Team Name: Neurologica VR

VDS: Draft Proposal

Product Name: VISUALIZE Data Structures

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Executive Summary

This document serves to host the specifications for the design and implementation of the "Neurologica VR: VISUALIZE Data Structures" application. The purpose of the application is to introduce the concepts of data structures as they relate to computer science through the unique and interactive platform of virtual reality. This solution addresses the lack of education in this topic and other similar topics to students in an academic setting. The application will offer an immersive learning experience for students or free learners, and a supplementary resource for educators to teach and grade their students. The goals of the project include:

- developing the application in Unity for execution on the Oculus Quest platform

- developing a Node.js backend application to manage web requests

- developing a website for the organization.

The Node.js backend application will be used for web requests to a database either through the application or website. The website will offer information about the application and organization, the ability to download applications, and a user system for registered users to change their account information and view the lessons they've completed and quiz results.

Application Overview

Business Objectives

Key	Summary
VDS-87	Provide free learners with a resource to learn about data structures
VDS-88	Provide students with a unique environment to learn in
VDS-89	Provide educators with a new tool to teach their students
VDS-90	Allow educators to grade their students with the application
VDS-91	Research the use of virtual reality applications for educative purposes

User Stories

Key	Summary	Linked Issues
VDS-103	As a User, I want to make an account, so I can save my progress and quiz scores.	VDS-125
VDS-105	As a User, I want to make an account from within the Unity Application, so I don't need to shut down the application.	VDS-125
VDS-106	As a User, I want to create an account from the Web Browser, so it is available when I use the Unity Application.	VDS-125
VDS-107	As an Admin, I want to make changes to the database from my personal terminal, so that I don't have to log into cPanel.	VDS-126
VDS-108	As an Admin, I want CRUD operations to the database to be secure, so that data isn't manipulated.	VDS-127, VDS-128
VDS-109	As a User, I want information being stored on the server, so that my progress is saved.	VDS-129
VDS-110	As a User, I want information being stored on the server, so that my quiz scores are saved.	VDS-129
VDS-111	As a User, I want to see my progress information from within the Unity Application, so that I know what I should learn about next.	VDS-129, VDS-130
VDS-112	As a User, I want to be able to initiate a password reset from within the Unity Application, so that I can recover my account information.	VDS-132
VDS-113	As a User, I want to take quizzes from within the Unity Application, so I can better learn from the VR lessons.	VDS-133
VDS-114	As a User, I want to be alerted if a server error occurs in the Unity Application, so that I know the issues are not caused by me.	VDS-134
VDS-115	As a User, I want tips about lessons to be available to me, so that I can better understand the lessons.	VDS-137
VDS-116	As a Student User, I want my quiz results emailed to me after completing lessons, so that I can store or submit them to my teacher.	VDS-138
VDS-117	As a User, I want the ability to skip to sections of lessons after I've viewed them at least once, so I can save time.	VDS-140

VDS-118	As a User, I want the ability to reset my quiz attempts to repeatedly take quizzes.	VDS-142
VDS-119	As a User, I want my quiz resets stored, to maintain the integrity of my scores for my teacher.	VDS-142
VDS-120	As a User, I want access to my user account from within the Web Browser, so that I can access my records outside of the Unity Application	VDS-144
VDS-121	As a User, I want to access my quiz scores from within the Web Browser, so that I can view or download them.	VDS-139
VDS-122	As a User, I want to learn about the organization, so that I can understand what they offer.	VDS-145
VDS-123	As a User, I want to learn about the Unity Application from the website, so that I can understand its benefits.	
VDS-124	As a User, I want to download the Unity Application from the website without requiring a registered account, so that I can access it on my computer.	
VDS-131	As a User, I want to initiate a password reset from the Website, so that I can recover my account information.	VDS-132
VDS-135	As a User, I want to be alerted of server errors on the Website, so that I know when a problem occurs.	VDS-136
VDS-183	As a developer, I want all the scripts and code to be organized and well documented to help maintain clean, understandable, optimized code	VDS-187
VDS-184	As a developer, I want all the required functionality of the Unity application to be documented so that I can meet all needs of the project	VDS-187

Non-Functional Requirements

Key	Summary	Linked Issues
VDS-93	The website must contain terms & conditions with standards used for virtual reality applications.	
VDS-94	The unity application must be fully available without the need for user registration.	
VDS-95	The application must maintain a 60-90hz refresh rate when running on the Oculus Quest.	
VDS-97	The server application and database shall be deployed to and hosted by Bluehost.	
VDS-98	The unity application shall support the Oculus Quest VR headset and Microsoft Windows operating system.	
VDS-99	Web requests made by the website and unity application shall handle all relevant HTTP error codes.	
VDS-100	The unity application shall host the same terms & conditions as the Oculus platform it is being developed for.	
VDS-101	The unity application shall host the same health and safety warnings as the Oculus platform it is being developed for.	
VDS-102	Users will be prompted to accept terms upon user registration or using the application without an account.	
VDS-187	All code and unity development processes must be documented and backed up.	VDS-183, VDS-184

Functional Requirements

Key	Summary	Linked Issues
VDS-92	The website must allow users to download the application.	
VDS-125	The system shall allow users to create an account through the Unity Application or Website.	VDS-10, VDS-105, VDS-106
VDS-126	The SQL Database shall allow administrators to make manual changes via a remote terminal.	VDS-107
VDS-127	Manual CRUD operations must be made by administrators only via the Server Application.	VDS-108
VDS-128	Automatic CRUD operations to the Database performed by the User must be contained to functionality within the Website or Unity Application.	VDS-108
VDS-129	The Database shall store Registered Account information such as User ID, Password, Name, Progress, and Scores.	VDS-110, VDS-111, VDS-109
VDS-130	The Unity Application shall present the User with progress information via the UI.	VDS-111
VDS-132	The System shall allow Users to initiate an account password reset via the Website or Unity Application.	VDS-112, VDS-131
VDS-133	The Unity Application shall offer quizzes related to each lesson for Users to complete via a UI panel within the application.	VDS-113
VDS-134	Users shall be alerted of server errors from within the Unity Application.	VDS-114
VDS-136	The Website shall alert Users of server errors.	VDS-135
VDS-137	The Unity Application shall display tips related to the current lesson via a UI panel.	VDS-115
VDS-138	Quiz score information including Score, current attempt number, and attempt resets, shall be generated and emailed to the User after quiz completion.	VDS-116
VDS-139	Generated quiz score documents shall be available for download on the Website, separated by quiz attempt number.	VDS-121
VDS-140	The Unity Application shall allow Users to skip through lesson sections after they have completely viewed the lesson at least once.	VDS-117
VDS-141	Quizzes shall allow for a maximum of two attempts and will keep the highest score of those two attempts.	
VDS-142	The Unity Application shall allow users to reset their quiz attempts, in turn incrementing their resets for that lesson by one.	VDS-118, VDS-119
VDS-143	The system shall store quiz score documents generated before attempt reset and make them available to Users via the Website.	
VDS-144	The Website shall allow registered Users to log in and access their account information, progress, and records.	VDS-120
VDS-145	The Website shall offer information about the organization and products, including the relative Unity Application.	VDS-122
VDS-169	The Unity application shall have an interactable UI	
VDS-182	The Unity application shall allow users to use the application without creating a new account	

Technology & Terminology

Blender – Computer graphics software used for 3D modeling

Bluehost – Web hosting company

cPanel – Web hosting control panel software

DrawSQL – Platform used to create database entity relationship diagrams

ECMAScript – JavaScript standard developed by Ecma international meant to ensure the interoperability of web pages across web browsers

Express.js – Back-end web application and server framework for Node.js

Figma – User Experience Design Tool

GIMP – Open-source raster graphics editor for image manipulation and editing

HTTP – Application layer protocol used to manage requests and responses between computer systems via the World Wide Web

JavaScript – Lightweight, interpreted, or just-in-time compiled programming language which conforms to ECMAScript specification

Jira – Proprietary issue tracking product for bug tracking and agile project management

MySQL – Open-source relational database management system

Node.js – Open-source back-end JavaScript runtime environment which executes JavaScript code outside of a web browser

NPM – Package manager for the JavaScript programming language

Oculus Quest – Virtual reality headset developed by Oculus

SQL – Programming language designed for managing data in relational database management systems

StarUML 2 – Open-source software used to support modeling

UML – Modeling language used in the software engineering field

Unity – Game engine used for 2D and 3D application development

Visual Studio Code – Integrated development environment

Business Processes

Academic Use Case

Current Business Process

The current business process for an academic setting with similarity to our product would be focused on an educator teaching a lesson to his or her class and grading them on assignments related to the lesson material. In most cases, the educator has lessons and assignments in an archive that they've built on during their careers. This process makes teaching new lessons require extra work by the educator. Our product would give supplementary resources to educators to teach new lessons to students and grade them on those lessons in a simple way. The product would also provide students with a unique way to experience their new lesson that their teacher would not be able to provide on their own.

New Business Process
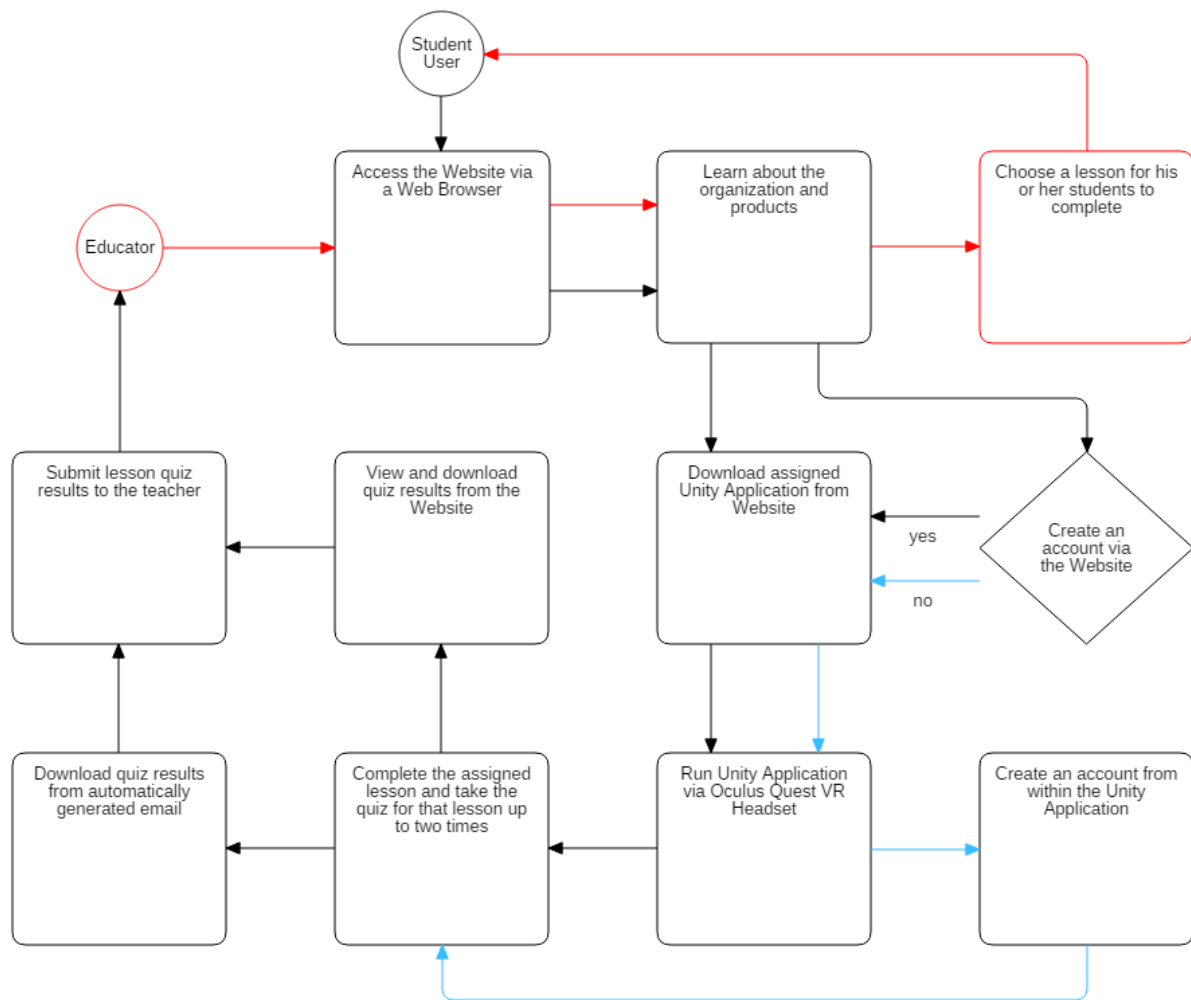
Free Learning Use Case

Proposed Business Process

```
                    ┌─────────────────┐          ┌─────────────────┐
   ╭──────╮         │ Access the      │          │ Learn about the │
   │ Free │         │ Website via     │          │ organization and│
   │Learning├──────▶│ a Web Browser   ├─────────▶│ products        │
   │ User │         │                 │          │                 │
   ╰──────╯         └─────────────────┘          └────────┬────────┘
                                                          │
   ┌─────────────┐  ┌─────────────┐  ┌─────────────┐    ◇ Create an
   │Download quiz│  │View and     │  │Download     │    ◇ account via
   │results from │  │download     │  │chosen Unity │◀───◇ the Website
   │automatically│  │quiz results │  │Application  │
   │generated    │  │from the     │  │from Website │
   │email        │  │Website      │  │             │
   └──────▲──────┘  └──────▲──────┘  └──────┬──────┘
          │                │                │
   ┌──────┴──────┐  ┌──────┴──────┐  ┌──────▼──────┐
   │Reset quiz   │  │Complete     │  │Run Unity    │   ◇ Create an
   │attempts to  ├─▶│chosen       │◀─┤Application  ├──▶◇ account from
   │retake quiz  │◀─┤lessons      │  │via Oculus   │   ◇ within the
   │             │  │             │  │Quest VR     │   ◇ Unity
   └─────────────┘  └──────▲──────┘  │Headset      │   ◇ Application
                           │         └─────────────┘
                           └───────────────────────────────┘
```

Models

Database Diagram

users	
🔑 **userid**	int
password	text
❄ email	text
first_name	text?
last_name	text?

scores	
🔑 **userid**	int
arrays_viewed	boolean
arrays_score	decimal
arrays_resets	int
lists_viewed	boolean
lists_score	decimal
lists_resets	int
binarytrees_viewed	boolean
binarytrees_score	decimal
binarytrees_resets	int
heaps_viewed	boolean
heaps_score	decimal
heaps_resets	int
hash_viewed	boolean
hash_score	decimal
hash_resets	int

drawSQL

Context Diagram

Level 1 Data Flow Diagram
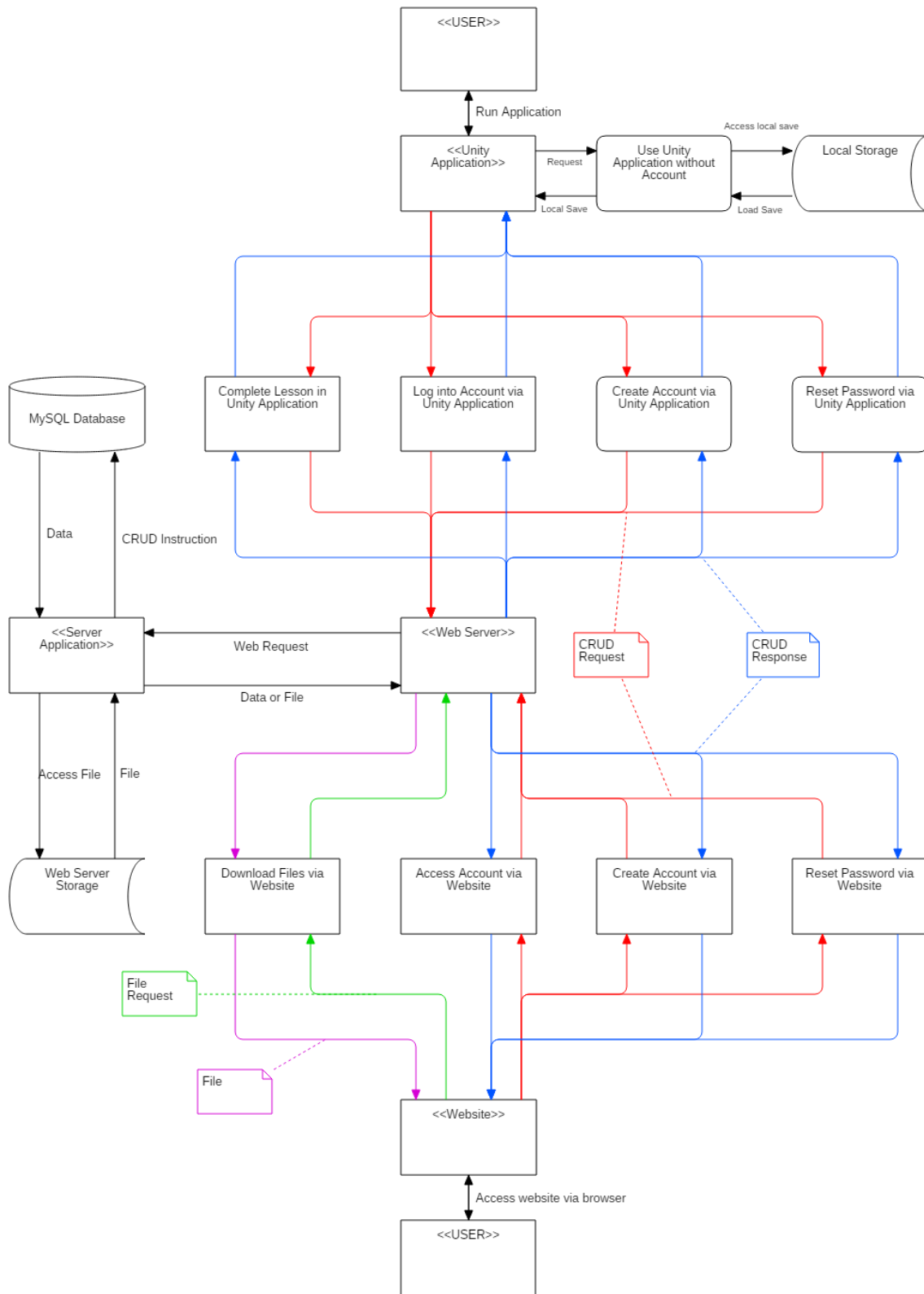
Mockups

Unity UI Mockup

The white space around panels represents the scaled canvas size within the scene of Unity Engine and will be transparent in the application at run time.

Login Menu

Create Account

Forgot Password

Reset Password

Verify Email

Main Menu

Welcome Back ${firstname}!

Progress

> Lesson 1 | **Arrays** (You *completed* this lesson!)

- Lesson 2 | **Lists** (You *completed* this lesson!)

Quiz Score: 93%

Quiz Attempts: 1 of 2

Quiz Resets: 1

> Lesson 3 | **Trees** (You *viewed* this lesson!)

> Lesson 4 | **Heaps**

> Lesson 5 | **Hash**

VISUALIZE
Data Structures   Options   Log Out

Lesson Menu (Lesson 1)

Lesson 1: Arrays   X << || 57%

Guide

Part 1: One Dimensional Arrays >>

Part 2: Multi-Dimensional Arrays >>

Go to quiz

Think about it
- What can you store in an array?

- What are objects in an array called?

- How do you know where things are in an array?

VISUALIZE
Data Structures   Options   Log Out

Quiz Menu

Quiz Menu (Early Submission)

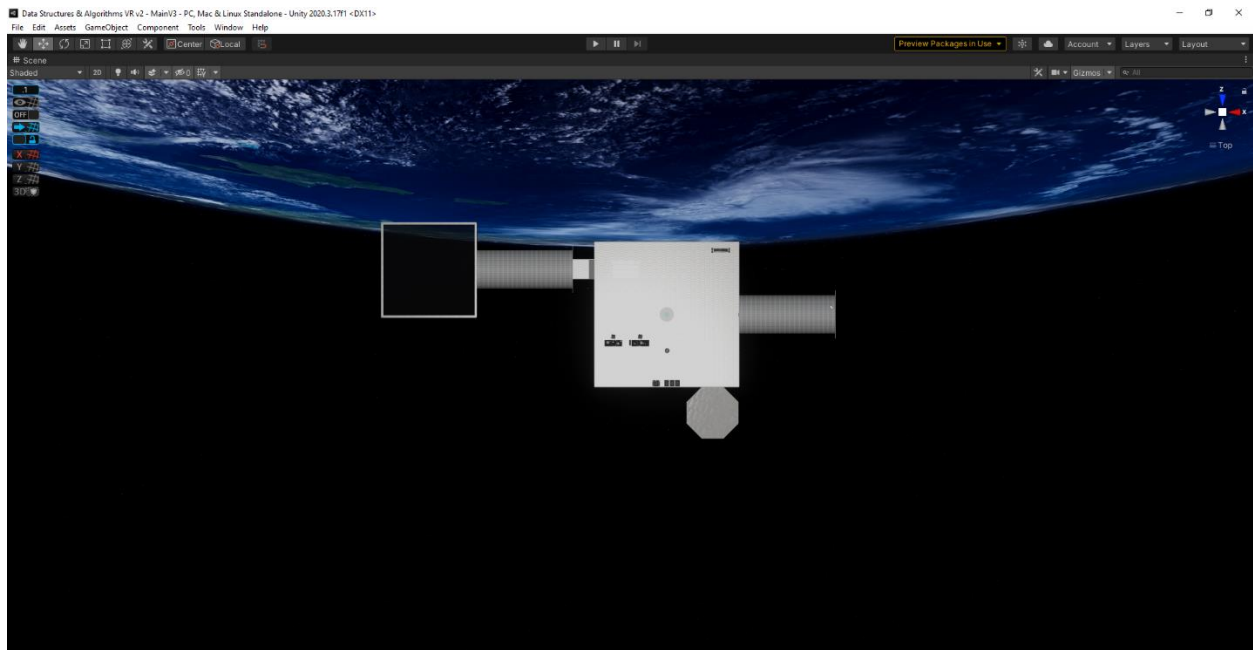Log Out Confirmation (Primary)
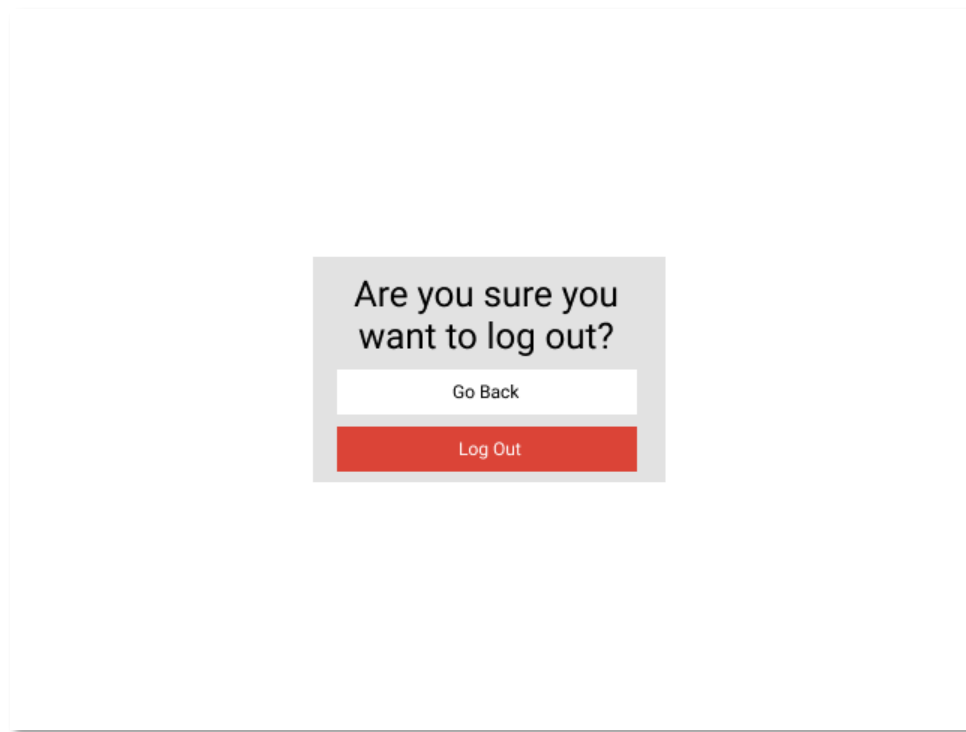
Log Out Confirmation (Quiz)
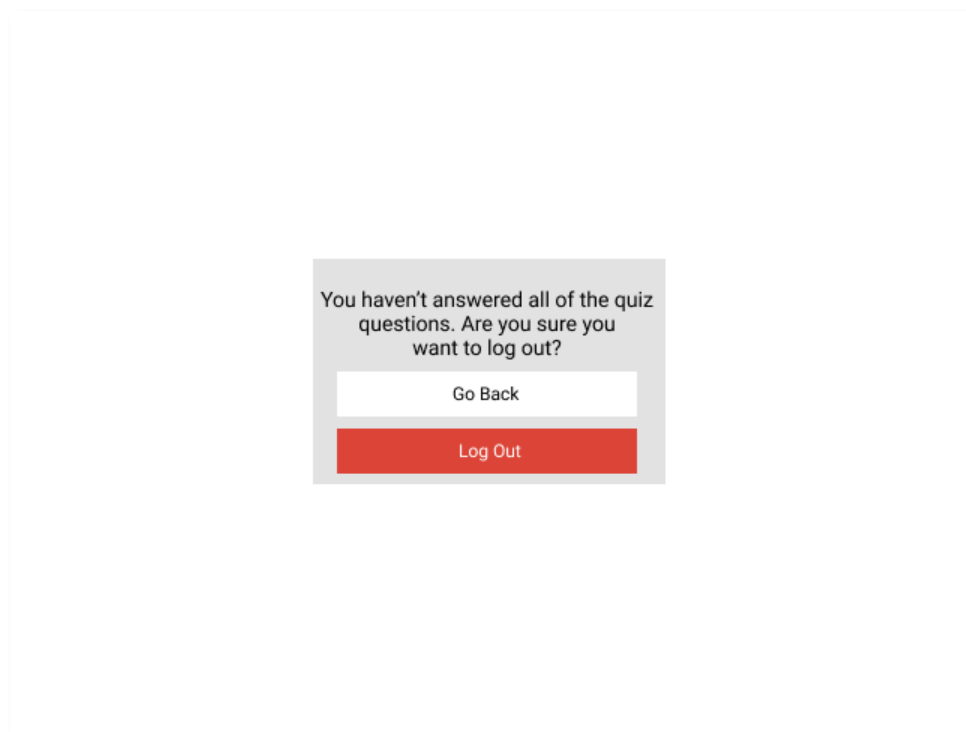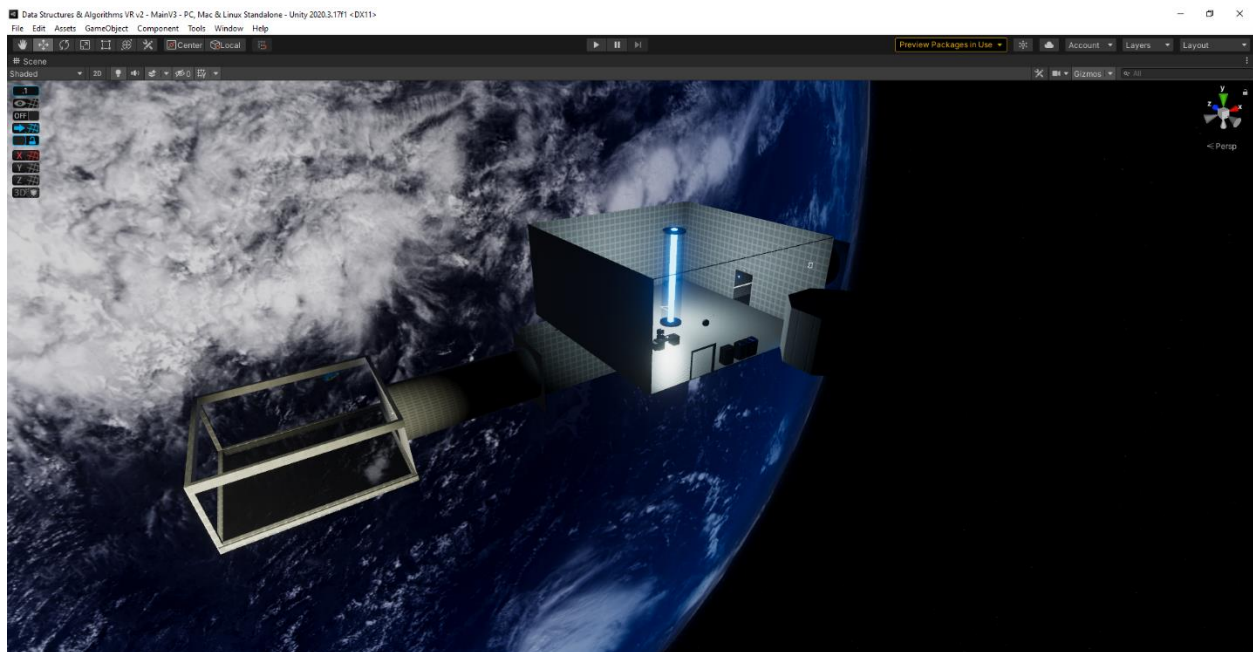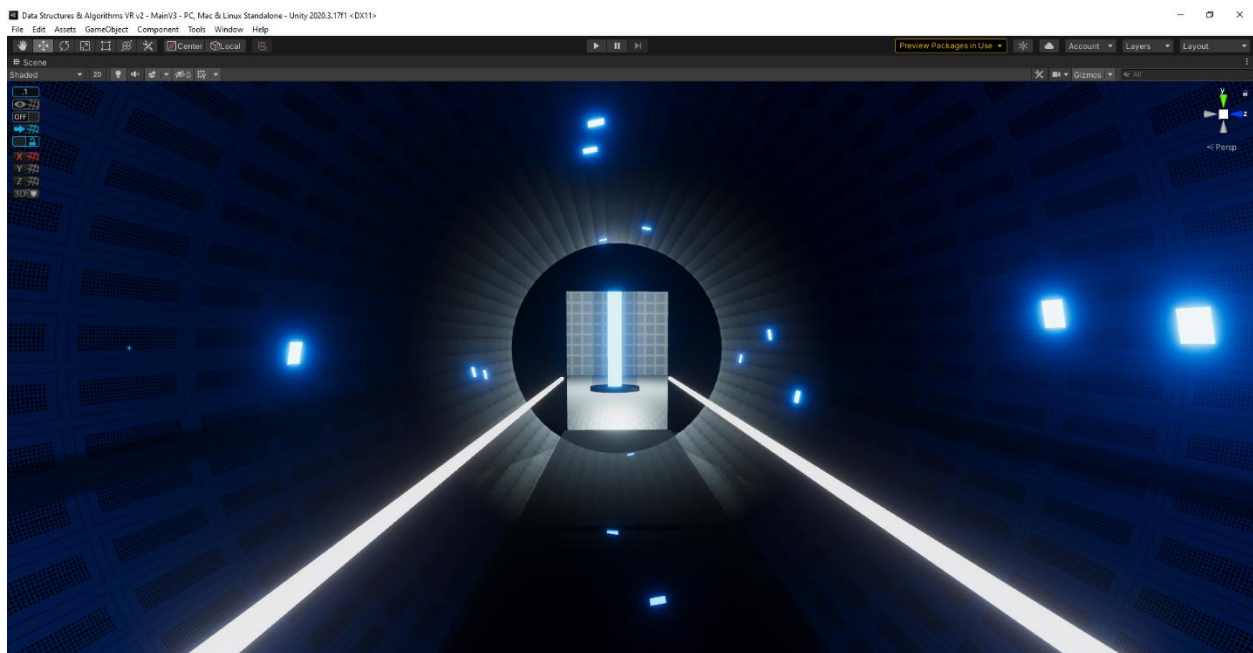
Unity Application Gallery
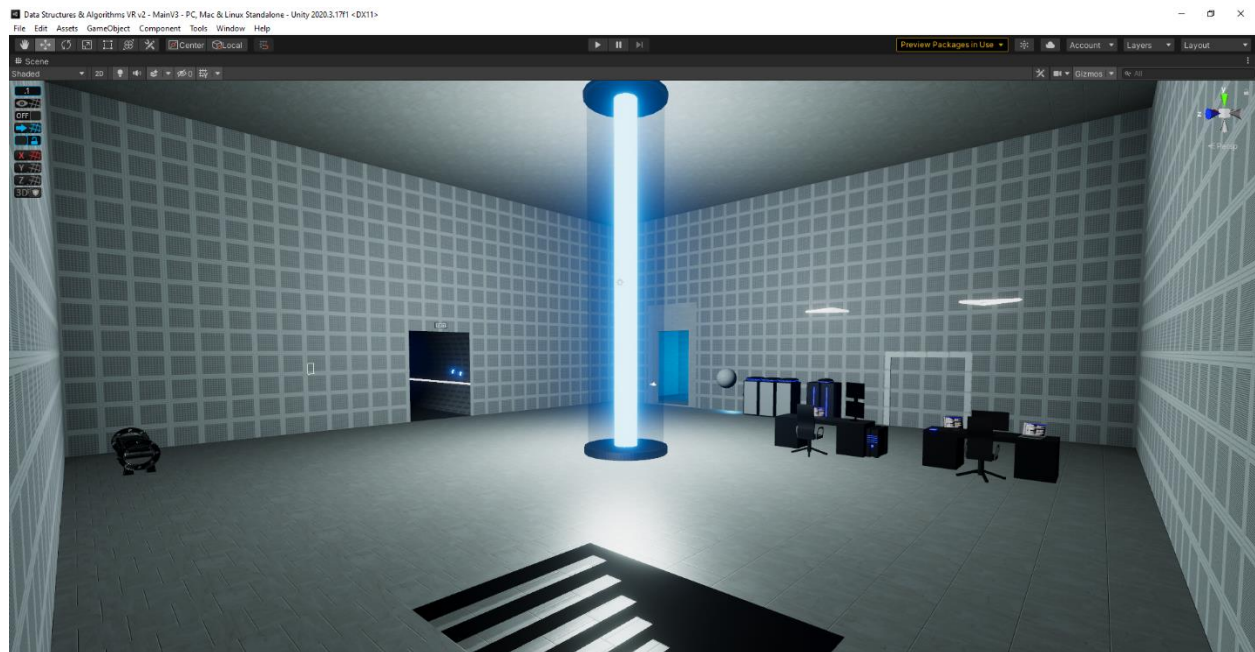
2D Floor Plan (Side)
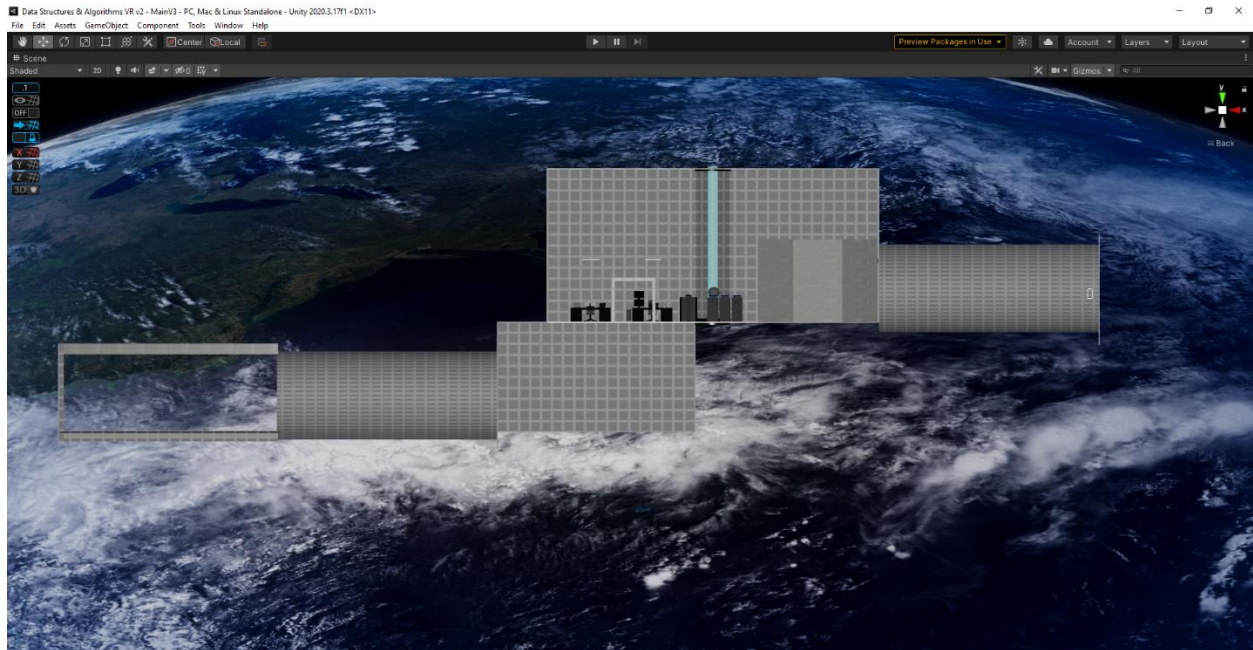
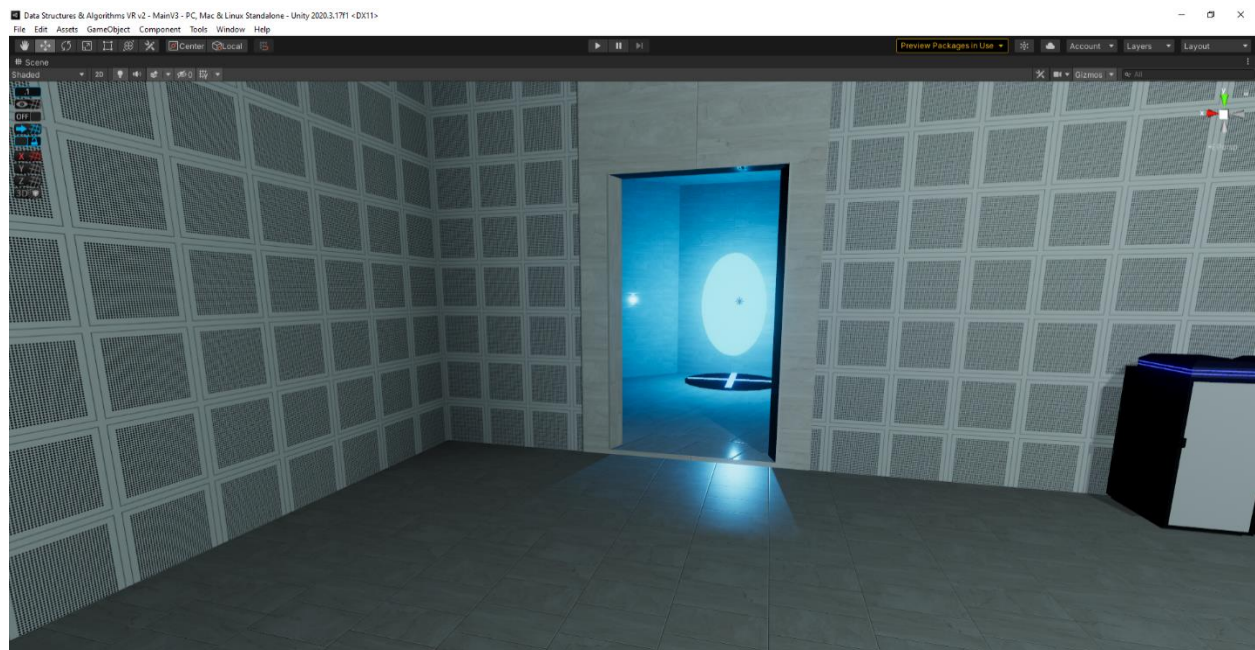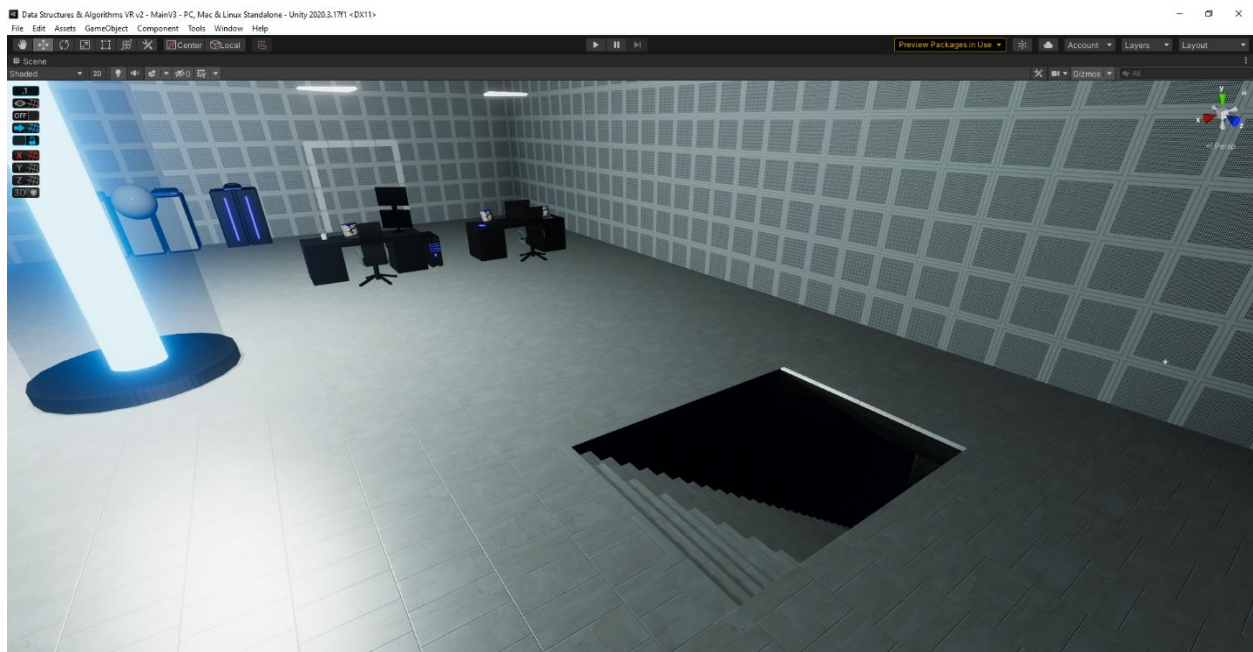## 2D Floor Plan (Top)

3D Overview

Spawn Point

Main Scene

Lesson Access

Stairwell to Viewing Room

Viewing Room