GNG 1103-B

Project Deliverable C

VR/AR for Construction

Professor M. Majeed

Group B03-4

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Introduction

At the start of October 2020, construction services giant *Ellis Don* requested that students at the University of Ottawa's Faculty of Engineering create a piece of software which would allow them to improve the efficiency of future projects through the use of cutting-edge technologies. During an initial interview with one of their representatives, a number of needs were outlined for the students to fulfill. Items specifically mentioned include the use of Augmented Reality (or AR) technology, the required ease of use, the need for cross-platform compatibility, as well as the need for offline accessibility, among other things.

In this document, students are now expected to formalize a list of design criteria based on the needs they were able to identify during the first client meeting. With these criteria in mind, students must then showcase an appropriate benchmarking of competing software to determine which would be best to model their product after. Finally, they must create tangible target specifications which will be used to evaluate their results once the project is completed.

Design Criteria (based on client needs)

#	Need	Design criteria
1	The program is easy to use	User friendliness
2	The program is accessible on multiple platforms	Cross-platform compatibility
3	Shows the many types of component that make up a building	Display options (for different views)
4	Shows the dimensions of specific objects	Mathematics & Data Entry
5	Potential hazards are displayed	
6	The program is accessible offline	Local Storage Size (in MB)
7	The program utilizes AR in a first person display	AR Display, Display quality (pixels), Camera vision.
8	A comprehensive tutorial is offered	Time (min) Simplicity of language Visual clarity
9	Multiple users can access it at once	Bluetooth synchronization
10	The program is usable with different build files	Compatibility Optimization

Tabulated List

Functional Requirements	Non-Functional Requirements	Constraints
- 1st Person AR view - Tutorial - Hazards display - Multidisciplinary BIM display - Object dimensions - Offline Access	- Aesthetics - User friendly interface - Stability - Updatability - File Compatibility - Cross-platform compatibility - Multi-user access	- Cost of project - Time to produce

Benchmarking

Specifications	Akular	SmartReality	ARki	Jig Workshop Pro
AR display	Basic AR interface	Basic AR interface	Basic AR interface	Advanced AR, indoor view
Tutorial	Multiple introduction videos	Basic Instructions on functions	Few instructions on maneuvering	Detailed tutorial
Hazards Display	N/A	N/A	N/A	N/A
Multi-discipline overlay	Only structural	Structural and mechanical	Only structural	Only structural
Object dimensions	Scale	Scale	Scale	N/A
Offline Access	Sub-par option available	On-device storage	N/A	N/A
User Friendly	Easy to use	Moderately easy	Easy to use	Easy to use
Aesthetics	Poor graphics	Basic graphics	Good graphics	Good graphics
Multiplatform	iOS and Android	Android only	iOS, android version in development	iPad and iPhone only
Multi-User Access	Up to 10 users	Single user only	Files shared between multiple users (not live)	Multi-User presentations

Updatable	Infrequent updates	Infrequent updates	Infrequent updates	Frequent updates
Reusability	Multiple file formats (obj, fbx, ifc skp)	Limited file format	Files can be imported and exported from other software	Multiple file formats (obj, stl and STEP CAD)
Cost	$1200/year	Free to use	$284/year	$588^{USD}/year $775^{CAD}/year

Numerical Comparison

Specifications	***Importance (weight)**	***Akular***	***SmartReality***	***ARki***	***Jig Workshop Pro***
AR display	3	2	2	2	3
Tutorial	5	3	2	2	3
Hazards Display	4	1	1	1	1
Multi-discipline overlay	5	2	3	2	2
Object Dimensions	3	1	2	2	1
Offline Access	3	2	3	1	1
User Friendly	5	3	2	3	3
Aesthetics	1	1	2	3	3
Multiplatform	3	3	1	2	1
Multi-user Access	2	3	1	2	3
Updatable	2	2	2	2	3
Reusability	4	3	1	3	3
Cost	3	1	3	2	2

**Importance rating 1-5; 5 being most important, 1 being least important.*

	Akular	*SmartReality*	*ARki*	*Jig Workshop Pro*
TOTAL SCORE	94	84	82	95

Target Specifications

List	Design Specifications	Relation (=,>,<)	Value	Units	Marginal Value	Ideal Values	Verification Method
Functional Requirements							
1	Augmented Reality Display	=	yes	N/A	3rd person AR	1st person AR	test
2	Tutorial	=	yes	N/A	Basic tutorial	Comprehensive tutorial	test
3	Hazards Display	=	yes	N/A	Basic hazards	Build-specific hazards	test
4	Multi-discipline overlay	=	yes	N/A	1-2 design disciplines shown	3-4 design disciplines shown	test
5	Object Dimensions	=	yes	N/A	Basic dimensions	Detailed dimensions	test
6	Offline Access	=	yes	N/A	Limited access	Complete access	test
Non-Functional Requirements							
7	User Friendly	=	yes	N/A	Hard to operate	Easy to operate	Analysis, feedback
8	Aesthetics	=	yes	N/A	Simple visuals	Modern, minimalistic visuals	test
9	Multi-platform	=	yes	N/A	iOS only	Android & iOS	test
10	Reliability	=	yes	N/A	Reliable interface, some bugs	Reliable interface, no bugs	test

11	User Access	=	yes	N/A	Single user access	Multi-user access	test
12	Updatable	=	yes	N/A	Limited updates	Full updatability	test
13	Reusability	=	yes	N/A	Single project	Multi project	test
Constraints							
14	Time to produce	<	8	weeks	>8	<8	Estimate
15	Cost	<	100	Dollars ($)	>100	<50	Estimate, Final check

Concluding Statement

Thanks to the in-depth information obtained during the first client meeting, the formulation of concise, unambiguous design criteria proved to be a simple task. Among the identified criteria, the top priorities were determined to be the user-friendliness of the interface, the use of a first-person perspective in an AR setting, as well as the display of multi-disciplinary building information.

Following this, thorough research allowed for a highly comprehensive benchmarking of competing software, which will allow the team to synthesize the strengths of different products into an optimized project outcome. Students particularly took notice of the user-friendliness of *Akular* and *ARki*, the detailed information displays of *SmartReality* and the superior aesthetics of *Jig Workshop Pro*. They also concluded that *Jig Workshop*, with a benchmarking score of 95, would be the best competitor to emulate in their designs.

Finally, all this information culminates in a target specifications table, which will be crucial to evaluating the project throughout its development. It outlines every requirement with minimal and ideal measures to meet as well as the methods by which this will be verified.

In conclusion, the team has managed to put together a substantial body of design specifications which will prove invaluable to the completion of the upcoming project deliverables.