GarbageGo:

A Smarter Way to Trash!

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Abstract

GarbageGo is a mobile application that helps with personal garbage disposal. There are two main pain points in the waste management experience. First of all, people struggle to correctly identify whether the trash they have belongs in the garbage, recycling, or compost bin. Additionally, people struggle to find nearby trash cans when they have a piece of trash to throw away. Therefore, we designed GarbageGo to address these issues. GarbageGo allows users to scan a piece of trash with their device's camera and then tells them in which bin the trash belongs. Furthermore, the application provides a community-sourced map to help users quickly locate nearby trash bins. This paper begins by describing our motivations for GarbageGo and our design process leading up to a high-fidelity prototype. Finally, it discusses what we learned from this project and the potential future directions of GarbageGo to universally provide a simple and efficient waste management experience.

Introduction

Littering is not moral, nor lawful, but searching for nearby trash cans might not always be an easy task. We oftentimes find ourselves holding on to trash for too long, or even end up forgetting about them. Moreover, with the restricted recycling laws, we can be penalized for putting the trash into the incorrect bin. Therefore, proper trash classification becomes not only a desire for preserving the environment but rather a daily necessity. Certain questions begin to arise, how are we supposed to do it right, and is there a way for us to quickly satisfy this need?

As of today, there does not exist a convenient and efficient way to dispose of trash when individuals find themselves in a confused state. The amount of time one needs to find the trash can they need can take much longer than expected. Also, with the limited resources on hand to help with trash classification, individuals are often left on their own to make a decision using their best judgment. In order to fill this gap, we have come up with the application, GarbageGo, a smarter way to the trash.

GarbageGo aims to take the headache out of practicing good trashing habits by providing users with quick and efficient resources to help them in this pursuit. The application prioritizes 3 key solutions to the issue: The first is providing a quick and efficient way to trash classification. The second is effortlessly locating nearby trash cans, and the last is incentivizing positive trashing habits. GarabageGo aims to encapsulate all of this in a user-friendly package with an easy-to-use and intuitive user interface design prioritizing the principles of HCI design.

For the development of GarbageGo, we will be going through an iterative design process prioritizing both usability and learnability. In order to do this, we begin by conducting interviews to understand the needs and struggles of potential users. The data collected through these interviews will be processed to develop personas of target users guiding the development of our application. By knowing the needs of our target users, we are able to build GarbageGo to better service our customers and keep them satisfied and happy. Following the need-finding process, we will begin developing low fidelity prototypes that will be presented to users to gain insight into the usability and intuitiveness of

the application. The feedback received through this process will be used to improve our application as we develop higher functioning prototypes. We intend on partaking in an iterative process to better improve our application for our customers.

Background

Our application aims to solve a dilemma, we as creators of this application, and many others, have faced, the lack of access to a convenient and efficient way to trash correctly. The goal of this application is to enable people who have good intentions to protect the earth and follow laws. We also want to encourage more people to properly dispose of their waste. We all understand the help this application is able to provide in terms of improving the process of identifying trash types and finding garbage cans. Even though the problem it solves is only a small step forward for larger-scale issues, namely environmental issues. We believe by simplifying the process of trashing, more people will be willing to invest the time into deposing trash correctly, thereby contributing to the protection of the environment. While the concept for our application may seem fairly simple on the surface, the ramification and effects it can have on our community can be substantial. We believe this application can have a positive impact on both the community and society around us. This motivates us to bring this idea to fruition, thus helping to resolve one of the pressing issues found in the world right now, waste management.

To better understand the views of users besides ourselves, we developed ten interview questions to learn about the trashing habits and experiences of the members of our community. We then categorized them into two specific question types: “Needs or Challenges” and “Values and Goals.” This classification helped us identify user needs, values, and goals. By conducting interviews with six potential users in our community, we were able to better understand the needs of potential users. We found that the main frustrations individuals face are the uncertainty they have on whether they master their skills to correctly classify trash types and the amount of time lost on blind searching for trash cans due to their inability to quickly locate nearby ones. Among the respondents, many have asked themselves, “which bin should this garbage go in?” Individuals are forced to take their best guess while in such situations, which unfortunately might not always be correct. Moreover, according to Waste Management, “the average contamination rate among communities and businesses sits at around 25%. That means that roughly 1 in 4 items placed in a recycling container is actually not recyclable” (Waste Management). Thus, a solution to this problem is on demand.

After consolidating the concerns and user needs we need to resolve, we ensured our application services the needs of our target users by creating two personas. Each persona represents a group of collective attributes based on all responses from the interview process. Considering some users are incentive-based rule followers, we added a competition and reward system to encourage users to try to correctly dispose of and identify the types of trash. The need-finding process as a whole allowed us to refine our solutions based on actual background status with insight into what we should consider and prioritize when developing the interfaces.

Conceptual Model

Having established the problems we are attempting to solve and the context around them, we turned our attention to the development of a mobile application that aimed to solve the aforementioned issues in an intuitive and easy-to-use package. From the offset, we knew we wanted to provide our users with a way to know which bin a piece of trash they are holding belongs to. To do this, we decided to utilize the camera utility found standard across nearly every smartphone in the world today. GarbageGo would provide users with a camera interface through which items of trash could be scanned, and the application would return which of the bins the item the user is holding belongs to. Next, we wanted to provide users with a quick and efficient way to locate nearby trash cans. To do this, we decided to modify the Google Maps API to be a tool through which users could locate and mark nearby trash cans. In this way, we could develop a map that is readily up to date and easy to use and follow due to the existing familiar infrastructure that is Google Maps. Lastly, we wanted to incentivize and reward positive trashing habits and behaviors in a simple and fun manner. In order to achieve this, we came up with a simple point-based system that rewards users based on their trashing habits. GarbageGo would keep track of user activity on the application and award points according to positive behaviors. By doing so, GarbageGo can be a social platform in which users can add and compete with friends while making the world around them a cleaner place. Having established the conceptual model for our

application, we were ready to mock-up sketches of a low fidelity prototype that would bring together all the elements of GarbageGo in one cohesive and appealing user interface.

Prototype / Implementation

We began the prototype implementation process by first developing low fidelity prototypes that were simple sketches of what the user interface of GarbageGo would look like. Making the low fidelity prototypes sketches allowed us to have a low stakes design that we could easily modify and overhaul based on user feedback. These sketches served as the fundamental framework for our project. We then evaluated the sketches as a group to determine the strengths and weaknesses in the design of the interface.

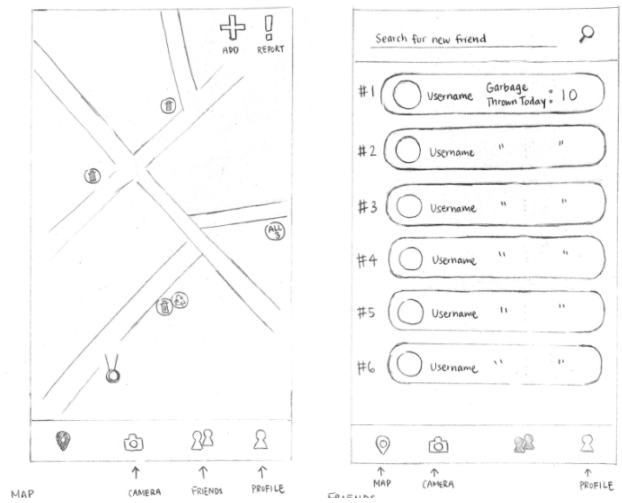

Figure 1: **These are two of the pages from the low fidelity paper prototype. On the left is the Map page, and on the right is the Friends page.**

Based on our evaluations as a group, we adjusted the design of our interface before we moved on to Figma to develop a higher functioning version of our prototype. For the high fidelity prototype, we decided to use green and white for the user interface to address our goal of making the environment greener.

The initial page the user sees is the login page. On this page, the user can log in with their existing username and password, or they can sign up with other social media accounts including the UCDavis Kerberos ID since our goal user is the UCDavis community.

After logging in, the user is at the Map page, with options to add trashcans and report missing trashcans. We also implemented a functional map prototype.

Our map prototype was implemented with the help of Javascript and Google Maps. This prototype is a map of the University of California, Davis. While the map's default location is the Silo Marker, users can drag the map around to their general location. They can also zoom in and out to observe the map in more detail or to get the entire view of Davis. Our map prototype also has a street view to see photographs of certain locations. Each garbage can location is represented by different icons depending on the type of garbage it takes. The blue, green, and black icons portray recycling, compost, and trash respectively. In many cases, there is more than one type of garbage that is available to dispose of, so the icons are merged to show the users all the different options.

At the bottom of the app is the navigation bar, which allows simple transitions between pages. There are four icons to the navigation bar: the map icon, the camera icon, the friends icon, and the profile icon, each of which lead to the corresponding page.

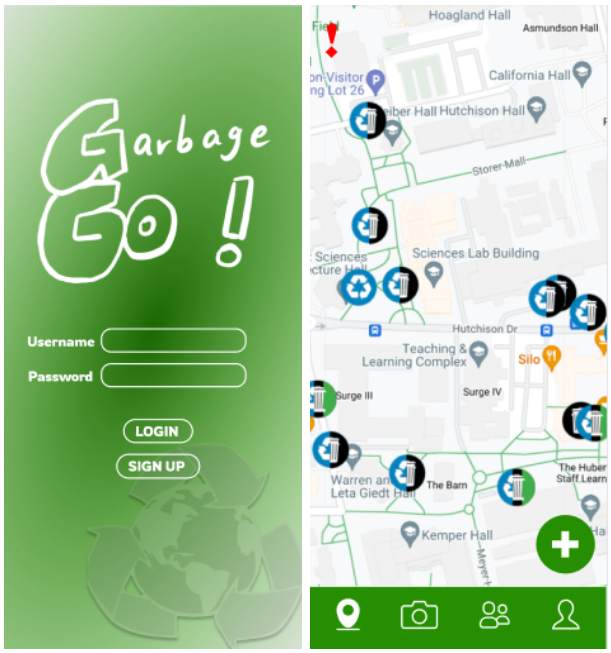

Figure 2: **On the left is the Login page, on the right is the map feature**

The Camera page allows users to scan a piece of garbage, and the app would return the user with the correct bin to through away the trash. The user may also log a point for throwing the trash into the correct bin.

On the Friends page, we can see the “number of garbage thrown today” of all the friends of the user and also the rank among the friends. Clicking the “WORLD” button, bring us to the page where we can see the rank of all users using the app. Also, at the top of the page, there is a search bar where users can enter either the email address or username of a user to add friends.

Figure 3: **Camera page, the right side shows an example of what the app returns after a scan**

On the Profile page, the user would be able to see their username profile picture and the number of points they have. Under that, there is a list of recent activities done by the user and the number of points added to each activity. Friends are also visible in the profile section. Finally, at the top-right corner, users can select the logout button to logout, returning them back to the login screen.

Figure 4: **On the left is the Friends page, on the right is the Profile page.**

Discussion

Our work offers a description of people’s struggles in finding the nearby garbage cans efficiently and correctly identifying trash bins. Our implementation provides an application that can solve these problems. The design of this application allows users to search the nearby garbage cans using the map feature and find the correct trash bin using the scanning feature.

Overall, our design creates a good conceptual model of the garbage disposal system, and it also has high discoverability in its icons and interface functions. The good mapping between each application page also makes it easier for the user to use. However, there is still room for future improvement. For instance, our current design doesn’t have very clear visual or audio feedback from the log-in page buttons. The future design can incorporate more such feedback. Also, our map page doesn’t have very good discoverability, since it might not be very clear for the user to realize the functions or meanings of the plus sign and the exclamation mark on the page. So we can incorporate a more explicit design, such as a location search bar or “Use my current location” feature, to further improve the design. Moreover, the future design can incorporate a more minimal design on the friends leaderboard pages, such as by adding

a scroll bar and only displaying a few friends at a time. Also, we can add a help menu on the log-in page to make it easier for the user to learn and use the application.

From this project, we learned more about how to identify user needs and use the design principles and concepts to design a product that's usable, useful, and enjoyable for the user. We also learned how to design an application that can allow the users to have a more efficient garbage disposal process and help protect the local environment.

Future Work

In the future, it would be beneficial to test our high-fidelity prototype with potential users to receive feedback and iterate. Some ideas we have for improvements for the application would be to use augmented reality to visually tag trash seen by the camera with the bin it belongs in. This change would improve usability by removing the need for the user to press a button to initiate the scan after opening the camera. Another improvement would be to give more utility to GarbageGo's points. Users could exchange their points for in-app rewards and thus, be further encouraged to mark trash cans and correctly dispose of their trash. Finally, the prototype is currently focused on the UC Davis campus. However, GarbageGo could be extended to other campuses and communities where users are willing to contribute to the marking of local trash cans. Ultimately, GarbageGo could be deployed nationally or internationally to help people everywhere dispose of their garbage correctly and efficiently.

Peer Rating

(17%) Edmond Li: Edmond created up to two interview questions and helped find someone to interview. He also came up with the project idea, programmed the map prototype, and created the map prototype icons.

(16%) Nicholas Chan: Nicholas conducted an interview for need-finding and analyzed the results of all interviews to help develop two personas for target users. He contributed to the development of a prototype for the map feature using the Google Maps API and Javascript.

(16%) Wenqing Wang: Wenqing designed the high-fidelity prototype logo and the signup page. She designed 2 interview questions and interviewed a potential user. She also took part in the project proposal, progress report, and final report.

(18%) Emily Yang: Emily constructed an interview for need-finding. She also created a low-fidelity paper prototype and contributed to the creation of the high-fidelity prototype using Figma, specifically the navigation bar, the Friends page, and the prototype interactions.

(17%) Jiss Xavier: Jiss helped come up with the questions to be used in the need-finding process, and was largely in charge of the high-fidelity prototype. He was able to develop the high-fidelity prototype in Figma and conduct the demonstration for the class.

(16%) Aileen Fong: Aileen contributed to two interview questions and conducted two interviews. She also analyzed the findings from the interview responses and finalized the characteristics of the two personas. She took part in the project proposal, progress report, and final report.

References

[1] Nwaogu, Claudia. "The Battle against Recycling Contamination Is Everyone's Battle." Waste Management, 4 Apr. 2018, mediaroom.wm.com/the-battle-against-recycling-contamination-is-everyones-battle/.

Links

Figma Link:

https://www.figma.com/file/A3fGVIO7hh04fhuP5gIEfQ/GarbageGo?node-id=0%3A1

Map Prototype Link:

https://github.com/Eddyme34/GoogleMaps