

# KASPER – ID5 PROJECT DOCUMENTATION

## SOFTWARE DEVELOPMENT TEAM:

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Tetland

## Contents

1.0 Requirements Document ID5 .....	3
1.1 ID5 Requirements .....	3
1.2 Mini Milestones for ID5 .....	3
2.0 Time Estimations .....	4
3.0 Design .....	5
3.1 API Document .....	5
4.0 Testing Document ID5 .....	5
4.1 Test Plan .....	5
4.2 Manual Test Report .....	8
4.3 Defect Report .....	10
4.4 State Transition Diagrams .....	15
5.0 Build Report .....	17
6.0 Incomplete Requirements .....	18

## 1.0 Requirements Document ID5

### 1.1 ID5 Requirements

- Thorough review of test cases for all back-end code
- Bug Fixing
- Code Policing
- Test Hooks
- Hallway Testing
- Acceptance Testing
- Documentation

### 1.2 Mini Milestones for ID5

#### Development:

- |  |   |
|--|---|
| - Detect and estimate the number of bugs in the system                                       | ✓ |
| - Communicate with the test team to determine bug priority                                   | ✓ |
| - Complete the revisions by the code police system   | ✓ |
| - Do a group review of tests for backend and improve the tests accordingly                   | ✓ |
| - Fix all high priority bugs   | ✓ |
| - Meet with doc lead to relay any necessary information relating to programmer documentation | ✓ |
| - Integrate Facebook login   | X |
| - Fix all reported bugs in the system  | X |

#### Testing:

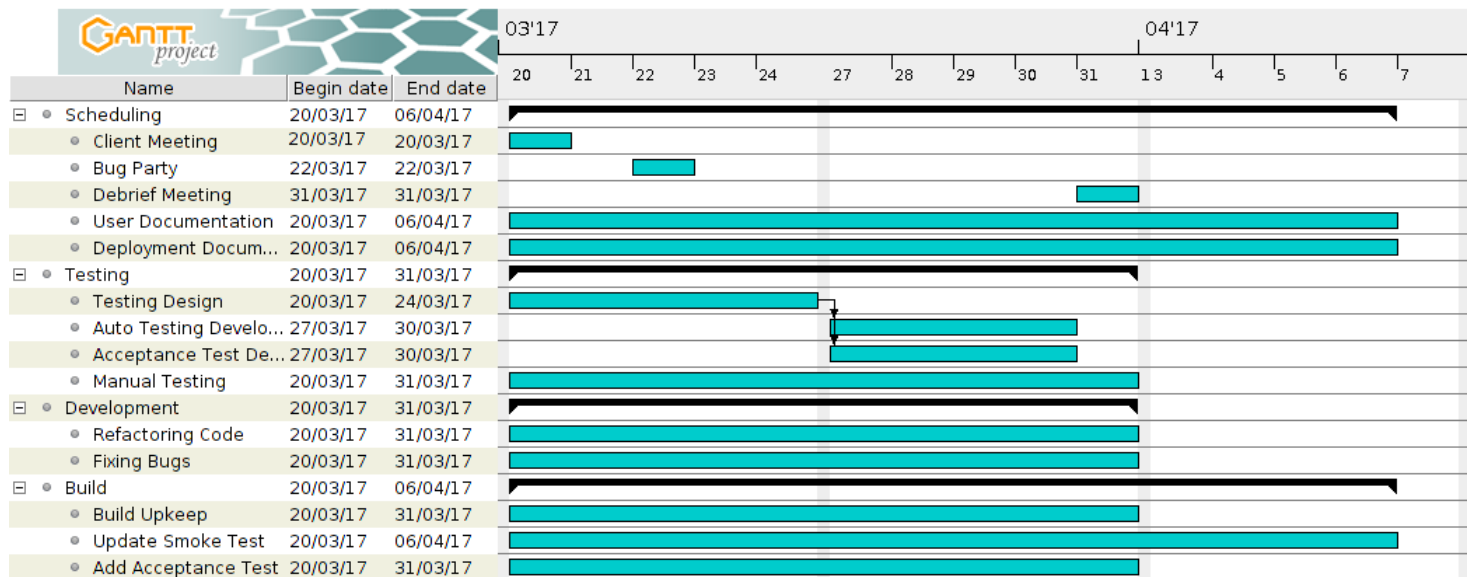
- |   |   |
|---|---|
| - Bug Party 2                                   | ✓ |
| - Hallway and Acceptance testing                | ✓ |
| - Defect estimation                             | ✓ |
| - Bug fixing with developers                    | ✓ |
| - Code policing (Goal: 75% coverage)            | ✓ |
| - Front end smoke test fixing                   | ✓ |
| - Write new regression tests for new bugs found | X |

#### Documentation:

- |   |   |
|---|---|
| - Organize, compile, and edit all documentation | ✓ |
|---|---|

## 2.0 Time Estimations

Gantt Diagram ID5:



To see time estimations on all individual tasks, please follow the link in Process Documentation, section 2.0 Activity Log, and click on the bottom tab labelled “Individual Activity Log”.

In ID3, development time estimations have been added for each assigned task on Trello. Trello cards now contain a coloured label indicating the approximate estimation of each task. These estimates were approximated by the dev team.

The following image shows the colour coded time estimation scale with which each trello card will be rated.



## 3.0 Design

### 3.1 API Document

The API document outlines the client server communication of our system. Our project will contain eighteen API calls, all of which are implemented, and all of which are in full communication with the server. These calls send a JSON body with relevant data. The server receives, parses, and processes the JSON using the database. When finished, the server will reply to the sender with a token containing the reply status and a JSON body with the requested information. The following link contains our updated ID4 API document and details on the various calls to our database.

Note: We are currently experiencing difficulty with this link. Please copy and paste it into your web browser.

[https://docs.google.com/document/d/1N4jt1\\_PgxPhXwdc1TcT7TBjFNOZqYO5L10ha3bpO5M8/edit#heading=h.1skatsa28we](https://docs.google.com/document/d/1N4jt1_PgxPhXwdc1TcT7TBjFNOZqYO5L10ha3bpO5M8/edit#heading=h.1skatsa28we)

## 4.0 Testing Document ID5

### 4.1 Test Plan

#### 4.1.1 Test Strategy

##### **Bug Party 2:**

The second bug party was held on March 22<sup>nd</sup> /17. The team split into two groups and ran manual tests for about an hour and a half. After the bug party, found bugs were compiled into a list and duplicate bugs were archived. Our total range estimate after the bug party was 37-43 bugs. Since then, over half of all bugs found have been fixed, beginning with the highest priority bugs.

##### **Hallway Testing:**

Hallway testing was held on March 29<sup>th</sup> /17. We used the Think-Aloud process with people outside of computer science. Testing was done in half-hour sessions with five different people.

Suggested areas of improvement by hallway testers:

- Make the Browse page Like/Dislike functionality more apparent
- Give feedback when adding images to a new Listing
- Provide a way to both contact the seller and view the seller without contacting them
- Provide an anonymous way to find out if someone has liked your Listing
- Add a filter option by city
- Use an actual listing title, rather than using the description for summarized information

The hallway testers found the app to be intuitive and discoverable. A major unhandled error was found by two of the testers. The bug was deemed high priority and the team aimed to fix it by the end of term.

Most hallway testers tried to login with Facebook first, but because this feature was unfinished, they were forced to use the regular registration page instead.

### Acceptance Testing (Done with Hallway Testing):

Outside of edit listings, Facebook login/registration, contact seller, and Google Map integration, the team has finished the requirements as specified by the client. For the most part, the app flows intuitively and seamlessly. In its current form, it can be used for its most basic purposes (aside from contact seller functionality). Filter listings was found to be quick and easy. Adding listings was basic, and required no assistance. User registration was easy, although some noted that the password may be too complicated for the app’s current functionality (one uppercase, one lowercase, one letter, and 8 characters’ minimum).

### Polishing:

The testers worked closely with the developers to pinpoint the most critical bugs and started work on them immediately. Many of the high priority bugs were fixed before Hallway Testing. After Hallway testing, a few more bugs were fixed in order to ensure the app was in good shape before handing it over to future developers.

## 4.1.2 Documentation

### Test Matrix:

Key:

Features	Unimplemented features	Tests	Tests access Features	Tests don't access Features
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Since ID4, nothing has changed with the test matrix. The Facebook Sign-In/Sign-up functionality has been left for future developers. With limited time left in the term, we chose to polish the pieces of the app that were already implemented, rather than introduce new features, and potentially new problems.

	App Sign-In	Facebook Sign-In/Sign-up	Sign-Up	Browse Listings Filter	Publish New Listing	Save W/O Publishing Listing	My Profile/Change Password/Sign out	Browse	Favourites	My Listings
Sign In with existing user										
Add a Listing (Signed In)										
Registering a new user										

Cycle listings (Signed In)										
Edit account information										
Register an existing user										
Invalid Sign-In credentials										
Change account password										
Like/Dislike a listing(own listing, or other user's listing)										

	App Sign-In	Facebook Sign-In/Sign-up	Sign-Up	Browse Listings Filter	Publish New Listing	Save W/O Publishing Listing	My Profile/Change Password/Sign out	Browse	Favourites	My Listings
Weak password given										
Navigation while signed-in										
Navigation while not signed-in										
Edit Favourites										
Delete Listing										

#### 4.1.3 Schedule

**ID1:**

Testing was mostly done manually on the front end of the application. The test team began creation of automated tests using Protractor. Tests and functionality were recorded in the test matrix, and all bugs were listed in detail in the defect report.

**ID2:**

The Test Team attempted to integrate automated end-to-end tests with TravisCI, updated the defect report, updated the flow charts to better reflect the new requirements/current state of the system, and re-created, simplified, and updated the test matrix.

**ID3:**

The first bug party was held. Continued updating of the test matrix, defect report, and flow charts was practiced. Testing on Android devices was successful, and brought new defects to the defect report which were unique to device use. The test matrix was updated much more thoroughly, with a better description of the state of our tests. End-to-end tests had to be updated once again, due to the changes in the front-end, and other requirements changes. The flow charts also changed significantly, showing access to new functionality and areas of the program not previously implemented. Protractor was successfully integrated with TravisCI, which was an issue we were having in ID2.

**ID4:**

Large amounts of testing have been done on the features that were previously unimplemented/bugged in ID3. Favourites page, Like/Dislike functionality, browsing, filtering, and publishing Listings were the main focus of testing. Many bugs were found, and the high priority ones were fixed quickly by collaborating with the developers. Some bugs still remain in the application, and will continue to be fixed throughout ID5. A better logging system was installed onto the project for easier debugging. A test database was created to replace testing on the actual database. This test database resets whenever we require it to, which helps with recreating bugs and cleaning out the system after playing around with user registration, listing creation, and saving information to a user, such as liked/disliked listings and profile information.

**ID5:**

The second bug party was held on March 22<sup>nd</sup> /17. The team split into two groups and ran manual test for about an hour and a half. After the bug party, all found bugs were compiled into a list, and duplicate bugs were archived. An estimation of the total defects left in the system was computed. Hallway testing was done a week later, after many of the bugs found during the bug party were eliminated. See the Hallway Testing report for details. Due to time constraints, new regression tests were not added. The front-end smoke test failed for various reasons, and the testers worked to fix the issues. One of the reasons for the failing smoke tests was an oversight in using a dysfunctional website to add placeholder images, which in turn failed the tests created by Protractor. Protractor waits for these images to load before continuing, but because they weren't being loaded due to the website, the tests timed out before finishing. Our goal of polishing the app for ID5 was successful. Many of the high priority bugs were fixed, and the app is in good working condition. Only a few unimplemented features require fixing (see untested areas and state transition diagrams).

## 4.2 Manual Test Report

### Bug Party 2: March 22<sup>nd</sup> / 17

**Testers:** Everyone



- Images don't appear for listings
- Changing password doesn't change password
- Username does not trim white space
- No filter for all provinces
- No feedback when liking/disliking a listing
- Change password closes the page even when the credentials are wrong
- Change password doesn't prompt user that their old password is wrong
- Updating province doesn't keep province selected
- Wrong error message for favourites tab when not signed in
- No placeholder to show if the browse page is empty
- Navigation bar title from edit listing page is incorrect
- No internet connection is not handled
- Negative prices for adding listings
- Favourites page thumbnail doesn't load properly
- Phone number can contain characters
- Browse page doesn't refresh after coming back from detail page
- Publish button doesn't work for already created listings
- Error checking on front and back end are inconsistent
- Signing in with an email created through registration and an incorrect password doesn't give an error prompt
- User activity is not reset to default settings when switching users on the same device in the same session
- No feedback when adding listing with invalid input
- Password fields clear on edit
- Filter bar ranges increase and decrease in size incorrectly
- No prompt when publishing a listing without an image

**Bug fixing with developers:** March 25<sup>th</sup> /17

**Testers:** Jeremy, Chris May, Ryan

- [Regression] Change password not properly changing password

**Last manual tests before Hallway Testing:** March 28<sup>th</sup> /17

**Testers:** Jeremy, Chris May, Ryan

- Repeated presses of "Publish Listing" will create multiple instances of that listing

**Hallway Testing:** March 29<sup>th</sup> /17

**Testers:** The Hallway Testers

**Bugs found:**

- Publish listing postal code
- See Hallway Testing Report

### 4.3 Defect Report

<b>Bug:</b>	Images don't appear for listings
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Navigate to Browse page (Browse page must not be empty)
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Repeated presses of "Publish" while adding a listing will result in multiple instances of that listing being created
<b>Reproducibility:</b>	100%

<b>Bug:</b>	Changing password doesn't change password
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	IV. Sign in on any account V. Attempt to change password on My Profile page -> Change password VI. Enter valid credentials VII. Sign out and attempt to sign in with new password. The password is unchanged.
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Username does not trim white space when signing in
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Attempt to sign in using any registered account, but include whitespace in the username field
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Steps taken:</b>	I. Sign in on any account II. Attempt to add a listing with correct information III. When publishing the listing, continue to press "Publish"
<b>Variations:</b>	Depending on the speed of the server, can create a lot of listings (slow) or only a few (quick).
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Change password closes the page even if the credentials are wrong
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Sign in on any account II. Navigate to My Profile page III. Attempt to change the password
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Change password doesn't prompt the user that their old password is incorrect
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Sign in on any account II. Navigate to My Profile page III. Attempt to change the password, using the incorrect "Current Password"
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Updating Province in User info doesn't keep province selected
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Sign in on any account II. Navigate to My Profile page III. Change the province of the user
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Wrong error message for favourites tab when not signed in
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. While not signed in, navigate to the favourites tab.
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	No internet connection not handled
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Use the application without Wi-fi and with Airplane mode turned on (on device), or disconnect computer from internet (on browser).
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Like/Dislike on "Browse" page breaks cycling of Listings on details page
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Like/Dislike any listing by swiping on the "Browse" page

	II. View detailed information of any listing, and attempt to cycle listings with arrow buttons
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Fields while registering user scroll up and out of view
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. On a mobile device, navigate to the registration page and attempt to register a new user
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	No feedback when liking/disliking a listing
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Like/dislike any listing while signed in
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Password fields clear on edit
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. On either registration page, sign-in page, or change password page, enter information into the password field. II. Select out of the field III. Select back into the field
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	On the filter page, all range bars extend and shrink when the range on the end of the bars goes from text to a number
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Navigate to the filters page</li> <li>II. Slide the dual sliders. The range bars incorrectly shrink and extend.</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Like/Dislike on "Browse" page breaks cycling of Listings on details page
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Like/Dislike any listing by swiping on the "Browse" page</li> <li>II. View detailed information of any listing, and attempt to cycle listings with arrow buttons</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	While adding a listing, no feedback given when inputting invalid input for postal code, bed, bath, price, square feet.
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Sign in</li> <li>II. Navigate to Add Listing page</li> <li>III. Attempt to add a listing without entering information in postal code, bed, bath, price, square feet fields.</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	Yes
<b>Screenshot:</b>	None

<b>Bug:</b>	Error checking on front end and back end are inconsistent
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>IV. Attempt to register a new user</li> <li>V. Enter a phone number with spaces, enter an email with 2 periods.</li> <li>VI. User cannot continue registration</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	No
<b>Screenshot:</b>	None

<b>Bug:</b>	Error checking on front end and back end are inconsistent
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Like/Dislike any listing by swiping on the "Browse" page</li> <li>II. View detailed information of any listing, and attempt to cycle listings with arrow buttons</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	No
<b>Screenshot:</b>	None

<b>Bug:</b>	While signing in with an email address created through registration, using incorrect password won't give an error prompt.
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Register a new user</li> <li>II. Sign out from that user</li> <li>III. Attempt to sign back in to that user, but with an invalid password, but valid e-mail address</li> </ol>

<b>Variations:</b>	The hard-coded users in the test database always give the error prompt.
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

<b>Bug:</b>	Error checking on front end and back end are inconsistent
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Like/Dislike any listing by swiping on the "Browse" page</li> <li>II. View detailed information of any listing, and attempt to cycle listings with arrow buttons</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

<b>Bug:</b>	User activity is not reset to default settings when switching users on the same device in the same session.
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Sign-in on any account</li> <li>II. Open a listing on the browse page</li> <li>III. Sign out from that account</li> <li>IV. Sign in with a different account than the previous one</li> <li>V. Navigate to Browse page, the listing is the same.</li> </ol>
<b>Variations:</b>	When the app is closed on the device, everything is reset.
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

<b>Bug:</b>	Able to input negative values when adding a listing.
<b>Reproducibility:</b>	100%

<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Sign in to any user and navigate to Add Listing</li> <li>II. Add a listing with valid information, but make the numerical fields negative.</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

<b>Bug:</b>	Phone number can contain letters
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. Register a new user</li> <li>II. In the phone number field, use characters rather than numbers.</li> <li>III. Registration is able to proceed.</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

<b>Bug:</b>	Browse page doesn't refresh after coming back from detailed listing page when liking/disliking.
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	<ol style="list-style-type: none"> <li>I. While signed in, navigate to a listings details page.</li> <li>II. Like/dislike that listing</li> <li>III. Go back to the main Browse page</li> <li>IV. The listing currently liked/disliked still appears in the list (It should not)</li> </ol>
<b>Variations:</b>	None
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

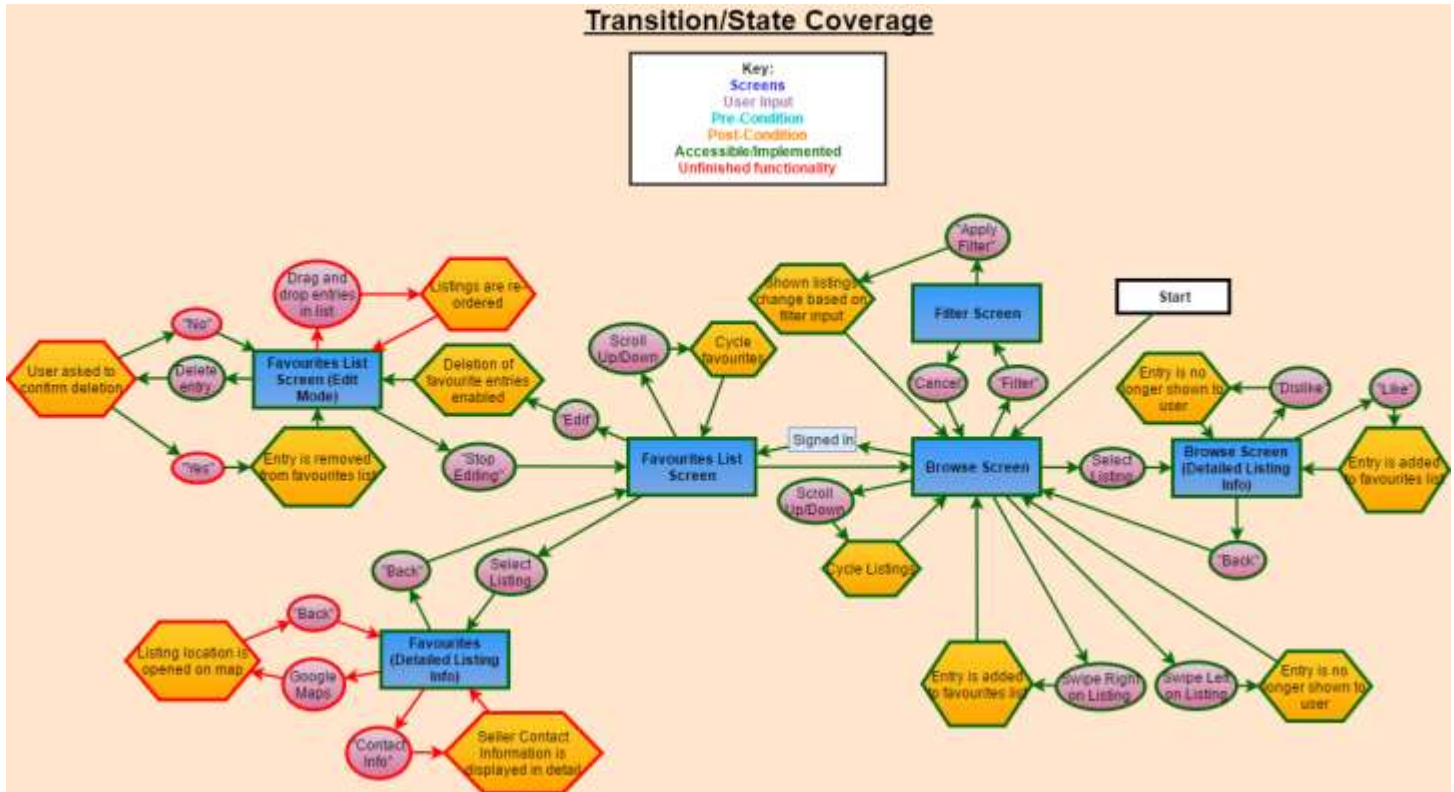
<b>Bug:</b>	Editing and publishing non-published listings is not functioning.
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<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. While signed in, attempt to edit an unpublished listing of that user.
<b>Variations:</b>	None
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

<b>Bug:</b>	Error checking on front end and back end are inconsistent
<b>Reproducibility:</b>	100%
<b>Steps taken:</b>	I. Like/Dislike any listing by swiping on the "Browse" page  II. View detailed information of any listing, and attempt to cycle listings with arrow buttons
<b>Variations:</b>	None
<b>Resolved:</b>	<b>No</b>
<b>Screenshot:</b>	None

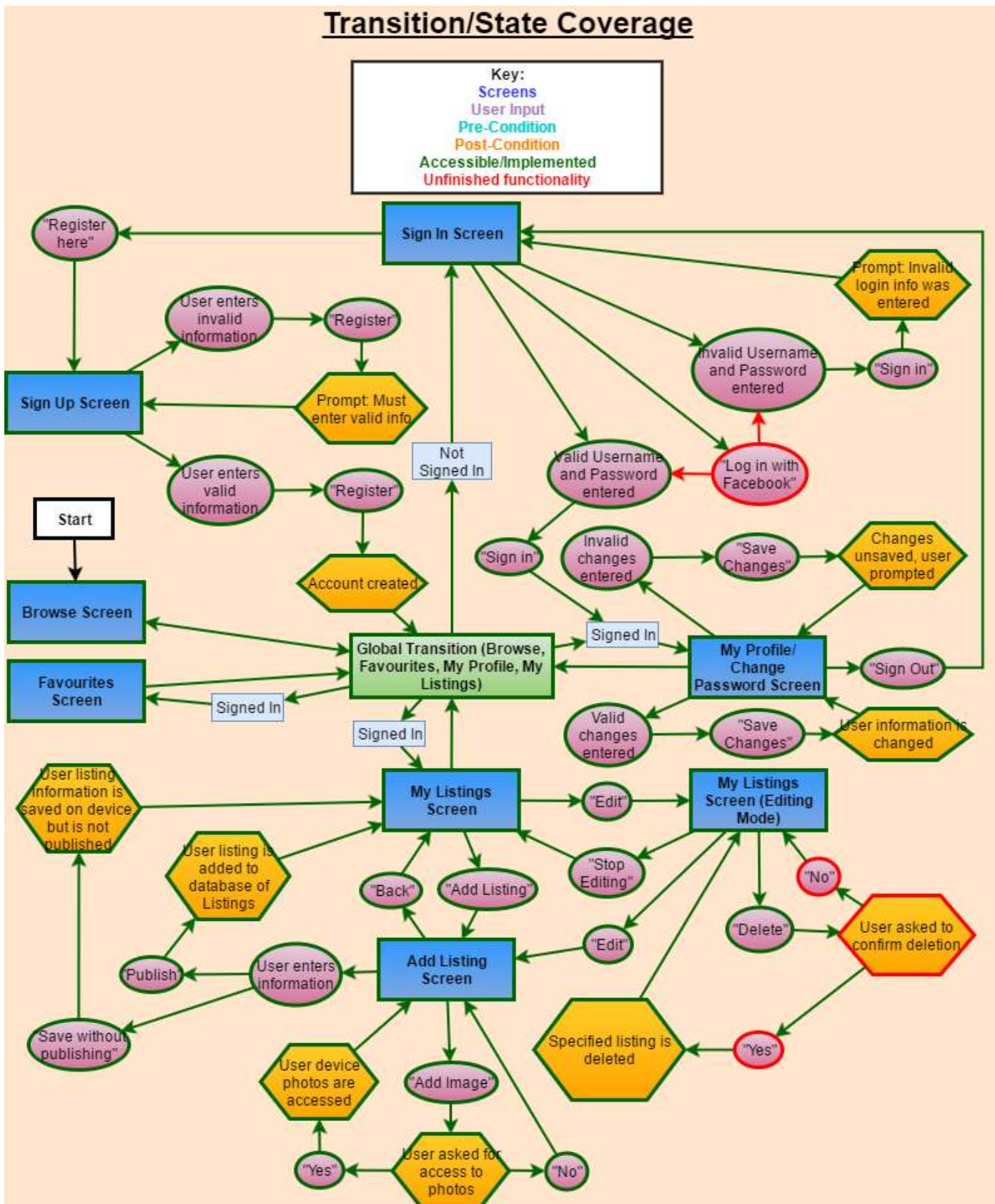
## 4.4 State Transition Diagrams

Filter, Browse and Favourites screen diagram. Unfinished functionality includes listing deletion confirmation in favourites list, re-ordering of favourite listings, seller contact info, and listing location using Google Maps.





Sign-In, Sign-Up, My Profile, My Listings screen diagram. Unfinished functionality includes Log-in and registration through Facebook, and deletion confirmation of own listings.





## 5.0 Build Report

### Smoke Test Status:

Front-end smoke tests are implemented and passing using protractor. Further regression tests have been added to the front-end smoke test suite since ID4. Back-end smoke tests are also passing, and additional unit and regression tests have been added to accommodate new functionality from ID4.

### Build Status:

The builds for iOS and Android are compiling. The Linux build and the remote server are undergoing smoke tests. After successful builds, the remote server updates from the repository. The test server is emptied before running the front-end smoke tests. Test data is added to the test server for end-to-end testing. We are running end-to-end smoke tests using Protractor on the Firefox browser and testing the back-end with Python scripts. After running the smoke tests, a file with the percentage of test coverage is pushed to the server. All testing has been conducted on the browser version of our app; smoke tests are not in place for other platforms. When the smoke tests pass, the build is pushing the source code to a branch (id5\_ReadyForTesting) dedicated to more rigorous testing.

### SDKs, Packages, and Tools:

- Cordova CLI: 6.5.0
- Ionic Framework Version: 2.0.0-rc.5
- Ionic CLI Version: 2.2.1
- Ionic App Lib Version: 2.2.0
- Ionic App Scripts Version: 1.0.0
- npm: 3.10.10
- jdk: 1.8.0\_121
- nvm: 0.32.0
- node: 6.9.4
- Java SDK 8
- packages listed in package.json
- plus ~400 other Ionic dependency packages
  
- Android:
  - o SDK Platform Android 7.1.1, API 25, revision 3
  - o Android SDK Tools, revision 25.2.5
  - o Android SDK Build-tools, revision 25.0.1
  - o Android SDK Platform-tools, revision 25.0.3
  - o Google Repository, revision 42
  - o Android Support Repository, revision 42
  
- iOS:
  - o OS: OS X El Capitan
  - o Xcode version: Xcode 7.3.1 Build version 7D1014Server:
  
- Browser:
  - o OS: Ubuntu 14.04 (trusty)

- Server:
  - o Python 2.7
  - o Google Cloud SDK v143.0.1
  - o Python Extension for google cloud v1.9.50
  - o Python Extension (Extra Libs) v1.9.49
  - o Gulp v3.9.1
  - o OpenSSH v6.6.1p1
  - o Sshpass v1.05
- End-to-End Tests
  - o Protractor v5.0.0
  - o Firefox v47.0.1
  - o Selenium v3.1
  - o Jasmine v2.5.3

Corodova 6.5.0 requires both jdk 1.8 (or higher), as well as npm v2.2.1 and node v4.0.0. We will be using the most recent version of node and npm to reduce version conflicts. Our servers are built on Google App Engine, which requires Google Cloud. The server uses Python 2.7, Python extensions for Google Cloud SDK, and the most recent version of Google Cloud SDK. Our end-to-end tests are written in Jasmine and run by Protractor, which sends to Ionic through the Selenium server. We are currently testing our system on Firefox v47.0.1, because of compatibility issues with newer versions. We are using Gulp to create a config file which allows the test team to toggle between the real and test databases. This is to prevent filling the real database with test data. We are using sshpass to login to the database server and update files. All developers and testers have been set up with the latest versions of the required tools. We are using Xcode 7.3.1 for compiling the iOS version of our app. The Ionic dependencies are extensive, and can be viewed in further detail at the following link:

<https://ionicframework.com/docs/>

Releases for our build can be found here:

<https://github.com/CMPT371Team1/Project/releases>

## 6.0 Incomplete Requirements

The following requirements will not be implemented this term. Each will be documented and passed on to future programmers in our Programmer Documentation.

- Sign in / Sign up using Facebook
  - o This feature is incomplete in the front-end, but complete in the back-end.
- Messaging Functionality
  - o This feature is incomplete in the front-end, but complete in the back-end. It includes functionality for sending initial messages to sellers, marking read messages, and deleting messages. Once implemented, it will need to be integrated with the back-end and tested.

- Edit listing
  - o This feature is incomplete in the front-end, but complete in the back-end
- Push notifications
  - o The app should be able to track changes in the database and trigger notifications to interested buyers
  - o Sellers should receive a notification if a prospective buyer sends a message regarding one of their Listings
  - o Buyers can elect receive “hot list” notifications for one or more of the following:
    - A Seller publishes a Feature Listing
    - A new Listing is added that fits some predetermined criteria (i.e. neighborhood, price range, seller, etc.)
    - Price change on a Favoured Listing
    - A Listing is published that contains similarities to past searches
  - o Sellers can elect to receive notifications regarding their personal Listings:
    - A Listing has been Favoured by a user
    - A buyer sets a price watch on a Listing
- Integration with Google Maps
  - o This feature should show Listings with regards to their physical location on a map. The Google Maps functionality should be accessible from the Detail page.
- Forgot password
  - o This feature should allow a user to request an email or text message containing reset information
- Re-order a Listing’s images.
  - o This feature should allow a seller to select a primary image to be displayed on the browse page, and to re-order a Listing’s images.
- Super Admin User
  - o A Super Admin User can access the following additional functionality:
    - Publish a Listing under any user
    - Edit any Listing
    - Remove any Listing
- API Versioning
- Edit User