Engineering Design - GNG 1103 [C]

Project Deliverable G

VR/AR for Recycling

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Section C03 – Group 11

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Contents

Abstract

This deliverable goes over the improvements made on the first prototype of the app, which resulted in the second prototype of the app. Previous feedback indicated that the presentation of the prototype and the recycling database of the app should be improved in future iterations. The second prototype of the app improved on the visual appeal of the interface and the content of the recyclable sorting.

Introduction

The project team has updated the app based on the feedback of the previous prototype. The feedback indicated that the product required further development in aesthetics and content. The second prototype intends to improve the aesthetics and expand the database in the first prototype. This prototype includes the app with a basic user interface, manual sorting search bar, manual sorting using categories, and AR scanning, and the website with the manual sorting features, a sorting game, educational links on recycling, a chat forum, and a map with various specialty recycling plant locations.

The second prototype aims to be a more appealing version of the previous prototype incorporating some of the feedback of the aesthetics and functionality of the first prototype. The current prototype has taken further consideration as to how the application will run on a mobile device and the content has been modified to fit the appropriate aspect ratio. As well various features have been redesigned for easier use based on previous feedback.

In this deliverable the second prototype of the recycling app and website were developed, the test plan for the different aspects of the prototype was expanded upon, and the prototype was tested with a small group of potential users and shown to the client. The deliverable explains the developments made on the second prototype, how the adjustments were made, and how the changes made correspond to the feedback of the first prototype. Then, the test plan will be elaborated upon. Finally, the feedback from a small sample group will be listed, along with plans for further development for the next prototype.

Prototype II: Updates and Changes

App

Main Screen and Button Layout

When the app is launched, the user is sent to the main screen with access to all of the product's features. The main screen allows users to switch between pages, each with their own function; Sorting, AR Scanning, and Education. Based on user feedback, a simplistic style was chosen to draw the eye of the user but also to avoid overloading their senses with too much information. Ideally, the app or group logo would be placed in the middle of the screen to fill in the blank space. The colour blue was selected as it seemed to be the easiest on the eyes when matched with the style of the app. The background of three stripes was chosen to resemble the group name, "SLASH" while also remaining complementary to the foreground.

Figure 1: Main Screen

Search Menu

The search menu underwent significant updates from the initial prototype. The text was enlarged based on the user feedback and the blank spacing below the search bar has been filled with manual search options (figure 2). To help the user find an item in the database, a text box was installed below and prints out the name of the closest item in the database to what is being typed in the search bar (figure 2). Once an item from the database is typed into the search bar and the search button is pressed, it still takes the user to a screen with an image informing the user where the item should be placed.
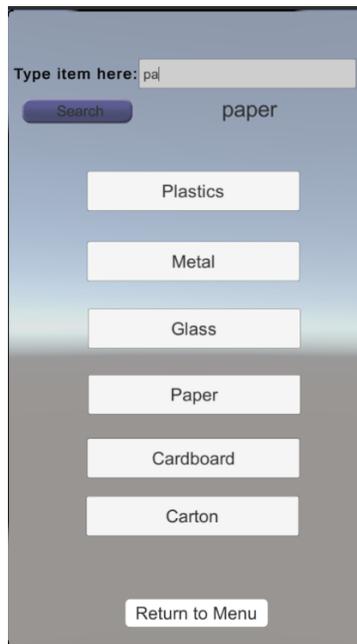

Figure 2: Manual Sorting Search Page

The new additions to the manual search screen are the buttons placed below the search bar. Each of the buttons takes the user to a specific page and explains to the user how to dispose of the different items (figure 3). These groups are written in text and have an image beside them to provide a visual representation of the item. Each group has an arrow that points to a text which writes out the correct location to dispose the item into. These locations are colour coded as well to help link the items to the corresponding-coloured bins. When the user is finished on that page, the return button will bring them back to the manual sorting page.

Figure 3: Manual Search - Metal Page

Many improvements have been made to the manual sorting page, but it still has a lot of work ahead of it. The specific classifications of the plastic categories have not been filled. Furthermore, some of the pages like the metal page above (figure 3) have many items and make the page appear squished. Moving forward, aesthetics will be prioritized. Additionally, the database of the search bar has not been updated since prototype I. A list of items to add to the database has been generated but has not yet been implemented. Lastly, along with the AR sorting, the client suggested that the bar code numbers be possible to search in the search bar. The manual sorting page still has more work to complete in the next prototype.

AR Sorting
The AR sorting function was improved on by modifying the notices to be attached to a canvas rather than attached to the target image. This addresses previous feedback that the notices were hard to read unless the object and camera were held steady. When displaying the notice on the canvas, the image appears on the user's screen instead of on the object itself. While the object is being scanned the notice will remain upright in the centre of the screen regardless of the position

and orientation of the objects bar code, unlike before when attaching the notice to the barcode caused the notice to change orientation with the bar code, preventing the notice from flickering due to the user moving the object or camera.
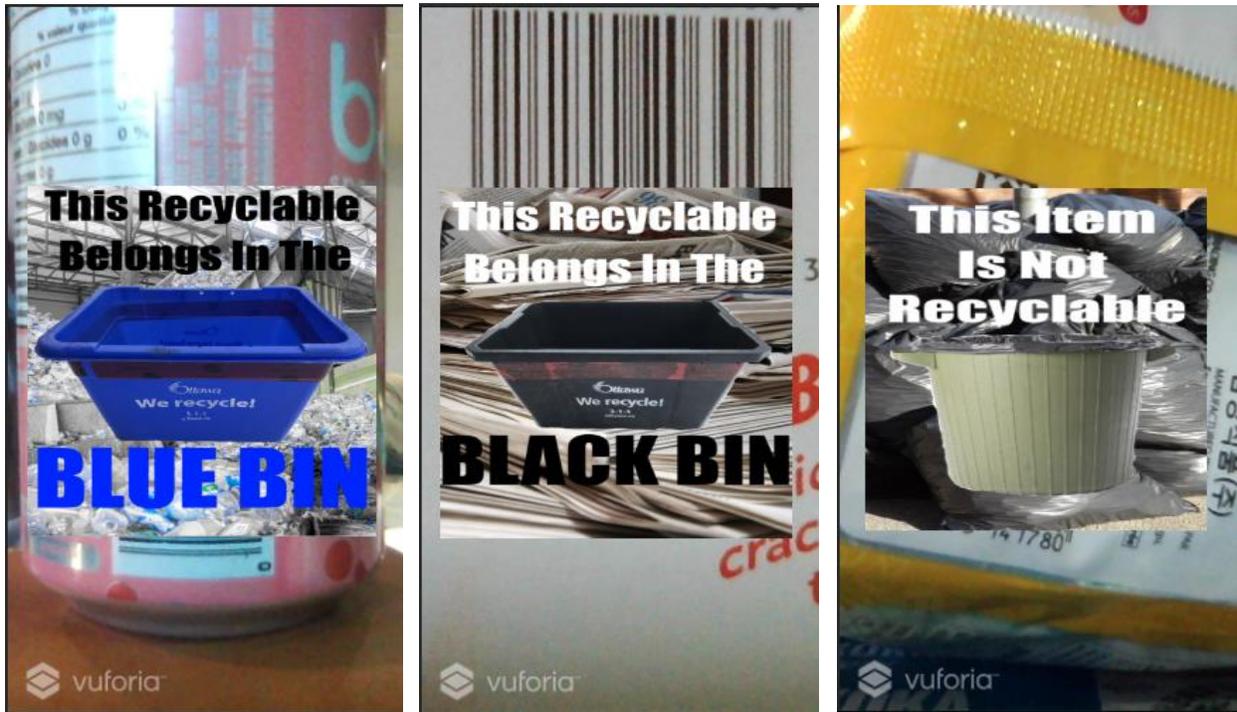

Figure 4: Notices with Recycling Information

Website

Many changes were made to the first prototype of the website to improve user experience and all feedback from the last round of testing was considered and implemented.

The home page (figure 4) was expanded to include information about the region that the website is discussing, the types of waste bins used, and a link to the Ottawa Municipal website where information about waste pick up days can be found.
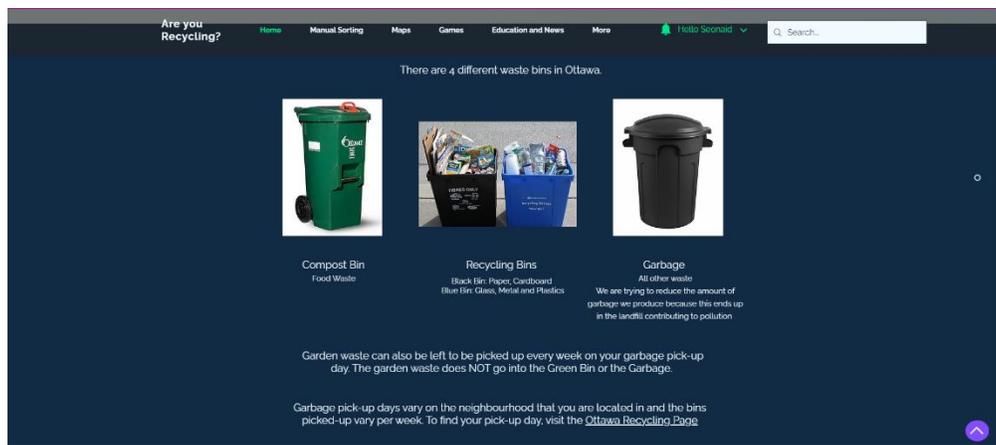

Figure 5: Home Page

The manual sorting feature of the website was also developed to include more categories such as Metal and Glass (figure 5), to make finding products easier and the database was expanded in general to include more items. There was also more breakdown categories included, such as adding an 'All Other Plastics' (figure 6) option to include more commonly found plastics around the home.
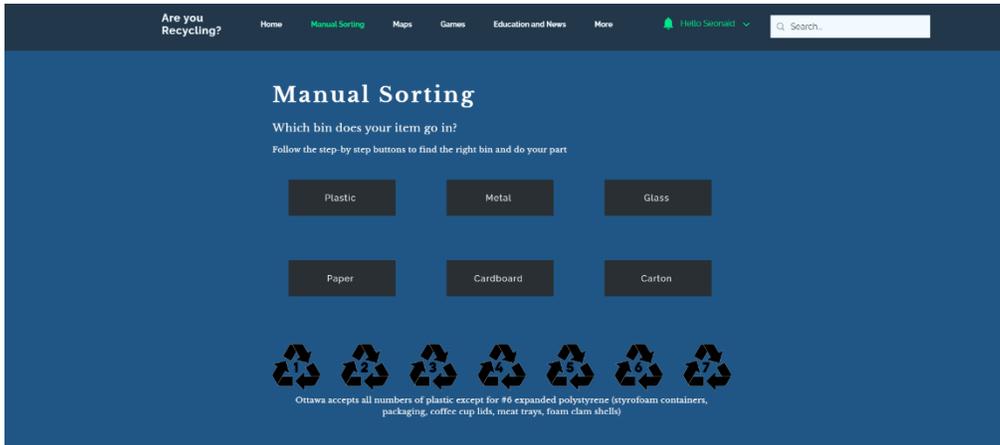

Figure 6: Manual Sorting Page
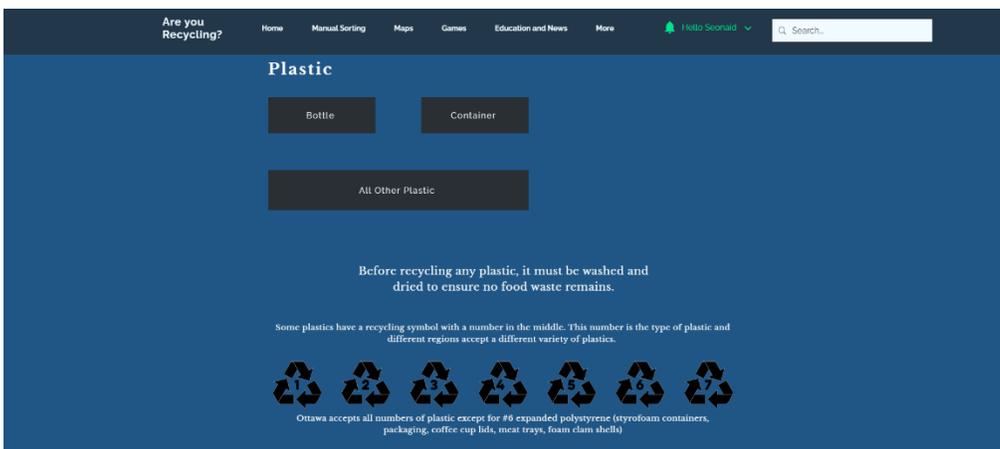

Figure 7: Plastics Manual Sorting Breakdown

One of the biggest improvements to the website was the addition of the Search Bar feature (figure 7) where users can search their item and they will be led to the page with relevant information for recycling details. This facilitates use of the website if the user chooses not to go through the detailed step-by-step breakdown of manual sorting.
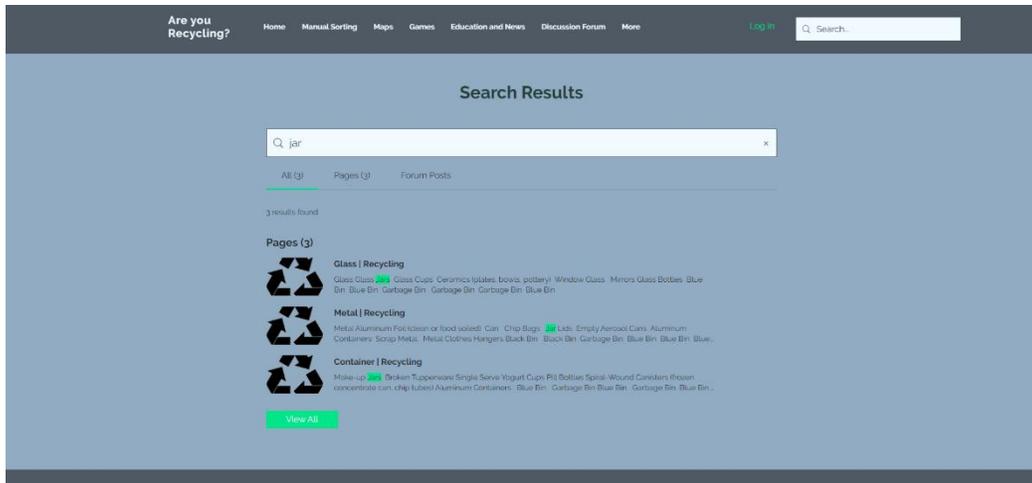
Figure 8: Search Results Page

The map for locations to recycle special recyclables was also improved by adding locations, operating hours (figure 8), and a list of all locations on the map (figure 9) below as was suggested in the feedback of the first prototype.
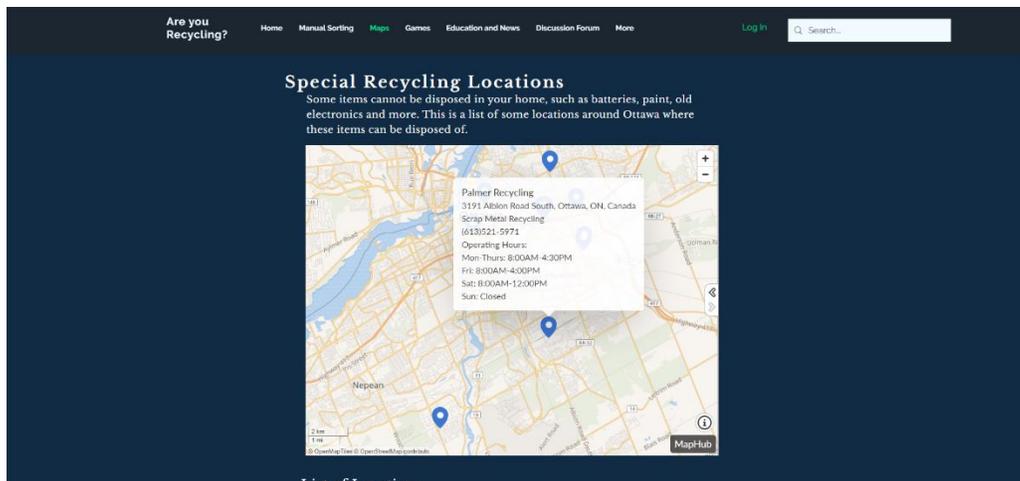

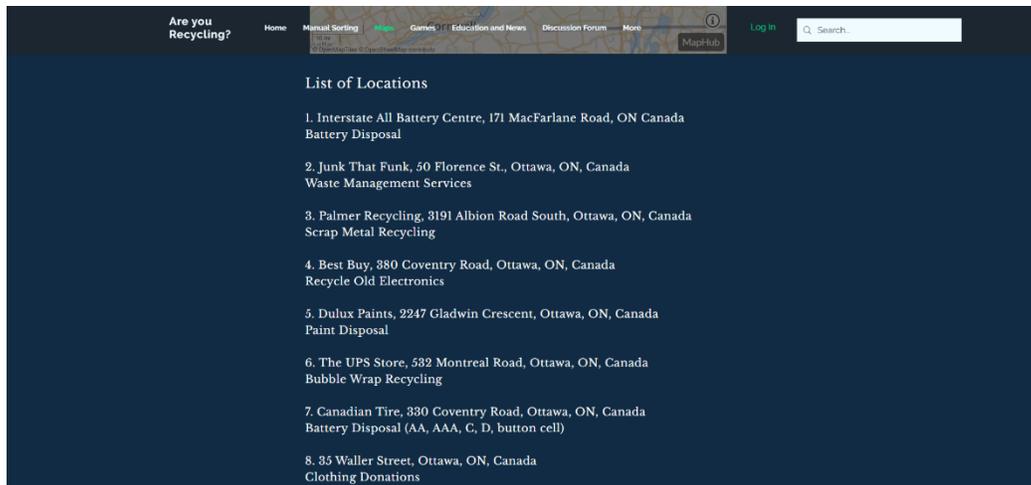*Figure 9: Special Recycling Page Information*

Figure 10: List of Special Recyclables Locations

Test Plan

After completing previous deliverables and first prototype, the second prototype has been created. The second prototype was presented to the client and more users for further feedback on the functionality of the product as well as the aesthetics this time. This is feedback to consider for improving the final design. The subtasks for the development of the prototype have been distributed evenly through the members of the group.

Why are we doing these tests?

Testing the prototype is an important aspect of the design process for multiple reasons. It can show the faults in the product and areas where further development is needed and it can be shown to the client and potential users for feedback about aspects that should be added, removed, improved, or changed. Continuous prototyping also allows the creators to continue to gain a better understanding of the software and materials that are being used for the final product, after initialling learning the software for the first prototype. The improvements are completed much faster because the initial learning stages are over. Completing the second prototype will provide a better understanding of what can realistically be accomplished in the remaining time and it will continue to highlight problem areas to correct for the final product.

What is the test objective and what is the prototype description?

The testing of the second prototype has specific objectives with the purpose of expanding on existing functions and improving flawed functions based on received feedback. The two parts of the prototype, the app and the website, require specialized testing for each feature, differing from previous testing, to ensure improvements have been made.

What is the test?

The tests to be conducted focus on determining the functionality of the prototype with its existing abilities. Some key tests to ensure the prototype operates as desired include:

- Can the app recognize items without bar codes?
- Can the search mechanic return the specified items with instructions?

- Can the manual sorting mechanic guide the user to the correct item?
- Can the app be accessed on all platforms? If not, which ones are available?
- Is the website searchable? Does it improve ease of use?
- How are the aesthetics of the product?

Tests will be conducted by allowing family members and friends to try the second prototype and provide feedback. This testing is more focused on improving the functions of the prototype and its details rather than assuring the tests can be done.

How will the results be used?

The results from these tests will be used to help improve upon functional aspects of the prototype and to improve the look of the product. These results will aid in indicating the project's progress and provide ample feedback on the current abilities of the prototype. The assessments received from these tests will be kept in mind for all later prototypes.

When is the testing happening and how long will it take?

Testing will occur over a day to allow multiple people to try the product at a time that it is convenient for them. The tests will likely take less than an hour for each person and feedback should be received immediately after or during. Testing will occur after the client presentation before further changes have been made for consistent feedback from the users and the client.

Testing Results and Analysis

The client and a handful of users were shown the prototype and the users were asked to use the prototype with minimal guidance before offering their suggestions. The client's and users' feedback is presented and discussed below:

App

The feedback from the client meeting is the following:

- How to deal with items that do not have bar codes with AR scanning
- Should we have a way to input the numbers on the bar codes into the manual search
- Should investigate image recognition software to increase the flexibility of the AR sorting
- Mentioned that the app should have a stylistic theme – work on the aesthetics of the app

To handle items that do not have barcodes, image recognition will be investigated. This will increase user friendliness and expand the database of the AR scanner to identify more items. The function of manually inputting barcode numbers will also be implemented to allow users to search the barcode number and receive a result for which bin the item belongs in. After improving the functionality of the app, the look of the app will be considered. A stylistic theme was suggested by the TAs to improve the aesthetics and build a more consistent and pleasant image of the product.

The user feedback regarding the apps functionality and aesthetics are:

- Have a way to return to both the general plastics page and the manual sorting page from the individual plastic categories pages
- Should have a way to return to the main menu from the different manual sorting pages
- When gibberish is typed into the search bar, it still maintains that what you are typing is correct. Should indicate the nothing with that lettering is found in database
- Questioned the use of the word AR – people may not know what it means
- Enter button on keyboard does not make the search bar work
- How would you address spelling mistakes? Can you address spelling mistakes?
- After error message about item not in database (needs to be fixed) the database list of items below does not always update
- The database search list below search bar should include everything like what the user is typing – not just a single item – and should fill the entire screen
- Also pointed out that a drop list would be ideal
- Items in search menu below should sort in alphabetical order
- When typing in gibberish the list does not remove items so has items that do not match the input
- The suggestions should not begin until after 2 characters have been typed into the search bar
- On the manual search pages, the different components of the items should link to their own recycling instructions (Ex. From the jar page should be a way to easily find out how to recycle the lid)

Many of the issue with the app involve the search bar and the search feature. While the drop-down menu would be hard to implement, the alphabetical list with removal of the items will be attempted with a sort of function within the C# code and a refresh of the items with every input. The code will also attempt to sort out gibberish by removing items from the list when nothing appears.

The aesthetics of the app will also be addressed going forward. The users noted that not everyone might be familiar with the abbreviation 'AR', so the button name will be changed to something more accessible. Furthermore, the plain backgrounds and buttons will be updated with a common theme as the app is mostly functional and the aesthetics is one of the largest remaining issues.

User Feedback for AR:

- Liked that the image would remain stationary and always appeared upright
- Thought that the background of the notice image was a little busy
- Would prefer a neutral background on the notice image

Website
After the client presentation, no feedback was received regarding the website from the client or the professor, but the TAs did provide some feedback:

- The map on the website should also have normal recycling bins

This suggestion will be implemented, because the client has shown interest in this idea previously, as he is an alumnus of the school, but the waste bins will not be added directly to the existing map. A second map with locations of the bins on campus will be added separately on a new page.

The user feedback from friends and family who tested the website is:

- Add instructions about how to throw away garbage – bags or no bags, garbage waste bundles, etc.
- Make information about #6 plastics more clear
- Add information about how to recycle mattresses, small appliances, and wood scraps

This feedback will be considered, and these are small things that can be added and corrected quickly for the following prototype.

Conclusion

The app has improved in many ways from the last prototype. The main improvements are the improved manual sorting function and the improved AR sorting. The AR sorting is now more user friendly, and the manual sorting is now more visually appealing and has improved functionality. In addition, the website has been improved, with the main improvements being the search bar feature. Finally, the testing of our product has provided feedback for further improvement and the results were analyzed and will be implemented into the final prototype and design if it is possible to do in the remaining time.