GNG 1103-B

Project Deliverable D
Design Concepts

Professor M. Majeed

Group B03-4

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Introduction

During the last few weeks, the students at the UOttawa faculty of engineering have worked diligently with the construction company *Ellis Don* to advance their AR-based building simulation project. They started by interviewing their client to determine the needs of their project, and followed that up by outlining the design criteria which will be used to create and evaluate their final product.

For this deliverable, students are expected to take the aforementioned criteria and use them to formulate conceptual designs for each major piece of the project. There are three such sub-systems to create concepts for: The Main Menu (which includes settings), the included tutorial, and the “in-game” AR view. Each team member will provide a maximum of three concepts per section, after which the team will deliberate on which ones suit the project best. Finally, the team will combine the best attributes included in the concepts to formulate a complete final design.

The Concepts

In this section, each team member will present their concepts, providing up to three per sub-system. Under each concept presented will be written a set of pros and cons as evaluated by the team.

The team will then choose one design per member for each subsystem and compare them, by scoring them numerically, to determine which concepts would best serve as the basis for the final design.

Mikael Mahfouz

Main Menu & Settings

Concept 1:

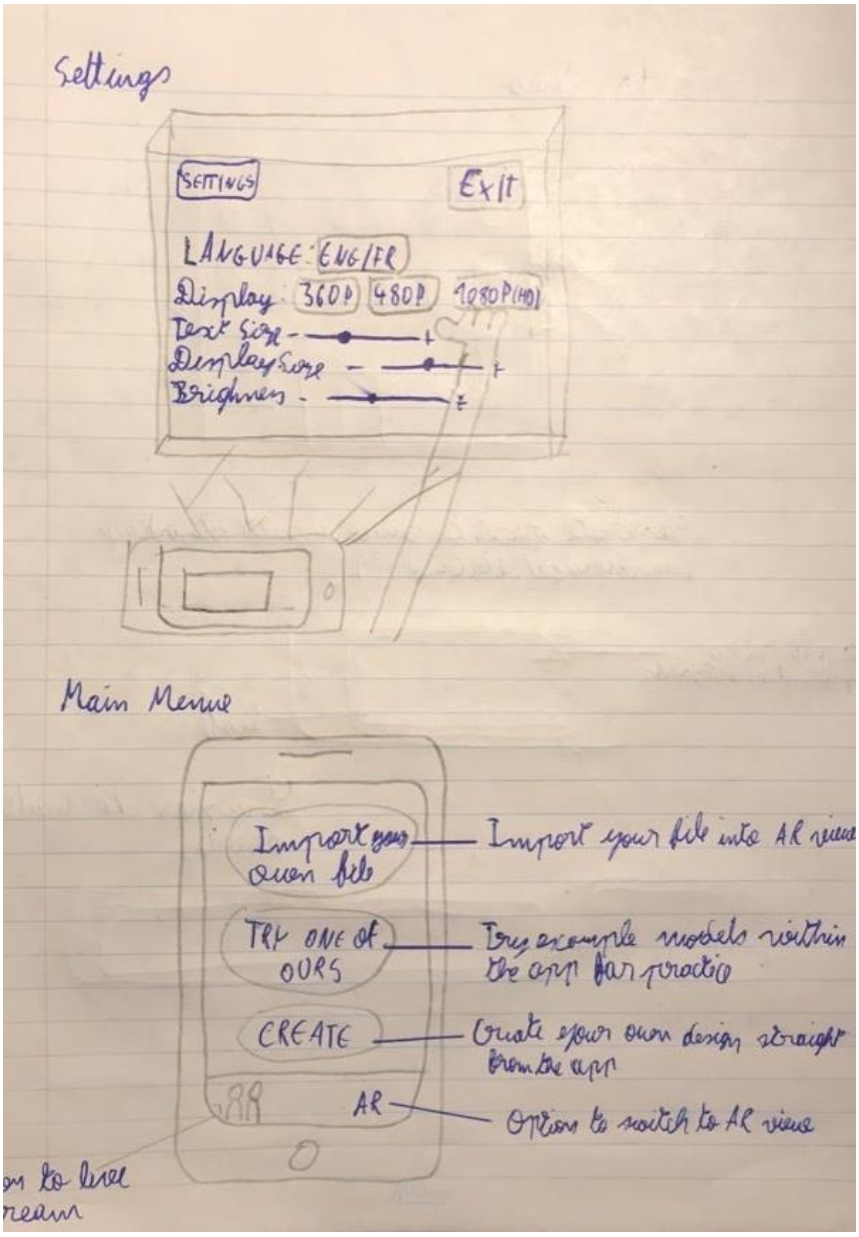
Pros:

- Settings can be edited without leaving AR
- Main menu easy to use
- Includes the option to load a sample file.

Cons:

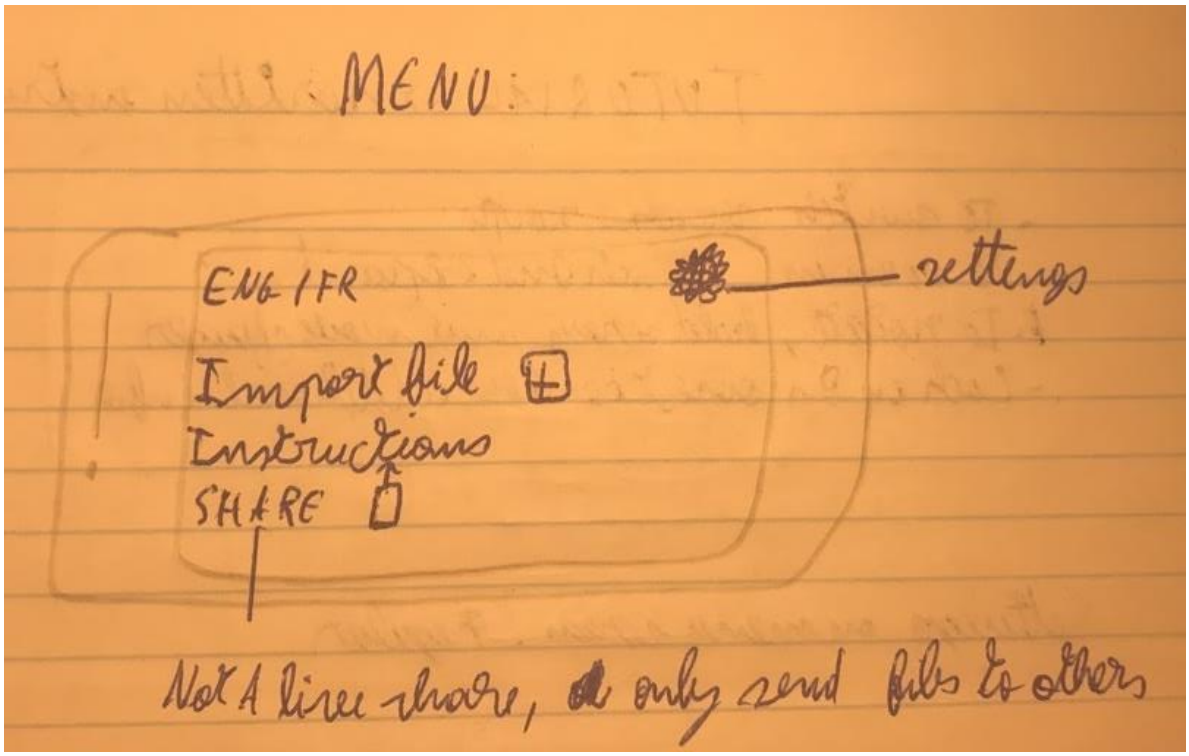
- Settings may be difficult to use
- No option to go back to tutorial

Figure 1: Main Menu Concept 1 by MM



Concept 2:

Figure 2: Main Menu Concept 2 by MM



Pros:

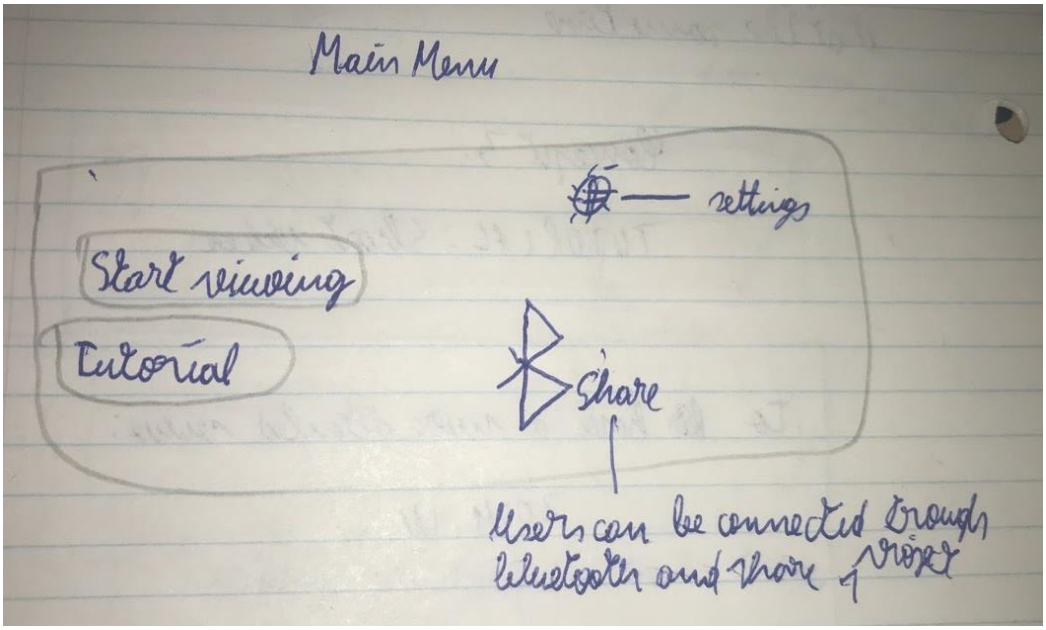
- Settings accessible from both main menu AND AR view
- Keeps settings separate from live view; optimal performance

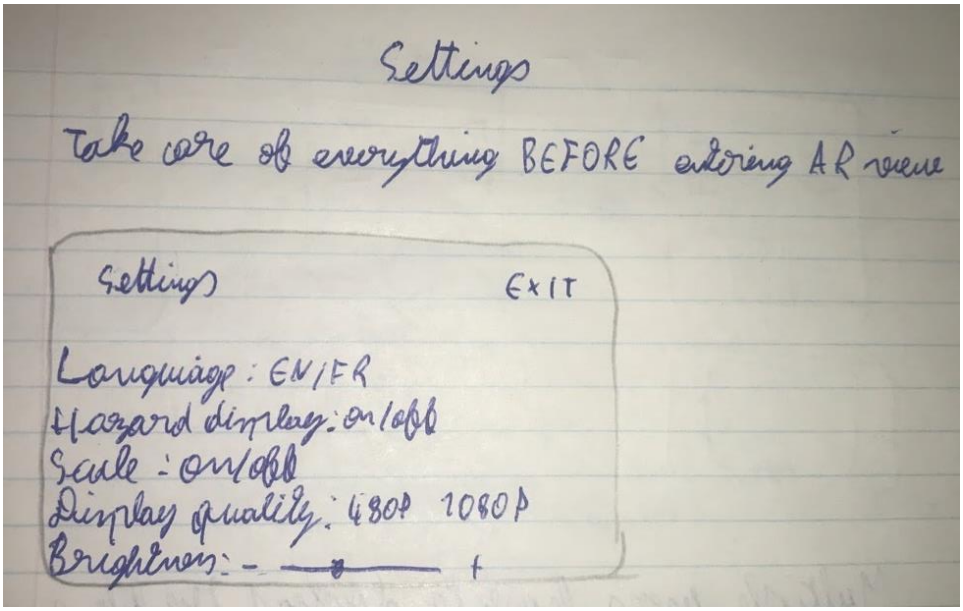
Cons:

- Not an actual multi-user experience (but good enough)

Concept 3:

Figure 3: Main Menu Concept 3 by MM





Pros:

- Both easy to use
- Tutorial and settings accessible from main menu

Cons:

- Can’t edit settings from the AR view. Must exit project

Tutorial

Concept 1:

Notes:

- Interactive “in-game” tutorial.

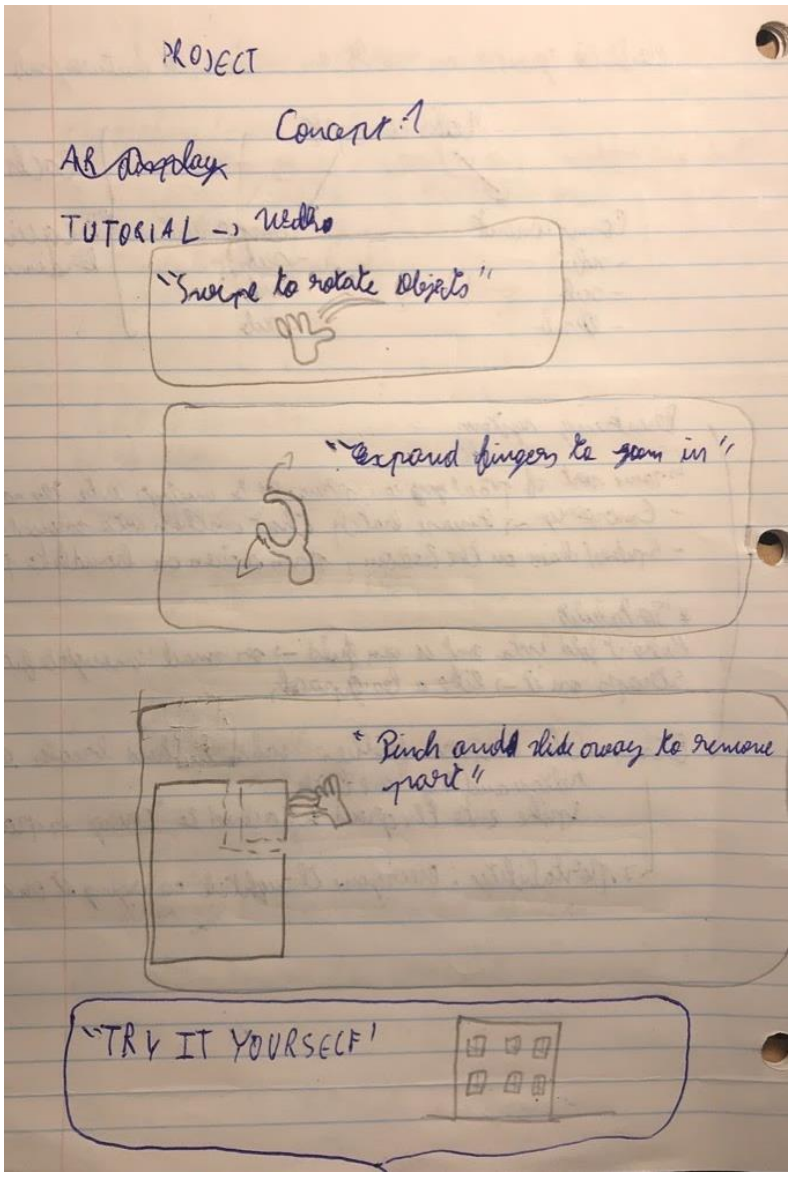
Pros:

- Interactive; best suited for learning

Cons:

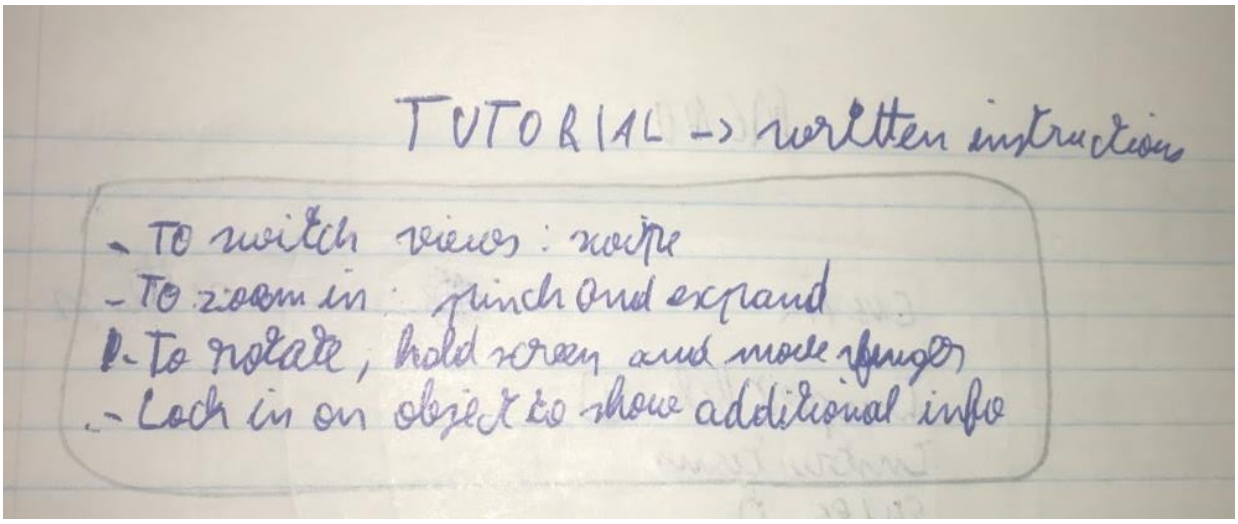
- Requires a lot of work to implement
- More time-consuming than other methods

Figure 4: Tutorial Concept 1 by MM



Concept 2:

Figure 5: Tutorial Concept 2 by MM



Pros:

- Easy to make
- Simple to consult

Cons:

- Requires interpretation
- Not as easy to use for laymen
- No visual indications

Concept 3:

Pros:

- Visual; demonstrative.
- Doesn't consume a lot of time

Cons:

- Hard to remember
- Non-interactive

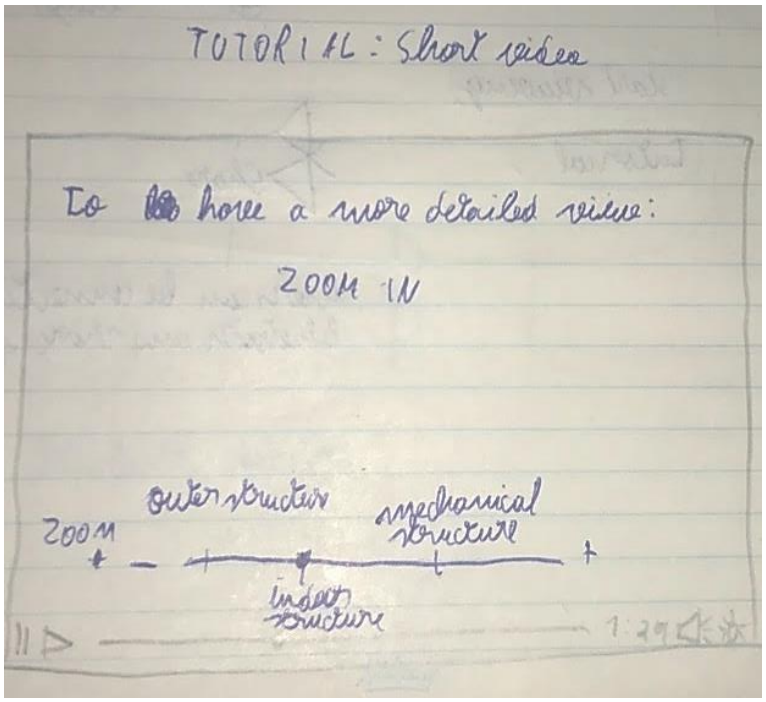
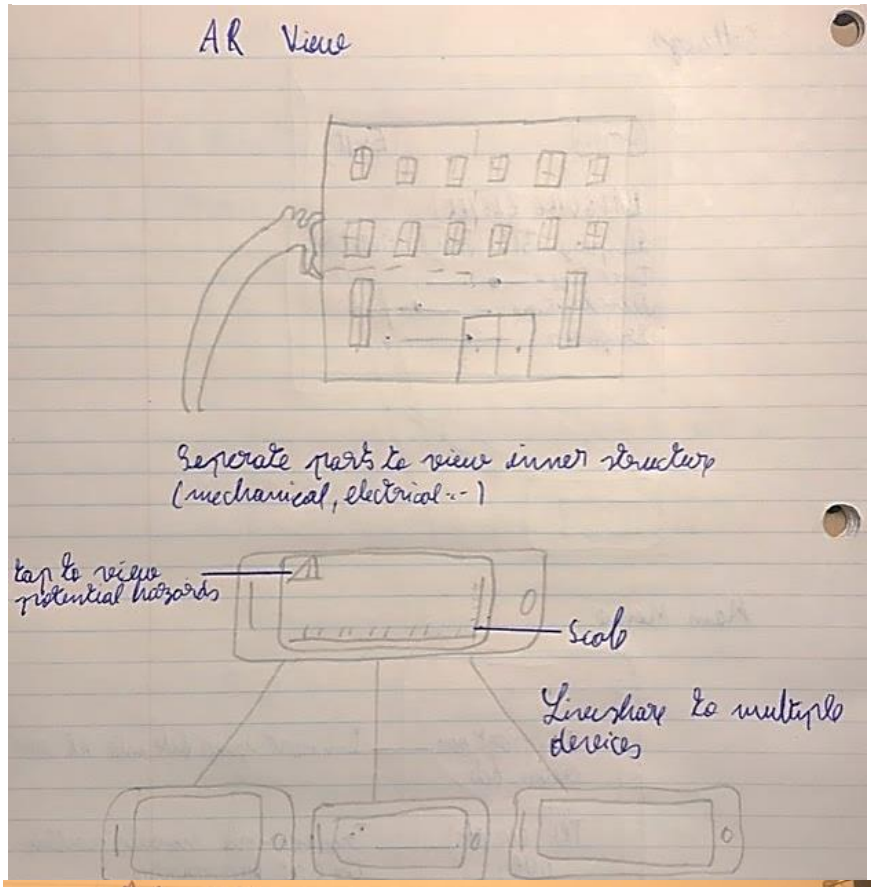


Figure 6: Tutorial Concept 3 by MM

In-game AR View

Figure 7: AR Concept 1 by MM



Concept 1:

Pros:

- 1st person AR view
- Scale on bottom of screen
- Can view entire building at once

Cons:

- Single user in control
- Difficult to scale down buildings

Concept 2:

Notes:

- Users can share files

Pros:

- Multiple people can interact with the project at once
- Easy to switch between different views
- Automatic scaling/hazards display

Cons:

- Can be chaotic
- Can lock in on objects unintentionally
- Scaling every object would take a very long time

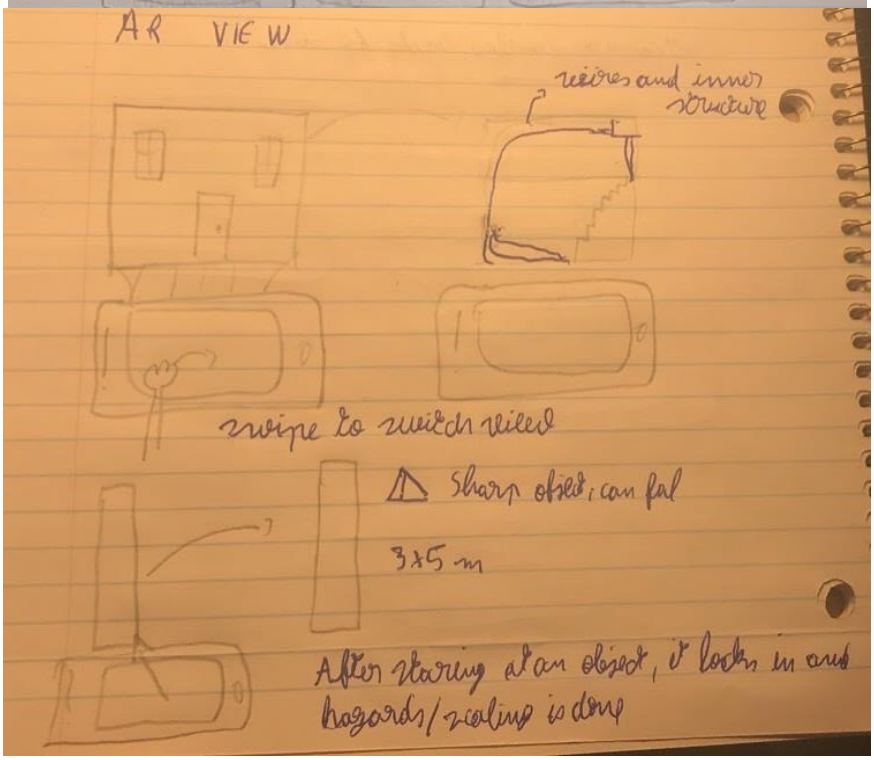


Figure 8: AR Concept 2 by MM

Concept 3:

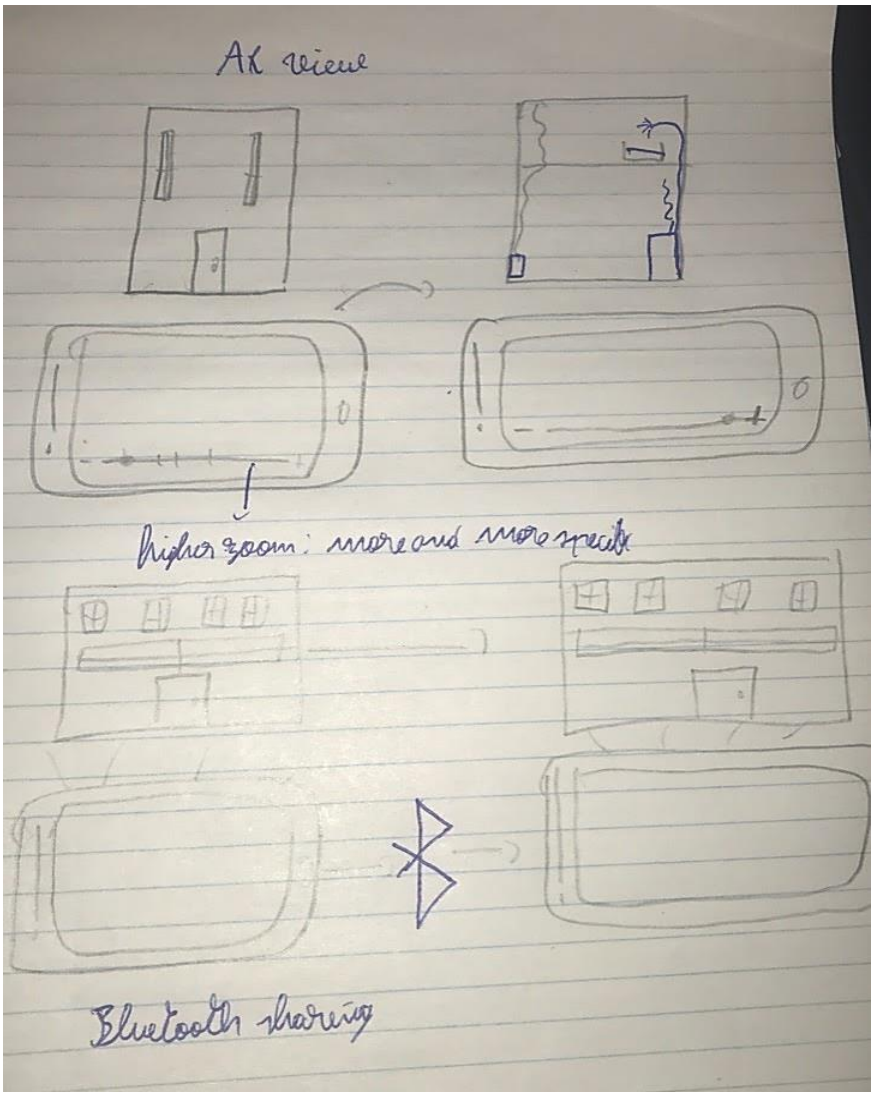
Pros:

- Every type of view available
- Easy to share

Cons:

- Might be difficult to find the right zoom
- No scaling or hazards display

Figure 9: AR Concept 3 by MM



Team's Decision

Upon deliberation of Mikael's designs, the team chose the following to proceed for further evaluation:

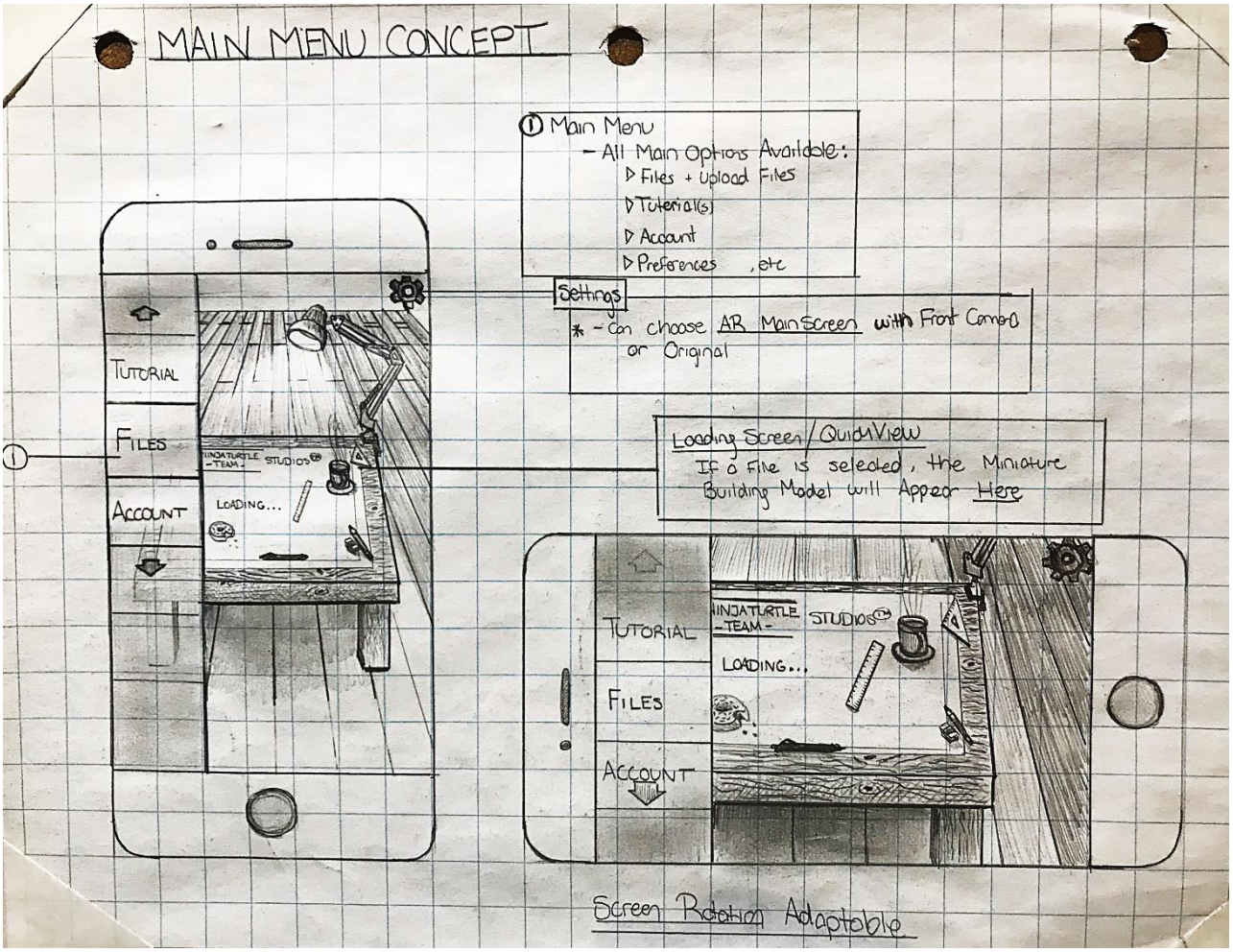
Table 1: Team Decision - MM's designs

Main Menu & Settings	Concept 2
Tutorial	Concept 1
AR view	Concept 2

Daniel Kesseler

Main Menu & Settings

Figure 10: Main Menu General Concept by DK



Concept 1:

Description:

- As drawn;
- Kept separate from AR view.

Pros:

- Visually stimulating
- Concise yet sufficient

Cons:

- Moderate effort to implement

Concept 2:

Description:

- Menus run with the AR view
- Menu controls are fully AR integrated

Pros:

- Visually stimulating

Cons:

- Difficult to implement
- The reliance on AR feels unnecessary and limiting

Concept 3:

Description:

- Combination of 1 and 2; switch between full AR and no AR from the settings.

Pros:

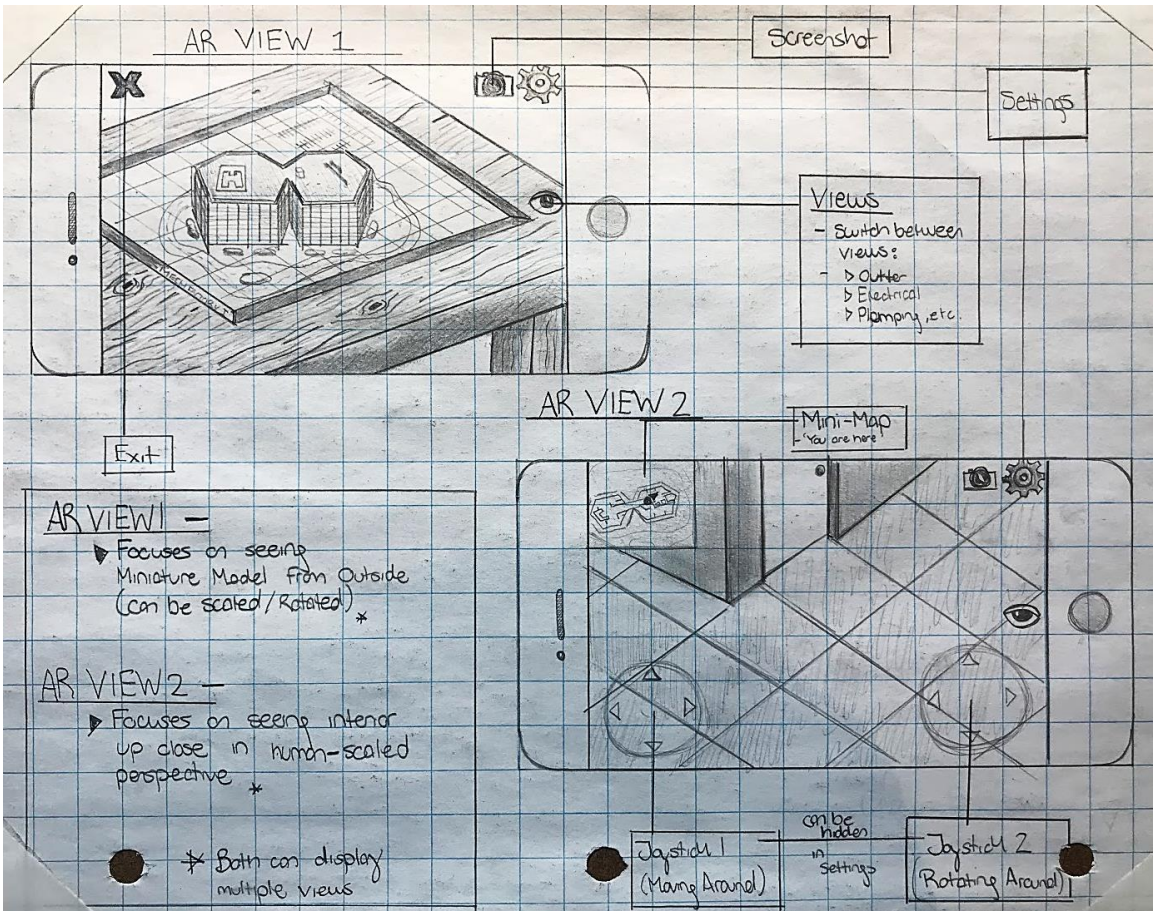
- Visually stimulating
- Adaptable for more or less powerful systems

Cons:

- Very difficult to implement
- The reliance on AR feels unnecessary and limiting

In-game AR View

Figure 11: AR General Concept by DK



Concept 1:

Description:

- Two different AR modes; one for walking through the interior of the Building Model, another for displaying the outer model on a flat surface mostly for outer details;
- Joystick Movement; one for linear movement, another for rotating (AR View 2)
- Touch screen for rotating or scaling building model (AR View 1)
- Mini-Map in left corner of AR View 2 allows for seeing 2D blueprint layout and tracking current position of the user relative to the Building model (Specifically shows the floor that the user is on for simplicity)

Pros:

- Offers different AR views for specific tasks

Cons:

- Can only access Table-Top view out side of AR walkthrough
- Can only access Walkthrough separate from table-top.

Concept 2:

Description:

- Mini-map in AR View 2 shows AR View 1 when tapped on, but with a location tracker of the user's current position in that building in 3D. No need for a separate place in the app to see AR building, both are found in the Walkthrough

Pros:

- Better visibility in 3D

Cons:

- No 2D Map

Concept 3:

Description:

- Both Concept 1 and Concept 2 are implemented;
- Users have access to both Walkthrough AR View 2 and Tabletop AR View 1 separately, but can also view the table top model by clicking on the 2D mini-map, which will still reveal the 2D blueprint, but there will be a button available to view tabletop model as well.

Pros:

- Dual implementation for optimal AR capabilities

Cons:

- Twice the features, meaning harder implementation

Team's Decision

Upon deliberation of Daniel's designs, the team chose the following to proceed for further evaluation:

Table 2: Team Decision - DK's designs

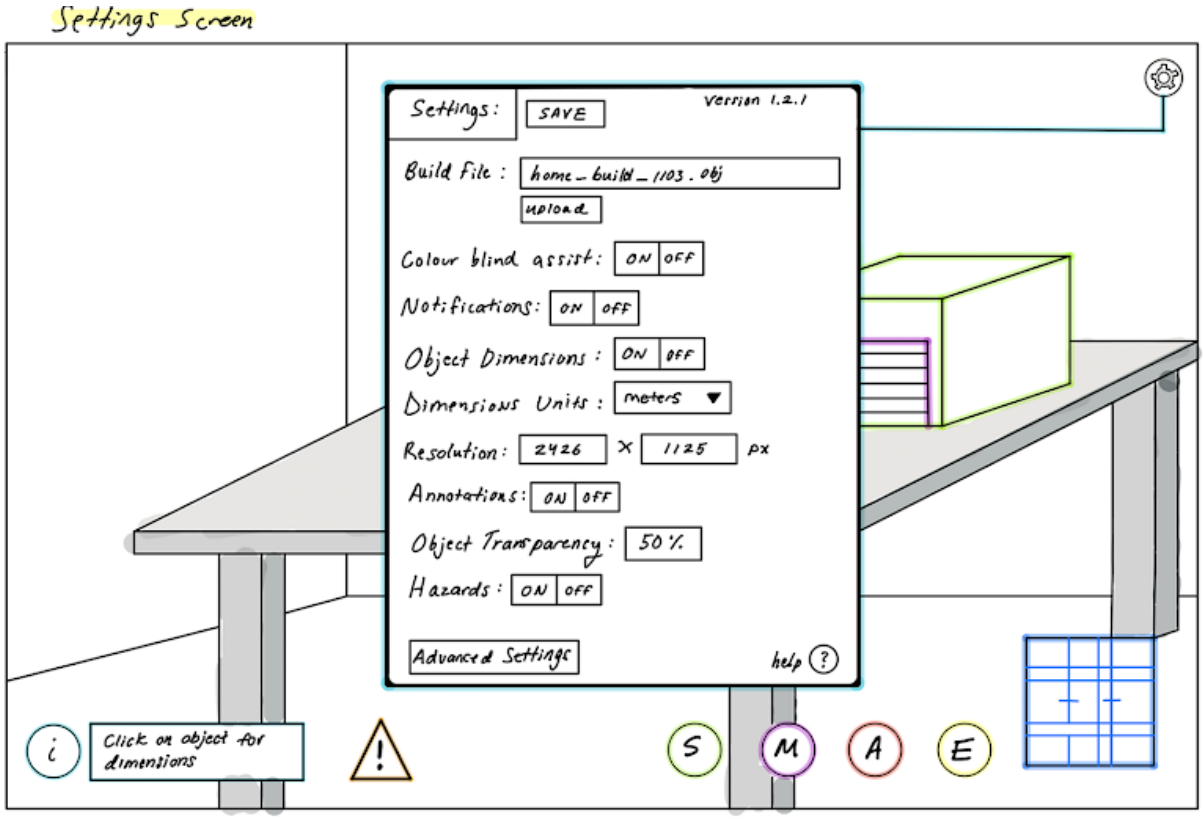
Main Menu & Settings	Concept 1
AR view	Concept 3

Matthew Villeneuve-Laroche

Main Menu & Settings

Concept 1:

Figure 12: Main Menu Concept 1 by MV



Pros:

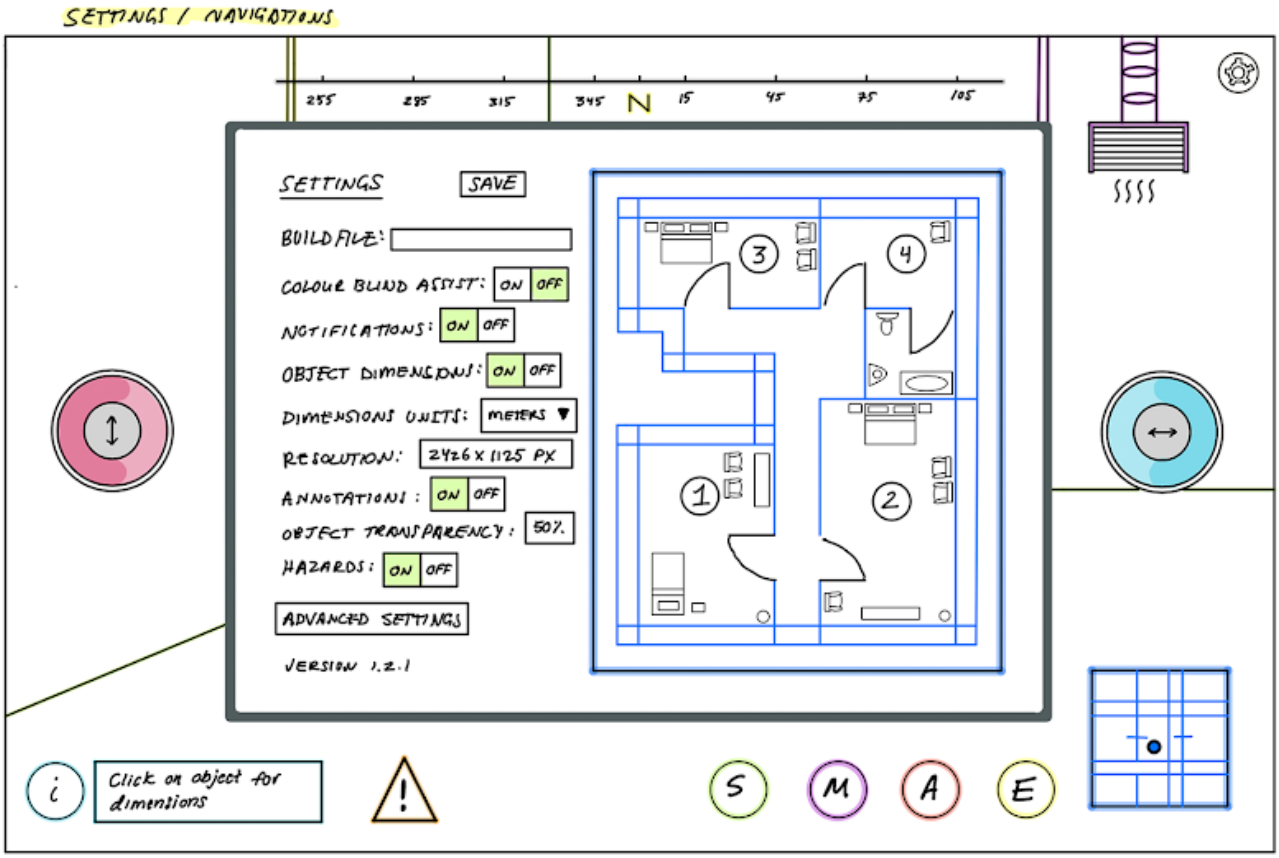
- In-screen settings available
- Simple and concise

Cons:

- No access to menu before the AR camera is turned on

Concept 2:

Figure 13: Main Menu Concept 2 by MV



Pros:

- Includes building map
- Accessible via settings COG from AR view and Main Menu
- Simplified on/off settings

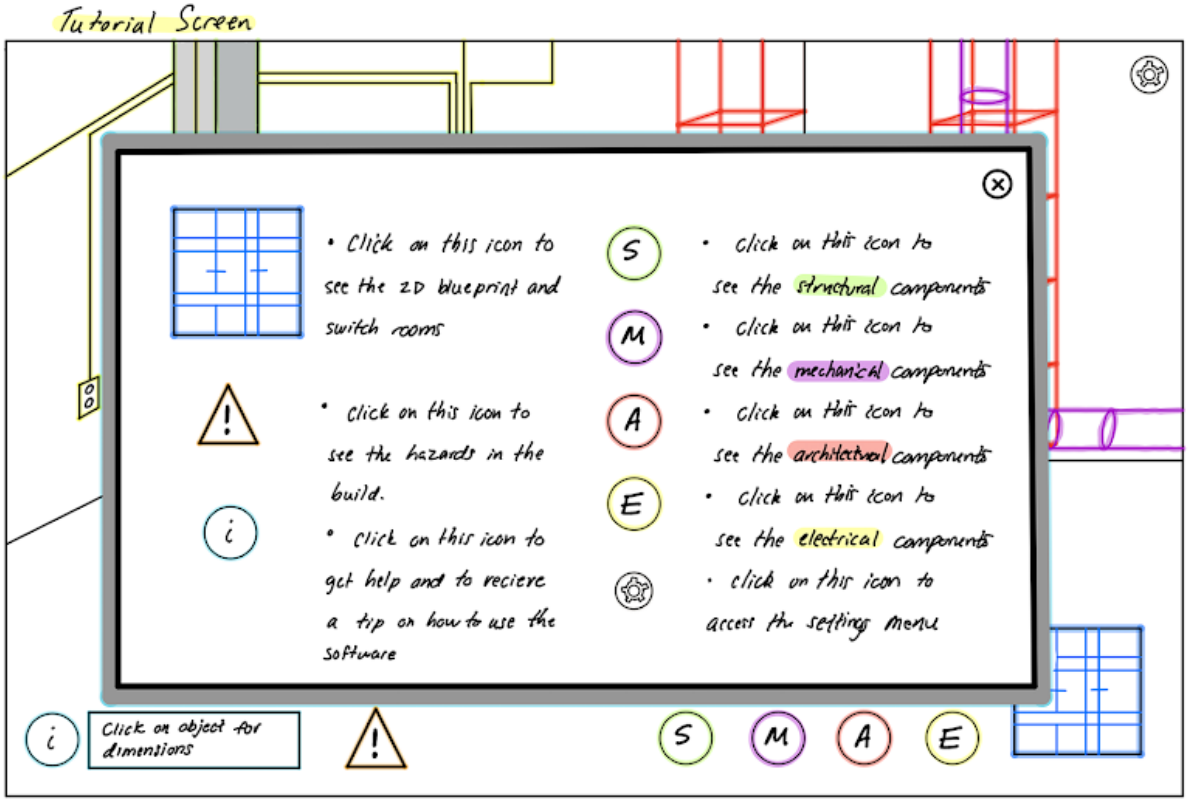
Cons:

- Visuals could feel overcrowded

Tutorial

Concept 1:

Figure 14: Tutorial Concept 1 by MV



Pros:

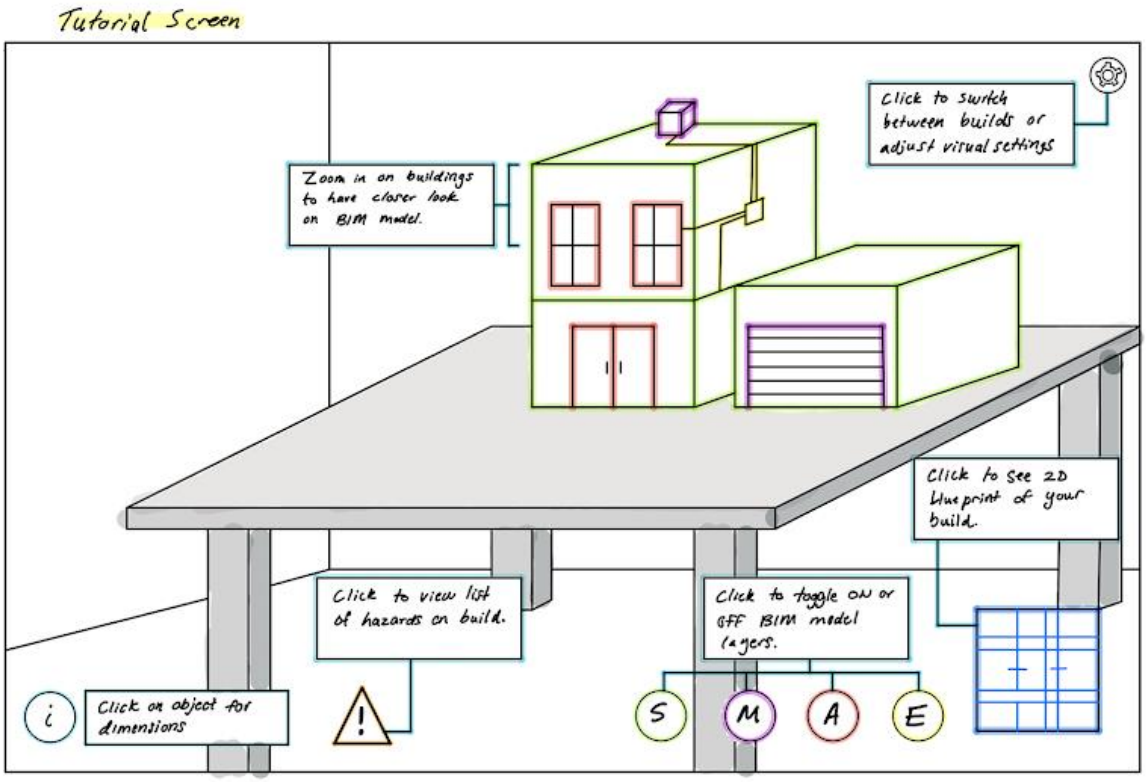
- Tutorial icon is accessible from the in-game screen
- Shows tips as you're using the software

Cons:

- Not interactive
- Need to navigate the screen to find your query

Concept 2:

Figure 15: Tutorial Concept 2 by MV



Pros:

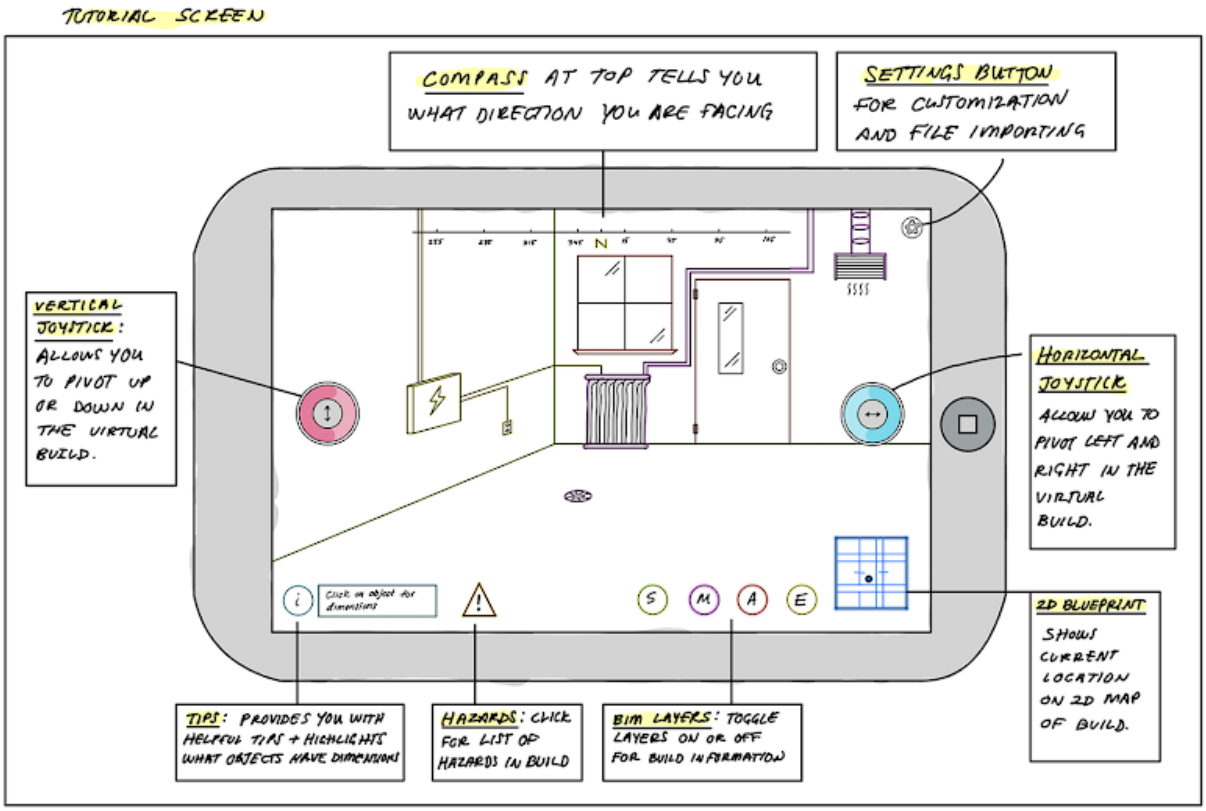
- Every instruction is clear and visible for the user
- Provides a lot of information

Cons:

- Crowds the screen
- Doesn't explain mechanics
- Hard to implement

Concept 3:

Figure 16: Tutorial Concept 3 by MV



Pros:

- Simple, sufficient instructions
- “I” button always available

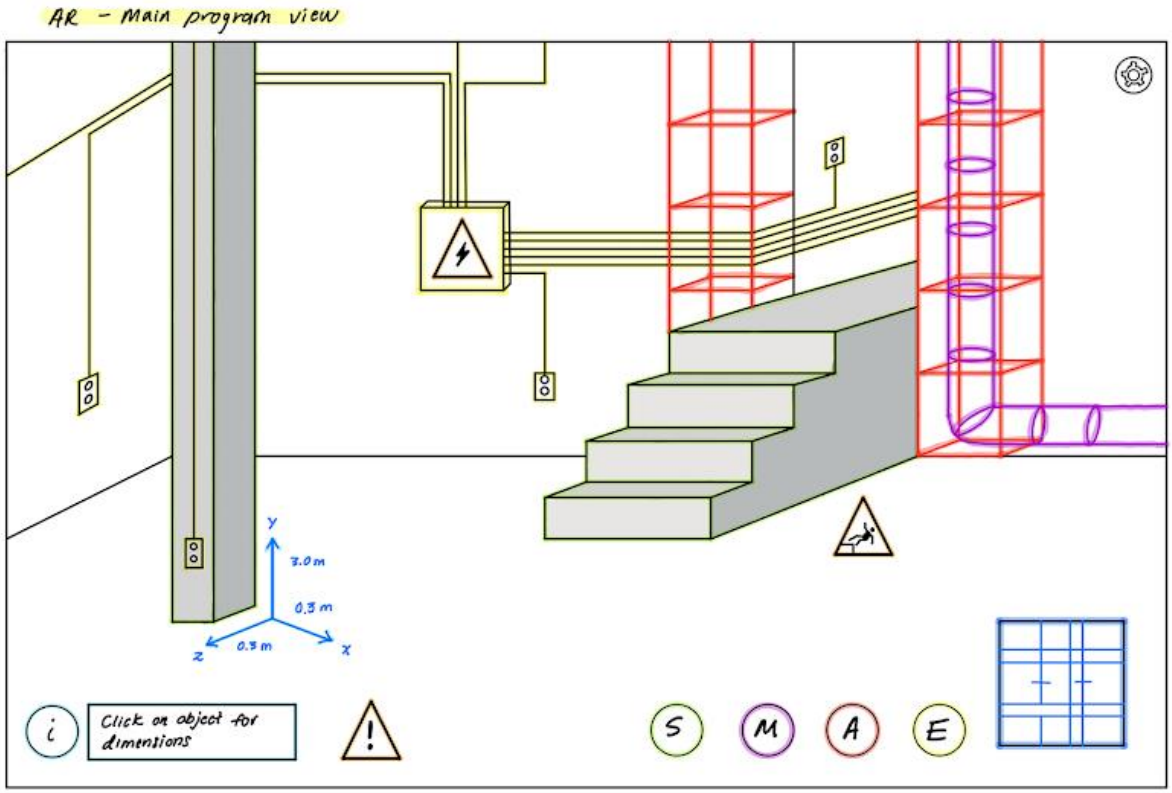
Cons:

- Not interactive

In-game AR View

Concept 1:

Figure 17: AR Concept 1 by MV



Description:

- 1st person AR view with visual BIM layers that can be toggled on and off and superimposed onto the camera view. Object dimensions can be viewed when object is tapped. 2D blueprint minimap in the bottom corner. Hazards and Settings page available from button access.

Pros:

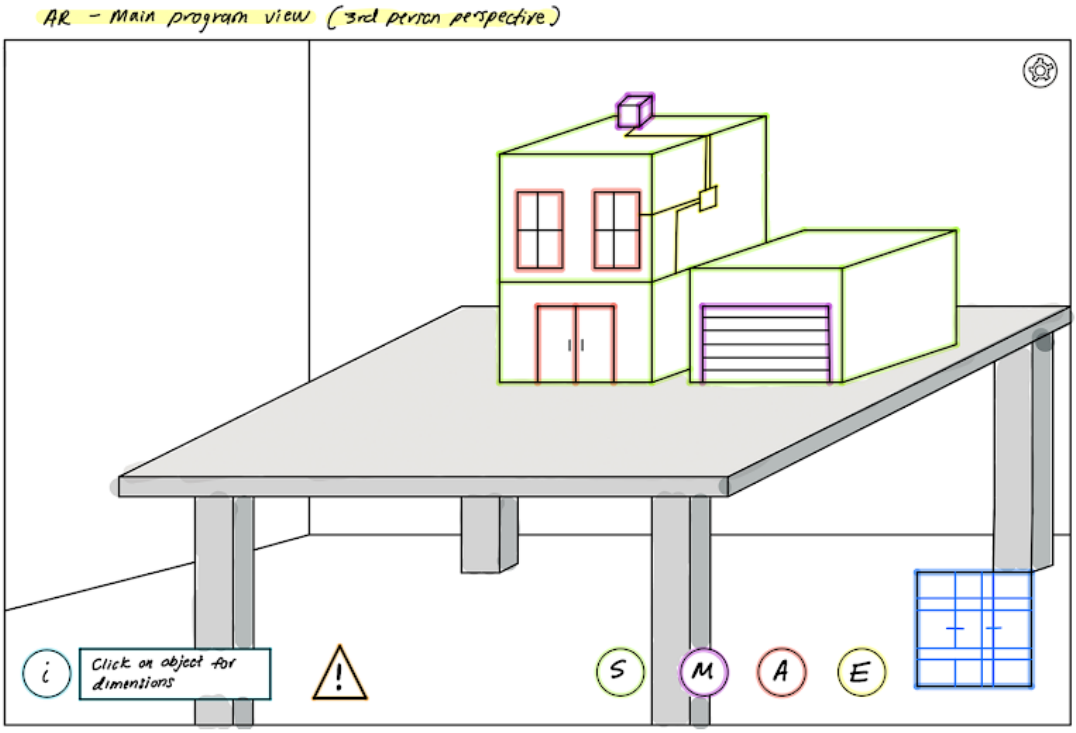
- Simple 1st person AR design
- On-screen icons and labels

Cons:

- Only 1 perspective available

Concept 2:

Figure 18: AR Concept 2 by MV



Description:

- 3rd person AR view with visual BIM layers that can be toggled on and off of a building on a table top. Object dimensions can be viewed when object is tapped. 2D blueprint minimap in the bottom corner. Hazards and Settings page available from button access.

Pros:

- Table top AR view
- Simple and clear

Cons:

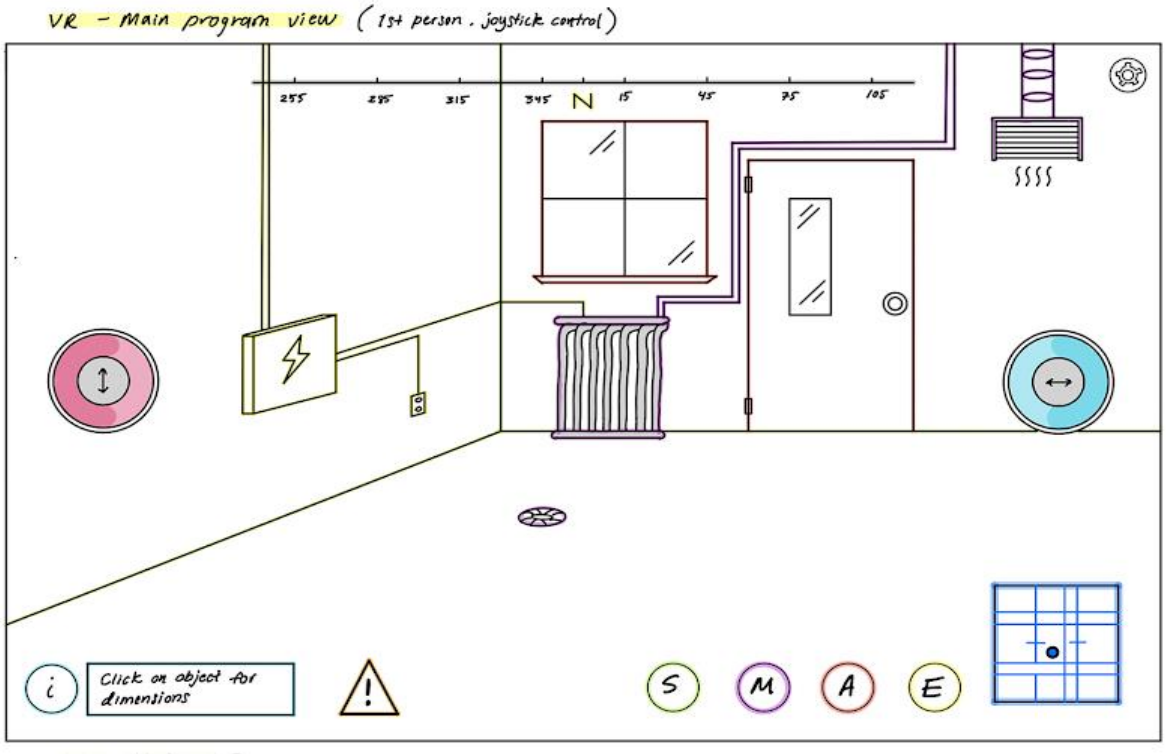
- Only 1 perspective
- No 1st person view
- Limited view of layers

Concept 3:

Description:

- Virtual building view with visual BIM layers that can be toggled on and off of a building on a table top. Vertical and horizontal joysticks control movement around the build. Object dimensions can be viewed when object is tapped. 2D blueprint is in Settings page. Hazards and Settings page available from button access.

Figure 19: AR Concept 3 by MV



Pros:

- Joystick control
- Clean design

Cons:

- No AR capabilities, VR only; goes against criteria

Team's Decision

Upon deliberation of Matthew's designs, the team chose the following to proceed for evaluation:

Table 3: Team Decision - MV's designs

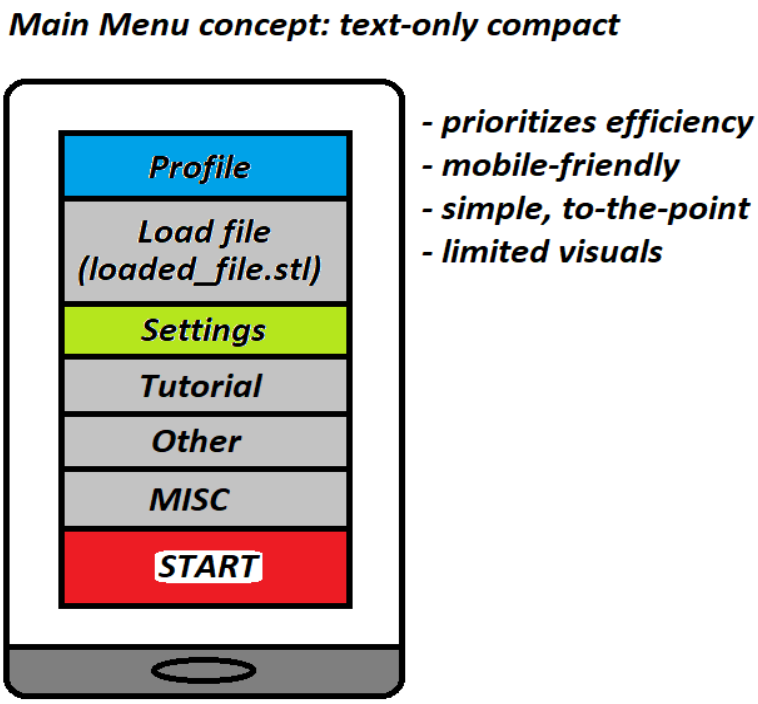
Main Menu & Settings	Concept 3
Tutorial	Concept 3
AR view	Concept 1

Joseph El-Nouni

Main Menu & Settings

Concept 1:

Figure 20: Main Menu Concept 1 by JE



Pros:

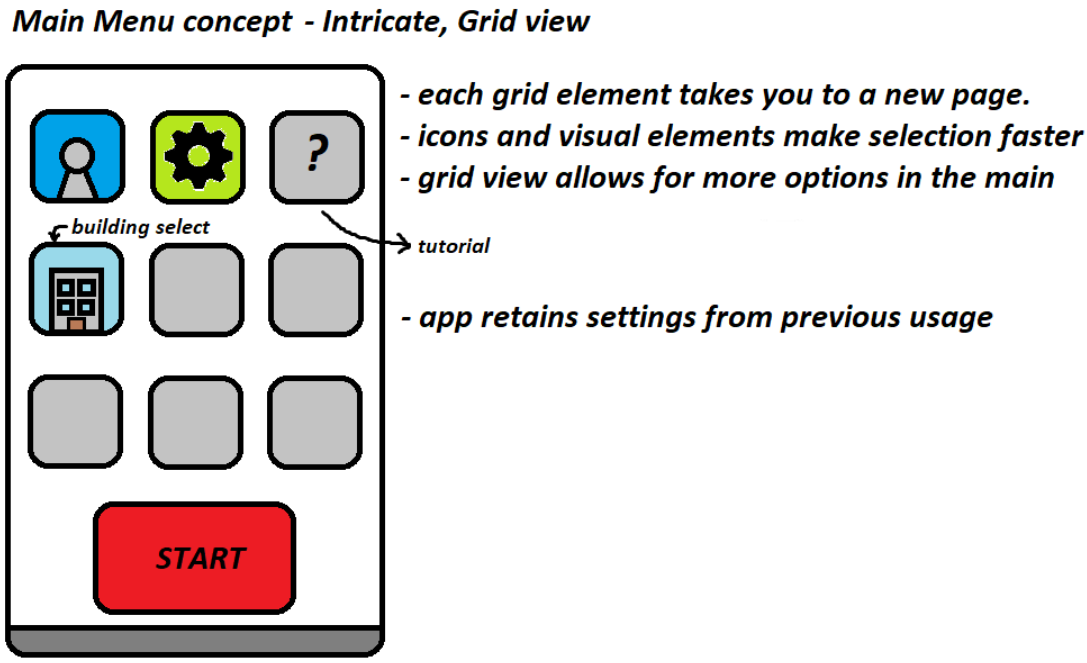
- Minimalist
- Simple to implement

Cons:

- No visual cues
- Requires prior knowledge to operate optimally

Concept 2:

Figure 21: Main Menu Concept 2 by JE



Pros:

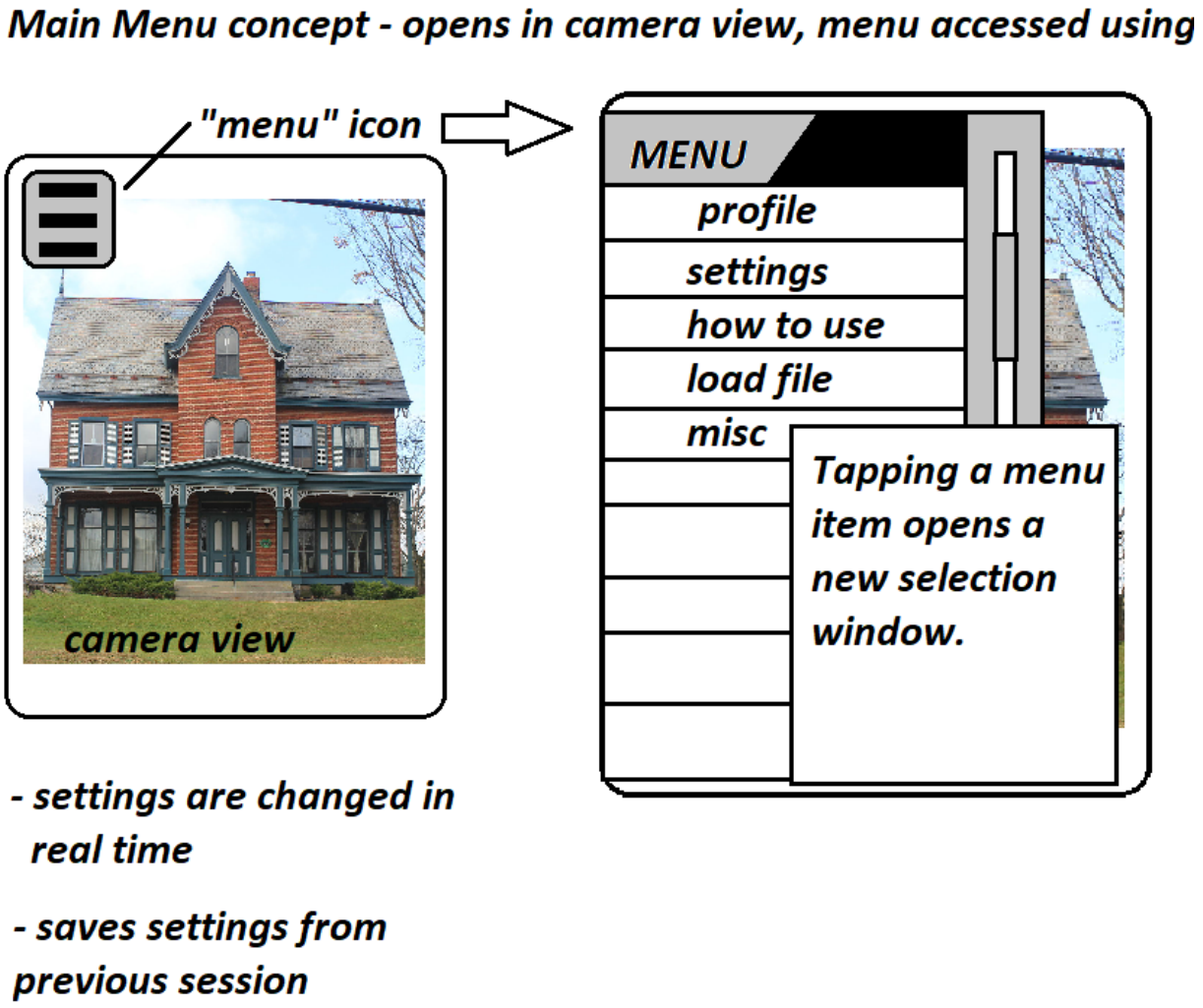
- More visually appealing than the text-only approach
- More options are visible in the main menu

Cons:

- Displays the least information due to the lack of text

Concept 3:

Figure 22: Main Menu Concept 3 by JE



Pros:

- Allows for live change of settings
- Minimalist

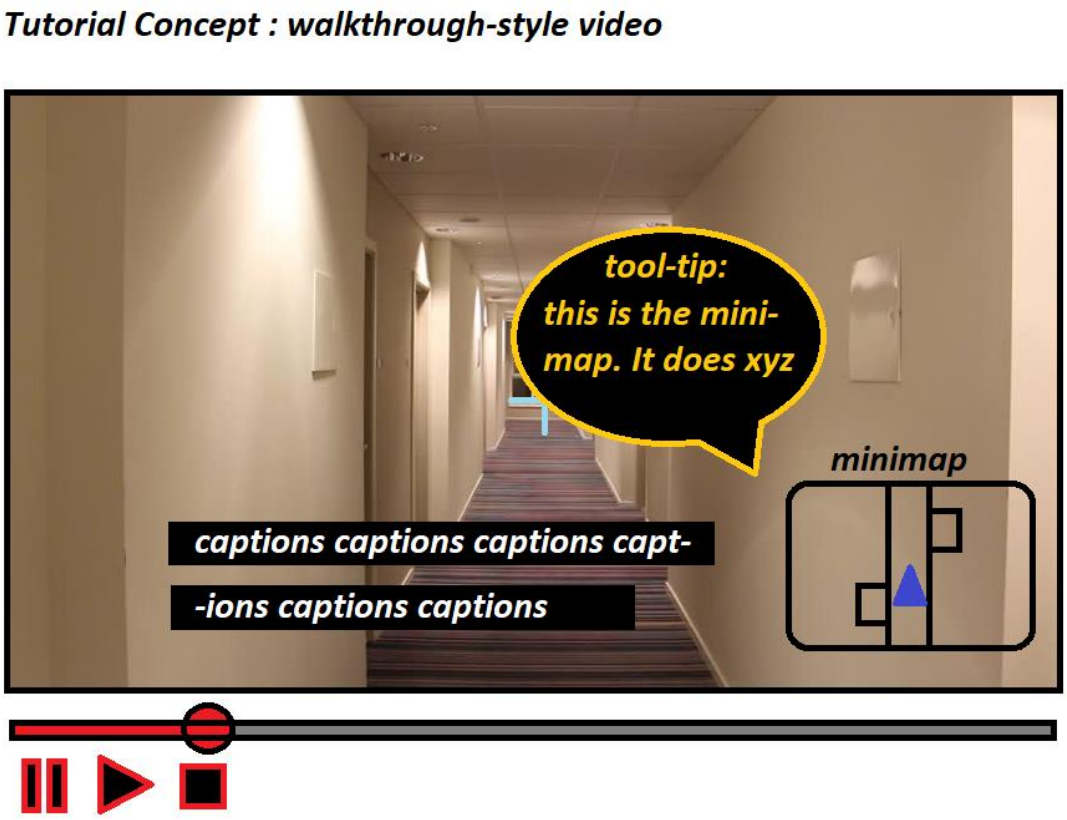
Cons:

- Could be hard to implement live visual changes
- Disruptive
- Cannot be accessed without the use of the camera

Tutorial

Concept 1:

Figure 23: Tutorial Concept 1 by JE



Pros:

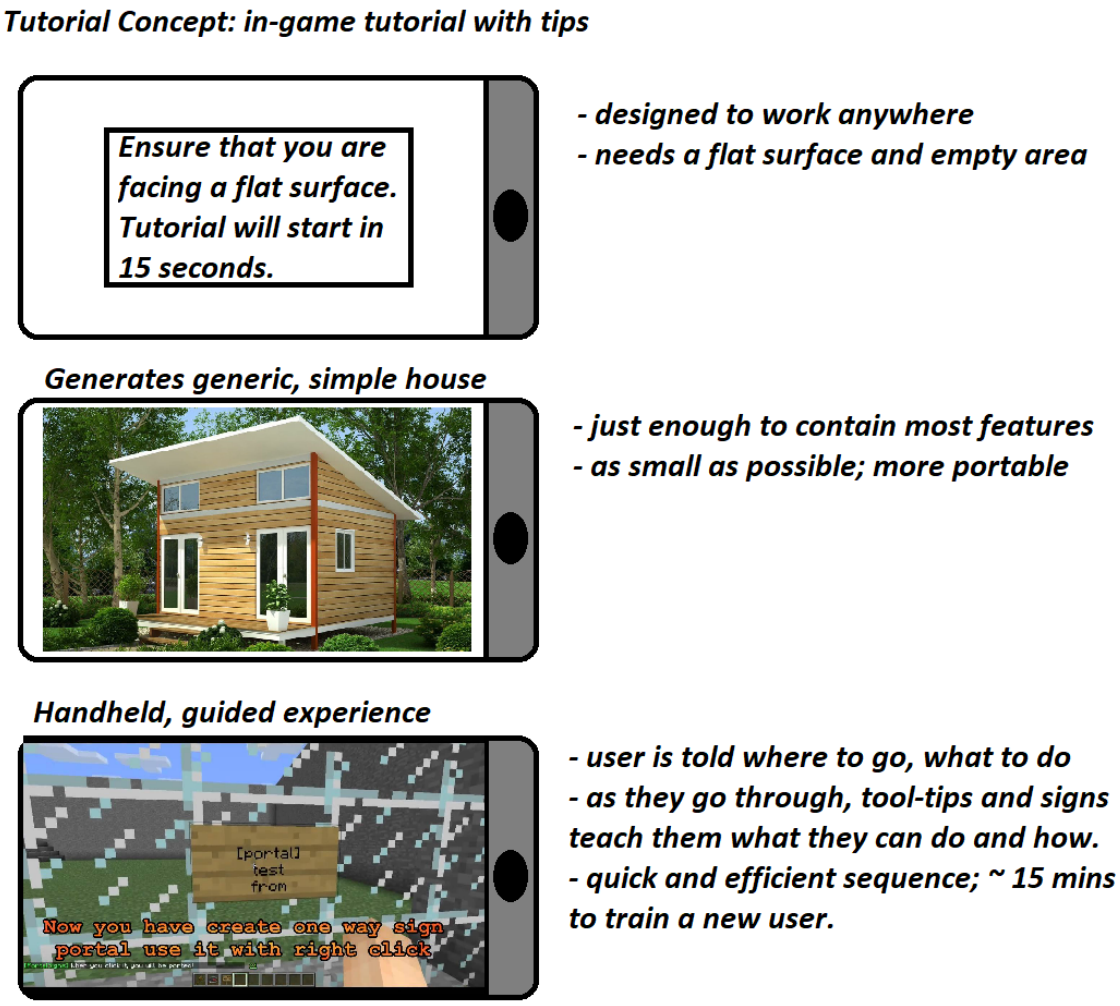
- Simple method to implement
- Video can be accessed at any time
- Timestamps point to specific instructions
- Visual approach

Cons:

- Non-interactive
- Hard to remember instructions
- View is idealized and edited, rather than conveying the true experience

Concept 2:

Figure 24: Tutorial Concept 2 by JE



Pros:

- Interactive
- Compactness allows for deployment in most areas
- Provides a sample file
- Easiest for new users regardless of expertise

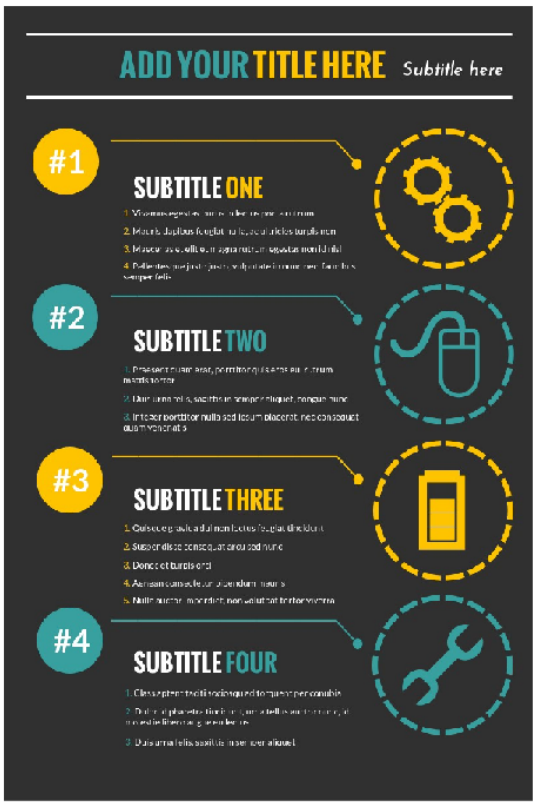
Cons:

- User must go through entire tutorial every time they forget specific commands
- Requires space
- Moderate difficulty of implementation

Concept 3:

Figure 25: Tutorial Concept 3 by JE

Tutorial concept - Infograph / Pamphlet



<-- general idea

- inforgraphic is split into sections for different control options

- guides the user through the process from accounts to file selection to "in-game" options, utilizing images to give general explanations.

Pros:

- Combination of text-based and visual information
- Comes in a physical copy if needed
- Easy to consult

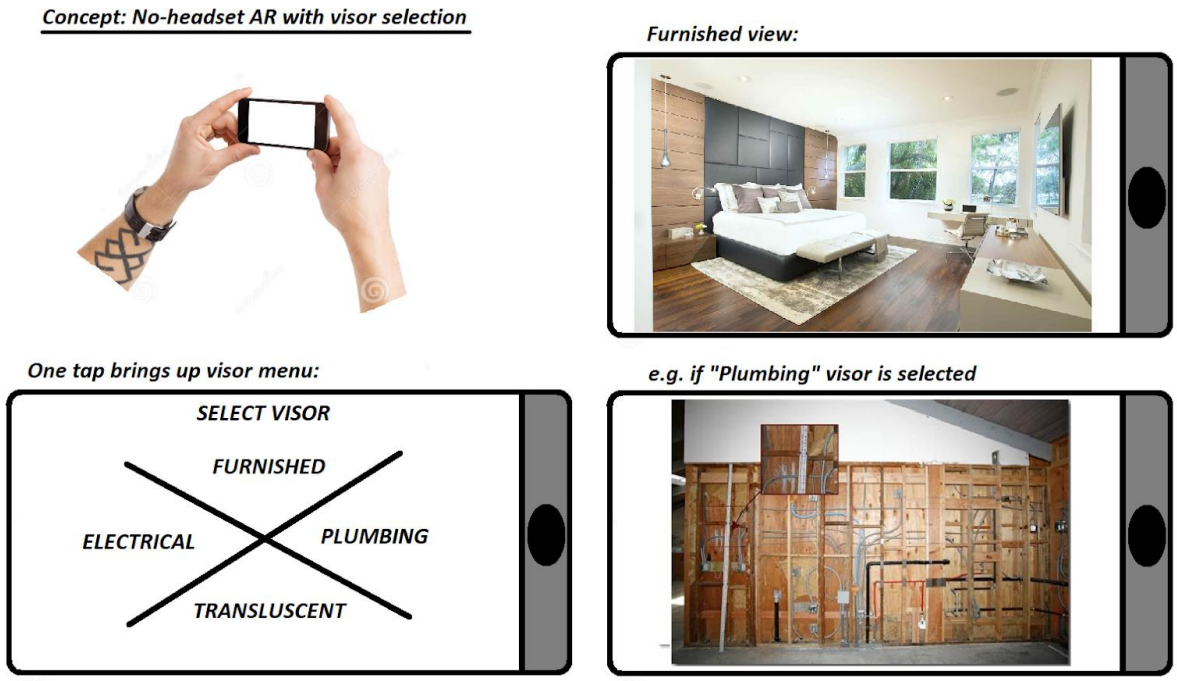
Cons:

- Limited space; can only contain so much information
- Non-interactive
- Requires minimum expertise

In-game AR View

Concept 1:

Figure 26: AR Concept 1 by JE



Pros:

- No headset; can be passed around between workers
- Visor menu is easy to utilize
- Great for viewing via tablet

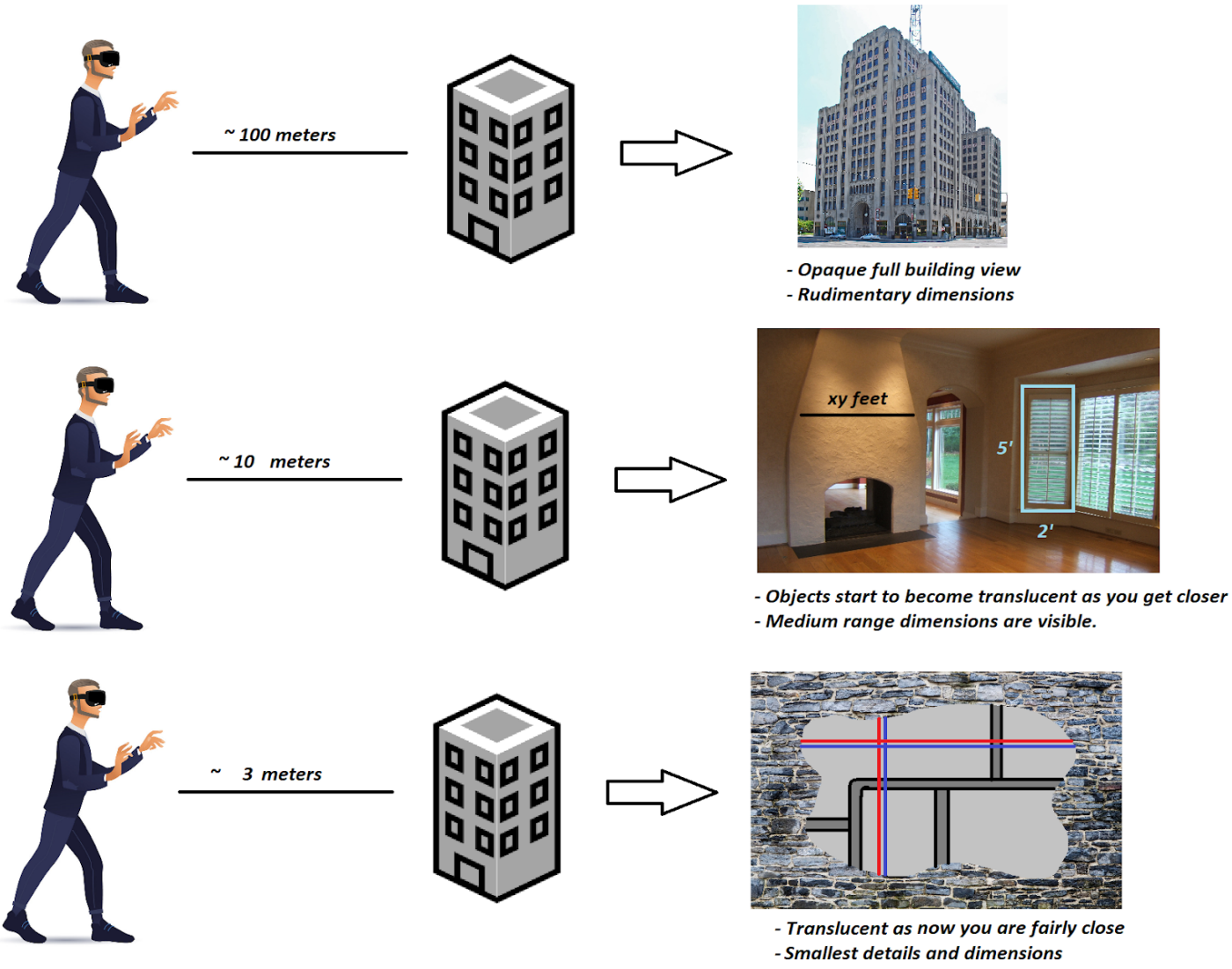
Cons:

- Single-user only
- View may be too small on a smartphone

Concept 2:

CONCEPT: Headset AR with distance-dependent information view

Figure 27: AR Concept 2 by JE



Bonus: minimap in corner
- Allows you to know where you are according to the building plans.
- Allows you to see (using color) how close you have to be to a wall for it to become see-through.

Pros:

- Minimal input requirement from the user
- Data never overcrowds user vision

Cons:

- Very experimental; most users would be unable to use effectively without training

Concept 3:

Figure 28: AR Concept 3 by JE

Concept - model details change depending on building stage

Ex. Stage 1 - Foundation

Stage 2 - Building frame

Stage 3 - inside the walls

- at every stage, all relevant info, including hazards, is displayed.

- stage is selected prior to heading into the field.

Pros:

- Displays necessary information; neither too little or too much
- Most suitable to the general nature of *Ellis Don* projects i.e. construction
- Narrows focus; users shouldn't get lost

Cons:

- User needs to switch views if they wish to see ahead in time

Team's Decision

Upon deliberation of Joseph's designs, the team chose the following to proceed for evaluation:

Table 4: Team Decision - JE's designs

Main Menu & Settings	Concept 2
Tutorial	Concept 2
AR view	Concept 3

Conceptual Design Rankings

In this section, the team took the selected designs from each member and compiled them into a table. Afterwards, each design was rated, with the highest scores being given to the best among them. These will serve as the basis for the final design further down in the document.

Table 5: Subsystem Design Rankings

	Concept Choice	*Ranking
Tutorial		
Mikael	1	1
Matt	3	2
Joseph	2	3
Main AR View		
Mikael	2	4
Daniel	3	1
Matt	1	2
Joseph	3	3
Main Menu/Settings		
Mikael	2	4
Daniel	1	3
Matt	3	2
Joseph	2	1

*Ranking: Score from 1-4; 4 Being the best.

Final Design Decisions

Main Menu/Settings Final Choice:

- We decided to choose the sub-system from Mikael's Concept #2 due to its accessibility outside of AR view as well as the option to view settings screen within the AR view. We also liked the functionality of Daniel's Concept #1 and will be implementing parts of it to our final concept.

Tutorial Final Choice:

- We decided to choose the sub-system from Joseph's Concept #2 due to its interactive tutorial and in-game example on how to use the system. We also liked the list/icon view of Matt's Concept #3, which can be pulled up at any time during the AR view.

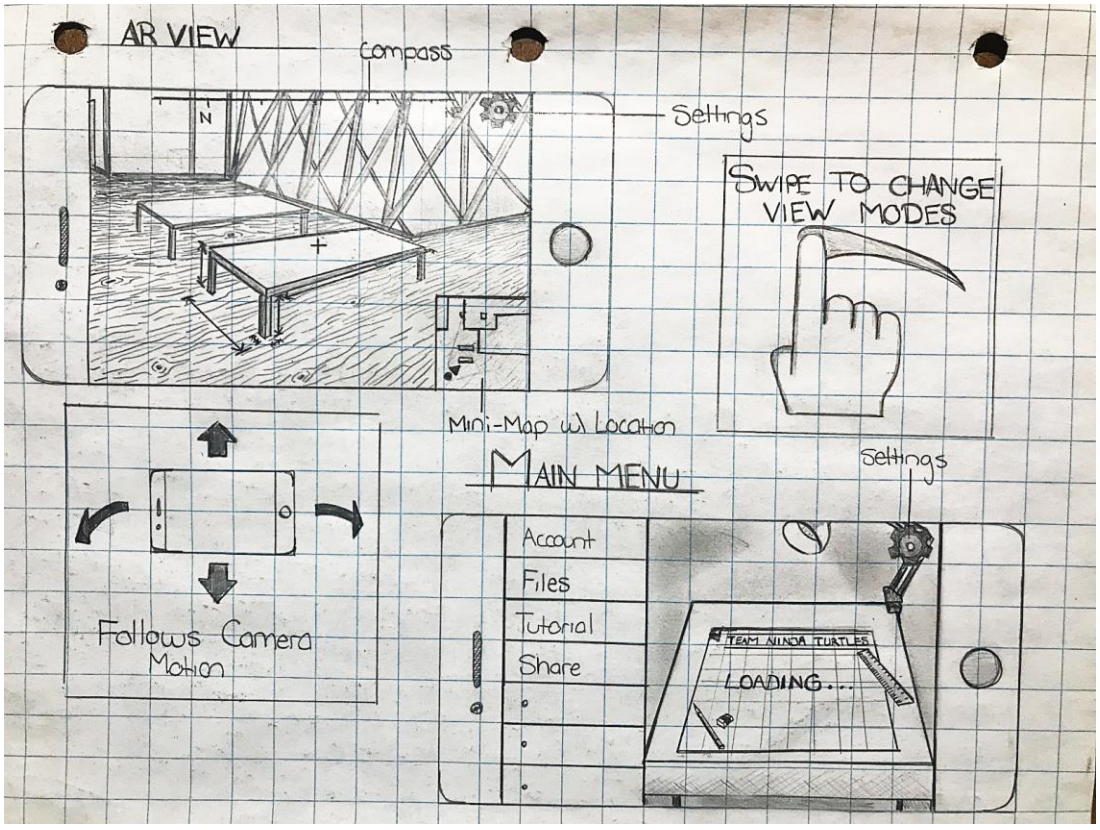
Main AR View Final Choice:

- We decided to choose the sub-system from Mikael's Concept #2 due to its dynamic AR view, which would provide the most information to the user while remaining the most user friendly. We also liked the idea of phased construction view throughout the build timeline, which was a core feature from Joseph's concept #3.

Final Design Concepts

Main Menu and AR:

Figure 29: Final Design Concepts Pt.1



For this final design, we based our Main Menu on the ideas present by Mikael, such as the listed options and the setting cog, whilst integrating visual elements from the concepts provided by Daniel, such as the menu's background and visual style.

The AR concept, in turn, combines ideas presented mainly from designs by Mikael and Matthew. It incorporates Mikael's concept of swiping the screen to change the visual content presented, as well as Matthew's inclusion of game elements such as a compass and minimap.

As for the tutorial, the team was content in utilizing the design provided by Joseph, which corresponds to Figure 24 in this document.

Conclusion

Based on the research conducted in previous weeks, the team members were able to create numerous concepts for every sub-system comprising this project. After analysing each concept's pros and cons, they ranked them from best to worst.

In the end, a potent final design was created by combining the best elements from the strongest designs presented. This design should, in principle, satisfy all the customer needs and design criteria established in earlier project deliverables.

Given that it will serve as the basis many future deliverables prototypes, the team felt that it was imperative for everyone to be happy with the outcome. Thus, they took it upon themselves to work as a team to analyse and compress their ideas in order to conceptualize a final product.