Verification and Validation Report: Farming Matters

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1 Revision History

Date	Version	Notes
03/06/2023	1.0	Recorded the results of some functional and non-functional tests
03/08/2023	1.0	Finished first version

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This document describes the test results of verification and validation (VnV) plan for Farming Matters. The VnV plan was continuously updated as the project evolved. The following document records the results of the current version of the VnV plan. It provides results of functional and nonfunctional requirements tests, unit tests, changes that will be implemented in the system as a result of the tests, and various traceability tables.

2 Functional Requirements Evaluation

2.1 Account Testing

Table 1: **Functional Requirements Evaluation Results**

Id	Description	Expected Result	Actual Result	Result
Test-AC1	User is not logged in and submits a correct email and password on the login form	User is logged in and can access game	Same as expected	Pass
Test-AC2	User is not logged in and submits an incorrect email or password on the login form	User login is denied	Same as expected	Pass
Test-AC3	User is not logged in and goes through 'reset password' flow	User is able to access password reset functionality through link sent to email	No reset password flow is present as it is not implemented	Fail
Test-AC4	User is not logged in and tries to login with correct credentials	Access is granted if the user is able to pass a human verification step (eg. captcha) and denied if they fail	Access is granted even if the user fails the verification	Fail
Test-AC5	User has an account and requests to delete it	User account and all user data is deleted	Same as expected	Pass

2.2 Game Mechanics Testing

Table 2: **Functional Requirements Evaluation Results**

Id	Description	Expected Result	Actual Result	Result
Test-GM1	User has over $1000 and purchases a new land tile that costs $1000	User owns tile and $1000 is subtracted from their total	Same as expected	Pass
Test-GM1	User does not have over $1000 and tries to purchase a new land tile that costs $1000	User does not own tile and no money is subtracted from their total	Same as expected	Pass
Test-GM2	User tries to plant a seed that is in season on an owned land tile	Seed is removed from inventory and planted on land tile	Same as expected	Pass
Test-GM2	User tries to plant a seed that is not in season on an owned land tile	Seed is not removed from inventory and not planted	Same as expected	Pass
Test-GM3	User has at least 1 seed planted on a land tile and ends turn	All planted seeds grow by 1 turn	Same as expected	Pass
Test-GM4	User has at least 1 seed planted on a land tile, has at least 1 fertilizer in their inventory, and tries to use fertilizer on a planted seed	Planted seed grows by 1 turn and 1 fertilizer is removed from inventory	Same as expected	Pass
Test-GM5	User purchases a new land tile	User owns tile	Same as expected	Pass
Test-GM6	User just created a new account and is playing for the first time	The consultant prompt should automatically happen to purchase for a consultants advice or not	Same as expected	Pass
Test-GM6	User is currently in Fall and switches to a next season which is Winter	The consultant prompt should automatically happen to purchase for a consultants advice or not	Same as expected	Pass

Table 3: **Functional Requirements Evaluation Results**

Id	Description	Expected Result	Actual Result	Result
Test-GM7	User purchases consultant advice	The consultant type of advice should be consistent throughout different seasons (each season you purchase a new consultant advice). Eache user is either assigned a deterministic or probabilistic prompt type, upon creating a new account.	Same as expected	Pass
Test-GM7	User purchases consultant advice	The consultant advice should be the same till a new season changes (i.e for 3 turns, the consultant advice should be the same)	Same as expected	Pass
Test-GM8	User purchases a crop and is able to purchase insurance button	user sees insurance button after purchasing a crop	Same as expected	Pass
Test-GM9	Switching to several seasons to see that when a random event occurs	The random event occurs in the occrect season which is visually observed by change in the visual game environment	Same as expected	Pass
Test-GM10	User is in Fall and ends 3 turns	Season changes to Winter	Same as expected	Pass
Test-GM10	User is in Winter and ends 3 turns	Season changes to Spring	Same as expected	Pass
Test-GM10	User is in Spring and ends 3 turns	Season changes to Summer	Same as expected	Pass
Test-GM10	User is in Summer and ends 3 turns	Season changes to Fall	Same as expected	Pass

2.3 Database Testing

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-DB1	Manual	The users plays three turns (one season) of the game trying to maximize profit	All user actions are logged in the corresponding logging table with the most recent action as the last entry	Same as expected	Pass
Test-DB1	Manual	The users plays three turns (1 season) without performing any actions	No actions are logged in the corresponding logging table	Same as expected	Pass
Test-DB2	Manual	Users plays three turns of the game trying to maximize profit.	The game state table contains the most recent game state in the corresponding account.	Same as expected	Pass
Test-DB2	Manual	Users plays three turns of the game trying to maximize profit and logs out of the game. The user logs into the game using their account credentials.	The game saves the state prior to logout in the game state table to the corresponding account entry.	Same as expected	Pass
Test-DB3	Manual	Users logs into the game for the first time and logs out without performing any actions. The user logs back into the game using their account credentials	The game loads in the new game state	Same as expected	Pass
Test-DB3	Manual	Users plays three turns of the game trying to maximize profit and logs out of the game. The user logs into the game using their account credentials	The game loads in the same state as prior to logout	The game loads in the NEW_ACCOUNT_STATE	Fail

3 Nonfunctional Requirements Evaluation

3.1 Look and Feel

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-LF1	Manual	Survey was provided to the supervisor, Dr. Yiannakoulias, for feedback on different interface elements	Every aspect under the 'Look and Feel' has an average rating greater than or equal to 4	Ratings: • Minimalistic Design: 4 • Consistent Colour Theme: 2 • Engaging Audio: 0 • Engaging Graphics: 5	Fail
Test-LF2	Manual	The game will be played on different SCREEN_RESOLUTION	All visual elements are visible and accessible to the user	Same as expected	Pass
Test-LF3	Manual	Asked friends to play and recorded the amount of turns they played	Average number of turns played to be over or equal to 12	Same as expected	Pass

3.2 Usability and Humanity

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-UH1	Manual	Survey was provided to the supervisor, Dr. Yiannakoulias, for feedback on different interface elements	The rating for "Easy to Understand' is greater than or equal to 4	The rating for ease of understanding was 3	Fail

3.3 Performance

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-P1	Manual	The user enters their account credentials and presses the login button	The system logs the user and displays the game within 5 seconds	Same as expected	True
Test-P2	Manual	The user plants a crop and harvests once ready	The game updates the interface (removing crop from from and adding to inventory) within 1 second	Same as expected	True
Test-P3	Manual	The 3D models for pumpkin is replaced by a different one. The user buys a pumpkin seed and plant it. The crops is harvested by the user once ready	The game updates the interface for all steps (buying, planting, harvesting) within 1 second	Same as expected	True

3.4 Operational and Environmental

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-OE1	Manual	The game will be played on different mainstream web browsers such Chrome, Firefox, Edge, Safari and Brave	The game will be able to be played among different browsers	Same as expected	True
Test-OE2	Manual	The game wll be played on different versions of a given browser for multiple browsers	Given that the game uses ReactJS which is only supported by web browsers that are ECMAScript 6 (also known as ES6) and above compliant. From recent web version search, Versions of Chrome 34-113, Edge 12-110, Safari 9-16.3 and Firefox 32-112 are supported (Source)	Same as expected, not tested for all version (mostly the last 3 version of each web browser)	True

3.5 Maintainability and Support Requirements

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-MS1	Manual	The user witch the game audio to a different track and monitor the effect on the game after the change	The game still runs smoothly	Same as expected	Pass

3.6 Security

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-SR1	Manual	Use common exploit vulnerabilities with the current versions or past versions of the technology used within the system that can lead to automated attacks.	The system shall prevent the creation of accounts in suspicion of automated attacked	Same as expected	Pass
Test-SR2	Manual	Basic cross site scripting (XSS) tech- niques will be used to see if the user is able to bypass the login screen. Some techniques include persistent, non-persistent and DOM-based cross-site scripting	The system shall prevent the user from logging in through a malicious attack or from damaging the user database	Same as expected	Pass
Test-SR3	Manual	Manually query the passwords in the data base and check to see if the user password is returned in plaintex	All user passwords are encrypted	Same as expected	Pass

3.7 Access

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-ACR1	Manual	The game was played at three locations. In two of those locations, the machine was connected to a private network. The machine was on a public network in third location.	The user is able to access and play the game at all three locations	Same as expected	Pass
Test-ACR2	Manual	The user is initially not logged in and enters a url that requires user credentials	User is redirected to login page	Same as expected	Pass
Test-ACR3	Manual	The user is initially logged in and enters a url that requires user credentials	User is not redirected to login page	Same as expected	Pass
Test-ACR4	Manual	The user is initially logged in and is tries to login on a separate computer	The new login is blocked	Same as expected	Pass

3.8 Integrity

Test Id	Type	Description	Expected Result	Actual Result	Result
Test-IR2	Manual	The user is logged into the system and performs actions for one turn. The user logs out and logs back in	The database returns the game state information within 5 seconds	Same as expected	Pass
Test-IR3	Manual	The user is logged into the system and performs actions for one turn. The user losses internet connection before logging out	The game state table contains the latest changes before the connection loss for the corresponding account	Same as expected	Pass

4 Unit Testing

4.1 Game Mechanics Testing

Table 4: **Functional Requirements Evaluation Results**

Id	Inputs	Expected Result	Actual Result	Result
Test-GM11	User does not have an item in their inventory, User has $1000 and purchases a single item that costs $150 and it is not in their inventory	User obtains purchased item	Same as expected	Pass
Test-GM11	User does not have any items in their inventory, User has $1000 and purchases a single item that costs $150 and it is not in their inventory	$150 is subtracted from their balance which is now $850	Same as expected	Pass
Test-GM12	User does not have any items in their inventory, has a balance of $0 and purchases an item of $150	User current balance remains the same of being $0	Same as expected	Pass
Test-GM12	User does not have any items in their inventory, has a balance of $0 and purchases an item of $150	The chosen item to be purchased is not added to the user's inventory	Same as expected	Pass
Test-GM13	User has 1 item in their inventory, has a balance of $1000 and purchases two items of $150	The quantity of that same item purchased again is now increased by one which is now 2	Same as expected	Pass
Test-GM13	User has 1 item in their inventory, has a balance of $1000 and purchases two items of $150	The user balance has decreased by $150 and now has a balance of $850	Same as expected	Pass

Table 5: **Functional Requirements Evaluation Results**

Id	Inputs	Expected Result	Actual Result	Result
Test-GM14	User has 1 crop in their inventory to sell and sold in the different season, this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The item they want to sell is in their inventory	Same as expected	Pass
Test-GM14	User has 1 crop in their inventory to sell and sold in the different season, this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The user balance increased by $150 and their balance is now $1150	Same as expected	Pass
Test-GM14	User has 1 crop in their inventory to sell and sold in the different season, this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The quantity of this crop that is sold decreases by 1 which is zero	Same as expected	Pass
Test-GM15	User has 1 crop in their inventory to sell and sold in the same season, this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The item they want to sell is in their inventory	Same as expected	Pass
Test-GM15	User has 1 crop in their inventory to sell and sold in the same season, this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The user balance increased by $150 and their balance is now $1150	Same as expected	Pass

Table 6: **Functional Requirements Evaluation Results**

Id	Inputs	Expected Result	Actual Result	Result
Test-GM15	User has 1 crop in their inventory to sell and sold in the same season, this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The quantity of this crop that is sold decreases by 1 which is zero	Same as expected	Pass
Test-GM16	User has 1 crop in their inventory to sell , this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The user balance increased by $150 and their balance is now $1150	Same as expected	Pass
Test-GM17	User has 1 crop in their inventory to sell , this crop has a marketvalue of $150 and has a balance of $1000 and sell that one item	The quantity of this crop that is sold decreases by 1 which is zero	Same as expected	Pass
Test-GM18	The current season is Fall and the next season is changed to Winter	The ambient light changes	Same as expected	Pass
Test-GM18	The current season is Winter and the next season is changed to Spring	The ambient light changes	Same as expected	Pass
Test-GM18	The current season is Spring and the next season is changed to Summer	The ambient light changes	Same as expected	Pass
Test-GM18	The current season is Summer and the next season is changed to Fall	The ambient light changes	Same as expected	Pass

Table 7: **Functional Requirements Evaluation Results**

Id	**Inputs**	**Expected Result**	**Actual Result**	**Result**
Test-GM18	The current season is Fall and the next season is changed to Winter	The camera angle changes	Same as expected	Pass
Test-GM18	The current season is Winter and the next season is changed to Spring	The camera angle changes	Same as expected	Pass
Test-GM18	The current season is Spring and the next season is changed to Summer	The camera angle changes	Same as expected	Pass
Test-GM18	The current season is Summer and the next season is changed to Fall	The camera angle changes	Same as expected	Pass
Test-GM18	The current season is Fall and the next season is changed to Winter	The base environment changes	Same as expected	Pass
Test-GM18	The current season is Winter and the next season is changed to Spring	The base environment changes	Same as expected	Pass
Test-GM18	The current season is Spring and the next season is changed to Summer	The base environment changes	Same as expected	Pass
Test-GM18	The current season is Summer and the next season is changed to Fall	The base environment changes	Same as expected	Pass

5 Changes Due to Testing

Source	Feedback	Changes
Supervisor (Survey)	Closing the shop or inventory is unintuitive	Added an X button on the top right of the shop or inventory modal
Supervisor (Survey) and TA	The tab buttons in the shop are unclear	Added hover and active effects to the tab buttons
Supervisor and TA	The tab buttons in the shop are out of place (i.e fixed to the top of the page)	Moved tab buttons to inside the shop modal
Supervisor (Survey)	The overall UI is not consistent	Changed shop and inventory background colors to match info header. Changed shop, inventory, and consultant buttons to match info header's
Supervisor and TA	The seeds in the shop are unclear (i.e what seeds can be planted in what season, how long do they take to grow)	Added hover to seed options that displays the seasons it can be planted in and growth length. Seed options changed to have background color that matches what season it can be planted in
Supervisor (Survey) and TA	The UI is unnecessarily cluttered when trying to sell items in the shop	Only items that you have at least 1 of are displayed when in the sell tab of the shop
Supervisor	The surrounding foliage on the farm is unattractive	Replaced tree model with grass model and flower model
Supervisor	There seems to be a possibility that the consultant options are overlooked	The consultant modal changed to automatically popup at the beginning of every season
Supervisor (Survey)	Needs more engaging audio	Added different background music for each of the 4 seasons. Added audio for button clicks, incrementing or decrementing money, harvesting crop, and planting crop.
TA	Buying seeds is unclear. It seems like you are buying the full grown plant rather than just the seed	The seeds in the shop have their icon and name changed to indicate they are seeds
TA	It is unclear what buying insurance on a crop does	Added a tooltip hover to summarize what buying insurance does
Test-DB3	Loading a saved game not working properly	Fixed database schema to allow for loading of a saved game
Test-AC3	Reset password flow does not provide email to reset password	Added reset password email notification that provides link to reset password
Test-AC4	Even if the user is flagged as a bot during a verification step, they are still permitted to login	Debugged login system and integrated result of verification to deny login if failing

6 Automated Testing

Because we initially used create-react-app to bootstrap our React application, Jest was already set up as the test runner by default. Because of this, we decided to fully use Jest for all automated testing. It greatly simplified the setup of automated tests as all that was required was to create stubs of libraries that were incompatible with Jest.

In order to automatically test functional requirements such as a user logging in, we used react-testing-library to implement end-to-end testing. The library can be used to render components and simulate user interaction such as typing into an input field or clicking a button.

7 Trace to Requirements

	FR1	FR2	FR3	FR4	FR5	FR6	FR7	FR8	FR9	FR10	FR11	FR12	FR13	FR14	FR15	FR16	FR17	FR18	FR19	FR20	FR21	FR22
AC1	X																					
AC2	X																					
AC3		X																				
AC4					X																	
AC5															X							
GM1			X				X			X							X					
GM2				X			X										X					
GM3							X															
GM4							X		X								X					
GM5										X						X						
GM6											X											
GM7											X									X		
GM8												X								X		
GM9																					X	
GM10																						X
GM11			X			X																
GM12			X			X																
GM13			X			X																
GM14								X														
GM15								X														
GM16								X														
GM17								X														
GM18																						X
DB1													X									
DB2														X								
DB3														X								
PG1																		X				
PG2																		X				

Table 8: Traceability Matrix for Functional Test Cases

	LF1	LF2	LF3	LF4	LF5	LF6	UH1	PR1	PR2	OE1	OE2	MS1	SR1	SR2	ACR1	ACR2	ACR3	ACR4	IR1	IR2	IR3
Test-LF1	X	X	X	X																	
Test-LF2					X																
Test-LF3						X															
Test-UH1							X														
Test-P1								X													
Test-P2									X												
Test-P3									X			X									
Test-OE1										X											
Test-OE2											X										
Test-MS1												X									
Test-SR1													X								
Test-SR2														X							
Test-SR3														X							
Test-ACR1															X						
Test-ACR2																X					
Test-ACR3																	X				
Test-ACR4																		X			
Test-IR1																			X		
Test-IR2																				X	
Test-IR3																					X

Table 9: Traceability Matrix for Non-functional Test Cases

8 Trace to Modules

Id	Modules
Test-AC1	M8, M11, M12, M13, M14, M15, M17, M18, M19, M20
Test-AC2	M8, M11, M12, M13, M14, M15, M17, M18, M19, M20
Test-AC3	M8, M11, M12, M13, M14, M15, M17, M18, M19, M20
Test-AC4	M8, M11, M12, M13, M14, M15, M17, M18, M19, M20
Test-AC5	M8, M11, M12, M13, M14, M15, M17, M18, M19, M20
Test-GM1	M8, M14, M22, M23, M24, M25
Test-GM2	M8, M14, M22, M23, M24, M25
Test-GM3	M6, M8, M14, M21, M22, M23, M24, M25
Test-GM4	M6, M8, M14, M21, M22, M23, M24, M25
Test-GM5	M22, M23, M25
Test-GM6	M1, M2, M3, M8, M25
Test-GM7	M1, M2, M3, M8, M25
Test-GM8	M5, M6, M7, M8, M25
Test-GM9	M3, M25
Test-GM10	M25
Test-GM11	M5, M6, M7, M8, M25
Test-GM12	M5, M6, M7, M8, M25
Test-GM13	M5, M6, M7, M8, M25
Test-GM14	M5, M6, M7, M8, M25
Test-GM15	M5, M6, M7, M8, M25
Test-GM16	M5, M6, M7, M8, M25
Test-GM17	M5, M6, M7, M8, M25
Test-GM18	M3, 25
Test-DB1	M8, M14, M18, M19, M20, M24, M25
Test-DB2	M8, M14, M18, M19, M20, M24, M25
Test-DB3	M8, M14, M18, M19, M20, M24, M25

Table 10: Trace Between Tests and Modules

Id	Modules
Test-LF1	M2, M6, M7, M10, M17, M22, M23, M24, M25
Test-LF2	M2, M6, M7, M10, M17, M22, M23, M24, M25
Test-LF3	M2, M6, M7, M10, M17, M22, M23, M24, M25
Test-UH1	M2, M6, M7, M10, M17, M22, M23, M24, M25
Test-P1	M6, M7, M8, M11, M12, M13, M14, M15, M18, M19, M20, M24, M25
Test-P2	M6, M7, M8, M11, M12, M13, M14, M15, M18, M19, M20, M24, M25
Test-P3	M6, M7, M8, M11, M12, M13, M14, M15, M18, M19, M20, M24, M25
Test-IR1	M6, M7, M8, M11, M12, M13, M14, M15, M18, M19, M20, M24, M25
Test-IR2	M6, M7, M8, M11, M12, M13, M14, M15, M18, M19, M20, M24, M25
Test-IR3	M6, M7, M8, M11, M12, M13, M14, M15, M18, M19, M20, M24, M25

Table 11: Cont. Trace Between Tests and Modules

9 Code Coverage Metrics

File	% Stmts	% Branch	% Funcs	% Lines	Uncovered Line #s
All files	97.29	88.88	71.42	97.14	
components	90.9	92.3	100	90.9	
Inventory.js	90.9	92.3	100	90.9	31
components/GameEvents/SeasonalEvents	100	100	57.14	100	
SeasonalEvents.js	100	100	57.14	100	
components/GameLogic	97.14	85.71	75	97.14	
VisualGameLogic.js	97.14	85.71	75	97.14	64

Figure 1: Test Coverage for Unit Testing Inventory, Game Logic, and Events

File	% Stmts	% Branch	% Funcs	% Lines	Uncovered Line #s
All files	88.88	100	33.33	94.11	
src	100	100	100	100	
Game.js	100	100	100	100	
src/components/LoginPage	100	100	0	100	
Login.js	100	100	0	100	
src/utils/auth/AuthContext	85.71	100	50	92.3	
index.js	85.71	100	50	92.3	62

Figure 2: Test Coverage for Testing Accounts and Authentication

10 Appendix

10.1 Symbolic Parameters

The definition of the test cases will call for SYMBOLIC_CONSTANTS. Their values are defined in this section for easy maintenance.

Table 12: **Symbolic Parameter Table**

Symbolic Parameter	**Description**	**Value**
NEW_ACCOUNT_STATE	The initial state of a new account	Turn 0, 9 tiles of land owned, $1000
SCREEN_RESOLUTIONS	The list of screen resolutions that should be supported by the user interface; given as a width and height	1920 pixels x 1080 pixels, 1366 pixels x 768, pixels, 1536 pixels x 864 pixels, 1440 pixels x 900 pixels, 1280 pixels x 720 pixels
MIN_TURNS	The minimum amount of turns played needed for a study participant to be a significant data point	12 turns

10.2 Usability Survey Questions

User Experience Survery						
The following survey will be completed upon playing the game after 20 minutes						
Look and Feel						
Minimalistic Design	0	1	2	3	4	5
	[0 = too much clutter of elements, 5 = no clutter and minimal feel]					
Consistent Color Theme	0	1	2	3	4	5
	[0 = inconsistent color theme, 5 = consistent color theme]					
Engaging Audio	0	1	2	3	4	5
	[0 = audio is terrible to listen to, 5 = audio is enjoyable to listen to]					
Engaging Graphics	0	1	2	3	4	5
	[0 = graphics are not pleasing, 5 = graphics are pleasing and comfortable]					
Usability						
Age Group	0	1				
	[0 = age less than 18, 1 = age is 18 or above]					
Easy to understand	0	1	2	3	4	5
	[0 = hard to understand, 5 = easy enough to understand]					

Appendix — Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Reflection. Please answer the following question:

1. In what ways was the Verification and Validation (VnV) Plan different from the activities that were actually conducted for VnV? If there were differences, what changes required the modification in the plan? Why did these changes occur? Would you be able to anticipate these changes in future projects? If there weren't any differences, how was your team able to clearly predict a feasible amount of effort and the right tasks needed to build the evidence that demonstrates the required quality? (It is expected that most teams will have had to deviate from their original VnV Plan.)

One way the VnV Plan was different from what we actually conducted was that some tests were added and some tests were removed due to requirements changing. For example in the VnV Plan, we had planned to allow users to buy buildings. However, this functionality was removed later on in development as the team didn't see a need for them in terms of game mechanics. With this removal, the tests associated with this functionality were removed as well. Another change was with where we would store game logic. In the

VnV Plan, we first had it such that clients would have to make requests to the server to do any game action such as buying or planting seeds, harvest or selling crops, etc. The architecture now is that the game logic is stored and handled client side, and so performance testing the game logic API requests was no longer needed.

These changes mostly arose from the fact that the team did not fully plan and discuss all game mechanics and how they would be intertwined with each other. They were mostly discussed in a vacuum rather than what role they would play in the encompassing game loop.

For future projects, we will further emphasize thorough planning of the entire product. This can be done by a number of visualization or planning methods such as sketches, storyboards, paper prototypes, or any other low-fidelity prototype. More communication with the client such as more meetings would also help iron out all the details of the project and reduce the number of changes or clarifications later on in development. However even with all of this, there is still no guarantee that all possible changes are anticipated, which further highlights how important it is to minimize these possibilities.