GNG 1103 Project Deliverable C

Universal Recycling Sorting

Design Criteria and Target Specifications

Submitted by

GNG 1103-C01, Group 2

Kristen Janzen, 300107082

Usama Shahzad, 300111792

Griffin Worboy, 300119873

Nader Mrad, 300118507

Cem Kiyik, 300073910

Date: 02/06/2021

University of Ottawa

List of Tables

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. Finally, Benchmarking was done to explore other products on the market that may meet the client's needs and wants.

This report has the focus on further developing and refining the set of metrics, setting target specifications for said metrics, further exploration of benchmarking and finally developing a list of design criteria. The set of design criteria will be used in the following report when solutions start to be developed by the team.

2. Metrics

Metrics can be used to translate the client's needs and wants into tangible numbers or in other words into attributes. The attributes or metrics are measurable which assists in ensuring that the product remains focused on the client's needs and satisfying the problem statement.

Table 1: Metrics, Units and Relative Importance

Metric Name	Importance (relative to one another on 1-4 scale)	Unit
User Friendly	1	Binary (yes/ no)
Accuracy	3	Percent (%)
Speed	4	Milliseconds
Cost	2	Canadian Dollars ($)

The metrics will help us achieve focused goals to ensure we are focusing on the client's needs and wants to achieve the ideal product. User friendliness, Accuracy, speed, and cost are all key metrics that should be included in the design based on the client meeting.

User-friendliness is the most important on the list as we need more users to engage in the app and use it properly. The easiest way to ensure that is by having it very user friendly, and easy to understand and use.

Cost is the second one on the list as we need to be able to create this app with low cost and make it free the public to increase the number of users on the app.

Accuracy. The more accurate the app the more useful it is to everyone, by ensuring that its actually accurate by at least 95% ensures that users are recycling properly, as the app is supplying correct information on where objects should be recycled.

Speed. Users hate slow buggy apps that cannot perform its requirement efficiently hence speed of the app is a particularly important metric that will ensure users keep the app instead of looking for an alternative.

3. Target Specifications

Target specifications are set values for the metrics. The target specifications identify acceptable and ideal values. The ideal values are the values that would be best to have, or to obtain the best results. The acceptable values are the values that must be met if the ideal value is not attainable.

Table 2: Metrics and designated target specifications

Metric Name	Importance (relative to one another on 1-5 scale)	Unit	Ideal	Acceptable
User Friendly	1	Binary (yes/ no)	1	1
Accuracy	4 (greater than 95%)	Percent (%)	99%	95%
Speed	5	Milliseconds	500	3000
Cost	2	Canadian Dollars ($)	0	100

The first metric is if it is user friendly, the project can either be user friendly or not. Since user-friendliness is the most important criteria, the project should be user friendly. As the metric is binary it can only be yes or no. Considering the project focuses on making recycling easier for people the acceptable and ideal target specifications will be yes (1). Secondly there is the cost metric, the project cannot cost more than $100 to build. If the project is an app, it is possible to cost 0$ to create, this will therefore be the ideal target specification. However, it is also possible to create a different product that would require money to be spent. As the budget is $100 the acceptable target specification is $100. Accuracy is another metric that is required. Without high precision, the project would not help users sort their recyclables and the recycling would not be pure enough to resell the recycled products. The client informed the team that the product must be 95-99% accurate. Taking this scale, the target specifications were created with an ideal value of 99% and an acceptable value of 95%. The speed is undeniably related to user-friendliness. A user wouldn't want to wait more than 3 seconds, the code should execute in less time and return a result. Therefore, the acceptable value was set to 3 seconds to not annoy the user and an ideal value was set to 0.5 seconds as this would provide a smooth-running experience for the users.

4. Benchmarking

Benchmarking is a method used to evaluate other products already available on the market and compare them to each other in order to identify the needs they meet or don't meet based on the design criteria.

Table 3: Benchmarking information about app specifications

Specification	Recycle!	Grow Recycling	Recycle Coach
Company	Bebat Vzw	Gro Play	Municipal Media Inc.
Cost	$0	$3.99	0$
App Size	27.6 MB	251.3 MB	48.2 MB
Compatibility	Apple/Android	Apple/Android	Apple/Android
Rating	3.0/5	4.5/5	4.8/5
User Friendly	no	yes	yes

Table 4: Benchmarking evaluation of app specifications

After benchmarking each product's specifications, they can then be evaluated and prioritized based on the customer's needs. In order to do this, each specification is evaluated on a scale of 1 to 3.

Specification	Importance (1-5 scale)	Recycle!	Grow Recycling	Recycle Coach
Company		Bebat Vzw	Gro Play	Municipal Media Inc.
Cost	3	3	2	3
App Size	1	3	2	3
Compatibility	2	3	3	3
Rating	3	1	2	3
User Friendly	4	1	3	3
Total:		25	32	39

In the above tables, 3 products were benchmarked and evaluated.

First, "Recycle!", an application made by Bebat Vzw, provides users with information about recycling collection and sorting based on the user's location. However, the application does not seem very user friendly due to the app not having a proper English language option, with some sections remaining in French. Also, the app seems to be limited in providing recycling information for only a few select locations.

Second, "Grow Recycling", by Gro Play, seems to do a good job in terms of being user friendly as it serves to educate users about the proper methods of recycling and where each type of recyclable item should go. On the other hand, the app is relatively large in size compared to other apps benchmarked above. It also doesn't help users find nearby recycling areas or sort their recyclables. Users may not be compelled to use this app since compared to the others, "Grow Recycling" is not free.

Finally, Municipal Media Inc's "Recycle Coach" is an application that provides detailed information about garbage types and drop off locations to the user along with directions and operation

hours. The app properly sorts recyclables for users and comes with a calendar that helps them stay updated on upcoming recycling events in their location. It also sends customizable notifications to its users in case any schedule changes occur.

Overall, “Recycle Coach” scores the highest in evaluation compared to the other 2 apps because it outperforms them in all the aspects previously stated. Because of this, the app can be used as a sort of model or reference when it comes to designing the final product.

5. Design Criteria

After the client meeting, we developed a set of needs/want statements and ranked them on their importance. Based on those statements we created design criteria out of them which will help guide us and ensure we meet all of the client's needs.

Table 5: Design Criteria, Functional Requirements, Non-Functional Requirements and Constraints

	Requirements
Functional Requirements	The product determines if an item is recyclable.
	The product determines and communicates the location and visual descriptors of the bin.
	The product will notify the user about anything it needs to communicate.
Non-Functional Requirements	The product should be cost effective for the owners. ($)
	The interface of the product should be easy to maneuver and easy to interpret.
	The product should be available to as many people as possible and be as versatile as possible.
Constraints	Product should be small and lightweight: max weight (g), max area (cm^2), memory (GB)
	The product has to be secure.

Functional requirements are functions that the product will be required to perform. In this case the functional design criteria were that the product must determine whether an item is recyclable, where to correctly dispose of it, a visual descriptor and potentially a location of a bin and that the product will provide notifications to remind the user to make use of it. Non-functional requitements are a set of criteria that should be able to be performed by the product but that do not impact the function of the product (they are not functions themselves). In this case the non-functional design criteria were that the product should be cost effective, easy to maneuver and interpret and that it should be versatile and available to the largest audience possible. The final type of design criteria were the constraints. The constraints are certain requirements that outline values that will limit the project, this helps the project remain focused on the client’s needs. For this product the constraints were set as the weight, meaning if a

physical object were to be created it would be low mass and/or area, if a software were to be created then the software should only take up so much memory space and the product must be secure (not leak information).

6. Reflection

The client meeting helped the needs and wants to be specified and understood more in depth. The client put most of his emphasis on the product being easy to use and easily accessible he also wanted to achieve the accurate sorting of recyclables and non-recyclables. The client meeting clarified that the product was to be made in a user-friendly way, this was due to the fact that the client wanted to reach the largest audience possible. The client recognized that if the product were hard to use then the users would not bother using it and this would result in not solving the problem statement. As a result of this data gathered from the meeting one of the largest focuses of this project was to make the solution as user friendly as possible. This was then reflected in the importance rankings of the needs as well as in the high valued target specifications.

During the client meeting, Mitch stated that he did not want to put too many restrictions and limitations on the project. This gave the team more freedom when developing the set of design criteria. As there were less limitations the design criteria were developed more with the goal of meeting and achieving the client's goal, needs and wants instead of focusing on specific criteria given by the client. In other words, the design criteria were the clients need and want statements translated into further tangible ideas.

7. Conclusions

We translated our client's needs into criteria that our design must uphold. Some of the main criterion that the design must uphold is the product must determine whether an item is recyclable or not. It must also communicate with the user about where the item should be disposed of. Our most important metrics are the operating speed at rank 4 and our accuracy at rank 5. Our Target specifications state that the acceptable accuracy of our product must be 95% or higher with a cost of no more than $100 as well as an operating speed in the range of 500 – 3000ms. Based on our benchmarking evaluation, we have determined that "Recycle Coach" is a good reference to model the final product around.