Project Deliverable C: Design Criteria & Target Specifications

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Table of Contents

1.0 Introduction

In a world so technologically advanced, it is very common for people to have some sort of smart phone on hand whether they be at home or out in public. Utilizing this to assist in the misplacement of recyclable items, an application is being developed as our final product. This application should identify various types of recycling products and be able to distinguish between their various recycling methods, all while being easily accessible. With the help of this application, we hope that the end result not only increases the amount of people that recycle but also decreases the amount of misplaced recycled items that end up in landfills. This report outlines the criteria and specifications that will be considered when designing our final product, and what is required in order to achieve our goal.

2.0 Design Criteria

In order for our project to be successful, we will examine various goals and designs that we would like to achieve in our final product. Primary design criteria consists of fundamental features that must be in the final result whereas secondary criteria are features that are highly desired but not absolutely essential. To achieve success when designing and implementing our product, it is important that we determine the functional and non-functional requirements.

2.1 Functional Requirements

Functional requirements are the primary method for the customer to communicate their specific needs in what they want in their final product. It will clearly define the scope of the project. Functional requirements will identify the basic behaviour of the system. It will define the inputs and the process to achieve the output. This section will list the required features and general characteristics that affect the user's experience.

2.1.1 High Priority

1. Ability to identify and categorize different types of waste such as plastics, compost, and garbage.
2. Points incentive system to promote more frequent use of application.
    a. Users will receive points for every time they recycle. The accumulated points can go towards a prize (ex. Gift cards).
3. The application can utilize Augmented Reality (AR) to categorize recyclable products.
    a. The software application called "Unity" can be used.

2.1.2 Medium Priority

1. The application will have a game-like element to make recycling fun and users can compete against one another.
2. Application will provide prerequisite information or warnings concerning proper recycling.

2.1.3 Low Priority

1. Users will have access to a geo-map which will reveal nearby garbage disposal locations, they will also be able to add new locations in a shared database.
2. The application can log all recycling history of users.
3. The application will be able to identify different types of plastics and tell users if it is recyclable or not.

2.2 Non-Functional Requirements

Non-functional requirements specify how the system should function (i.e. means of executing its operations). Non functional requirements refers to inessential criteria and does not affect the functionality of the product. In other words, if the non-functional requirements are not obtained, the product will still be able to complete its basic purpose.

2.2.1 Reliability

1. The application will be available for use 95% of the time.
    a. The 5% pertains to the update of the application.
2. The application will be free and widely available to consumers.
3. Application will detect whether the item is recyclable or not.

2.2.2 Usability

1. The application will have a simple user interface.
2. The application will comply with the City of Ottawa garbage disposal and recycling regulations.
3. The audience that the application will be targeted towards individuals who have a smart device and can download this application.
    a. The application is suitable for individuals of all ages.

2.2.3 Performance

1. The application will identify the correct category for recycling 95% of the time.
2. The application will be able to run smoothly 80% of the time.
    a. The 20% is to account for the lack of experience in application development, limited knowledge, limited budget and limited time.

2.2.4 Other

1. The application can promote awareness of the consequences of not recycling properly. Ultimately it will encourage individuals to recycle properly and help reduce greenhouse gas emissions.
2. The application will be a cost effective solution to solve the problem of improper recycling habits.
3. The application will be able to be downloaded from the Google Playstore

3.0 Technical Benchmarking

At the present moment, there exist a plethora of various recycling application solutions. However, upon further evaluation, it becomes increasingly apparent that none of the available apps has the capability to fully meet the needs of our client as outlined in 'Deliverable B'.

The large majority of the apps are informative in nature and aim to educate its users about recycling. Many have a directory in which the user can manually look up products to access pertinent information such as which bin the item can be recycled in, or a drop-off location for the item. These apps often also provide their users with a recycling schedule and reminder for their city of residence. While these apps meet the need of conveying which type of materials can be recycled, the issue with this type of solution is threefold. First and foremost, the client was seeking a simple and user-friendly solution- this manual directory was onerous on the user and takes several steps before they can access the necessary information. The complicated interface presents as an obstacle for the everyday app user and as such, an obstacle for successful recycling. Furthermore, the currently available apps are all municipality specific or country-specific impeding upon scalability which was emphasized as a high priority need by our client. Lastly, these apps all lack any type of incentivization for the users.

Another prominent category is the 'game type apps' which intend to encourage recycling by educating its users in a fun and interactive way while offering rewards to incentive their participation. These types of apps tend to be geared towards children and focus on relaying general advice instead of the practical information necessary to properly dispose of recyclable materials thereby failing to address the issue of improper recycling.

It should be noted that none of the above apps utilized augmented reality technology. The available augmented reality recycling applications are markedly less crowded, with only a handful on the market and none can fully meet the needs of our client. The only app which closely relates to our solution is the ‘Recycling Starts Here’ app which was designed to encourage blue bin recycling in the city of Winnipeg, Manitoba. The app works with four recycling bins placed strategically around the city, the consumer can point their phones at the bin prompting an educational augmented reality experience that informs the user what items can and can’t be recycled. By engaging with the app, the user is automatically entered into a draw to win one of many instant prizes. The limitations of this app is that it is only compatible with a select few blue bins in the city of Winnipeg thereby stifling any potential scalability and failing to provide users with information for black bin recycling. While the app does not meet all of the clients needs, there are aspects of this design which could serve as a benchmark for our solution.

4.0 Target Specification

4.1 Design Specification

In terms of design specifications, the ideas of app platforms and method of development arise. Due to limited budget and equipment restraints, our app will be built on the Android platform, due to the developer fees with Apple.. The method of development chosen is the Unity Platform, with the utilization

of ARCore for Google developers. With limited app development experience, the team will rely on tutorials and plugins to aid in the creation of the app.

4.1.2 Method of Development

The method of development we will be using is the Unity AR software, as recommended by the TA's. With limited experience in app development, the Unity software was the clear choice for our team, as it offers many plugins, and integrated prefabrications that will make the app easier to develop. Rather than hard coding each section of the app, Unity offers a free library easily accessible. Lots of tutorials surrounding Unity exist, which will prove to be very important for our team.

4.2 Targets Specified

For an app, high-priority target specifications such as boot time, overall performance and waste article identification can depend on factors such as phone performance and internet conditions. The three features listed above are of major importance, though setting ideal values for these conditions would vary on device and internet connection. For fully ideal conditions, the following values of specifications would be best described below.

Table 1: Design Specifications

Design Specification	Relation (=, <, or >)	Value	Units	Verification Method
Boot Time	<	5	seconds	Test
Waste Article Identification (AR)	<	5	seconds	Test
Accuracy	>	95	%	Test
Cost	=	free	$	Final Check
App Size	<	30	mb	Final Check
Game Aesthetic	=	yes	N/A	Analysis

Further desired requirements are explained in **2.0 Design Criteria**.

5.0 Metrics & Constraints

5.1 Project Metrics

Setting project metrics is a predominant tool when it comes to project management. Having clear and defined project metrics will ensure that our group is successful and efficient when creating our recycling application. In order to achieve this, we will implement a tool to measure our performance called Key Performance Indicators (KPIs). KPIs track the progress of work generated and helps us understand how

the project is performing. As a group, we have decided to set several project metrics in order to optimize our success. In addition, the SMART method will be utilized to help guide us in the correct direction to achieve our performance metrics. The SMART method stands for Specific, Measurable, Accountable, Realistic and Timely.

5.1.1 Specific

Being specific indicates what result is expected so that performance can be judged precisely. In our case, the result that we expect is to create a working augmented reality application to help the user identify which items are recyclable to reduce landfill waste. We believe that using the Unity software will allow us to do this.

5.1.2 Measurable

Measurable represents that the intended result has to be something that can be measured and reported. This result must be measured in quantitative and/or clear qualitative terms. Weekly meetings will be conducted to get updates from each member of the project's progression.

5.1.3 Accountable

In order to be accountable, the performance measure has to be owned by a specific team in which they produce the intended results. The team members responsible for delivering this project are Monica Harada, Branden Leung, Ethan Leung, Keera Moretti, and Alexander Fournier.

5.1.4 Realistic

Being realistic is ensuring the performance measurement goal is within reach given the time and resources provided. In order to create and develop the app, we have to take into consideration design constraints and risks associated with this project. We must also consider the limited time frame we have for developing.

5.1.5 Timely

Being timely is ensuring the performance results can be achieved during a specific time frame. We will identify start and end dates. To achieve the desired result, our team will complete the project by the end of the semester (4 month duration). We started the project in January and will complete the final iteration of our product by March 28th, 2021.

5.2 Constraints

1. Security and Privacy Risks
2. Budget Constraints
    a. Only given $100 dollars to execute our project.
    b. The low budget means we are limiting the quality of the application.
3. Limited Time
    a. The current COVID-19 pandemic has forced university studies to be completely online.
        i. Since we are all at home under lock down, we are unable to meet in person and collaborate.

ii. We are only able to meet once a week during our team meeting or during lab sessions due to conflicting schedules
iii. We are only given a 4 month duration to design and execute a working application.

6.0 Conclusion

To conclude this deliverable, our team has decided to create an application using *Unity AR* that allows users to identify what recycling method is to be used on their item at hand. Given this as our target specification, our team has broken down the functional and non-functional requirements and have a good idea in what direction the project is headed towards. Included was team metrics and any constraints we may have to help us track our progress and optimize success as a team, while also staying on task. Moving forward our team will focus on conceptual designs using the information in this document, and select the optimal combination of concepts to utilize our final product.