GNG 1103-B

Project Deliverable F

Prototype I and Customer Feedback

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Group B03-4

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November 14th, 2020

Introduction

During the last few weeks, the uOttawa engineering students collaborating with *Ellis Don* have made significant strides in the creation and improvement of their AR construction software. Recently, they finalized their design concepts, formulated a plan and budget, and presented their progress to the client, who has so far reacted positively to their overall performance. With their design now finalized and approved, students must now proceed with the creation of prototypes in order to demonstrate the feasibility and practical performance of their intended product.

The first prototype, presented in this deliverable, is centered around the idea of "proof-of-concept". As such, whilst its scope is large, it is not expected to be fully functional. This document will outline the technical details of this prototype, followed by a report on the feedback, received from the client, regarding the direction that the project is taking. The latter portion will prove invaluable to the further refinement of this project.

Prototype Test Plan

Why are we doing this test?

There are multiple reasons to require tests for this prototype. For one, it is important to determine that it will function properly on the targeted platforms, in this case being 'mobile devices'. What's more, tests would allow students to evaluate their capacity for developing AR applications within Unity that compile properly and function as intended, at least in principle.

Furthermore, a test may be necessary to simply check that the established designs are feasible, given the limited experience of the students and the short time allocated to the project.

What are the specific test objectives?

As previously stated, the objectives for these tests include the verification of feasibility, as well as a rudimentary 'proof-of-concept' for the core subsystems.

More specifically, students seek to test the basic functionality of the various subsystems within the app, such as cycling through BIM layers, toggling different settings, and accessing a tutorial. There is also the goal of being able to place a building model on a real-life surface or in a real space and "walk through" using a mobile device. Of course, this implies the additional objective of getting the project to function on a mobile device (Android or iOS).

What exactly is being learned or communicated with the prototype?

This initial iteration will teach students how their conceptual subsystems (main menu, settings, tutorial, hazards, AR view) translate from Unity to the real world. It will give them insight into the relative convenience of a mobile interface, as compared to a mouse on a computer. With this information, they can adjust the size, placement, and order of things displayed in the app such that it becomes more user-friendly and ergonomic.

Furthermore, the prototype will communicate the feasibility of specific features directly to students, allowing them to adjust their designs, should they find the direction they are taking to be too difficult, given their relative lack of experience in this development field.

What are the possible types of results?

Results are expected to mainly fall into the qualitative category, as opposed to quantitative. For this first prototype, it is more important for students to measure things like whether the programmed buttons retain their functionality on a mobile device, or whether they are able to switch between menus and the camera view properly.

Therefore, the results will mainly consist of a binary “working” vs. “not working” for each subsystem and each of the parts within them. Ease of use is another metric that will be assessed with the testing, which can be rated on a scale of 1-5. It can be measured by requesting feedback from friends or family members, and asking them whether the app is user friendly or not, given that this is the first of many prototypes.

How will these results be used to make decisions or select concepts?

These results will give the team valuable information on what works in the prototype, and confirmation on whether it is headed in the proper direction to meet the client’s needs. If the current concept does not work as was originally planned, results will make it apparent, allowing the members to decide how they could change or alter certain concepts in the next prototype.

Essentially, these results will provide a reference and point of view, which will be used in every iteration of this prototype to ensure that the students are creating a product that not only meets their client’s needs, but retains an ease-of-use suitable to the needs of laymen.

What are the criteria for test success or failure?

The criteria for the tests’ success or failure is if the functionality of the subsystems and their buttons are retained when transitioning from Unity to mobile. If the product works well with touch gestures and performs the way it was intended to, the prototype is considered a success. If the product does not translate well to a mobile application, or is difficult to use, or simply does not function as intended, the prototype will be considered a failure.

What is going on and **how** is it being done?

Describe the prototype type (e.g. focused or comprehensive) and the reason for the selection of this type of prototype.

The prototype is of the physical and focused kind, with the aim to assess only the very key functionality of the idealized product. As it does not contain all of the intended features, this first iteration is not yet considered to be comprehensive. It is considered physical because it involves the actual construction and testing of a product, as opposed to an analytical prototype, which would imply a more predictive and theoretical approach.

Describe the testing process in enough detail to allow someone else to build and test the prototype instead of you.

This prototype consisted in the construction of a number of “scenes” in Unity (like levels in a video game) that act as the platforms on which our subsystems rest. Each scene has a view in mind, and contains interactive objects (mainly in the form of buttons) which will govern the software’s properties and behaviours. For example, in the “AR Camera” scene, there are currently four buttons that, when clicked, will toggle on or off the various ‘building information’ layers that combine to form a given building model (utilizing placeholder scripts and assets for the time being).

Scenes are designed such that, through a series of button-taps, they are made inter-reachable in an interactive “game-like” application. The project is then compiled and exported as an external application file for both Android and iOS, which can then be manually installed on the given device and tested for functionality.

What information is being measured?

The information being measured is the basic functionality of the structural elements of the Unity scenes in the app. Specifically, students are measuring the functionality of the buttons on each scene in the compiled mobile application, outside of Unity. They are also measuring the ease of use for these buttons to see if they are appropriately sized, spaced out, positioned, etc.

What is being observed and how is it being recorded?

The information being observed includes the measurements of the interactive elements, functionality and ease of use, for each scene. This information is being recorded using qualitative descriptions, tabulated and written down in a separate document. The observations are detailed and evaluated so that future prototypes can implement changes to fix underlying issues or improve upon positive observations.

What materials are required and what is the approximate estimated cost?

The materials required are the Unity 3D software, a computer capable of running Unity, proper compilers and programming software (such as Xcode and VIsual Studio), and finally a mobile device to test the application (Apple iPhone or Android device). All of these materials come at zero cost, and the team does not foresee many additional costs for this project. If anything, there is the potential purchase of building models from a 3rd party (~$20 at the most). However, this remains uncertain.

What work (e.g. test software, construction, modeling or research) needs to be done?

Rudimentary testing suffices for the current prototype. Moving forward, the team's programmers will have to model the "AR Camera mode" selection into a working building model to see various layers of a construction project. They will also need to create a tutorial walkthrough, update the main menu, create a detailed hazards screen, implement a mini map function, and potentially an account interface to save work onto a personal profile. After each step is completed, the prototype will naturally require more in-depth testing of the subsystems to ensure correct functionality.

When is it happening?

How long will the test take and what are the dependencies (i.e. what needs to happen before the testing can occur)?

The tests will only take a few hours over one or two days. This prototype is still very primitive. Thus, the tests are expected to give very straightforward results.

Before the testing can occur, the basic scenes required for the application must be created in Unity, compiled for multiple platforms (using XCode, among others), and exported to a mobile device, from which the software can then be deployed and tested.

The following Gantt chart outlines how such a test period fits within the time constraints of this project.

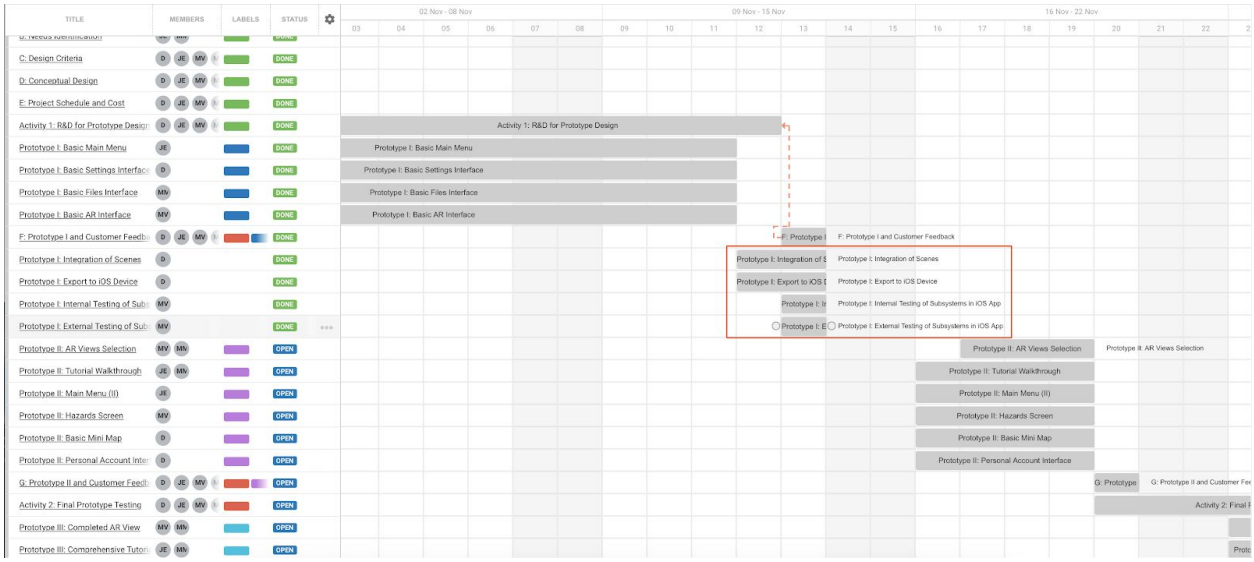

Figure 1. GNG1103 Project Gantt Chart (Testing subtasks highlighted in a red box.)

When are the results required (i.e. what depends on these tests in the project plan)?

The results for the Prototype 1 tests are required by November 14th (due date for Project Deliverable F). The updates needed for the second prototype's sub-systems are dependent on the results of these tests in the project plan. Without them, the team will find it very difficult to improve and integrate all subsystems into a complete, comprehensive prototype, and the rest of the project plan will have to be delayed.

Prototype I

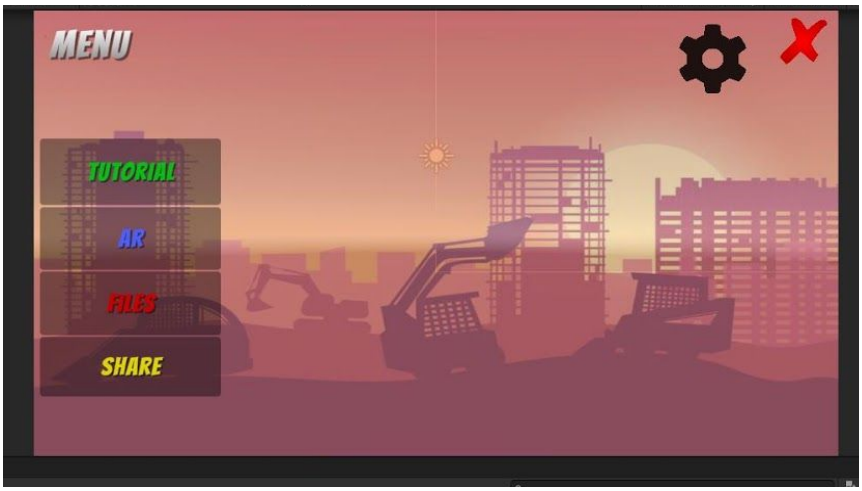

Figure 2. Prototype I Main Menu. Basic Main Menu Interface; AR button navigates to the other Ar scenes. Buttons are placeholders until the next Prototype arrives.

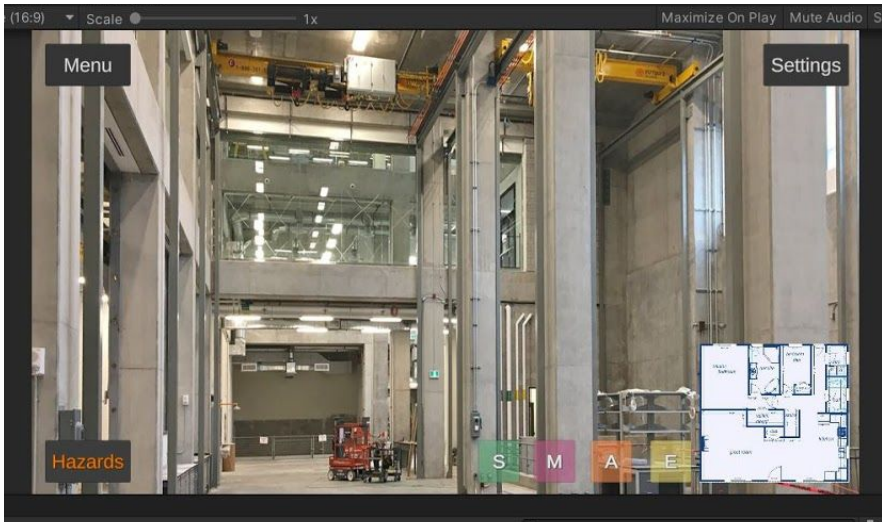

Figure 3. Prototype I AR Screen. Basic placeholding AR viewer setup; menu, settings, hazards, mini-map and different views will be available to select all while walking through the 3D building model.

Figure 4. Prototype I Hazard Screen. Hazards screen currently lists possible hazards to look out for, prototype-II will bring with it a checklist to make sure the user has what is needed to ensure safety and hazard control.

Figure 5. Prototype I Settings Screen. Basic setting setup and placeholder for prototype-II. Current model allows for navigating back to the AR viewing screen and pulling down settings options for resolution, dimensions and movement as well as sliding speed slider with no immediate effects.

Client Feedback

Overall, the client expressed mostly positive feedback with regards to prototype 1 and its performance. They had also previously expressed satisfaction with the conceptual designs, and felt content in how it had been translated by the students into their first prototype.

An important remark they made was the need to ensure that the toggled camera views in the “AR view” scene would be accessible simultaneously, allowing for multiple BIM layers to be viewed at once, and not simply one at a time. The students were grateful for the feedback, and expressed their intention to integrate this idea into their next iteration of the prototype.

Conclusion

Based on the concepts they established in previous weeks, students were able to come up with a plan for a set of three prototypes, starting with a “proof of concept” prototype 1, with the following iterations intended to be more comprehensive, integrating feedback from tests and presentations into their design.

With this deliverable, the students have now completed the first prototype for their AR construction project, and have outlined a detailed testing plan to ensure that it is working in a way that fulfils the needs expressed by their client. Following a presentation of this prototype, the students, in utilizing the feedback they obtained, are now ready to move on to the next iteration, the second prototype, where they will integrate more detailed subsystems and enhanced functionality to their AR program.