University of Ottawa

GNG 1103-B00: Engineering Design

Project Deliverable C: Design Criteria and Target Specifications

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Deliverable C

1. Introduction

In this deliverable, we will be focusing on the functionality of our product based off of deliverable B, where we analysed the list of needs our client wants. By sorting through the functional and non functional aspects of the product, we will establish a list of the most important design criteria which will then permit us to complete the task of technical benchmarking. With those two aspects completed and finalized, we can determine target specifications to finally determine the conceptualisation of our final solution.

2. Needs and Design Criteria

Table 1.0: Needs Statement, Design Criterion, Functional/Non-functional needs

Importance (5>1)	Need	Design Criteria	Functional or non functional
5	Able to see BIM in either VR or AR	Switch between operating modes	Functional
2	Tech and environment friendly	- Takes little memory - Simplified commands to reduce energy consumption	Non Functional
3	Software application must be open source or free of use	Accessible to everyone Available for free	Non Functional
5	The product can see every single component of the building in 3D (wires, pipes, walls…)	Accuracy and Specificity of displayed information	Functional
4	The product is compatible with android and ios	Compatible with the two main operating systems: Android and IOS	Functional
4	The product is easy to understand and accessible	-Bilingual user guide - Available tutorials	Functional
3	The product is accessible off-site and on-site	Accessible from anywhere	Functional
3	The product graphics are accurate	Accuracy and aesthetics	Non Functional
3	The product is easy to use	User friendliness	Functional

3. Benchmarking

Table 2.0: Metrics and Benchmarking Properties

#	Metric	AR foundations	Vuforia	ManoMotion
1	Switch between	Yes	Yes	Yes

	operating mode			
2	Open Source	Not open source. [1]	Vuforia is not open source, but it has a free version and the price of the full version is reasonable. [2]	Contains open source software subject to license terms. [3]
3	Compatible with different operating systems	Yes	Yes	Yes
4	Accuracy and aesthetics	Tolerable	Tolerable	Tolerable but depends on the surroundings(e.g light)
5	Cost	Free with Unity. For unity plans, see below. [4]	Develop for free, purchase deploying. Basic - $42/mo, Basic + Cloud - $99/mo and more.	The SDK is free of charge for both private and business users up to 10 000 end users for each application.
6	Motion Tracking	No	No	Yes
7	Limited Area	No	Yes (you need to select a target area)	No
8	2D Tracking	Yes	Not clear	Not clear
9	Device Requirement	Android 7.0(minimum) Iphone 6S	Android 4.1.x+ ios 9+	Any smartphone with camera feature
10	Device tracking	Yes, included in ARCore, ARKit, Magic Leap, HoloLens. [5]	Yes included, but must enable Vuforia Fusion. [6]	Only hand and skeletal tracking. [12]
11	Plane detection	Yes, included in ARCore, ARKit, Magic Leap. [5]	No, so far Vuforia doesn't provide plane tracking of the real world [7]	The developers have integrated ARkit thus allowing the device to detect planes.
12	Occlusion/depth masking	Yes, included in ARKit. [5]	Yes, use the occlusion model in Unity.	Yes, included in SDK 2.0
13	Measures Distance	Yes. [8]	Yes. [9]	Yes
14	Anchors	Yes, included in ARCore, ARKit, Magic Leap, HoloLens. [5]	Yes, using World Anchor. [10]	Yes, using Google ARCore

Table 2.1: Comparison of Importance Given by each Plug-in

#	Metric	Importance (5>1)	AR Foundations (5>1)	Vuforia (5>1)	ManoMotion (5>1)
1	Switch between operating mode	5	5	5	5
2	Open Source	3	0	2	4
3	Compatible with different operating systems	5	5	5	5
4	Accuracy and aesthetics	3	4	3	2
5	Cost	3	5	3	1
6	Motion Tracking	2	0	0	5
7	Limited Area	4	5	3	5
8	2D Tracking	4	4	1	1
9	Device Requirement	3	3	4	5
10	Device tracking	5	5	4	3
11	Plane Detection	5	5	0	5
12	Occlusion/depth masking	3	4	3	3
13	Measures Distance	4	5	5	5
14	Anchors	4	4	4	4
Total		**53**	**54**	**42**	**53**

Therefore, the plugins with the most similar total importance to the desired design criteria and metrics are Manomotion, and AR Foundations.

3.1. Definitions

Operating mode: In our case, the viewing mode. Either AR or VR.

Open Source: The source code of an open source program is available for everyone to use, modify and distribute for free.

Compatible with different operating systems: Ability to function with ease across different devices.

Accuracy and aesthetics: Allows users to precisely navigate through a structure that while being pleasing to the eye.

Cost: Money required to buy and use the product.

Motion Tracking : It is an ability to respond when physical motion is detected.

Limited Area : It defines the maximum area in real life on which the device can detect as editable.

2D Tracking: 2D tracking is when you only use two coordinates to represent an object.

Device Requirement:: Defines the minimum or ideal configuration.

Device Tracking: track the device's position and orientation in physical space.

Tracking: The ability of the AR device to find its relative position and orientation in the physical world. If the environment is too dark, for example, the device might "lose tracking", which means it can no longer accurately report its position.

Plane Detection: Detect horizontal and vertical surfaces.

Occlusion/Depth masking: Apply distance to objects in the physical world to rendered 3D content, which achieves a realistic blending of physical and virtual objects. Allows a more seamless view of 3D.

Measures Distance: Measures the distance of real life objects.

Anchor: An anchor is a particular point in space that you want the device to track. The device typically performs additional work to update the position and orientation of the anchor throughout its lifetime. Anchors are generally resource-intensive objects.

4. Target Specifications

Table 3.0: Functional Requirements

#	Design Specifications	Relation	Value	Units	Importance (5>1)	Verification Method
Functional Requirements						
1	Switch between operating mode	-	Yes	-	5	Testing
2	Accuracy and Specificity of displayed information	>	-	-	5	Testing
3	Compatible with different operating systems	=	Yes	IOS & Android	4	Testing
4	Bilingual user guide	=	Yes	French and	4	Testing

				English		
5	Accessible from anywhere	=	Yes	Cloud	3	Testing
6	User friendliness	=	Yes	-	4	Testing

Table 3.1: Constraints

#	**Design Specifications**	**Relation**	**Value**	**Units**	**Importance (5>1)**	**Verification Method**
Constraints						
8	Time	>	>dec 1	days	4	\
9	Cost	=	50	$	3	Estimate
10	Computer system RAM	<	8	GB	3	testing
11	System requirements	<=	Phone with a camera	N/A	3	Testing

Table 3.2: Non-Functional Requirements

#	**Design Specifications**	**Relation**	**Value**	**Units**	**Importance (5>1)**	**Verification Method**
Non-Functional Requirements						
11	Sustainability	=	Yes	N/A	2	Testing
12	Accessible to anyone	=	Yes	N/A	3	Testing
13	Accuracy and Aesthetics	<	9	%	3	Testing

5. Reflection

Speaking to the client is essential to establishing initial ideas and plans for the project. The client meeting let's us not only figure out what the client wants, but also look into which needs are more important and which needs are less essential. By finding a list of prioritised requirements, we are then able to look into them and find multiple solutions for our client. For example, our client told us that he would like a product that is compatible with multiple operating modes. This then permitted us to look into specifications for various operating systems, notable Android and IOS. The client meeting also helps us decide what our main priorities and goals of the project are. In fact, with information from the client, we can make our own table with information we researched. In fact, this comes into play in this deliverable. We were able to cross reference different needs with different characteristics we researched and tabulated. This let's us clearly understand where the client needs to stand beside design criterias, constraints and the

functional aspects of the product. By doing so, the group is able to decide what needs to be prioritized. In fact, we decided that the functionality of the product is much more important than focusing on the aesthetic aspect of it. All of our decisions however, are limited by constraints, set not only by the client, but by the timeline and the way the course is set. Moving forward, more research and benchmarking will help us improve lessen constraints and make our overall product as efficient as possible. Therefore, this deliverable permitted us to not only organise and better visualise our future tasks when creating this product, but also clearly showed us what is expected of us in the completion of the work.

6. Conclusion

In conclusion, in this deliverable, we analysed the needs of the client and associated each one of them to a design criteria. The design criteria allowed us to establish what is functional, what is non functional and even constraints introduced by the project. With this done, we were then able to benchmark different similar products to establish the standards and quality our product had to meet. Using both, AR Foundation and Manomotion combined with the built in ARkit, would allow us to have the optimum final design of the app and give us the features we desire. This also facilitated our capacity to figure out an average cost as well as average functionality of similar products on the market. All of the above helped us clearly define what is needed of us, what we need to do and how we need to do it respecting the constraints. Therefore, we can quickly begin finding different design concepts.

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