

Project Deliverable F: Prototype I and Customer Feedback

GNG 1103 - Winter 2021
Faculty of Engineering - University of Ottawa



uOttawa

Course Coordinator: Muslim Majeed
Teaching Assistant: Ebin Joseph & Jasen Lee
Client: Mitch Bouchard

Due Date: March 7th, 2021

Team Name: GreenAR World



Group #6 Members:

Monica Harada (#300004298)
Branden Leung (#300005206)
Ethan Leung (#300160832)
Keera Moretti (#300050228)
Alexander Fournier (#300022050)

Table of Contents

1 Introduction	3
2 Prototype Test Plan	3
2.1 Prototype Test Plan Chart	3
2.2 Stopping Criteria	5
2.3 Test Results (Monica/Ethan)	5
3 Prototype I	6
3.1 Analysis Strategy	6
3.2 Basic Proof of Concept	7
4 Feedback and Comments from Potential Users	12
5 Plans for Prototype II Based on Prototype I Results	13
6 Conclusion	14
7 Wrike Snapshot	14

1 Introduction

The objective of this deliverable is to make an actual working prototype of our design and assess its functionalities in order to better understand what we must improve. To do this our team has designed the interface for our application and have tested it out to ensure it achieves the goals we have set. To keep this information organized our team will record what is being tested, why and how it was tested, and finally when the test occurred. Feedback from peers will also be collected and documented in this deliverable as it will be used as a reference moving forward. Finally, our team will brainstorm ideas and improvements we feel are necessary to make based on the data and feedback we receive and agree upon what changes must be made for our next prototype.

2 Prototype Test Plan

2.1 Prototype Test Plan Chart

Test ID	Test Objective (Why)	Description of Prototype used and of Basic Test Method (What)	Description of Results to be Recorded and how these results will be used (How)	Estimated Test duration and planned start date (When)
1	Make sure object recognition is operating correctly	Enter 3 image targets for unity to recognize.	If all targets are correctly recognized with 100% accuracy, it is deemed successful.	2021-03-05 (1 day)
1.1	Recognize Chewbacca Squishmallow Plushy. This will be used as a test if image recognition works.	Utilize Unity to recognize the Chewbacca Squishmallow. The application will have a short description saying what the object is, what the disposal method is, and any other key notes.	If this target is uniquely identifiable with 100% accuracy, it is deemed successful.	2021-03-05 (15 minutes)
1.2	Recognize the tissue box. This will be used as a test if recycling information pops up.	Utilize Unity to recognize the tissue box. The application will have a short description saying what the object is, what the disposal method is, and any other key notes.	If this target is uniquely identifiable with 100% accuracy, it is deemed successful.	2021-03-05 (15 minutes)
1.3	Recognize a shoe box. This will be used as a test if	Utilize Unity to recognize a shoe box. The application will have a	If this target is uniquely identifiable with 100% accuracy, it is deemed	2021-03-05 (15 minutes)

	recycling information pops up.	short description saying what the object is, what the disposal method is, and any other key notes.	successful.	
2	Analyze button functionality	When the analyze button is pushed, it should be able to capture the image target and display information (i.e. what the item is and if it is recyclable or not). The analyze button will be designed to show up on the screen only when an object is recognized.	The analyze button will either work or will fail. If our design works, the analyze button will show up on screen and once pressed, will reveal information. If the button fails, we will be troubleshooting and develop a method to determine the problem.	2021-03-05 (5 minutes)
3	User Interface with Introduction Screen	Since there is a start button in the introduction, when we test the button, the application will be able to go from the introduction screen to the main screen.	It is deemed successful when after the start button is pressed, the application will open up the main screen in its camera view.	2021-03-05 (10 minutes)
4	Implementing the flash toggle. Depending on the mobile phone's camera quality, it may need additional light to detect an object. This is also helpful during the evening.	There will be a flash setting when analyzing the item in the camera view. It will be tested by pressing it.	It is deemed successful if the flash toggle enables the flash to turn on or off.	2021-03-05 (10 minutes)
5	Search Button	There will be a search button that will display a search bar. Since this is the first prototype and due to limited time constraints, the current search button will redirect to the City of Ottawa regular waste disposal practice website.	This part of the prototype is deemed as complete if upon clicking the search button, redirects to the City of Ottawa regular waste disposal practice website.	2021-03-05 (10 minutes)

2.2 Stopping Criteria

The following section is to set stopping criteria for each test objective defined in section 2 of this deliverable. Stopping criteria is defined as the criteria that will allow us to end each test we perform for prototype I. Each test will be deemed successful when we are satisfied with the results achieved from our testing objectives.

Test ID	Stopping Criteria
1	If all image targets (1.1,1.2,1.3) are recognized three-times each in random order, we can conclude this test.
2	When the analyze button is tested 3 times for various objects stated in test ID #1 while yielding the correct information, this test can conclude.
3	When the start button on the introduction screen successfully redirects to the main screen 3 times, the test will come to a conclusion.
4	When the flash toggle is pressed, the flash on the smart device should turn on or give an indication that is on. Pressing it a second time will turn off the flash. If this is successful 3 times in a row, the test is then completed.
5	When the search button is selected, the application will redirect to the City of Ottawa regular waste disposal practice website. In order to determine if the test is complete, the search bar will redirect the user to the City of Ottawa regular waste disposal practice website. .

2.3 Test Results (Monica/Ethan)

Test ID	Test Results
1	It has been concluded that all of the test items have passed the stopping criteria. When putting the Chewbacca Squishmallow Plush (initial test) in the camera view, the analyze button pops up and when clicked on, it displays relevant information. When putting the tissue box and shoe box in the camera view, the analyze button pops up and when clicked on, it displays information such as what the item is, the method of disposal (put in black bin), and other key notes. This was repeated 3 times in random order and the application functioned as desired.
2	The application had issues for recognizing the Chewbacca Squishmallow Plush. It was successful a few times but it seemed that we needed to put the object within a specific distance from the camera. The information it was revealing was correct when the plush was successfully recognized. Since our design is to have the “Analyze” button show up when the object is detected, the “Analyze” button would appear then disappear before any information can be revealed. The reasoning for this is the lack of Vuforia image identification points. For the next prototype, object recognition will be improved. As for the tissue box and shoe box, the analyze button was successful
3	Results deemed successful. From the introduction screen, the application is able to go to the

	main screen (in its camera view) after the “Start” button is selected. It has done so successfully without delay or issues for all 3 test runs.
4	The flash toggle was present and is located beside the analyze button. When the flash toggle is selected, the flash successfully turns on and off.
5	The search button is successfully able to redirect to the City of Ottawa regular waste disposal practice website without issue.

3 Prototype I

Prototype I consists of a simple start screen, followed by the main screen where the object recognition was implemented. The main goal of prototype I was to implement object recognition effectively and reveal information surrounding the object recognized. Extra features were added to this prototype such as a flash toggle and a search link. The introduction screen was also introduced, which simply displays the team logo, slogan, and a start button to advance to the main screen.

3.1 Analysis Strategy

For the introduction screen, simple tutorials were followed to implement the gradient background, with the team’s logo and slogan on top. The start button was made with a simple UI button with a C# script that will advance to the main screen when clicked.

The main screen fixed icons such as the flash toggle and search link buttons were created on the main canvas. Both contain different C# scripts that will allow a device to use its flash, and another to open the City of Ottawa Waste search website respectively. For object recognition, each individual image target created contained an analyze button that will only appear when said specific target is identified. Upon click of the analyze button, it will reveal an unique UI panel containing text surrounding the disposal method, type of item, and any special notes. The UI panel will also present an image of the sorting of disposal, ie, a black, blue, or green bin. These ideas were formulated through brainstorming and combinations of tutorials and readings retrieved from the internet.

3.2 Basic Proof of Concept



Figure #1: Screenshot of Introduction Screen

Description:

In Figure #1, we have created an introduction screen on Unity. This screen includes our application logo, the application slogan, and a physical start button that the user will have to press on in order to proceed to the main screen.

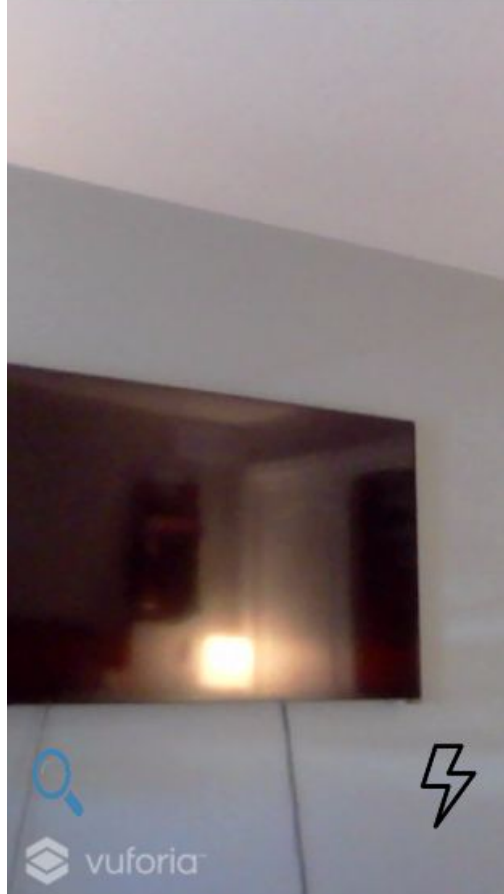


Figure #2: Screenshot of Main Screen Camera View

Description:

Figure #2 shows a screenshot of what the main screen looks like before any test objects are detected in its camera view. The bottom right features a flash toggle. If an object cannot be recognized, the flash toggle can be used to help the camera of a mobile device get a better view of an object. The bottom left of the screen has a search button. In Prototype I, when the search button is selected, the application will redirect to the City of Ottawa regular waste disposal practice website.

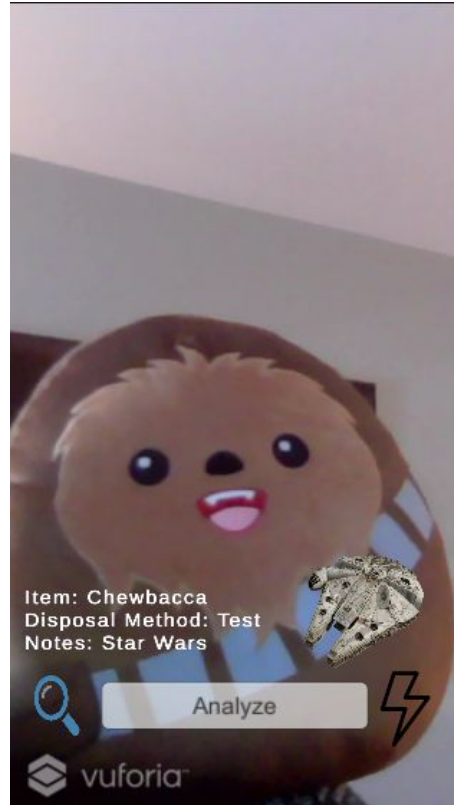


Figure #3: Screenshot of Main Screen with Chewbacca in Camera's View After Selecting the "Analyze" Button

Description:

Figure #3 demonstrates the information displayed after the "Analyze" button is selected. In this example of Chewbacca plush, it displays the name of the item, disposal method, and other key notes. Alongside this shows an icon that represents where to dispose of these items. The purpose of this object was to test if the image recognition works. This item will not be included in our final design.



Figure #4: Screenshot of Main Screen with Tissue Box in Camera's View

Description:

Figure #3 demonstrates the main screen with a tissue box in the camera's view. The "Analyze" button will only show up on the screen when the tissue box is in the camera's view and it is recognized.

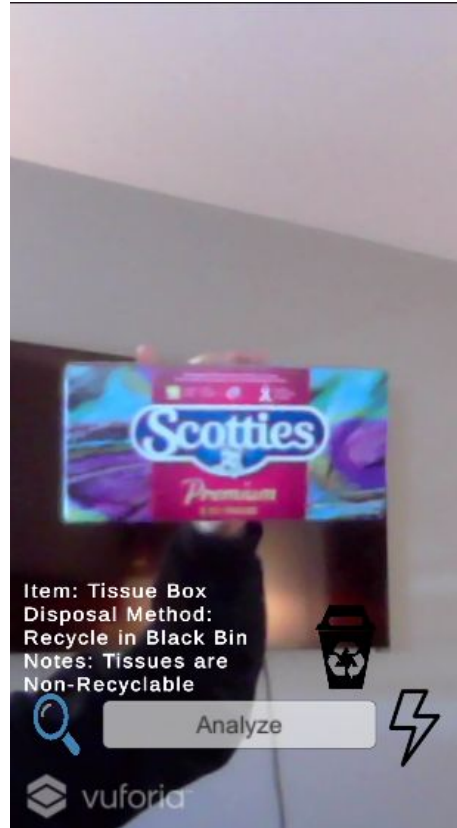


Figure #5: Screenshot of Main Screen with Tissue Box in Camera's View After Selecting the "Analyze" Button

Description:

Figure #4 demonstrates the information displayed after the "Analyze" button is selected. In this example of the tissue box, it displays the name of the item, disposal method, and other key notes. Since the tissue box is paper, it displays that the tissue box is required to be placed in the black bin. Since it is in the black bin, there is a small black bin logo

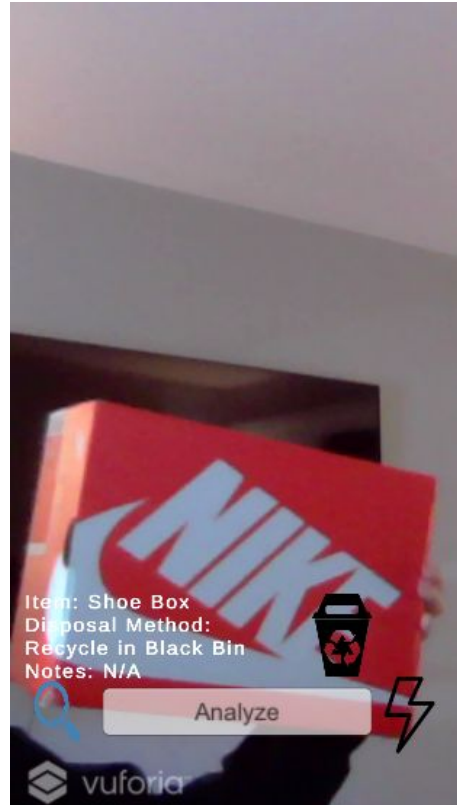


Figure #6: Screenshot of Main Screen with Shoe Box in Camera's View After Selecting the "Analyze" Button

Description:

Figure #6 demonstrates the information displayed after the "Analyze" button is selected. In this example of the shoe box, it displays the name of the item, disposal method, and other key notes. Alongside this shows an icon that represents where to dispose of the item. In this case, the disposal location is the black bin since it is cardboard.

4 Feedback and Comments from Potential Users

All test subjects prefer to be anonymous in their feedback/comments and do not want their name mentioned in our deliverable. Therefore, we have put in all feedback and comments we received and organized them by test subject number. All feedback and comments will be quotation based and will describe as close as possible to what was actually said. We have interviewed a wide variety of people including family members, friends and neighbours. We are unable to interview strangers since we are currently working remotely. We have received feedback through email, text, social media, phone call and in person for Prototype I.

Test Subject	Feedback/Comments
1	“This application seems quite easy to use and looks like it has potential. I know that many people don’t recycle their garbage properly and this seems like a fun and easy way to help fix that issue. I think that the flash toggle is really smart so it is compatible for daytime or nighttime use. I think I already do pretty well with recycling but I know that I can improve.”
2	“I usually don’t have enough time to think about what recycling product goes where because I am always on the go. I know that I should change but sometimes, I simply don’t know where to put the recyclable items. Until you told me, I didn’t know you weren’t supposed to put batteries in the garbage. Your application seems like a good idea. Honestly, I don’t know if I would use this application but if there was some incentive like a gift card or coupons like other apps have, I might.”
3	“I try to always do the right thing when it comes to recycling but there is always some doubt whether something is recyclable or not. I think this app would really help me out. It would be a great way to have my kids learn the rules and importance of recycling at a young age. Your current prototype seems like a good start. I hope you can successfully implement the other menus that you were hoping to achieve.”
4	“Every disposal I make, I ask myself if something is recyclable or not. I often google if something is recyclable or not if I’m not sure. I think the app you’re developing would help me save time googling if something is recyclable or not. I’m not really good with phones or technology so I think it's wonderful that you are trying to make it simple, easy to use and informative. I’m quite surprised that an application like this doesn’t exist yet. One thing I would suggest is that if you can, have the application analyze more than one recyclable item at a time.”
5	“This is a very good idea. I'm surprised this hasn't already been invented. I feel like people will really like the simplicity of just scanning an item to figure out how to recycle it. Looking up if I can dispose every item can become very time consuming.”
6	“Knowing exactly how to recycle certain items can be hard sometimes. I see this app helping quite a bit of people and overall getting more people to recycle. It would be cool if it was able to remind you when to take out the recycling too.”
7	“It’s a great idea but it seems like it may be difficult to execute in real life and may be slightly over ambitious based on your current knowledge of app programing.”

5 Plans for Prototype II Based on Prototype I Results

Prototype 2 will build upon the rudimentary functionalities developed in prototype 1. The primary goal of prototype 1 was to develop the ability to identify commonly disposed of household items and sort the items into their respective recycling categories using AR technology. This ability is the cornerstone of the app and needed to be developed first in order to ensure the subsequent components would function properly.

While we have been successful in basic image detection and classification, the scope of the identifiable items in prototype 1 is severely limited. For prototype 2, we will now take the image capture a step further and significantly increase the range of items it has the ability to identify and sort. Since this app is still in its infancy, we will program the municipal recycling bylaws for the city of Ottawa for the sorting in prototype 2, however, the aim is to eventually advance the app to have the ability to select and display various municipalities bylaws across Canada.

In order to achieve this functionality, our team must begin by compiling a comprehensive list of items that can be recycled in each category (blue, black, green), as well as a list of everyday household items that cannot. This list must include visual representations of each item so that we can program them into the Unity platform which is being utilized to develop this application. A comprehensive and accurate sorting of all possible items into their respective recycling categories will likely represent the most challenging component to develop in the entire app. Our team anticipates that several attempts will be made before we are able to achieve our goal of 95% accuracy.

It has been determined from the development of prototype 1, that our conceptual design of the second main screen illustrating if the item should be disposed of in the blue box, the black box, the green bin, or if it can not be recycled, will not be feasible to develop in Unity. Therefore, in prototype 2 we will build upon the pop-up text that was developed for prototype 1, to make it more aesthetically pleasing and congruent with our design interface. Furthermore, item-specific instructions such as 'Rinse item thoroughly before recycling' will also be included in prototype 2.

Prototype 2 will include other nuanced design features for the main screen from the conceptual design such as the menu bar which reads: "Scan, Settings, Info, Rewards". Moreover, we will begin to develop the template of these pages however they will not yet be functional, but will instead serve as a representation of the design.

6 Conclusion

In conclusion our team has developed our first prototype of our design and have included the main functionalities that we believe are necessary. From this we were able to plan out which tests to perform on these functionalities and determined what we wanted the stopping criteria to be. Feedback from our prototype was also gathered and recorded, as this will be used to help improve our design for our next upcoming prototype. Moving forward our team will create an upgraded version of prototype 1 and perform various tests on this one as well. An analysis and the justification for this prototype will also be included. From here we will gather feedback once again and continue to assess which areas need improvements.

7 Wrike Snapshot

<https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=IGGZzgTHKPJAzGPUIJqLMR8zo8hIW0Bc%7CIE2DGNJVG3DALSTGE3A>