GNG 1103 Project Deliverable G

Universal Recycling Sorting

Prototype 1, Feedback, and Prototype Testing

Submitted by

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1. Introduction

The project of “Waste Management” was a project assigned to the teams by the client Mitch Bouchard. Mitch Bouchard is part of a family business in the field of mechanical part supply. This project has a goal of improving the quality of recyclables and decreasing waste in landfills by creating a system to assist people in sorting their recyclables properly. Though many individuals believe that recycling is enough to make a change in the world this is not the case when looked at on a large scale. Many recyclables are missorted and end up in landfills and/or shipped overseas to countries that have more room for landfills than Canada does. In fact, many people do not know how to recycle and opt for throwing everything into the garbage instead resulting in further pollution in our environment. Creating a product to help people learn and understand how to sort their recyclables and garbage easily could help in the big picture of managing and reducing the amount of waste on the planet.

Previously the team was tasked with identifying and developing the client’s needs and wants, the problem statement, a list of metrics and some benchmarking of similar products on the market. The client’s needs were identified during the client meeting in the form of statements, these were then used to develop a list of needs and wants for the product (user friendly, cost effective, determines eligibility of items to be recycled, determines items respected disposal location and that the product is versatile and can be used by a wide variety of people) the need and want statements would guide the team in creating a product that would meet the client’s expectations. From these needs and want statements a problem statement could be developed: A need exists for people to reduce waste in landfills by creating a user friendly, cost-effective product that helps customers and users to recycle correctly and efficiently. Once the problem statement was defined metrics were determined to express the client’s needs in the form of attributes that are measurable. Benchmarking was done to explore other products on the market that may meet the client’s needs and wants then target specifications and determined a set of design criteria were determined. Then a brainstorming session was held to identify the main subsystems and concepts for them, a final design idea was also determined. Following this the prototyping and testing phases, analysis of the systems critical components, a detailed design of the system as well as the bill of materials (BOM) were created. Finally, the first prototype was developed, tested and some feedback was received.

This report has the focus on reporting on the development creation and testing of the second prototype. A stopping criteria was also defined and an analysis of the feedback from the testing as well as the feedback received in the third client meeting are also summarized.

2. Client Feedback on First Prototype

During the third client meeting the first prototype was explained and demonstrated to the client, during this meeting the team also had the opportunity to present to the client the next steps and prototypes to expect from the team. During the feedback portion of the presentation neither the client nor the professor had any negative feedback for the team. The client did greatly appreciate the concept of the feedback and mentioned that he greatly looked forward to when this feature would be up and running.

3. Company Branding and Logo Design

After some brainstorming, drafting, design and voting the team came to the conclusion that the product would be named “BeEco” and that the company would be named “BeEco Friendly Inc”. The name was created to sound like the “eco”, or “be eco” so that the company’s name would sound like “Be eco-friendly”. The name of the product and the company therefore reflecting the theme of recycling and environment conservation.

The “Bee” portion of the name was to create a name that was easy to remember and catchier. Not only this but bees are often used as a symbol of the changing environment and need to take action and create a more environmentally friendly planet. As recycling is a way to reduce waste, litter and potentially even pollution this once again fit the team's message. From this concept sprouted the idea for the logo:

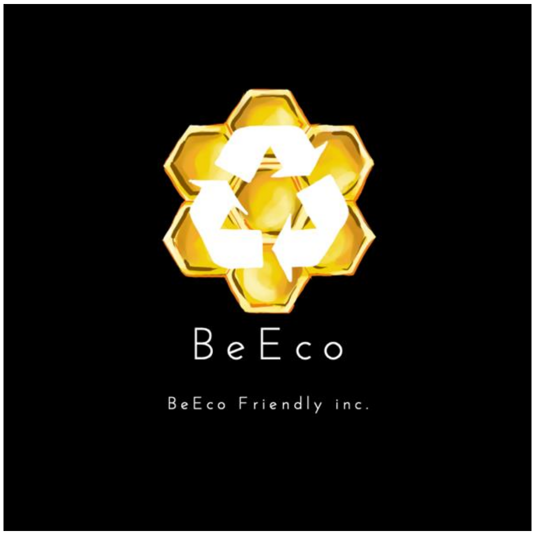


Figure 1: BeEco: Logo and Company Name

This first draft of the logo features a honey comb to tie in the name of the product as well as the recycling symbol so that the concept and purpose of the app is clearly communicated to potential clients and users.

4. Analysis of Critical Subsystems

The focus for prototype 2 was the material identifying system. When the scan button is pushed the camera will take a picture of the material and store it in a library. It will take the scanned photo from the library and approximate the material based on the shape and color of the material. As the app gets used the library will grow allowing items to be scanned against a larger database, thus improving accuracy.

5. Prototype Development

The second prototype was developed using the IBM Watson visual recognition software. This enabled for a library of images to be uploaded and sorted to train the AI. This allowed for the group to upload 250(?) 1250 images to be uploaded and sorted (250 of each type of material) into different material categories. Then using the training feature the group was able to train the AI to determine the material of a scanned object, this is done when the software compares the scanned material to the stored images in the library, once the system determines a or many closely matching images it can identify the material as it has been fed information on what the library images materials are.

6. Prototype Testing

Prototype testing is done to ensure that the prototype fulfills the function that it is created to accomplish. This is done in order to ensure that the product will respond to the problem statement and meet the client's needs and wants. To ensure accurate testing a set of stopping criteria were defined, both alpha and beta testing are preformed, and the results are analyzed.

6.1. Stopping Criteria

The stopping criteria is criteria that must be met in order to stop iterating on the prototype development and testing. This set of criteria will be set based on the critical assumptions and features being tested as well as on the client's needs and wants in order to ensure that all important factors and requirements of this prototype are being met.

The critical component being tested and developed in the second prototype was the ability of the prototype to detect the object and the material of which it is made of. This is to ensure that the system can correctly identify the object and direct the user to place it in the correct bin in future prototypes.

Table 1: Stopping criteria and assumptions or needs being tested

Assumption or need being tested	Stopping Criteria "Unit"	Stopping Criteria
BeEco can be used to identify an object and its recyclable material	Binary (yes/no)	Yes

As this is a critical component to the function of the system as well as to the success of the project and meeting the clients needs and wants as well as solving the problem statement the stopping criteria would be based off of a binary (yes or no) criterion. The stopping criterion would be "yes", meaning that the BeEco can identify the object as well as the recyclable material.

6.2. Feedback from Testing on Prototype

The prototype was tested by allowing other people to go ahead and use it and give us their feedback. Overall, the feedback was very positive and there is still room for improvement for which we will be further improving our design for the next prototype.

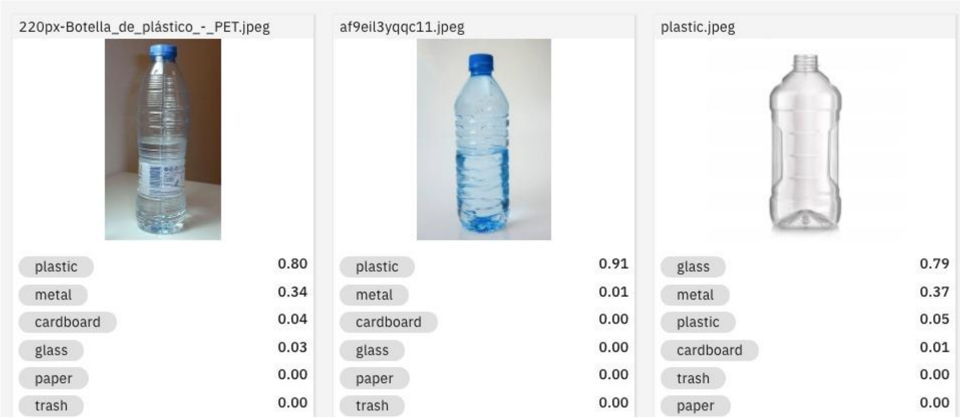
Table 2: Customer feedback

Name	**Feedback**	**Rating (out of 10)**	**Identifies object and Recyclable material (Y/N)**
Samantha	The app was working very well I liked the bright colors and all the available features. It works fairly accurately	**8**	**Y**
Greg	The app is really user friendly and correctly identifies the object that I am scanning	**9**	**Y**
Lux	I love the app and I think that it's very straight forward and easy to use to scan products to recycle	**9**	**Y**

Overall, the scanning system was well received, during the alpha testing within the group there were some inaccuracies that will be further developed in future prototyping.

6.3.Testing Analysis and Results

After testing the second prototype, we were able to conclude that, for the most part, it functions as intended. The main issue we came across was that the accuracy of the scan is not as accurate as was initially desired. The scan for a few objects turned out to be just over 50% accurate. As a result, the accuracy issue will be improved in the next prototype.



220px-Botella_de_plástico_-_PET.jpeg

plastic	0.80
metal	0.34
cardboard	0.04
glass	0.03
paper	0.00
trash	0.00

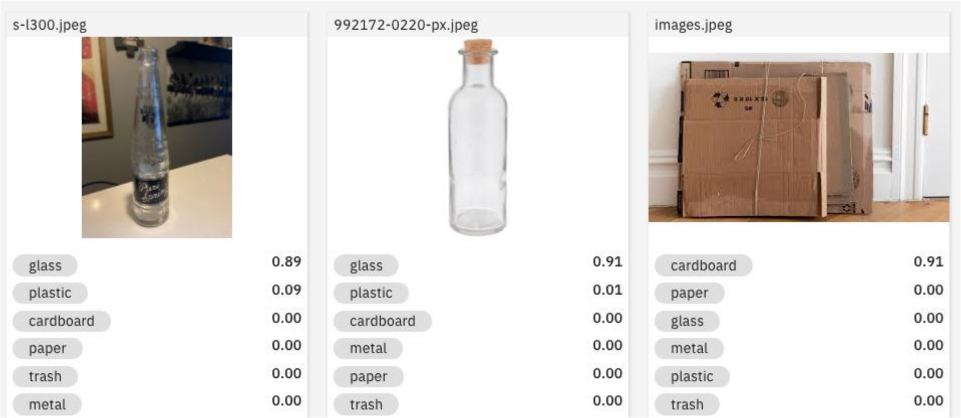
af9eil3yqqc11.jpeg

plastic	0.91
metal	0.01
cardboard	0.00
glass	0.00
paper	0.00
trash	0.00

plastic.jpeg

glass	0.79
metal	0.37
plastic	0.05
cardboard	0.01
trash	0.00
paper	0.00

Figure 2. scanned bottles



s-l300.jpeg

glass	0.89
plastic	0.09
cardboard	0.00
paper	0.00
trash	0.00
metal	0.00

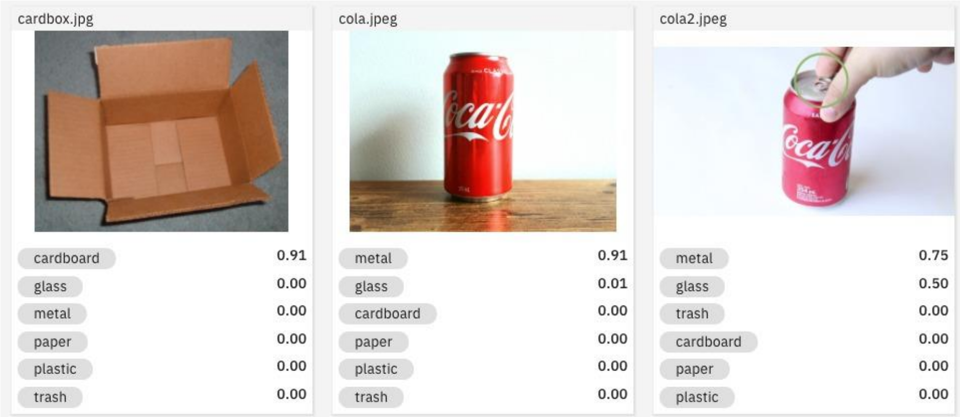
992172-0220-px.jpeg

glass	0.91
plastic	0.01
cardboard	0.00
metal	0.00
paper	0.00
trash	0.00

images.jpeg

cardboard	0.91
paper	0.00
glass	0.00
metal	0.00
plastic	0.00
trash	0.00

Figure 3. scanned bottles and cardboard



cardbox.jpg

cardboard	0.91
glass	0.00
metal	0.00
paper	0.00
plastic	0.00
trash	0.00

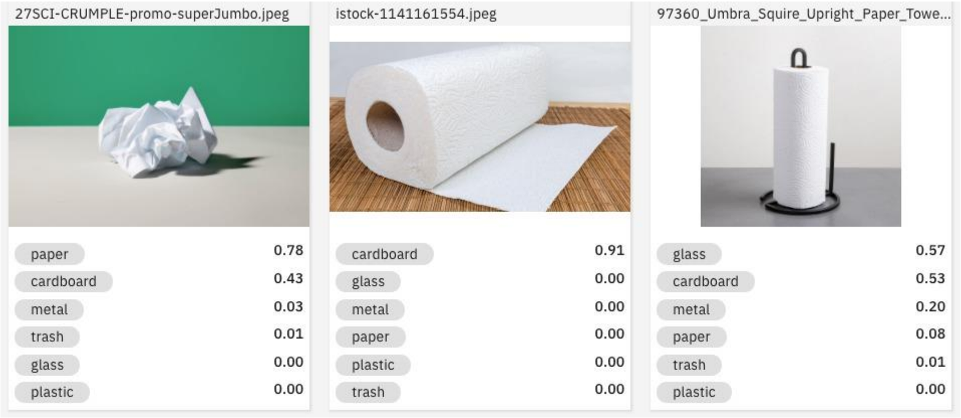
cola.jpeg

metal	0.91
glass	0.01
cardboard	0.00
paper	0.00
plastic	0.00
trash	0.00

cola2.jpeg

metal	0.75
glass	0.50
trash	0.00
cardboard	0.00
paper	0.00
plastic	0.00

Figure 4. scanned carboard and cans



27SCI-CRUMPLE-promo-superJumbo.jpeg
paper 0.78
cardboard 0.43
metal 0.03
trash 0.01
glass 0.00
plastic 0.00

istock-1141161554.jpeg
cardboard 0.91
glass 0.00
metal 0.00
paper 0.00
plastic 0.00
trash 0.00

97360_Umbra_Squire_Upright_Paper_Towe...
glass 0.57
cardboard 0.53
metal 0.20
paper 0.08
trash 0.01
plastic 0.00

Figure 5. scanned paper and paper towels

The above figures provide examples of the effectiveness of our prototype's scanning feature. The accuracy of the scan seems to range from around 80% to 90% for most of the objects that were scanned. However, one issue we came across was that the prototype was unable to accurately detect paper towels, as shown in Figure 5. It generally mistakes them for cardboard or glass. This issue will be resolved in the third prototype.

7. Conclusion

The focus of this prototype was to be able to accurately determine the material being scanned and to test the prototype to ensure it is functional and accurate. We also received and compiled feedback from our peers on the functionality and the interface of the prototype. For the next prototype we are planning on finalizing the rest of the user interface and the rest of the subsystems.