop/Computer
    - Equipped with Oculus desktop app for linking the headset and PC
    - Acceptable GPU power: GTX 1060 equivalent or later
- Internet Connection
    - To Download/Update Software if necessary
- USB-C Cable
- VR Headset (Meta Quest 2)
- 2 x Touch Controllers

Implementation Description

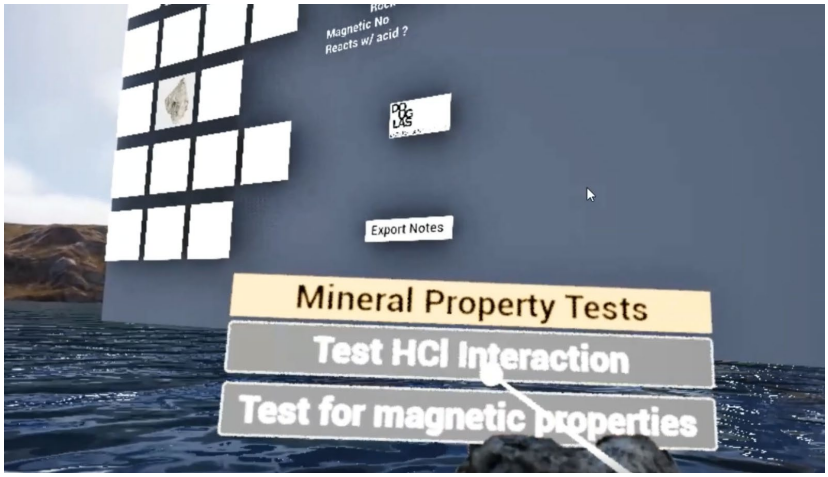
Map



The map was a 3-step process. First, the terrain was to be sculpted to add height and depth to resemble an island. Once the island terrain had been established, the next step involved painting the ground with various textures to add realism and visual interest. Finally, tree foliage was scattered through the island to bring some vegetation.

Rock Samples

The rock samples implemented into the program allows the user to pick up and test rocks in various ways, providing an immersive and engaging experience. The process of implementing these rocks involved having a high-definition 3D scan of the rock or finding one off the internet.



Journal

The implementation for a journal system was meant for user-convenience, it allows the program to store test results done on the rock, like testing for magnetism or reaction with acid. These results can then be exported and viewed on an excel spreadsheet without having the user take off the VR headset often. Below is an image of the prototype of the journal.

Future Extensions

More Interactive Elements

- More rocks to identify
- Addition of tools such as a ruler or compass

More Diverse Environments

- Addition of other environments where different types of rocks would be found

Multiplayer Option

- Groups can join a single session using multiple VR headsets

Summary

The VR experience developed in this research project simulates a geological mapping field-trip and allows students to practice the process of mapping geological feature of an environment in a virtual setting prior to an off-campus lab. The VR experience is developed using Unreal Engine 5.1 for the Meta Quest 2 headset. Future extensions aims to make the experience more interactive and realistic.

License and Attributions

Rock type 1 (gneiss):

Gneiss1: Granitoid Gneiss by EDUROCK Aalto University is licensed under CC BY 4.0

Gneiss2: DalEES_Struc_Flt004 by Mike Young, geoScotia, Dalhousie University is licensed under CC BY 4.0. / Triangles and vertices have been reduced.

Gneiss3: Gneiss / RU Geology / by Grace Psenicska, distributed by Dr. Parvinder Sethi is licensed under CC BY 4.0.

Rock type 2 (shale):

Shale1: Rock X by GSGEQueens is licensed under CC BY 4.0. / Triangles and Vertices have been reduced.

Shale2: Sedimentary Sample by MSU GGP is licensed under CC BY 4.0.

Shale3: Tidal Rhythmite, USA by Sara Carena is licensed under CC BY-NC 4.0. / Triangles and Vertices have been reduced.

Shale4: Burrows in mudstone, Germany by Sara Carena is licensed under CC BY-NC 4.0 / Triangles and Vertices have been reduced.

Rock type 3 (limestone):

Limestone1: Limestone by EDUROCK Aalto University is licensed under CC BY 4.0.

Limestone2: Organic Limestone by EDUROCK Aalto University is licensed under CC BY 4.0.

Limestone3: Dolostone, Spain by Sara Carena is licensed under CC BY-NC 4.0. / Triangles and Vertices have been reduced.

Rock type 4 (granite):

Granite 1: Granite by University of Queensland EAES is licensed under CC BY 4.0. / Scale ruler has been cropped from model.

Granite 2: I-type granite by University of Queensland EAES is licensed under CC BY 4.0. / Scale ruler has been cropped from model.

Granite 3: I-type Granite by University of Queensland EAES is licensed under CC BY 4.0. / Scale ruler has been cropped from model.

Granite 4: I-type Granite by University of Queensland EAES is licensed under CC BY 4.0. / Scale ruler has been cropped from model.

Rock type 5 (basalt):

Basalt 1: Basalt by EDUROCK Aalto University is licensed under CC BY 4.0

Basalt 2: Lava by EDUROCK Aalto University is licensed under CC BY 4.0

Basalt 3: Vesicular Basalt by University of Queensland EAES is licensed under CC BY 4.0. / Scale ruler has been cropped from model.

User Manual

Launching the CR Trip Application

1. Launch the Oculus desktop application and turn on your headset.
2. Setup may be required. Simply follow the steps prompted for either wireless (AirLink) or wired connection on the Oculus app and headset.
a. For Douglas College headsets, there is a Meta account login associated with each of the college-owned headsets. Contact CEIT for information.
3. Within the headset, navigate to Settings > Quest Link > Launch Quest Link
4. If successful, the VR-environment should change to a large, white grid plane.
5. Launch the EAESVR application from the windows desktop.

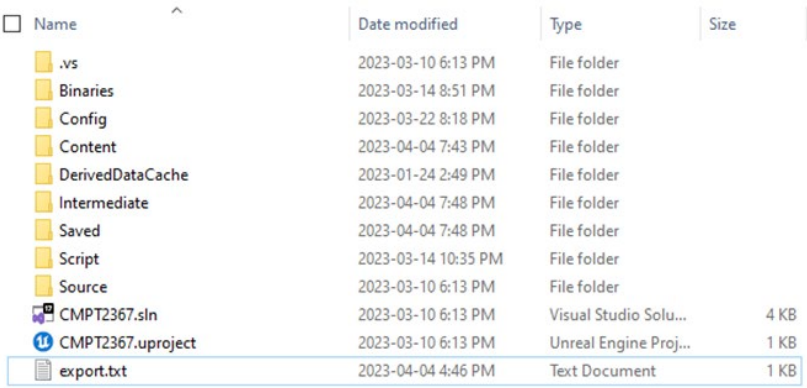
VR Controls

Left Analog Stick	Adjust Facing Angle
Y-Button	Open Interactions Menu
X-Button	Open Interactions Menu
Rigth Analog Stick	Move
B-Button	Open Settings Menu
A-Button	Open Map
Trigger Buttons	Menu Interact
Grip Buttons	Grab Objects

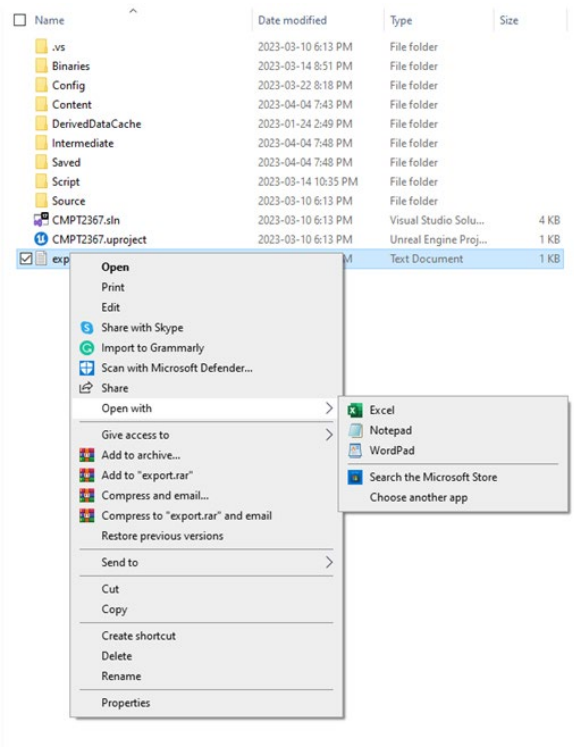
Importing VR Data into Excel

Method 1

1. Find the “export.txt” file inside the Program folder

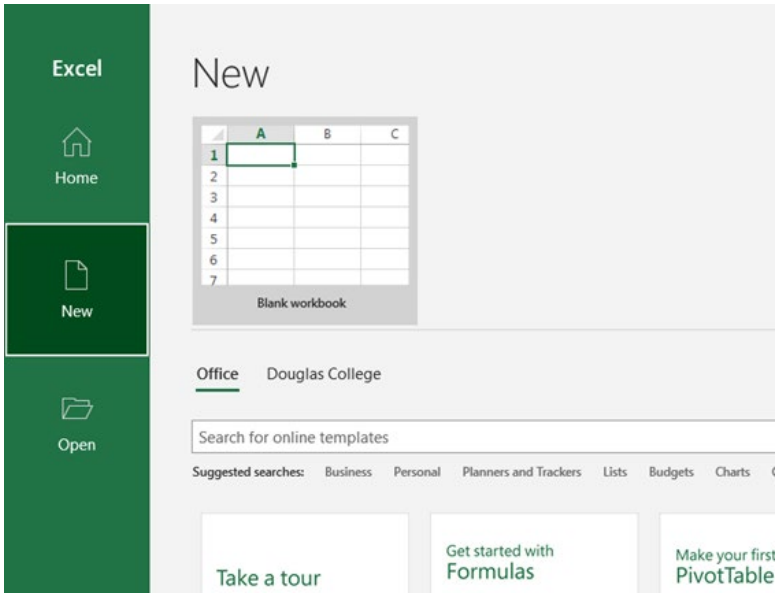


2. Right-click and open with Excel

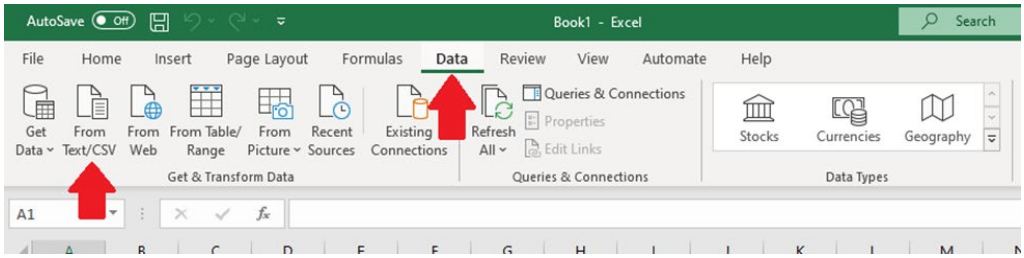


Method 2

1. Open a blank workbook in Excel



2. Go to the Data tab and click From Text/CSV



3. Find the “export.txt” file and import