GNG1103 Report

Project Deliverable – K

User Manual

Submitted by

Group B03-5

Briar Vandenberg, 300058322

Victoria Jancowski, 300203985

Lauren Healy, 300131780

Edwin Jazvac, 300211195

Maya White, 300117859

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University of Ottawa

Abstract

This report details all the fundamental features and functions on the ARC application created for EllisDon Construction. The user manual outlines how the features were developed throughout the design process and implemented into the application. Furthermore, this report discusses the creation of the product and the detailed steps that were taken to enable each function in the final prototype. Details of installation, operation and maintenance are discussed, including future steps to improve the product. Ultimately, this document informs the user of all work that was completed throughout the duration of the project. Conclusively, this report includes further recommendations for the future updates, and addition of new assets to the ARC application.

Table of Contents

1 Introduction

This report details all the features and functions on the ARC application created for EllisDon Construction. Based on client feedback and multiple client meetings a final functioning prototype was established to ultimately fulfill the initially outlined design criteria. The fundamental features of the ARC application include, but are not limited to the user interface, augmented reality camera view and the aerial augmented reality camera view. In the simplest terms, Augmented Reality Construction (ARC) is a free application that allows users to view all aspects of 3-D Building Information Models, including mechanical, electrical, structural and architectural systems in augmented reality.

The objective of the user manual is to elaborate on how the fundamental functions of ARC were created, along with how to use each function properly for the best results. The installation process, maintenance, and the operations necessary for the use of the application are further discussed for future improvement of ARC. Ultimately, this report discusses all future recommendations for the application, along with issues that occurred during the development process and how to mitigate these issues in future development.

2 Product Features

This section of the report outlines the features of the application and their overall function and purpose as part of the final product.

2.1 User Interface

The user interface was created to allow users to navigate through the application. The interface is available identically in French and English. The interface includes a language

selection screen, tutorial video, FAQ page, a site safety reminder and an open file screen which will lead the user to the AR scene with the 3D building information model (BIM). The interface scenes are connected using scripted buttons.

2.2 Augmented Reality Camera

An augmented reality (AR) camera provides the user the ability to overlay 3D models and information through the user's camera and impose it real-time in the world. The AR camera is embedded in the scene that contains the 3D BIM files and opens when the user chooses their desired building plans. Upon opening the file, the camera places the BIM file directly over the identical surrounding world meshing the two together to create the experience of augmented reality. The camera is programmed to be at one and a half meters tall, which serves as an average height at which one holds a phone. The camera's origin is anchored at the front entrance of the STEM Building; this is where the user will operate the camera after they select the desired BIM file. To terminate the AR function and camera view, the user is required to exit the current scene.

2.3 Aerial Augmented Reality Camera

The aerial camera provides the user with the ability to place a small 3D version of the building onto a targeted area, identified with a target symbol. To operate this function, the user waits for the target to appear on a flat surface and places the building on the target by physically tapping on the screen. The user can then walk around the spawned building, rotate the building and zoom in, out, and through the building. To exit the function, the user presses the exit button.

3 How it's Made

This section of the report thoroughly and concisely documents how each individual feature of the application was developed and unity and how they were integrated to create the application.

3.1 Game Objects, Scenes, and other 3D Assets

3.1.1 User Interface Panel and Controls

The user interface panel was created using the Unity panel and button features to create the menus and text mesh pro assets for the text. The interface design is very simplistic and easy to navigate using the buttons.

3.1.2 Camera System

The camera system was designed using the XR functions provided by Unity. Both an AR Session and an AR Origin were created and implemented into the scenes where they were required. The AR Session and Origin were set to the origin coordinates (0,0,0), to ensure the camera would function properly and to simplify the scripting and positioning. The building files were moved in relation to the camera's position, to allow the camera to remain at the origin. The aerial view camera was the only camera that required additional scripting.

3.2 Scripts

3.2.1 Main Menu/ Scene Management Scripts

Upon opening the app, you are greeted with the Main Menu screen where users can choose their preferred language as well as access the tutorial and FAQ

pages. When a language is chosen, the user first sees a pop-up safety reminder before continuing to the open file page. The Main Menu and all the connected scenes used a very simple method to switch between them. UI buttons in each scene and were programed with the use of a scene manager to load a specified scene. This allowed for quick and efficient movement throughout the app.

3.2.2   Camera Scripts

The aerial camera required a complicated script which included both plane tracking and ray-casting abilities. The ray-casting function allows a ray to shoot out from the center of the camera and determine where it intersects with a trackable. A trackable is defined as something that can be either detected or tracked in the real world. In the aerial view script, the trackable is defined as a plane. After the plane had been detected by the ray-cast manager, the script tells the AR camera to place a 2D-target on the detected plane. When this target is placed, the script allows for the placement of an object, which in this project is the BIM file. After the BIM file is placed, the regular function of the AR camera continues, now with the ability to place a desired object and view a scaled down and aerial view of the object. The user can then rotate, walk around, or walk through the object. Other than the aerial camera, no other camera scripts were required.

3.2.3   Toggle Scripts

The toggle scripting, as added through Unity, allowed the selective view of the various disciplines in the ARC application including mechanical, electrical, structural and architectural systems. Firstly, a universal material, in this case various

bright colors, were assigned to every component in each discipline (for example, all electrical components were assigned a purple material). Then, toggles labelled with each discipline were added to a plane as a UI function in the AR scene. In the toggle script, each toggle was assigned to the corresponding material of that discipline, as well as an "on and off" function to effectively increase the transparency of the material in "on" mode and decrease the transparency of the material when in "off" mode. This script was attached to each UI toggle using a Script Manager game object. After these steps, the toggles could be used to selectively view particular combinations of the disciplines while using the ARC application.

4 Installation, Operation and Maintenance

4.1 Installation and Operation

To build the game, it is important to make sure that all the scenes are included in the "Scenes in Build" list. Furthermore, if any scripts are using Unity's editor, remove them or place them in the Unity Editor Folder (create one if not present). Finally, select the directory to build the file and click build. This will create the executable file. To perform any icon changes, or product name changes just access the player settings located in the build settings.

4.2 Maintenance

When performing maintenance and updates, look to section 4.1 before building the game. Maintenance of this application could require debugging and improving the graphics when working with large files.

5 Trouble Shooting

5.1 Camera Calibration

The camera calibration is set only to the entrance of the STEM building and has no other entrance points. To calibrate the camera, and have a working and functioning AR view, the user must first stand directly between the entrance doors and about two meters back. Only then can the building file be opened and function properly. If the app closes, or needs to be reopened, the user must go back to the entrance of the stem building and reopen the building files, according to the method described above.

5.2 Aerial Mode

The user must wait a few seconds for the aerial view to open and the target to appear. They must then be pointing the camera at a flat surface, so that the ray-caster can detect the trackable (plane), and when the target appears, tap the screen. After the building appears the user must move very slowly and uniformly in order to get a proper view of the building, as the program file is very laggy. If the aerial function mode doesn't work, the user must exit to the previous screen and re-enter the aerial mode to re-calibrate.

6 Recommendations for Future Work

In future work, it is highly recommended that more assets and features are added to the application for an advanced user experience. A primary additional feature that would be advantageous to the application would be the ability to leave comments in real-time on the site. Furthermore, creating a tool that would allow users to see the materials used for each object and an object's dimensions would be ideal for the construction industry.

Version control is an important future improvement to the ARC application. This feature would allow for continual updating of files, and the ability for all members to work on the application design simultaneously without data loss. This would improve communication between all parties using the application, thus making it an advantageous feature.

Overall, the application can be improved by debugging and reducing lag time so that the app is seamless and lacks major functionality errors. To conclude, the completion of the ARC application was successful in accomplishing the task as outlined by the client. However, as outlined in this report, the team recognizes that there are improvements to be made to the existing prototype, and additional assets that could improve the user experience that could be implemented in future development of the application.

7 Conclusion

To conclude, this user manual documents the application's features, how they were created, the operation and maintenance required for the application and recommendations for further development. This manual as well identifies the issues that were encountered throughout the development of the application and how to avoid these issues if the application is to be further developed. This user manual was detailed with the goal of guiding users into how the product was made for them to take the mantle and further bring along this project.