Deliverable F – Design Criteria

Group 5
Khadij, John (6400290)
Nicoll, Sebastian (300187458)
Senathirajah, Abera (300187714)
Shouldice, Michael (8589011)
Todd, David (300194033)

Report presented to Dr. Muslim Majeed
For the Engineering Design Course
GNG 1103

University of Ottawa
Department of Engineering
Ottawa, Ontario

Table of Contents

Introduction

After creating an initial description of the AR app as well as discussing a contingency plan and the means that will be used to accomplish the app, it is now important to create feasible model for the app. To create a model an initial prototype has now been created based on the chosen criteria and metrics, while considering the risks and costs of proceeding with this idea. This prototype will be tested to evaluate its strengths and weaknesses to adjust for the next prototype. The initial prototype creates the framework to create more intricate models and prototypes. The ideas presented in this deliverable demonstrate how the app will function and how all its features will be incorporated. The next steps are to build on this prototype while continuing to assess the prototype based on the feedback giving to ensure the success of the project.

Project Risks and Contingency

A major risk is tied to the possibility of the app failing entirely. Subsections of this risk are limited to the database being insufficient, the code not working, and the user interface being non-functional. All these risks have relatively simple fixes. The database can be improved by adding more images, the code can be debugged, and the interface can be modified if need be.

The next potential risk to consider is the costs of services changing. These services include software engines like Unity and Vuforia, as well as the Apple/Samsung store itself. For the purposes of this project, Unity and Vuforia are free to use, and the expense to list an application on the store sits at ~$100/year, which falls within the acceptable cost limits. If the software used to code and implement this project begins to cost money, then the overall cost of the application will increase. In this case, it may be necessary to find some other medium through which to post the application, as any money used on Unity or Vuforia will exceed the cost limit. In terms of scheduling risks, everything stated above, if it were to happen, would require time to fix. So, any risk to the project's success invariably affects the schedule laid out.

Project Costs

Material/Tool	Cost
Programmer/ developer	Free
Unity	Free
AR Tool	Free
Recycling material for testing	Free

|	
Total	0$

Since the project is still in the prototyping phase, there are no costs associated to it. Once the project is finalized, costs such as the developer licencing fees will be added. Also, if the project needs outsourcing for its completion, another cost can be added. However, in its current state the total cost of the project remains at zero dollars.

Analysis of Critical Components and Systems

The system in question is the Vuforia image database. This component will be used in the app for AR scanning component to function. The app scans the material and creates an image of the object. From there the code takes the created image and compares it the images stored in Vuforia. The database needs to be large enough so that all items can be scanned or at the very least the most common household objects. The database also must be efficient so that the app does not exceed the storage/size limit that was set a target in the metrics phase of the project. Vuforia has a "target simplification" and "target generator" feature that integrates itself with the scanner. It allows a simplified 3D model to be created for the object to be tracked and compared as well as target specific shapes. Vuforia enables the AR applications of the app with the simulation of 3D objects.

Description of Prototype I
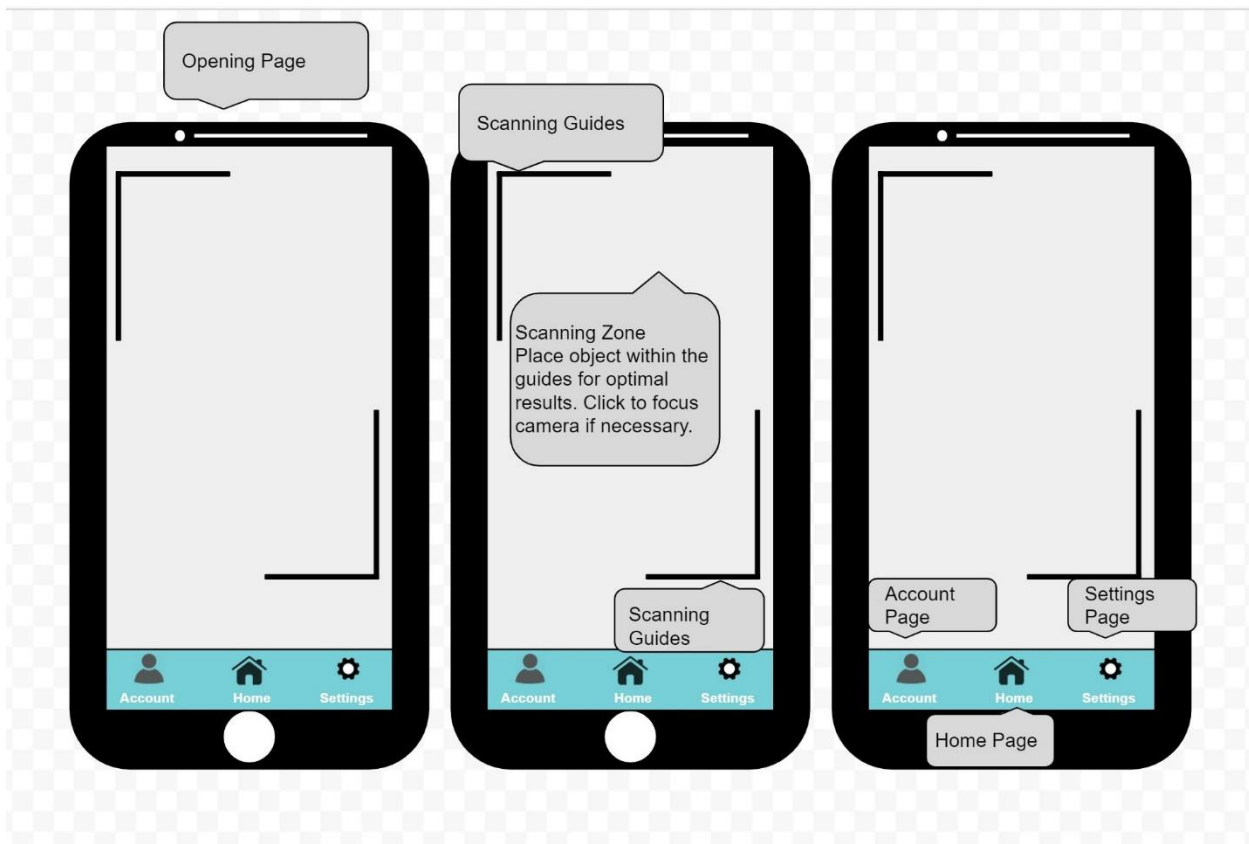
The objective of the opening screen is to help the user scan the material and determine its fate in the most efficient manner possible. The page opens directly to the scanning screen with a scanning zone that is blocked in by scanning guides to help the user. At the bottom of the screen the user can find three buttons to help guide them to where they would like to go, whther that is to the settings or account page or back to the home/scanning screen. The opening page is as simple as possible and the three buttons were designed to reduce visual clutter and direct attention to the scanning.
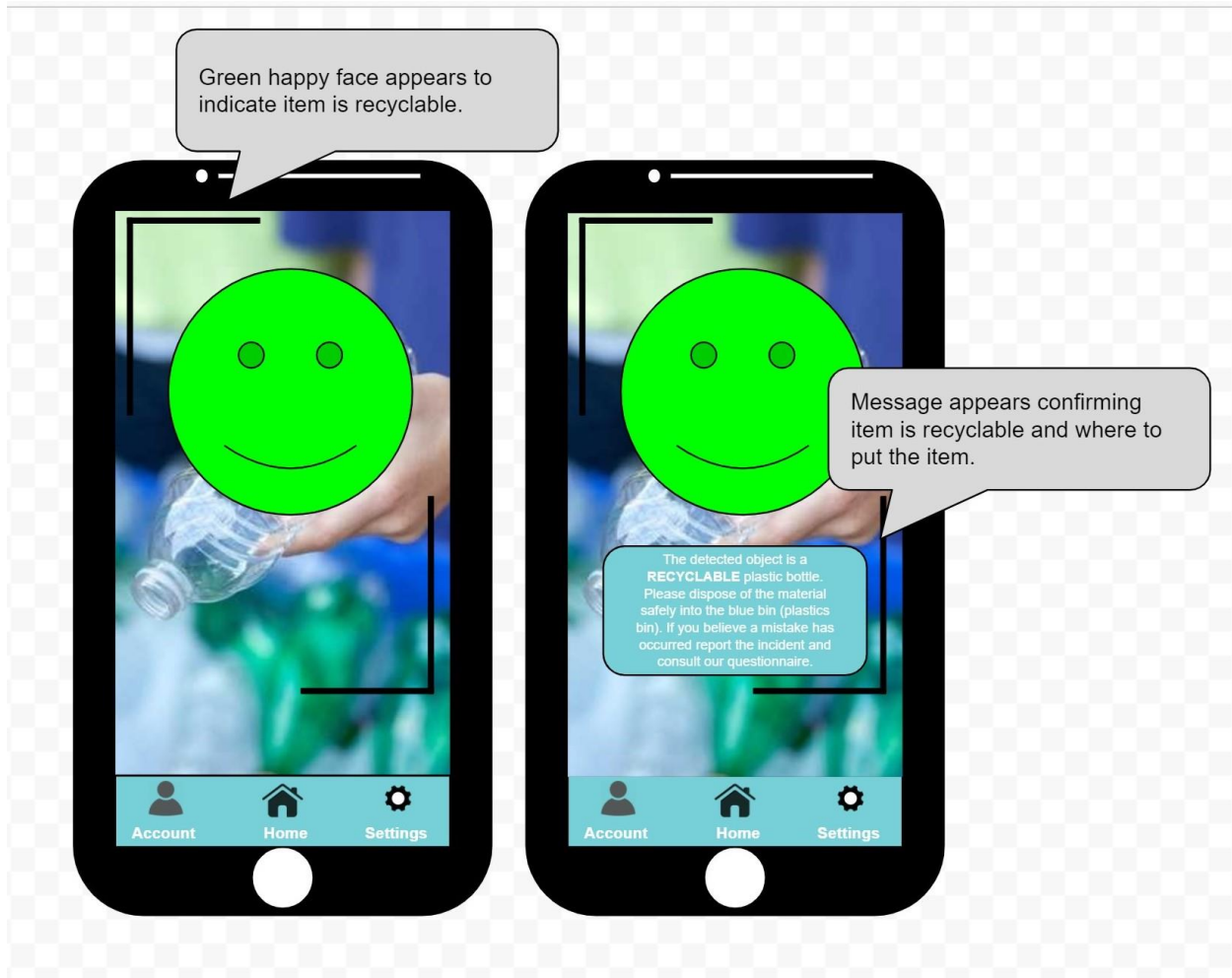

In the case that the item is recyclable a large green smiley face as well as a message will appear on the screen. The smiley face to first and foremost help the user distinguish the fact that this item is indeed recyclable. The message reiterates this by bolding the message determining the fate of the item and then going into detail about where the item should go and to consult the questionnaire if they believe a mistake has occurred.
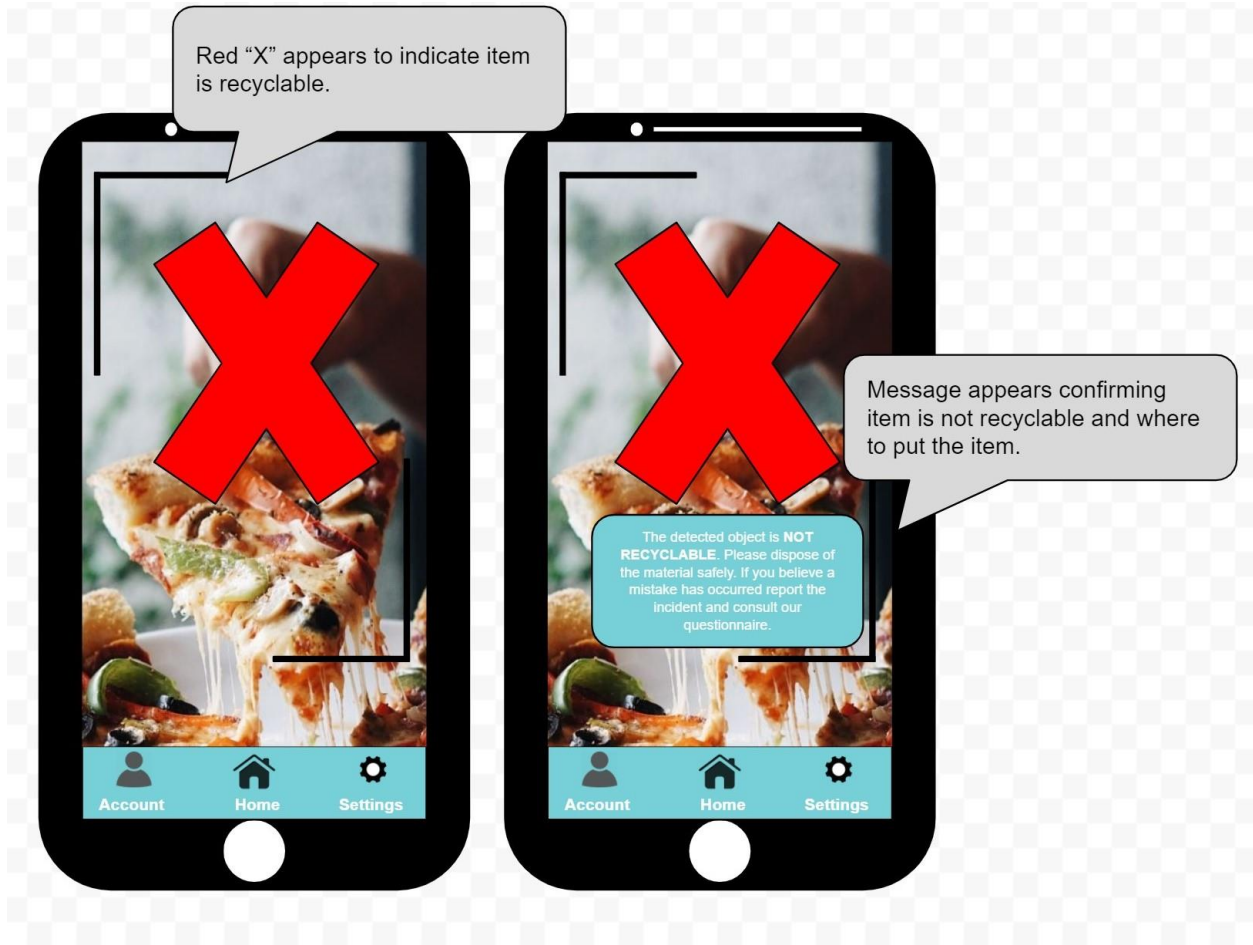
In the case that the item is not recyclable a large red "X" as well as a message will appear on the screen. The smiley face to first and foremost help the user distinguish the fact that this item is indeed not recyclable. The message reiterates this by bolding the message determining the fate of the item and then going into detail about where the item should go and to consult the questionnaire if they believe a mistake has occurred.
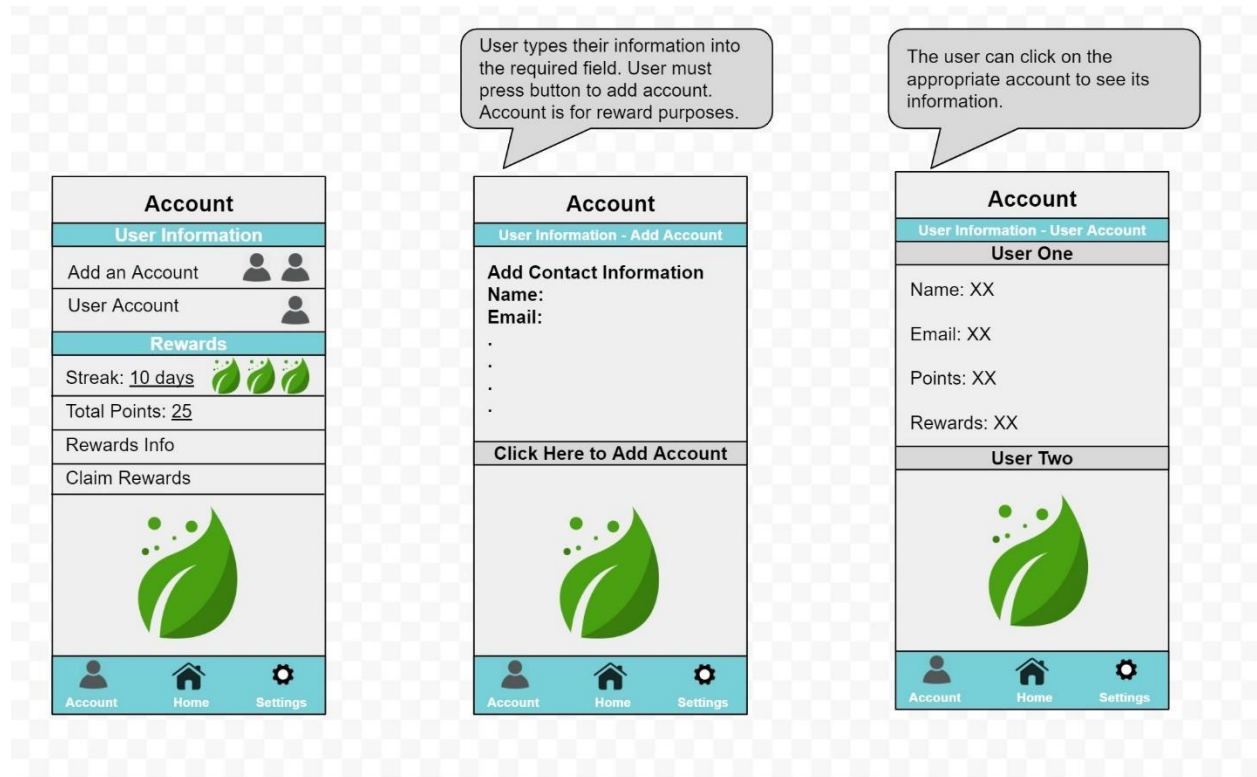
The user can then go on to click the account page to use the rewards feature. The account page includes the user information section and rewards section. In this figure specifically the user information features are displayed. These features allow the users to create multiple accounts by giving their contact information and any information that will further be necessary for the rewards to work. The user can also review their account information by clicking on the "User Account" button.
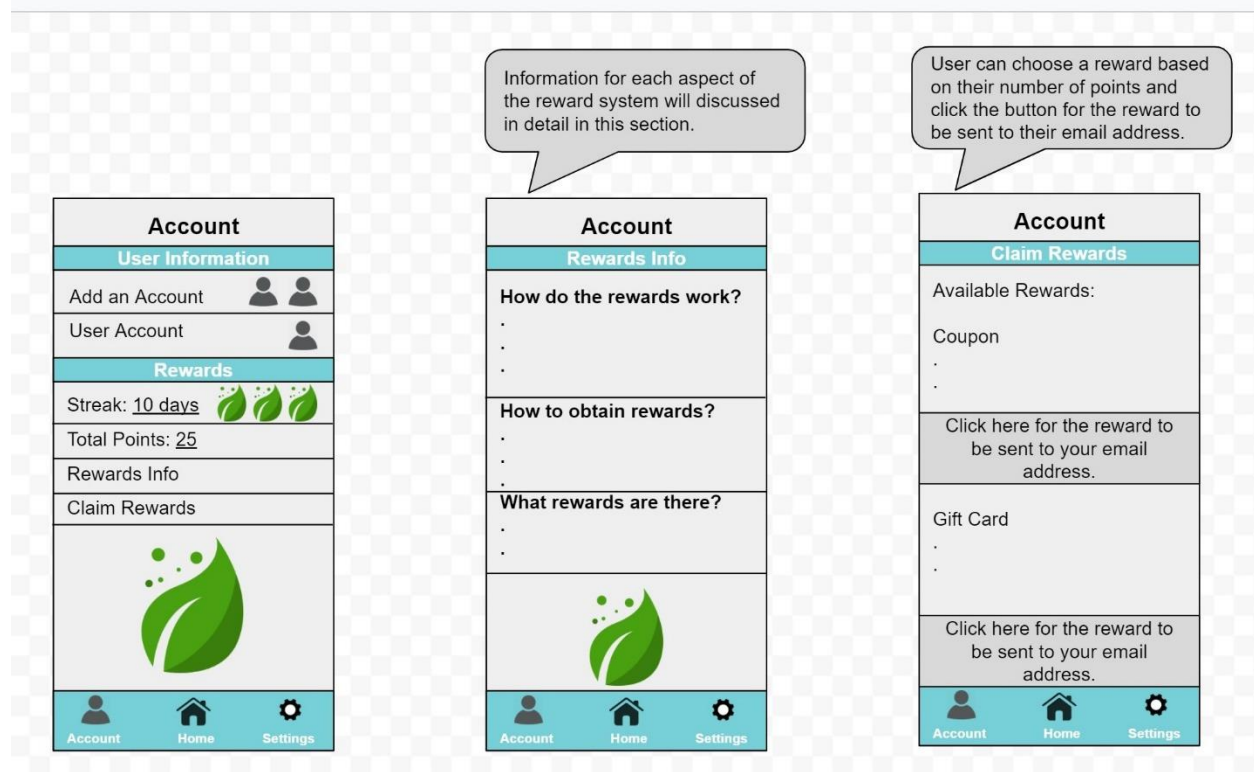
While on the accounts page the user can go to the rewards section to understand how the rewards work and to claim the rewards they have accumulated. The rewards information section describes how the rewards work, how to obtain the rewards and what rewards are offered. The "Claim Rewards" button takes the user to page that calculates their available rewards based on the point system which is described in the rewards information section. The options will be outlined and then a button will appear below each available reward to send the reward to the user via email provided in the account user information.
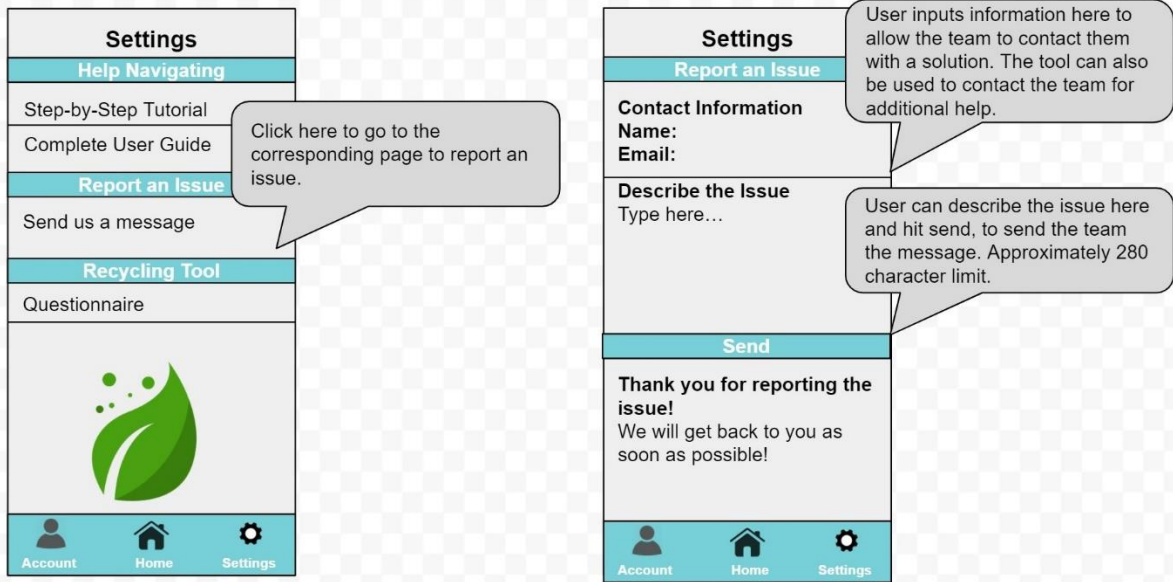
In the settings page the user will find three sections: Help Navigating, Report an Issue and Recycling tool. This figure focuses on reporting an issue. The user clicks the "Send us a message" button to take them to a corresponding page in the reporting section. Here the user can once again input their account information and describe the issue so that the team can solve the problem as soon as possible. The character limit is based on the number of characters that are allowed by Twitter for their Tweets, making the model familiar to the user.
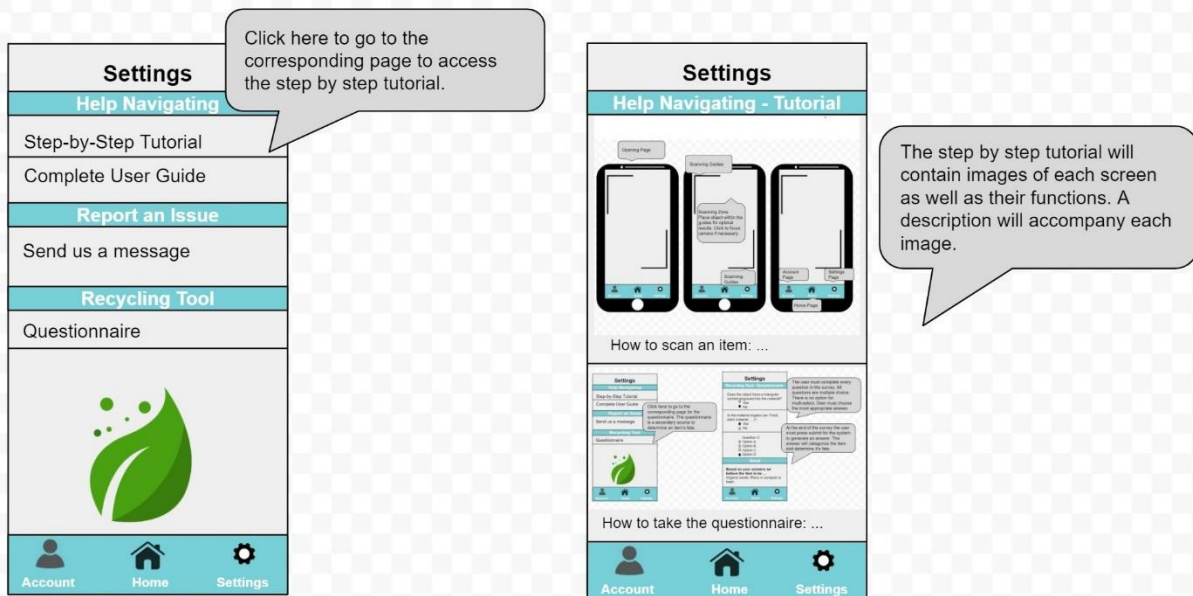
Within the settings page the tutorial exists to help the user navigate the app in its entirety. The tutorial will contain step-by-step images and descriptions to accompany the diagrams. This will allow the user to take a virtual tour of the app and its features. The tutorial is there to show how a simulated user would interact with the app and how to do so most easily.
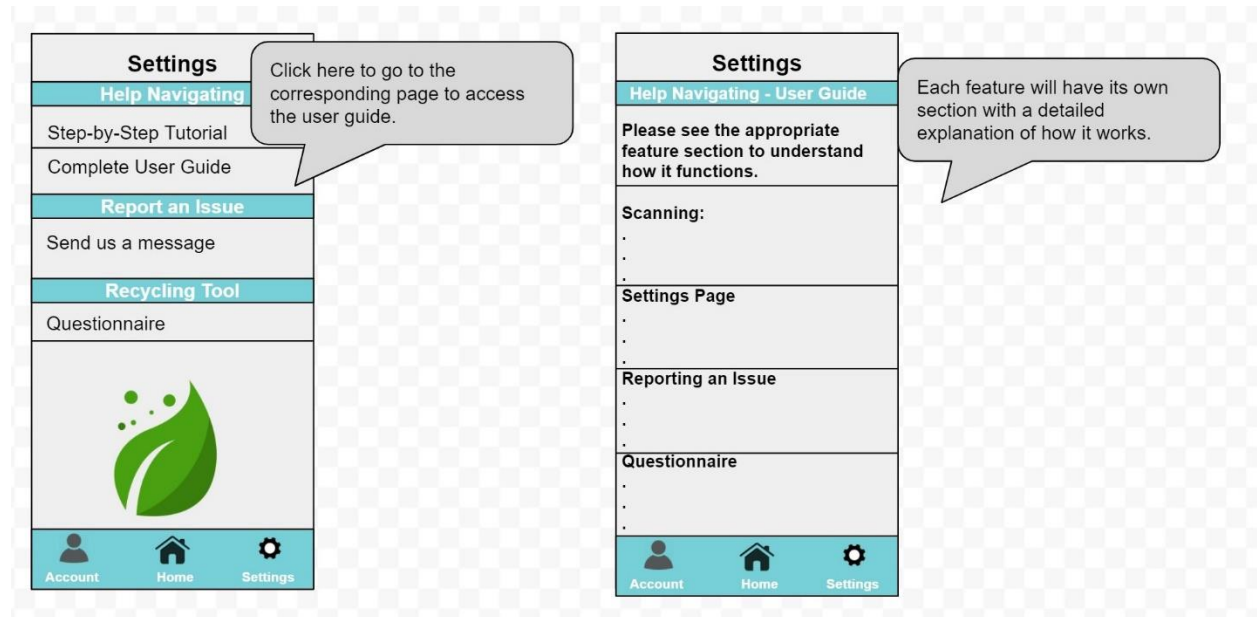
The user guide exists in the settings page as well. The user guide is there to go in detail and explain how every single function works. This is separate from the tutorial which takes a more visual and user-oriented approach whereas the user guide takes a more technical approach. The more technical approach allows users who wish to learn more about the app and its inner workings as well as to provide technical support without using resources to answer messages from users.
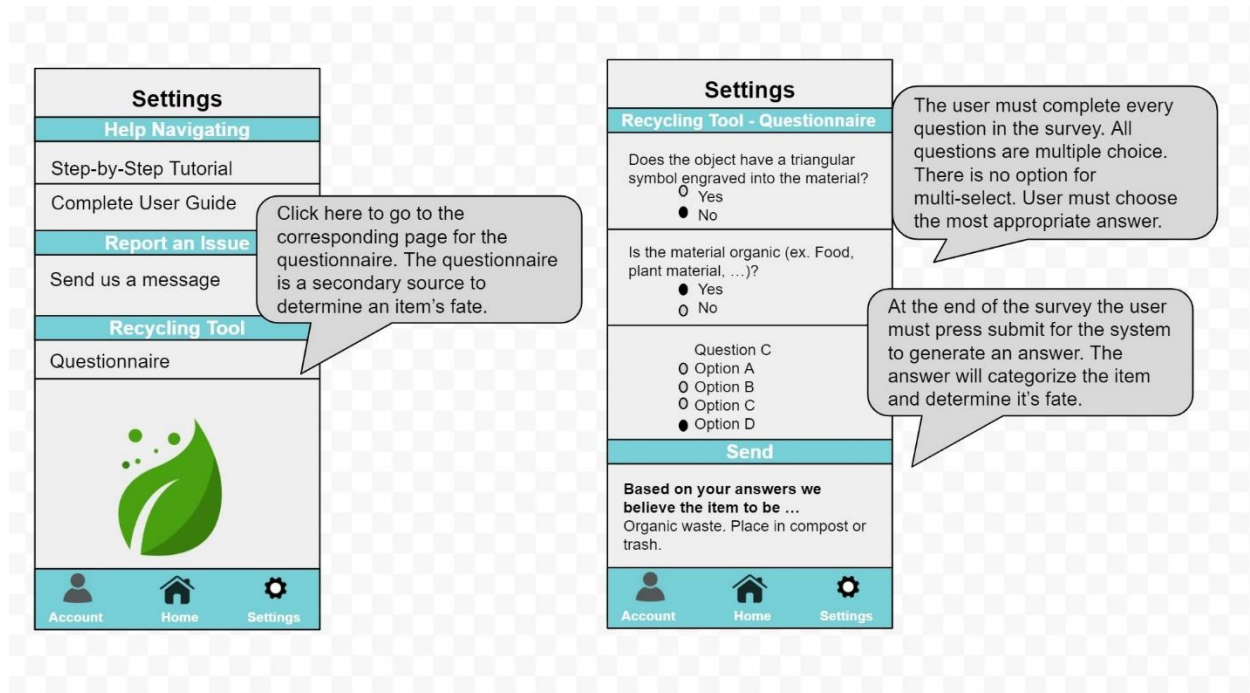
The questionnaire serves as a fail-safe for the app. It is an alternative method for users to arrive at the conclusion of the item's fate without using the scanner. This would occur if the app does not function within its success rate. The questionnaire is under the settings page and tool page. The user must answer multiple choice questions regarding the item in question and then click the send button at the bottom of the questionnaire for the app to determine where the item should be placed. The multiple choice aspect is to easily integrate the questionnaire into the code using a series of conditional statements to sort the item through a flow chart like process into the correct category.

Testing

The testing of the app refers primarily to its efficiency and complexity of actions. The client has emphasized the need for a user-friendly solution, ergo the simplicity or complexity of the app must be tested. In this case because the first prototype is a larger scale of proof of concept with detailed sketches of the framework of the app, the efficiency is all theoretical. Therefore, for this prototype the complexity will be the criteria being evaluated in the testing phase. The complexity metric is calculated by the number of clicks or actions a user must go through to accomplish the given task. For our app, the task is being able to recycle. The complexity is thus measured by the number of steps for the user to scan the object. The ideal case is that the user clicks on the app icon, opens the app which opens the scanning portal screen and clicks once more to focus (if even necessary). Two actions (at maximum) are required for the user to accomplish the task. From there on out the complexity increases with the additional features to increase the user experience. However, the rewards feature for example is not essential to the user to recycle/scan the object so these features will not be considered for the complexity of the app. In a non-ideal situation where the app fails to recognize the object and the user goes on to use the questionnaire tool to determine the fate of the item, the number of required actions will increase. The actions will go from two actions to clicking the settings page, the questionnaire button

and then completing the questions and clicking the send button to submit the questionnaire. There are an additional three steps at the very least and one action for each questionnaire question. If ten questions can determine the items fate, a total of approximately fifteen actions will be required if the app fails to recognize the item and if the user goes on to use the fail-safe questionnaire.

Testing will also occur at the next client meeting when this initial prototype is presented. The prototype will be compared to the client's needs and expectations. By presenting a thorough walk-through of every feature and function of the app, the features of the app can be evaluated based on the predetermined criteria. Based on the feedback the app will be modified to create the most successful model possible.

In the future prototyping and testing will revolve around the three major systems of the app: interface, code, and database. The testing of the code will revolve around whether the app is able to scan the item which means the code must work. From there the success rate of the code will be evaluated and different coding paths will be tested for their success rate and run-time. The interface will be tested based on how well the app is able to integrate the other two systems and how closely the app resembles the generated sketches and first prototype. Lastly, the database will be tested based on how many images exist and are usable or more efficient to scan the object.

Future Prototyping and Objectives

In the future with the next prototypes modifications will be made to rework the first prototype model. This includes updating the contact information page in the report section of the settings page. Instead of making the user resubmit their account information, which is already inputted in their account information, the user will be able to select their account. The system will then be able to determine who is sending the message and will allow the support team to send a message to the email associated with the account that sent the message. Lastly, the contact information and the rewards section will be updated. Based on future partnerships the rewards page will be more accurate and outline exactly what rewards are available and how they will work. Based on the scope of the rewards, the contact information may become more intricate and include a safety feature.

The objective for the next prototype is to create a working app/model of the app that integrates the preliminary code into an interface in the unity sphere for the application. This includes creating the code that will scan the item and retrieve the image and then compare it to the database created. The goals for the interface is to create all the screens and integrate the code for the app to function. The extra features will be last in the order for the interface since the priority is for the app to work.

Prototype Adjustments – Model Improvements

Based on previous sketches and models as well as the initial client meeting, changes have been made to complete the first prototype. Initially the app had scanner guides to help the user scan the item by placing the item in between the guides. These guides would change colour from black to red/green based on whether the item is recyclable. While this system was not incorrect it was inefficient and left much to be desired. The guides are too small and not obvious to the user. Since a varied demographic will be using the app, the user-friendliness must not just include the complexity of the app but the clear detailed sorting of materials. The client made the comment that it should be more obvious if the item is recyclable. Consequently, instead of the scanner guides changing colour, a large red "X" appears on the screen if it is not recyclable, and a large green smiley face appears if it is recyclable. Based on this newly acquired knowledge, the message that appears on the screen to confirm the item's fate was also modified. The message now clearly says where the item should end up and has the bold messaging confirming the item's fate, instead of a small message that is easily ignored.

The concept of making the app more user-friendly and clearer continued into the additional features. While the additional features increase the complexity to some extent, these features add to the usability of the app for example the user guide is an incrementally important part of the app to help those who want to learn about how to use the app to its full potential. However, these features could be done in such a manner as to exemplify the goals of the app. Consequently, titles were bolded and placed in a way that would be most beneficial to the user to see. They were reorganized compared to previous models and the various buttons are now well defined and easily identifiable.

Conclusion

In conclusion, this prototype builds the framework for all future prototypes and features. Continuing to assess risks to the project ensures that a successful solution will be achieved. The AR app demonstrates promising features that have the potential to efficiently solve the waste management problem and fulfill the client's needs.

Appendix A