Project Deliverable C

-Design Criteria and Target Specifications-

Group B4

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Introduction

The goal of this deliverable is to present a set of design criteria, constraints, and metrics that the groups final project must encompass. The project, which was determined by the client interview and as a part of Deliverable B, is to create an AR/VR application that our client, EllisDon, can use to visualize 3D Building Information Models (BIM) on a construction site. This would eliminate the loss of information that comes from switching between a 2-dimensional model and a 3-dimensional one, which still happens using traditional blueprints. Exactly how this application functions is yet to be determined, but the completion of this deliverable will aid in deciding and clarify the direction of the final solution, as well as set target parameters that the final project will hope to achieve.

Prioritized Design Criteria

Any project an engineer hopes to complete must have some kind of needs. Be it a house or an application, the project's client (the person who wants the product) has certain requirements that they want the final product to have. As engineers, it is our job to take these client needs and transform them into design criteria; quantifiable concepts that are used to ensure every single need has some kind of measurable quality which can then be compared to similar market products. While one need can be measured by multiple criteria, it is important that every need has a design criteria so that nothing is forgotten from the interview to the final product.

Criteria

Below is a table containing the client needs decided on in Deliverable B and the corresponding design criteria the group can use as quantifiable metrics for benchmarking.

Number	Need	Design Criteria
1	Ability to view 3D Building Information Models (BIM) in VR or AR	- Mobile device compatibility - Display size (cm)
2	User-Friendly interface	- Ease of use - Easy to learn
3	Compatible with common mobile devices	- Portability (ability to move to another operating system) - Mobile device compatibility
4	Open source or free to use software	- Cost ($) - Programming language

5	Training and implementation instructions provided	- Operator training - Easy to learn
6	User interactions directly on device	- Ease of use - Speed - Responsiveness
7	Low cost ($50 budget)	- Cost ($)
8	Sleek, clean-looking application to be used in a professional environment	- Aesthetics - Customizability - Localization (ability work in other spoken languages)
9	Various 3D file types available (electrical components, mechanical components, full building)	- File layer compatibility
10	Ability to use offline	- Ease of use - Offline Compatibility
11	Multi-user functionality	- Network environment
12	Can support opening various 3D file formats (.OBJ, .STL etc.)	- Ability to communicate with other programs

Table 1: Client needs and the corresponding design criteria.

Functional, non-functional, constraints and metrics

While having design criteria is nice, they are useless if they cannot be quantified. The criteria decided on in Table 1 have been split into three categories: functional requirements, non-functional requirements, and constraints. Functional requirements describe processes that are vital to the function of the project. For example in this project, the ability to view BIM files is considered a functional requirement. Non-functional requirements describe criteria that, while not vital, still remain important to the final project goal. For example, aesthetic and reliability, which are both crucial if a product ever hopes to be used. Finally, constraints are things that need to be held in mind that might limit a project. A general example of a constraint is cost, as it is never good to go over the clients expected budget. A table containing any and all metrics, all of this project's design criteria, their expected values, the units they will be measured in, and their verification method can be found below.

#	Design Specifications	Relation (=, <, >)	Value	Units	Verification Method
Functional Requirements					
1	Ability to display 3D BIM	=	yes	N/A	Test
2	Ability to import and export files	=	yes	N/A	Test
3	Compatible with different operating systems	=	yes	N/A	Test
Constraints					
1	Cost ($)	<	50	$	Estimate, final check
2	Memory size	<	Phones memory	GB	Test
3	Processor speed	<	Phones processor	GHz	Test
4	Display size	=	Phones display size	cm	Test
Non-functional Requirements					
1	Aesthetics	=	yes	N/A	Test
2	Reliability	>	90	%	Test
3	Program speed	<	2	seconds	Test
4	Localization	=	yes	N/A	Test
5	Customizability	=	yes	N/A	Test
6	Cloud storage	=	yes	N/A	Test

Table 2: Project design criteria, values, units, and verification methods

Technical Benchmarking

Benchmarking is an insanely useful engineering tool. As engineers, our job is not to create drastically different and new, bleeding-edge experimental technologies; that is a scientist's job. Our job is to improve and adapt existing technologies to better suit our needs. This is why benchmarking exists. Its job is to compare existing products that match our design criteria or contains parts of our design criteria.

For this project, different AR and VR application building softwares are being benchmarked against each other to pick the one that can best aid in the group in the completion of this product. Because of the team's low-level experience with coding and the project's scope, it was unanimously decided to try and adapt existing software rather than create a whole new program from scratch. That is why different software is being benchmarked. That being said, the team is eager to approach any challenges, and should none of the software meet our expectations, we are happy to push ourselves and learn what we need to to produce a quality final product.

Specifications	Weight	Google expeditions	Google earth VR	BBC Civilisations AR	Ink Hunter	Unity Reflect
Ability to display 3D BIM	5	4 (Yes)	4 (yes)	1 (No)	1 (No)	5 (Yes, powerful)
Ability to import and export files	4	4 (Yes)	4 (yes)	1 (No)	2 (Only png)	5 (Yes)
Compatible with different operating systems	5	5 (Yes, Android or later and iOS 8.0 or later)	4(Yes, Windows 8.1 or later, Android 7 and iOS 8.1)	3 (Yes, need iOS 11 or Android 7)	5 (iOS 8 or later, Android 4.1 and up)	3 (Yes, need iOS 11.3 or later)
Cost ($)	3	5 (free)	5 (free)	5 (free)	5 (free)	5 (free)
Memory size	2	2 (2 GB to 4 GB)	1 (8 GB RAM)	5 (112.2 MB)	5 (203.1 MB)	2 (large, variable)
Processor speed	4	3 (around 2 GHz)	2 (around 2.70 to 3 GHz)	3 (less than 1.4GHz)	5 (less that 450 MHz)	3 (Powerful phone needed)
Display size	3	3 (Works on many	5 (Works on all)	3 (Works on many phone	5 (Works on all	3 (Works on most current

		phone sizes)		sizes)	current phones)	phones)
Aesthetics	1	4 (polished)	5 (polished)	4 (polished)	5 (polished)	4 (as polished as we make it)
Reliability	4	2 (65%, some problems with some of the data layers available)	3 (80%)	3 (80% positive)	4 (90% positive)	4 (Experimental)
Program speed	4	3 (feels quick)	3 (sometimes quick but takes time to load other times)	3 (feels quick, some text menus)	4 (feels comfortable)	4 (comfortable)
Localization	3	4 (yes)	5 (yes)	5 (yes)	5 (yes)	3 (On us)
Customizability	1	3 (some)	5 (possibility for customized tours)	1 (no)	3 (some)	5 (build it)
Cloud storage	4	4 (sometimes)	4 (yes, on Google Cloud storage)	1 (no)	1 (no, import every time)	4 (could be built in)
TOTAL SCORE		151	149	116	157	166

Table 3: Technical Benchmarking and Scoring

Target Specifications

Target specifications are decided using the benchmarking from the step above. It is used to decide on ideal specifications for the final product, but also acceptable values if something must be sacrificed. For this project, the decided on specifications can be found below

Design Criteria	Units	Ideal Value	Acceptable Value
Ability to display 3D BIM	N/A	Yes	Yes
Ability to import and export files	N/A	PDF, OBJ, STL	STL, OBJ,
Compatible with different operating systems	N/A	Yes	At least iOS and Android
Cost ($)	$	Free	<50
Memory size	GB	<5	<10
Processor speed	GHz	2.4	>1.8
Display size	in	158.4x78.1	138.4x67.3
Aesthetics	N/A	Yes (polished)	Yes
Reliability	N/A	100%	>90%
Program speed	GHz	5	>2.4
Localization	N/A	IOS & Android	iOS and Android
Customizability	N/A	Yes	Yes
Cloud storage	N/A	yes	no

Table 4: The ideal and acceptable design criteria values