University of Ottawa

GNG 1103-B00: Engineering Design

Project Deliverable D: Conceptual Design

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October 15, 2020

Abstract

In this deliverable the team members came up with their individual concept and presented it with the rest of the group. The team then went through the individual concepts and marked down the promising features of each concept. From that, three concepts which are a combination of the characteristics of the individual concepts are created. Finally those concepts are compared using a rating system to determine which one is the most suitable for the project's needs.

List Of Tables

List Of Figures

1.   Introduction

In the previous deliverable, we analysed different design criteria that were feasible with not only project constraints but client needs as well. In doing so, we were able to establish a list of criteria that would meet the requirements. Therefore, in this deliverable, based off of our design criteria, we will be individually creating our own conceptual designs that will then be combined to create three different project concepts. Based on a grading scale, we will be able to determine which of the three is the best option for us by whichever concept obtains the highest score.

2.   Individual Concepts

2.1.   Aidan

2.1.1.   Login Screen

2.1.1.1.   Allows user to sign in with an account already created instead of making a specific account for the app (can use google, icloud or facebook)

2.1.2.   Welcome Page

2.1.2.1.   Gives the user three options for working on a project as well as a help button for further assistance

2.1.2.1.1.   *Start New project* allows users to upload their blueprint into the app to get right into designing their structure.

2.1.2.1.2.   *Open Project* allows users to access the cloud and open a preexisting project.

2.1.2.1.3.   *Freelance Mode* allows users to immediately dive into the app and start testing out all available features.

2.1.3.   FAQ

2.1.3.1.   Gives the user a link to our youtube page which shows additional tutorials on how to navigate the app.

2.1.3.2.   Allows other users to submit problems that can be answered by other users as well as the creators.

2.2.   Mahad

2.2.1.   User Prompt

2.2.1.1.   Asks the user to create an account or login

2.2.2.   Menu options

2.2.2.1.   Load a previous project or start a new project

2.2.2.2.   Choose the view type : list view, map view...etc

2.2.2.3.   Navigate in the project and be able to add, annotate and see characteristics

2.2.3.   Have extra informations

2.2.3.1.   Source code available

2.2.3.2.   Open FAQ where people can ask questions and post answers

2.2.3.3.   Allow modifications of in app features

2.3. Peter
    2.3.1. Bottom tile
        2.3.1.1. Cost of total changes
            2.3.1.1.1. list of individual changes made
            2.3.1.1.2. display each cost(giving them details that they can use to reconsider)
            2.3.1.1.3. total cost
        2.3.1.2. Notifying others who are in the app about changes
            2.3.1.2.1. Display the names of members who have made any change
            2.3.1.2.2. Click the name to see the details of the modification
        2.3.1.3. Annotation notification
            2.3.1.3.1. Display note titles
            2.3.1.3.2. Clicking the titles leads to detailed information
    2.3.2. Tutorials of app functionality (Video vs Text)
        2.3.2.1. Explains everythings as the user enters either in video format or in text. Let users have access to it whenever he/she require it.
        2.3.2.2. It could be divided into multiple parts and whenever users access a certain feature, short instruction or video will pop out.
    2.3.3. Bilingual
        2.3.3.1. To approach a wider range of customers, more languages should be added.

2.4. Sarah
    2.4.1. Tools
        2.4.1.1. Measure: This will allow the user to select point A and point B and after this, they can measure length in a straight line of whichever area they wanted in the real world.
        2.4.1.2. Insert: Allows the user to insert a feature or a 3D model from the library available. The library would contain blank models of walls/doors/switches/hinges etc anything that was used in the BMI and can be inserted into the AR. This will be further divided into separate filters for
        2.4.1.3. Annotate: When selected, the user will be able to type an unlimited number of characters of notes they want to put for a specific feature or in its general vicinity. This will allow only text, numbers, and symbols, nothing too fancy like emojis etc.
    2.4.2. Select
        2.4.2.1. Annotate: When selected, the user will be able to type an unlimited number of characters of notes they want to put for a specific feature or in its general vicinity. This will allow only text, numbers, and symbols, nothing too fancy like emojis etc.
        2.4.2.2. Hide: This would allow users to hide specific items if they did not want to remove the entire layer. This would be useful when visualizing and figuring out order. For example when a wall is selected to hide, only that

wall will be invisible, everything around, below, and above it will be shown all the same.

2.4.2.3.   Display all Dimensions: When selected, the user will be shown a pop up window with all the details of the item they selected. For eg. if they select a pipe, they can see all measurements, build features, materials etc.

2.4.2.4.   This feature can be replaced by allowing users to just hold down on the object they wish to select, and the pop would show up all the same. Both ways can exist, depending on what the customer wants.

2.4.3.   Layers

2.4.3.1.   Allow users to see an eye next to the name of the layer, so then when they click on it, the eye closes and the layer becomes invisible. The kinds of layers we would have are structural, mechanical, electrical etc. as much as the BMI allows. You can click multiple eyes closed at the same time and vice versa.

2.5.   Noor

2.5.1.   Live camera vs premade project

2.5.1.1.   Camera: using the camera directly would give the user a simple view of his surroundings with no details other than components turning into AR and their material being shown (no details for wiring, piping…).

2.5.1.2.   For projects, the whole building can be shown in more detail with specifics about every part that would be shown because information about the project has already been inputted into the document. The premade project would allow users to move anywhere inside their building as well.

2.5.2.   Material appearance

2.5.2.1.   Each material has their own colour to avoid clutter of text on the screen space.

2.5.3.   Removing or editing parts of projects

2.5.3.1.   the user may remove/edit their project, doing so allows them to see if they can change the building configuration. A safety warning may appear in case edits made cause the building to become unstable or no longer follow certain regulations.

3.   Global Concepts

3.1.   Global Concept #1

At initial contact, the user will be prompted to either register a new account with the app using their emails, Google, Facebook, or a company login using their work email addresses as shown in Figure 1. Then they will be asked for their language preferences, and the main two languages offered are English and French. Video youtube tutorials will be accessible in French and English. However, written tutorials will be offered in other language options such as Arabic, Urdu, Korean, and more.
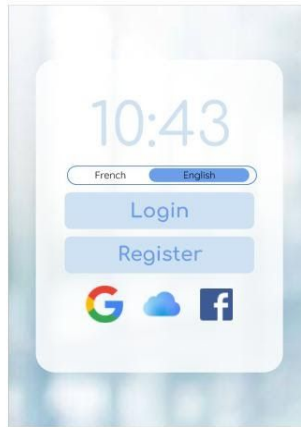
Figure 1. Registration Page

As seen in Figure 2 below, the welcome page will ask for the user to either start a new project, open an existing one, or go through freelance mode. A new project means the BIM needs to be uploaded and no previous changes will be present. The help function will allow users to read through frequently asked questions, access our contact information and it will also contain a textbox for users to submit any questions they want to ask. The tutorial will be mandatory for the user's first run through and will create pop up boxes pointing towards a specific feature and explaining exactly what their function is and how to use it.
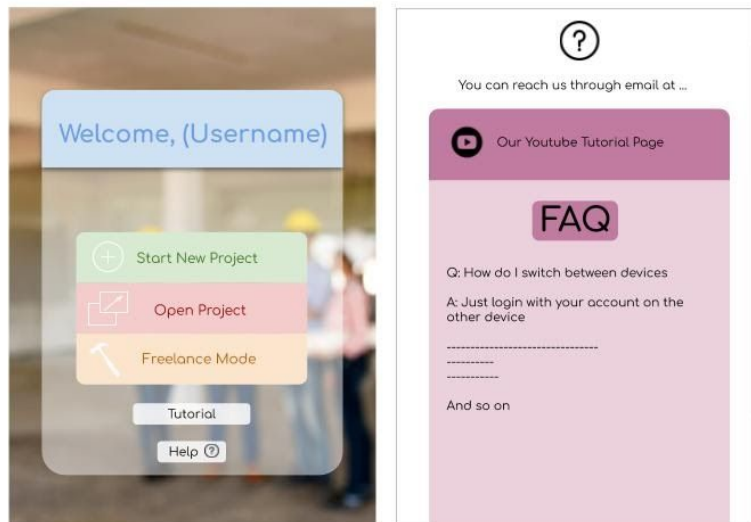

Figure 2. Welcome and Help Page

As you get forwarded into the app and the camera is open, the user will be able to see 6 clickable options, and the project title. The title will be named after the BMI file uploaded or

whatever the user chose if they were in freelance mode. Three horizontal lines can be seen on the top left corner indicating the menu, which when clicked, contains the option to logout/sign-out, return to the main menu, or ask for help.
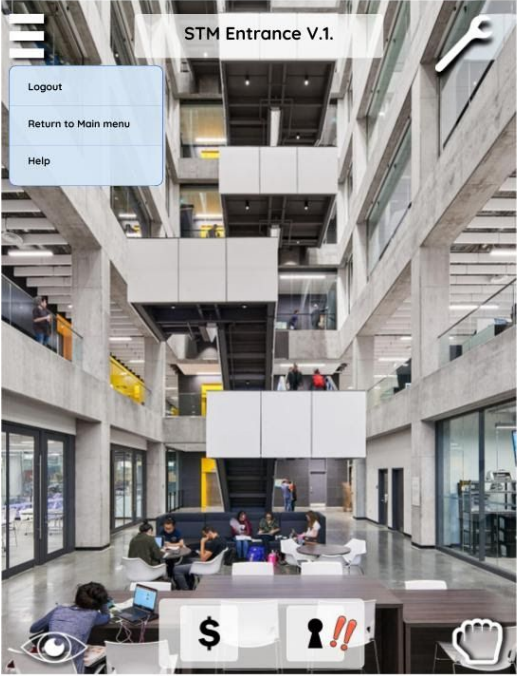

Figure 3. Menu Pop-Up

On the top right corner is a wrench icon named "tools" which contains the options to delete, insert, or annotate a feature. The delete will allow the user to delete an individual feature and everything around, under, and over it will still be visible.
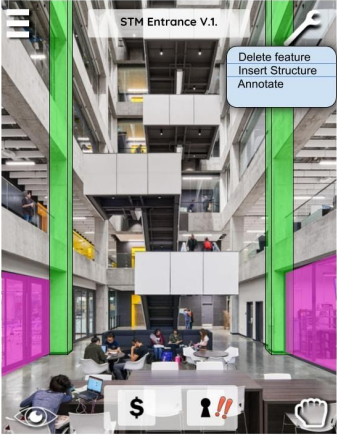

Figure 4. Tools Pop-Up

When Insert Structure is selected, a library of readily available features/structures will pop up, allowing the user to filter through the specific kind of structure they want to insert (doors, walls, hinges, beams etc), the material they need, and the size they require. Everything made of one material will be color coded the same for ease of view.When the item is being placed, the user will be informed if either the placement or the size is not in compliance with safety regulations.
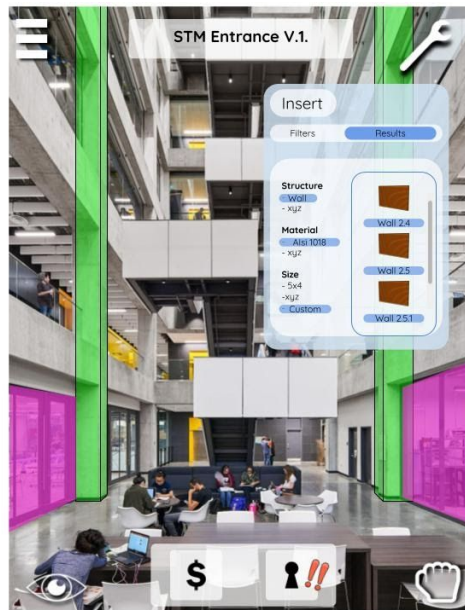

Figure 5. Insert Feature Pop-Up

The annotate feature will allow the user to select the item they want to write a note on, and then a pop up will allow them to write an unlimited amount of characters (text, numbers, and symbols only, no emojis).
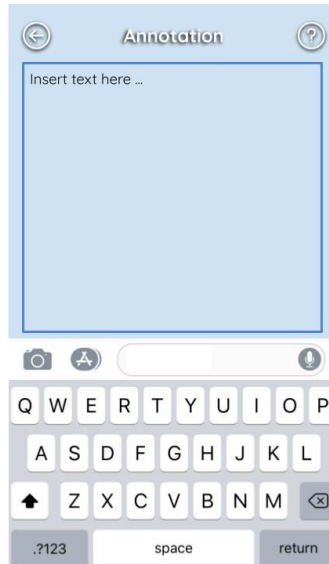
Figure 6. Annotate Pop-Up

The hand icon also known as the "select" feature will be prompted when clicked on a 3D object and the user may Annotate, Hide, Measure, or to display all dimensions/information available. There is some overlap of options available in tools and select because the user can click tools and then find an object to work on, or click select and find an object to work on before deciding what to do for it. This is left here to appeal to different working styles of users. The annotate feature works the same as it does in tools. The hide feature works almost exactly like the delete feature, the only difference is that the item will not be permanently deleted, only made invisible and the user is able to reverse this. This would be useful when visualizing and figuring out order. For example when a wall is selected to hide, only that wall will be invisible, everything around, below, and above it will be shown all the same. When display all dimensions is selected, the user will be shown a pop up window with all the details of the item they selected. Measure would allow the user to select point A and point B and after this, they can measure length in a straight line of whichever area they wanted in the real world. They can also measure things like radius, area, volume, using the values they input or the ones provided with the BMI. The units are all convertible between imperial and metric standards.
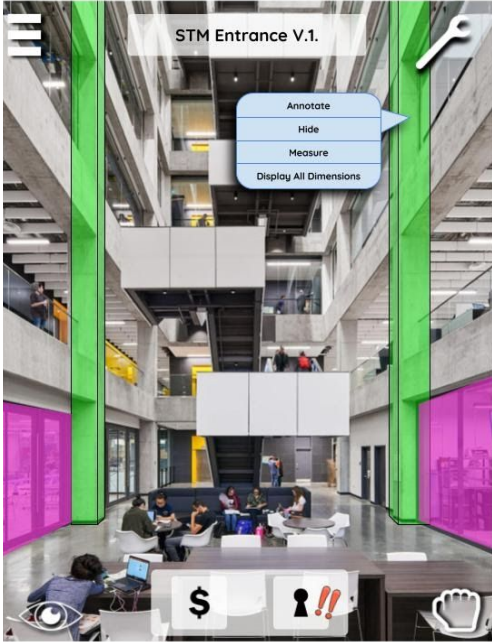
Figure 7. Select Pop-Up

The eye icon displays the Layers feature, when selected, the user will see a pop up containing an eye next to the name of each layer. If the eye is selected, the selected layer becomes invisible. The kinds of layers we would have are structural, mechanical, electrical etc. as much as the BMI allows. You can click multiple eyes closed at the same time and vice versa.
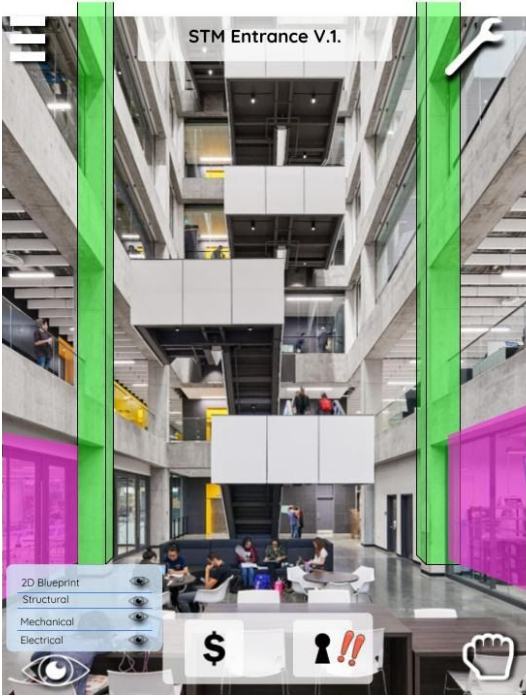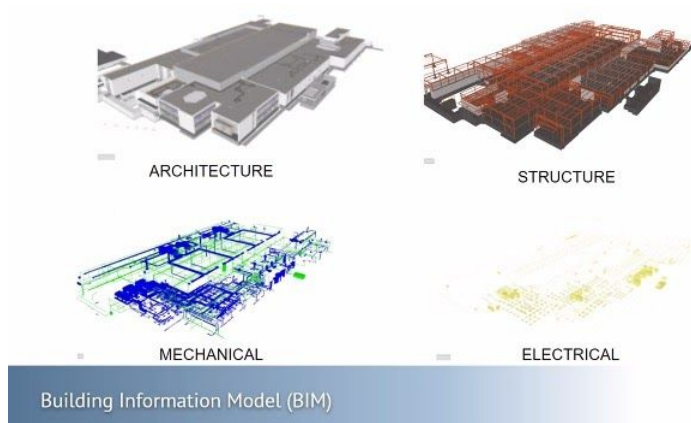
Figure 8. Layers Pop-Up

Figure 9. Layers Available

In the bottom center, there are two features, price breakdown, and changes. Price breakdown allows the user to view the total cost of all added features from tools and see an approximate range. "Changes made" contains two tabs, personal and everyone. When personal is selected, the user can see exactly what changes they made to the model and in what order. In the "everyone" tab, the user can see what changes everyone else working on the same model and connected to the same cloud software (as they would at a private organization), have done. In addition to this, two red exclamation marks will appear once other people start making changes.
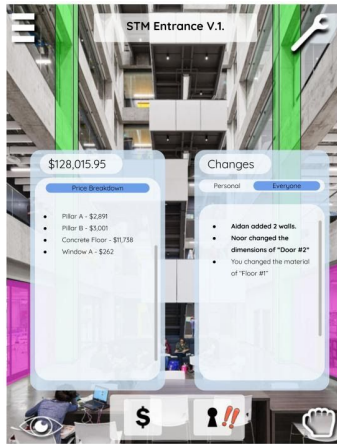

Figure 10. Price Breakdown and Changes Pop-Up

Below demonstrates a flowchart for the logical run through of the app through the lens of a user.
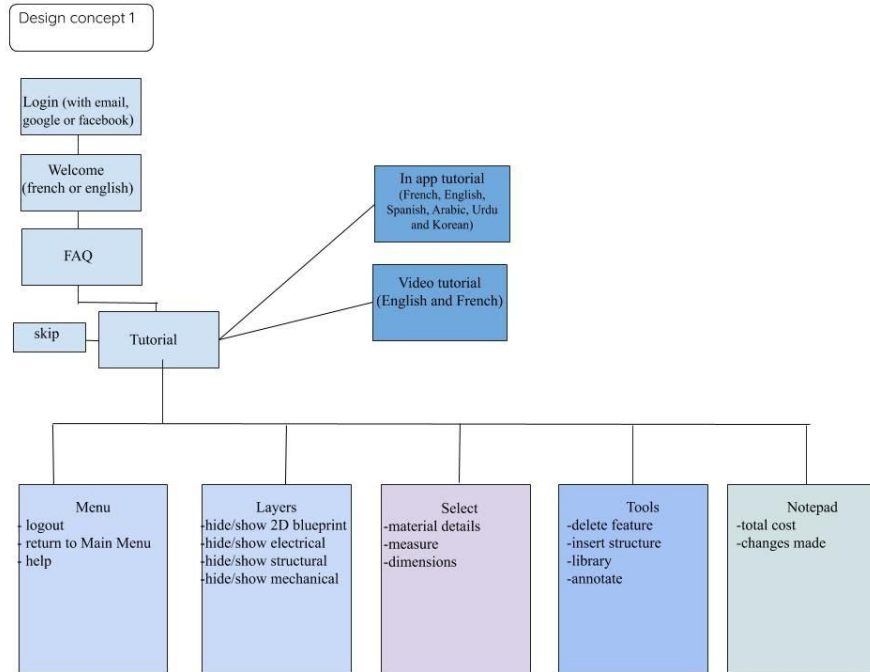
Figure 11. Global Concept #1 Flowchart

3.2.   Global Concept #2

Global concept 2 is very similar to the first one. However there are some changes. First of them being that the graphics are simpler in this concept. Meaning this concept takes less memory which is a good advantage but we're also dropping on image quality. Therefore, a good balance is needed to choose. Another difference is that the library is not an available option and that the tutorial is only available in English. The third major difference is that the materials are not color coded and that the material names are written on the shapes and cannot be moved, thus obstructing the view. And finally the annotate feature has more options to offer. The flowchart for this concept can be seen in the figure below.
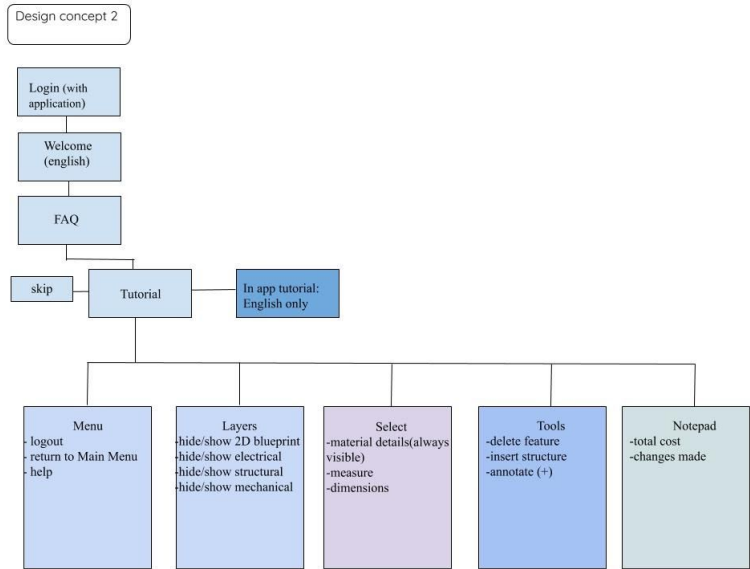
Figure 12. Global Concept #2 Flowchart

3.3. Global Concept #3

This concept is similar to both 1 and 2. One major difference is that the aesthetics and graphics are nicer in this one. This is a good advantage at first glance but it takes more ram space which is not ideal if you have a limited memory space or if you want you're designing your app to take less space.

Another major difference is that the items are all in list view and you have to click on them to see the specifics. Finally the tutorial section is only an FAQ with 5 pre-answered questions and there is no option to ask questions for the users. The flowchart of this concept can be seen in the figure below.
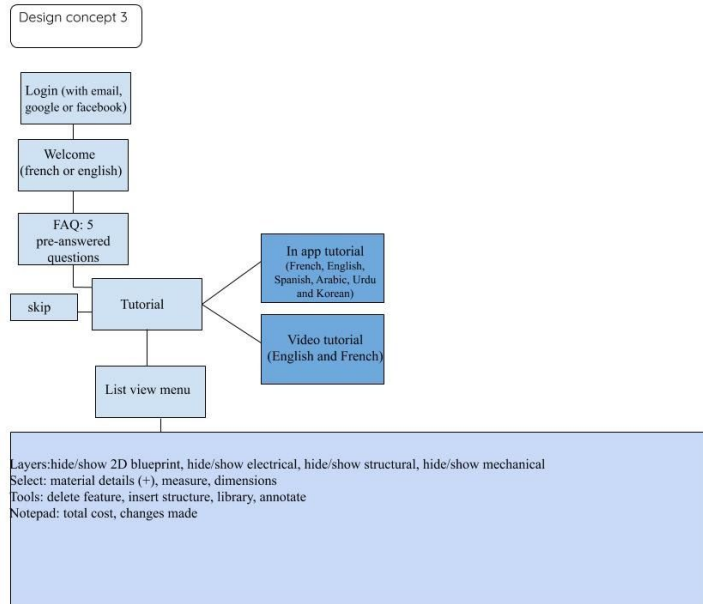
Figure 13. Global Concept #3 Flowchart

4. Comparison of Global Concepts

Table 1. Comparison of Global Concepts with Design Criteria and Metrics, out of 3

Product specification	Global Concept # 1	Global Concept # 2	Global Concept # 3
Accuracy and aesthetics	2	1	3
User friendliness (Main Menu, faq, how the info is displayed on screen, Sign-In Screen, Bottom Title (extra), Library,Annotation)	3	2	1
-Takes little memory -Simplified commands to reduce energy consumption	2	3	1
Accuracy and Specificity of displayed information (labels, Dimensioning)	3	2	1
Switch between operating modes	3	3	3
-Accessible to everyone -Available for free	3	3	3

Bilingual user guide + Tutorial	3	1	2
Compatible with the two main operating systems: Android and IOS	3	3	3
Accessible from anywhere	3	3	3
Total	25	21	20

5.   Final Global Concept

The Global concept #1 is most suitable for the framework of our design. As far as the time spent and the materials required are concerned, other two concepts may be considered, but they cannot offer much to users; the design should give an immersive experience without much technical difficulties, and by this standard, the first design concept is selected. Global concept #1 encompasses everything the client had requested and excels in the categories pertaining to ease of use and overall simplicity while still being able to perform all necessary tasks. The client had emphasized accessibility and Global concept #1 is by far the most accessible to all. Starting when the user first opens the app, they are immediately offered with different language options which other Global concepts lack. Moving on to the "Help" page - which is integrated in every screen in the app - this feature allows the user to access informative tutorials as well as our FAQ - which anyone can ask questions on - for any problems that they encounter. Global concept #1 has the perfect balance between simplicity and functionality and therefore is the ideal choice.

Conclusions and Recommendations for Future Work

In this deliverable, we compared three different global concepts. Each of them having their own characteristics. The concepts are the fruits of individual designs the team members came up with. Based on our previous deliverables, we wrote down the list of needs the global concepts must satisfy in order to be considered. On the side, we assigned ratings (from 1 to 3) for each need. At the end, those ratings were added up to have a total rating for each global concept. The global concept number one has the highest total and therefore is the one we will be using for our future work.
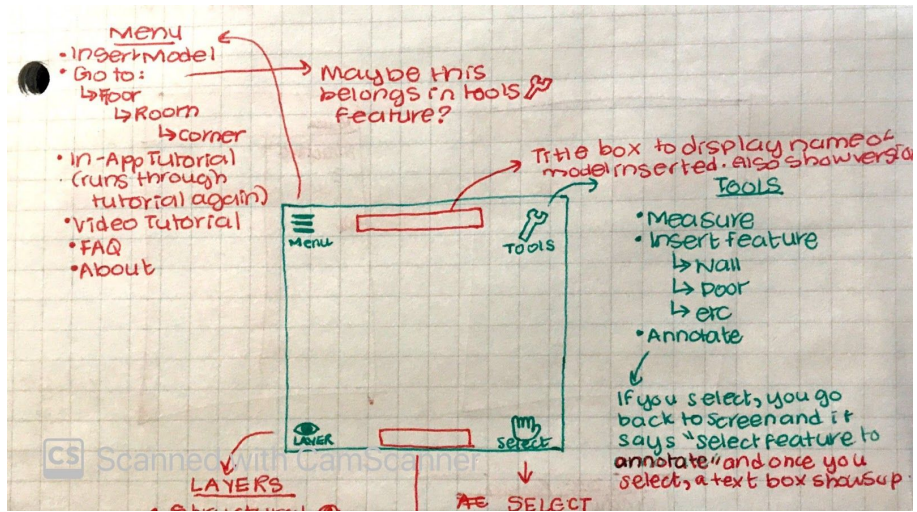
6.   Appendix

Figure 14. Sarah's Initial Idea