



# Trash Warrior App

## Team 1

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# Executive Summary

## Project Goals

Identifying high density areas of trash collected due to flooding or illegal dumping is a challenge for environmental stewardship organizations. Typically cleaning up of such sites consists of scouting missions, planning, and organizing large scale volunteer driven operations.

The initial intent of the project was to create a tool that will assist environmental organizations with clean up operations. After feedback from field and useability testing the project took an exciting turn and switched focus entirely.

## Stakeholders

The stakeholders are not-for-profit organizations and their associated volunteers. Our model organization is [Missouri River Relief](#). They were gracious enough to have a member of our design team discuss needs, analyze tasks, and do field testing. The inner circle group of volunteers act as crew members, do scouting expeditions and help with organizational duties, were kind enough to provide feedback. We considered River Relief and the volunteers as an ideal representation of future stakeholders.

## Design Methods and Models

Based on the Conceptual Model presented by Sharp et al (2019) the designers established metaphors and analogies, developed concepts, and linked relationships between the concepts and the user experience.

We set out to determine what functions the product will perform, how the functions are related, and what information is needed (Sharp et al, 2019, p.74-75 & p.444).

## Evaluation Outcomes

The low-fidelity evaluation, field test, and feedback from volunteers revealed the need to switch focus entirely and focus on the volunteer instead of the organization's viewpoint. Volunteers will now be enabled to schedule their own Trash Mobs with minimal input from the associated organization. In return the organization will benefit from access to the data generated.

Enabling volunteers to be self-sufficient is an unexpected and exciting approach not initially thought of.

# Problem Analysis and Requirements

## Part 1: Analysis

### ***1.1 - Description of the technology/tool, the purpose, and current users***

The current tools available are printed paper maps, laminated to create some water resistance, notebooks, markers, and pens. Topology maps of local waterways are obtained from GIS sources. In addition one-way radios and a whistle is taken on-board the motor boat to help with communication.

The map is initially used during the scouting expedition to indicate where trash is located, and what types of trash are found. Information such as the quantity of trash located will determine the size of crew needed for removal.

Also the hardware and tools needed for the specific clean-up site are noted on the maps. Large tyres need to be sawn into manageable chunks, chain saws, crow-bars, and the number of plastic bags needed are calculated.

Toxic waste dumps need to be communicated with state agencies to organize safe cleanup. The location needs to be accurately noted on the map with notes of the surrounding access roads.

The map then is used to capture data for historic purposes and to determine possible future trash aggregations. The data is shared with researchers and other grass-roots organizations.

The current users are boat operators, crew leaders, and directors of the scouting mission. Managers taking the volunteer groups out to the sites to be cleaned. The various department heads of the organization also interact with the tools on a regular basis.

### ***1.2 - Introduction of problem based on symptoms (i.e. observations, conversations, performance outcomes, etc.)***

The scout manager's goal is to record and communicate the location of trash items along creeks, rivers, and other areas in a timely and accurate manner. The location needs to be precisely indicated on a printed map. Accurately recording the site location is challenging as reading a map is a skill obtained with training and practice. Especially in more isolated areas.

Descriptions of the types of trash, notes on tools needed, and possible HAZMAT material all need to be noted using pen and paper while outside in varying weather conditions. While in a boat the tools are not always water resistant.

The administrator needs to be able to decipher this information to plan the cleanup exercise. Routes are planned, number of people determined, trash trucks, drop off, collection points, and equipment are all extracted from the aggregated information. Collecting the information only happens once the scouts return and the information is relayed from person to person. This causes a delay in the collection of data.

The context in which the tasks are performed can vary. The majority of the time it is outside in varying weather conditions. Groups of volunteers, crew members, and leaders travel by boat or on land to either find or remove trash. Trash can be in the form of small collectables such as household garbage to large items such as refrigerators.

Sources that reveal interaction issues/symptoms (observations, conversations, performance outcomes, etc.)	<p>Symptoms of an interaction problem with the current tool have been revealed through observation, conversations, and outcomes:</p> <ol style="list-style-type: none"> <li>1. Observation: Scouts have been observed x 3. Administrators have been observed x 2. Collectors have been observed x 15</li> <li>2. Conversations: Scouts have said that indicating a position on the map takes practice and can be challenging.. Adding more detail such as notes is challenging. Administrators have said that it helps with planning routes and collection points. Collecting more detailed data is challenging. Collectors have said it makes it easy to follow directions to collections sites. On occasion cell phone connection was intermittent.</li> <li>3. Performance outcomes: Records show that detailed data is often difficult for administrators and collectors to accurately locate in a timely manner based on the information recorded with the tool.</li> </ol>
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***1.3 - Collect and analyze user analysis data collection for at least 5 users to confirm current interaction issues.***

Users were analyzed using an unstructured interview. People interviewed were:

- Organizations that coordinate trash removal in watersheds
- People or groups of volunteers
- Volunteer who want to report trash
- Administrators of the organization overseeing the operations

Open-ended questions were used to help determine the wants and needs of the users. These interviews helped to elicit responses that the designers had not considered (Sharp et al, 2019, p.269). These interviews determined:

- How do the trash coordinators receive information on where to pick up trash?
- What kinds of data do they have for their trash pick-up locations?
- What instruments do they use to track that data?
- Do they assign groups to certain areas? If so, how do they decide who goes where?
- Are there certain areas that have recurring pick-ups?
- How are users reporting trash now?
- How do volunteers get assigned to locations?
- How can we make the process easier for all?

#### ***1.4 - Environmental Analysis***

Sites include creeks and rivers in Missouri where MMR conducts trash collection. Physical characteristics include some difficult terrain that is accessible by boat and on-foot only. This requires tools to be lightweight and portable. Lifespan will be long-term with periodic updates as needed. Nonprofits will provide feedback on the need for revisions as they arise. The season of trash scouting and collection is influenced by weather. Spring, summer, and fall are the primary seasons of operation. However, scouts may report trash any time of year while “off duty.” Scouts generally use the tool during daylight hours. Patterns of use include both scheduled (by scouting teams organized by nonprofits) and sporadic (by scouts when “off duty”). Equipment is not always compatible with the tool. In remote areas a reliable data connection cannot always be established.


#### ***1.5 - Inclusivity and Cultural Analysis***

The users range in age from middle school to senior citizens. Individuals and large groups can use the app to claim a plot of trash to eradicate. Users may range from novice to expert level with technology.

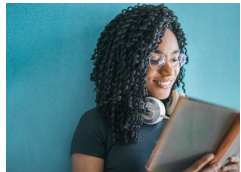
The app will need an option to enlarge fonts to accommodate visual impairment. Some users may have physical limitations or disabilities and may need to know if the site is accessible. Also, those with physical disabilities may not be able to lift heavy items.

## 1.6 - Personas:

### Alex


	<p>Single , short-term User (Trash Reporter)</p> <p>Alex is a 17 year-old high school student. He often goes fishing with his dad and they encounter quite a bit of trash. Alex knows that there are groups who pick up trash, but he's not sure how to report it.</p> <p>Goal</p> <ul style="list-style-type: none"><li>● To find the quickest and easiest way to report trash.</li></ul> <p>Where we can help</p> <ul style="list-style-type: none"><li>● The app has to be easy-to-use.</li><li>● Alex may be fishing in some remote locations with no cell service.</li></ul>
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### Stella

	<p>Long-term user (trash administrator)</p> <p>Stella is the administrator for the trash pick-up. It is her job to gather information on the trash sites, determine the risks associated with the sites, and send the correct number of volunteers to the location.</p> <p>Goals</p> <ul style="list-style-type: none"><li>● Obtain accurate information on the amount of trash and its location.</li><li>● Send the appropriate amount of equipment with the volunteers.</li><li>● Find an accurate way to track statistical details of</li></ul> <p>How We Can Help</p> <ul style="list-style-type: none"><li>● Make the app quick and easy to use.</li><li>● Create a dashboard to display statistics.</li><li>● Create tools that can determine the number of people and amount of equipment needed.</li></ul>
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## Marge

	<p>Single, long-term user (trash volunteer)</p> <p>Marge is a 73 year-old retiree who would like to perform some type of community service in her spare time. Marge isn't really great with technology, but she can use apps if someone installs them and shows her how to use them. Marge wears reading glasses and would benefit from a larger font. She also recently had knee surgery and can't walk on uneven terrain or lift anything over 20 pounds.</p> <p>Goals</p> <ul style="list-style-type: none"> <li>● Marge would like to use the app once a month to find trash to collect.</li> </ul> <p>Where we can help</p> <ul style="list-style-type: none"> <li>● Use larger fonts</li> <li>● Include a small help menu</li> <li>● Create a way to indicate the terrain of the site</li> <li>● Create a way to indicate the amount of trash and if it includes heavy items</li> </ul>
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### 1.7 - Task Analysis

<p>Hierarchical task analysis. Provide the textual notation OR graphical representation.</p>	<ol style="list-style-type: none"> <li>0. To identify trash sites             <ol style="list-style-type: none"> <li>1. Identify trash piles                 <ol style="list-style-type: none"> <li>2. Report a trash pile                     <ol style="list-style-type: none"> <li>2.1 Access map information                         <ol style="list-style-type: none"> <li>2.1.1 Information of satellite image</li> <li>2.1.2 Information of coordinates</li> </ol> </li> <li>2.2 Access search screen</li> <li>2.3 Identify trash pile</li> <li>2.4 Submit trash site to list</li> <li>2.5 Submit photo of trash site</li> </ol> </li> </ol> </li> <li>3. Confirm trash site.</li> <li>4. Claim a pile of trash to clean up.                 <ol style="list-style-type: none"> <li>4.1. Access trash pile map information</li> <li>4.2 Input information of individual/organization conducting cleanup</li> </ol> </li> <li>5. Confirm to clean trash pile</li> </ol> </li> </ol>
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	<p>6. Mark the trash site clean in the app.</p> <p>Plan 0: do 1, 2, 3, Plan 4: do 1, 4, 5, 6,</p>
<p>Method used for analysis of user interactions.</p> <p>Rationale for this choice.</p>	<p>Method: This analysis will use scenarios based on the types of users and the types of tasks they will have to perform.</p> <p>Rationale: This will allow users to perform tasks from start to finish.</p>
Analysis of user #1 interactions	This user will use the app to report a trash pile to an administrator and include a photo.
Analysis of user #2 interactions	This user will claim a pile of trash in the app and then mark it complete once finished.
Analysis of user #3 interactions	This user will enter a reported pile of trash into the app. They will then mark the trash heap clean once it has been removed.
<p>Scope: Describe the scope of the project, meaning the number of features and tasks that will be the focus and your rationale.</p>	<p>Number of features: The project will focus on four features.</p> <ul style="list-style-type: none"> <li>-</li> <li>-Map usage to identify trash site, photo submission, Mobile challenge accessible- Y/N, Hazmat (icon to indicate hazardous material/large items, questionnaire), clean up completion with hours completed (get volunteer certificate), Add notes for clean up</li> </ul> <p>Number of tasks: The project will focus on four tasks.</p> <ul style="list-style-type: none"> <li>- Report, Admin, clean completion</li> </ul> <p>Rationale: This project will only focus on basic features to support the tasks required. Advanced features can be added further along in the development.</p>
Instruments for data collection and analysis.	<p>Data collection instrument: Reporting and observation</p> <p>Data analysis instrument: Qualitative analysis</p>

## Part 2: Project Management

This plan details how the project will be managed over the project duration.

### 2.1 – Team goals and milestones

GOALS		Description of goals and milestones	Date of checkpoint
Goal A		<b>Low Fidelity Prototype</b>	<b>12/1/20</b>
	Milestone A1	Create 6 mockups	10/26/20
	Milestone A2	Complete write-up on mockup	11/1/20
	Milestone A3	Post on Db	11/3/20
Goal B		<b>High Fidelity Prototype</b>	<b>12/1/20</b>
	Milestone B1	Complete prototype	Week 2
	Milestone B2	Complete write-up on prototype	Week 2
	Milestone B3	Post	12/1/20
Goal C		<b>Evaluation Report</b>	<b>12/14/20</b>
	Milestone C1	Conduct the evaluations	12/1/20-12/6/20
	Milestone C2	Write report	12/7/20
	Milestone C3	Each person in the team reviews	12/12/20
	Milestone C4	Post Team Portfolio	12/14/20

### 2.2 - Individual Roles and Estimated Task

Milestone	Karen roles/tasks	LaCassidy roles/tasks	Rúan roles/tasks
A1	Create 2 mockups/Organize and schedule Zoom meetings and create Google doc, if needed	Create 2 mockups	Create 2 mockups: Splash screen & Landing page
A2	Contribute to ⅓ of write-up	Contribute to write-up	Contribute to write-up
A3	Post on DB	N/A	N/A
B1	Contribute to ⅓ of prototype/Organize and schedule Zoom meeting and create Google doc, if needed	Contribute to prototype	Contribute to prototype
B2	Contribute to ⅓ of write up	Contribute to write up	Contribute to write-up
B3	Post	N/A	N/A
C1	Assist in conducting evaluations/Organize and schedule Zoom	Create and conduct evaluations	Source evaluators Assist in conducting evaluations

	meeting and create Google doc, if needed		
C2	Write $\frac{1}{3}$ of report	Write $\frac{1}{3}$ of report	Write $\frac{1}{2}$ of report
C3	Review for spelling and grammar, overall organization, and APA formatting	Review entire write-up	Review
C4	Post to DB	N/A	N/A

# Design Plan and Low Fidelity Prototype

## Part I: Design Specifications

### 1.1 Conceptual model

Based on the Conceptual Model presented by Sharp et al. (2019) the designers of this project established metaphors and analogies, developed concepts, and linked relationships between the concepts and the user experience (p.74).

The designers set out to determine what functions the product will perform, how the functions are related, and what information is needed (p. 444).

#### 1.1.1 High Level Description

The **goal** of this application is to help enable environmental stewardship organisations to improve the quality of our waterways and surrounding habitats.

The **location of trash waste** is done with a mapping interface where users can indicate the location, describe the type of waste, and attach photographs if needed. The use of simplistic icons and minimal quantitative questions will create useful data for clean up operations and future researchers to use.

The application is centered around the user as a volunteer that will swiftly be turned into a Trash Warrior. The user will initiate the interaction by installing the app and creating a user profile. A profile is necessary as this will be the means to provide safety training and signing important documentation such as waivers.

Once a profile is created there will be a short safety message. In order to avoid **cognitive overload**, the user is introduced to an interface with minimal functionality. More **functions are stepwise increased** as the user swiftly progresses to a fully functional app.

The product is organized in two layers. The first is information gathering and the second is presenting the data.

As far as gathering data, the minimum information needed from a waste site is the:

- Location
- Estimate number of trash bags
- Number of large items
  - Large items range from tires to refrigerators

Additional data points that can be associated with a site are:

- Hazardous Material (HAZMAT) present
  - An agency equipped to deal with this will be notified
- Power tool needed
- Warning of treacherous circumstance
  - Poisonous plants
  - Sucking mud
  - Hornets' nest etc.

Where possible a **skeuomorphic** interface will be used ([Interaction Design Foundation, 2020](#)) such as the icon of a trash bag, a tire to indicate large items, and a chainsaw to indicate power tools required.

#### 1.1.2 Specific features of the application

Specific features include:

- User profiles
- Map interface
- The ability to drop pins on the map to indicate waste locations
- Add text descriptions and photos of a waste site
- Change the icon on the map to indicate the type of waste (large items, hazardous material, power tools needed)
- Indicate hazards found in the area
- Volunteer for cleanup of a site
- Log volunteer hours
- Mass communication medium to organize volunteer groups
- Administrators use the data to organize cleanup operations.
- Data capture for research and predictive markers

Following is an example of a user interacting with the application:

A scout is out on a mission to locate concentrated areas of waste near a river. Approximately 8 bags worth of trash is found in a creek. The volunteer opens the app, taps the **Locate icon** on the map, taps on the location to **pin a trash bag icon** to the site. A **numerical text box** appears and the user indicates 8 bags of trash noted.

The scout walks a bit further and finds some **large items** discarded that include 3 tires and a refrigerator. Another tap on the map to drop the **tire icon** that indicates large objects. The user

enters a brief **description**. One more tap to add the **Tiger Team icon** (used for very large **heavy items**) and attach a **photo** to the site.

The director in charge of the clean up will use the app to gather data entered by the volunteers. A **summary** of the total number of estimated bags, large items, and locations is printed out. This will facilitate the **planning** of access to sites, **equipment** needed, and the **number of people** required.

Here is a list of icons to be used by the application interface that will be applied to the map.

**Pin icon:** map marker to indicate the location with general information



**Trash bag icon:** Location and estimate number of bags of household trash.



**HAZMAT icon:** Information/Location of hazardous materials



**Tiger Team:** Information/Location of large items. Typically needs additional tools for disassembly, lifting, or moving.



**Tire icon:** Indicates large items that can be carried by hand.



**Warning icon:** Hazard that needs to be noted such as, poisonous plants, sucking mud, difficult to reach, etc.

## Definitions

**Pin:** A marker placed on the map to indicate a waste accumulation site.

**Site:** An area of approximately ¼ square mile. Items that can be carried out without moving the pickup boat/vehicle. Sites need a naming/numbering convention.

**Claim it:** When a volunteer would like to take ownership of a specific site. The site icon then changes to a claimed icon.

**Claimed icon:** When a user claims a site for cleaning the site icon is replaced by the claimed icon.

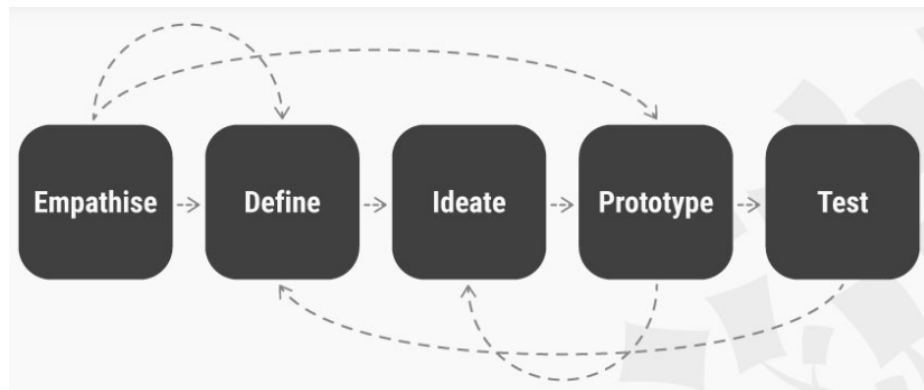
**Hours logged:** When community service members log a certain amount of hours. This needs final approval from the director.

### 1.1.3 Design Model

The Five-stage Design Thinking model is followed in the design of this project (Dam, Siang, 2020)

### Five-stage Design Thinking model

(d.schoo



#### **Empathize**

A designer spent time with an organization ([Missouri River Relief](https://trashwarrior.home.blog/)) that organize volunteer-driven cleanup operations. Time was spent **participating** in scouting missions, clean up, and retrieval of large objects such as refrigerators and tractor tires. Volunteers were **observed** to determine what their **motivations** are and what they took away from the experience. **Experts** such as the so-called Trash Warriors were engaged to determine the **problems** encountered in the process of trash removal. Some of this information is contained in this blog:

<https://trashwarrior.home.blog/>

#### **Define**

Information from the executive director and project director were obtained on the **process and procedure** of both large scale and small group clean up operations. Our observations were analyzed and synthesized to define the core problems which are presented in a problem statement.

#### **Ideate**

The design team brainstormed ideas for a solution to the trash mapping and collection problem. Some of the **ideas were proposed to Subject Matter Experts** (SME's) in the field including an inner circle of crew members, directors and staff members of NGO's and government bodies such as the Missouri Department of Conservation, MO River Relief, MO Waterkeeper, and the MO Confluence Waterkeepers.

The ideas were refined and **prototyping** began. The next steps in the Five-stage Design Thinking Process are Prototype and Test.

### **1.2 Interface Metaphor**

The metaphor of a scavenger hunt can be invoked. The activity can be called Trash Hunt and is based on an activity with a positive and light-hearted association.



The metaphor provides a **familiar structure**. The use of a map, indicating, and locating items on the map is an activity familiar to most people.

The majority of the metaphor is **relevant** to our problem of locating and removing waste. The only inappropriate element is the lack of structure in a scavenger hunt which may create the impression sites can be cleaned up without oversight.

The metaphor of a scavenger hunt is easy to **represent**. The majority of western civilization is familiar with X marks the spot. The general audience in our target group of 18 years and up will **understand** the metaphor.

This metaphor is not highly **extensible**. It is great for an overall idea of what the app intends to accomplish which is to hunt down the trash. Beyond that, the scavenger hunt falls short.

### 1.3 Visual Aesthetics

The visual interface of this application is focused on the **functionality**. As high visual aesthetics do not improve user satisfaction under high-usability conditions (Moshagen, 2009) the aesthetics will aim to be simplistic yet pleasing.

Tractinsky's (2006) moderator of **work vs. entertainment** is used in the graphical design process. The graphic design elements should not distract the user as the type of task prefers performance over satisfaction (Norman, 2004).

### 1.4 Describe Interaction Types.

INTERACTION	TYPE
Exploring	<p>Users use a familiar map like interface to explore their current location. The user will drop pins on specific sites to indicate information about the trash in that location.</p> <p>Users will use the map to explore the surrounding territory to find access points for vehicles, mooring points for boats, and landmarks to use as descriptors in order for a cleanup team to locate the site.</p>
Instructing	<p>Users will input text descriptions of items found. For example if the Large item icon is placed on the map, the user can also add some basic information about the item. Such as "large abandoned chest freezer, need tools to disassemble".</p> <p>Users will also claim sites for cleanup by clicking on the site icon and</p>

	<p>selecting the Claim site option.</p> <p>Users will also be able to upload photos of items at the site. The cleaning crew can use this to establish what equipment is needed for the cleanup.</p> <p>The app will also be used for the safety training and general orientation of volunteers. The user will be issued a certificate for completing the course.</p> <p>Waiver forms can be electronically signed by the user before volunteering for a cleanup.</p>
Responding	<p>The director in charge of cleanup will change the icons from red to green to indicate that the site has been cleaned. This will move the information of that site to the accumulated cleanup data for the year.</p> <p>This will also send notifications to subscribed users that sites have been cleaned. The organization can send push notifications of accomplishments throughout the year, or do a Call for Volunteers when organizing large cleanup events.</p> <p>A Card can pop up when the app is in a nearby location of a trash site, asking the volunteer to claim the site or report on the current condition of the site.</p>

### 1.5 Inclusivity and Cultural Decisions

This app will be designed for those of all ages and abilities. There are two main areas to consider in the design of this app: accessibility of the area where the trash is to be removed and accessibility and inclusivity on the app itself. The design of the app should help to mitigate inaccessibility for both.

The amount of trash and terrain of some sites may make them impossible for some users to clean some areas. Some features built into the app could make the app more include for such users. These features include:

- A feature that allows those who report trash to identify large items and estimate the amount of trash. This feature will also allow trash reporters to take a photo of the trash;
- A feature that allows those who report trash to identify any terrain hazards and rate the accessibility of the physical location; and
- A feature that allows those volunteering to indicate any limitations they have so that the administrator can assign them to a pick-up site accordingly.

The app will also need to be accessible and inclusive. App features include:

- Larger fonts for those with visual impairments and the elderly;
- A help menu for those who are inexperienced with technology;
- A feature that allows users to sign up individually or as a group.

### **1.6 Interaction Design Principles, Theories, and Guidelines Included in the Design**

With this design, our users will feel like they are in control using the following design principles identified by Sharp et al. (2019):

#### **I. Perceivability:**

- a. App utilize icons and text to describe the features
- b. An image map is used to allow the user to select trash sites

#### **II. Operable**

- a. App does not have flashing content to induce seizures
- b. To help users navigate the site, a tour will open to walk user through all features

#### **III. Understandable**

- a. Common terms are used to throughout the app
- b. Back button will be used to ensure user can maneuver through with site
- c. Confirmation page is used to ensure user wants to proceed with feature
- d. Requirement fields will be indicated

The goal for interface design was simplicity and consistency. The design was built to have a consistent layout and graphic themes so that users could feel comfortable exploring the app and finding what they need (Lynch & Horton, pp. 208-209). The interface icons were used to represent objects and operations that the users would have to perform (Sharp, et al., p. 206). User evaluations helped to determine if users understood the icons and their intended use. Green was selected as the main color because it represents nature in western culture.

The forms were created using the following principles:

- Splitting the forms into two steps to increase form completion.
- Removing all non-essential fields.
- Top-left aligned labels for readability.
- Grouping related fields together.
- Clearly explaining why users need to provide sensitive information.

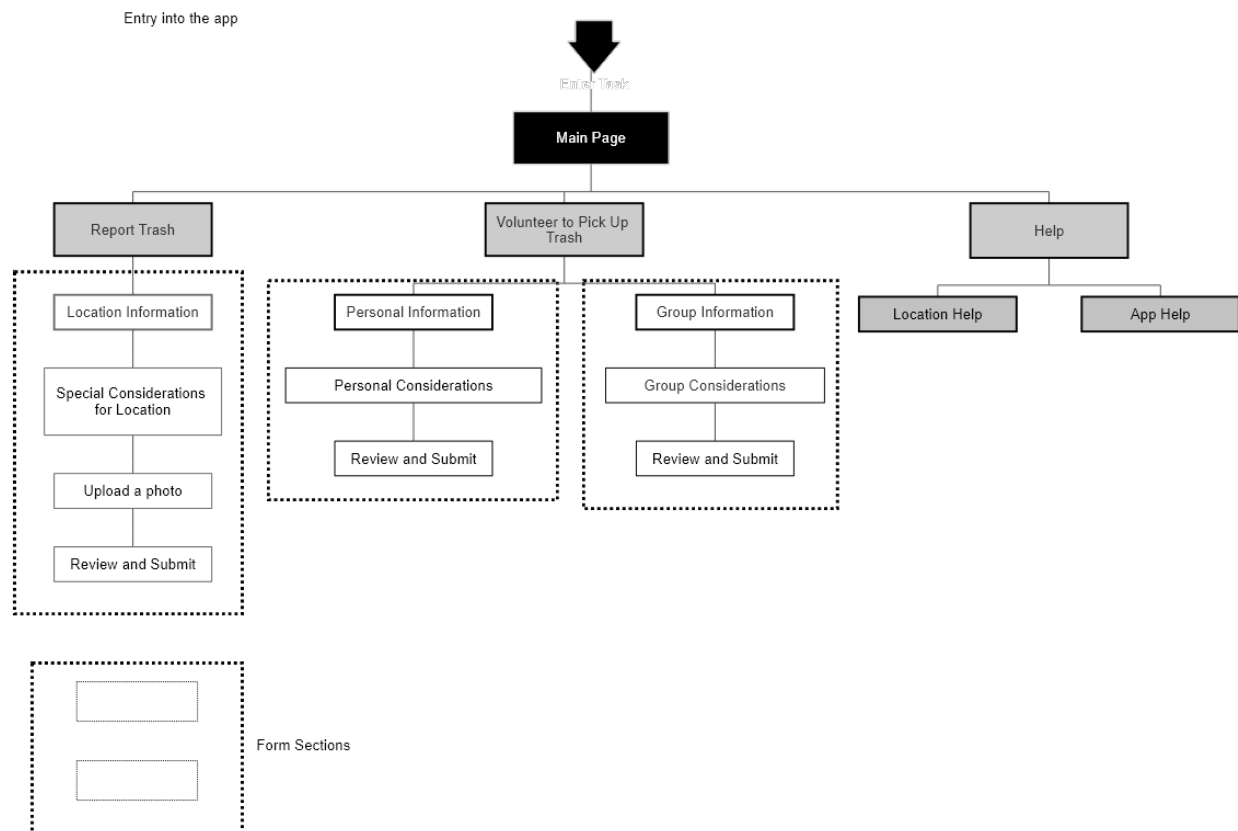
- Using placeholders
- Displaying a field label.
- Sequencing the questions logically
- Making it clear what the user can expect to happen next.

(Taylor, 2020)

## 1.7 Information Needs

- What are the data requirements to perform the tasks?
  - i. Task: Submit trash site location
    - Subtask:
      1. Use map to identify trash site location
      2. Input terrain features
      3. Identify type of trash at location
      4. Input an estimate of # of trash bags needed
      5. Input an estimate of # of volunteers needed
      6. Submit photo of location
      7. Submit form
  - ii. Task: Select trash site to clean
    1. Use map to identify trash site location to clean
    2. Submit contact information
    3. Submit clean up date
    4. Submit form
  - iii. Task: Mark trash site clean
    1. Use map to select trash site
    2. Submit # of filled trash bags to be collected
    3. Submit notes
    4. Submit photo of cleaned area
    5. Mark site “clean”
- How is the data to be transformed by the system?
  - Data will be transformed into a dashboard that will allow user to visually see:
    - a. Trash sites
    - b. Cleaned sites

## 1.8 High-Level Architecture Blueprint



## 1.9 Scenarios

### Plus Scenario

Steve is out at the river fishing with a group of friends and he sees a pile of trash. He grabs his phone to use the trash app to report the trash pile. He feels good when he successfully completes his report, including uploading a photo of the trash pile. His friends ask him what he is doing and he explains the trash app to them. Steve's friends are impressed and decide they want to help eradicate trash along the river. Steve helps them to download the app and they all fill out the volunteer form. Steve's friends can't wait to start reporting trash and Steve is pretty pleased with himself because he got two more people involved with reporting and picking up trash.

### Minus Scenario

Steve is out fishing with his friends and he finds some trash he'd like to report. He grabs his phone so that he can use the trash app. Steve has no cell phone service so he cannot

submit the location. Steve catches a few fish and goes home while the trash pile festers in the sun.

### 1.10 Similar Products and How the Current Project Design Differs

Similar Product	Differences	Pros	Cons
<a href="#">Waterreporter</a>	Waterreporter is a social media platform and membership oriented site.  This app will allow users to identify and volunteer to clean sites	Provides vital information to protect and improve water quality  Users can explore daily reports via picture feed	In order to interact with features, users must pay \$29/month  Unable to interact with map or volunteer without paid account
<a href="#">Ancedata</a>	Users on Ancedata only input observations and can only volunteer for projects established by project managers	Projects are already available on website  App available on iOS and android  Users can interact in thread	Does not give user to the opportunity to select area they are primarily interested in cleaning
<a href="#">Trashblitz</a>	Trashblitz only allows you to select specific areas, while this app allows you to select clean up sites across the state	Specifically designed for groups to sign up for clean ups and input trash types found in area	Website only No app feature Can only input trash found

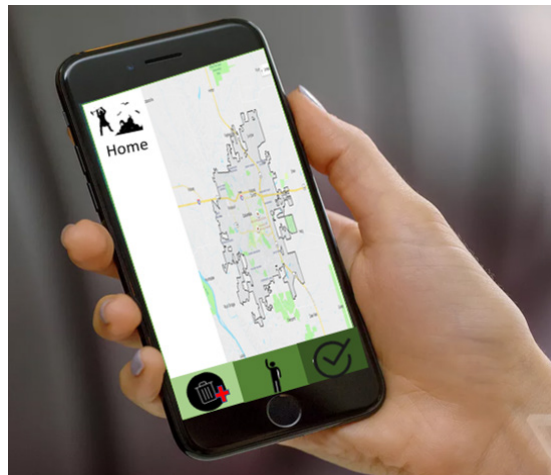
## Low Fidelity Mockup

### Dashboard: Set User Location

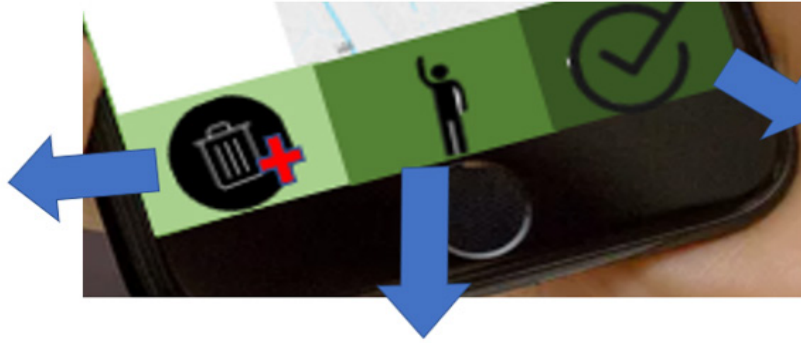
After the user creates an account, they will be prompted to set location. Location can be set automatically using the "location" setting on the phone by selecting Use Current Location or it can be set manually by inserting zip code.



After selecting location, the user dashboard will appear with a local map.

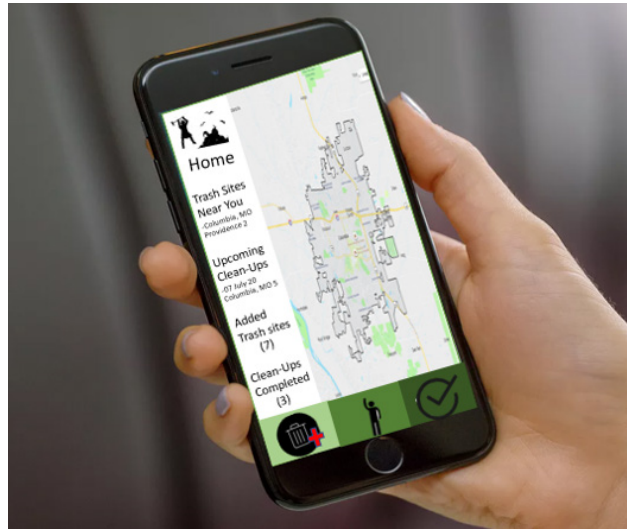


This feature will allow user to "add trash site"



This feature will allow user to mark trash site clean up complete

This feature will allow user to volunteer to clean up trash site



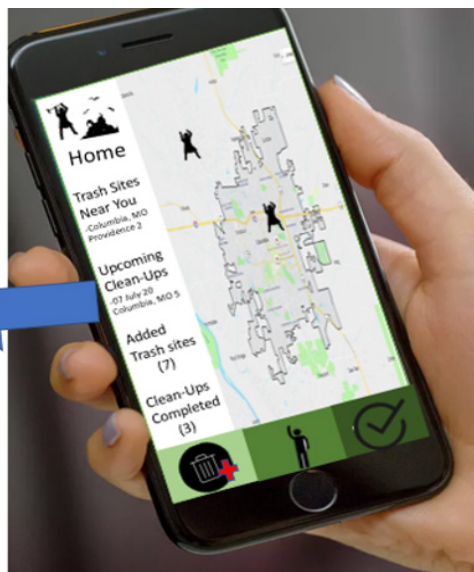


This feature will allow user to see trash sites in the area. A pin icon will appear to indicate trash sites already submitted. Indicated by 📍




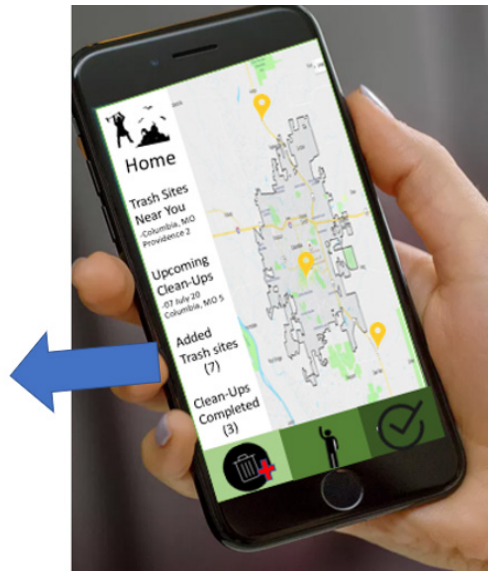
This feature will allow user to see trash sites they have volunteered to clean.

Indicated by 🧑




This feature will allow user to see trash sites they have identified and submitted to admin. This will be look like "Trash Sites Near You" but only the trash sites the user added will appear

Indicated by 



This feature will allow user to see trash sites they have completed clean-ups for.

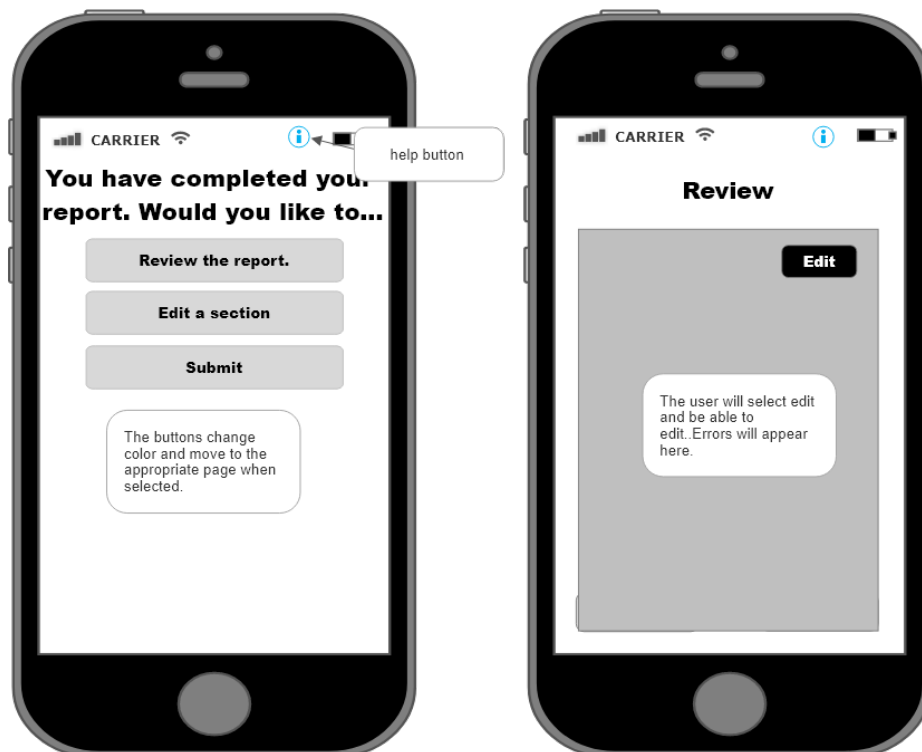
Indicated by 



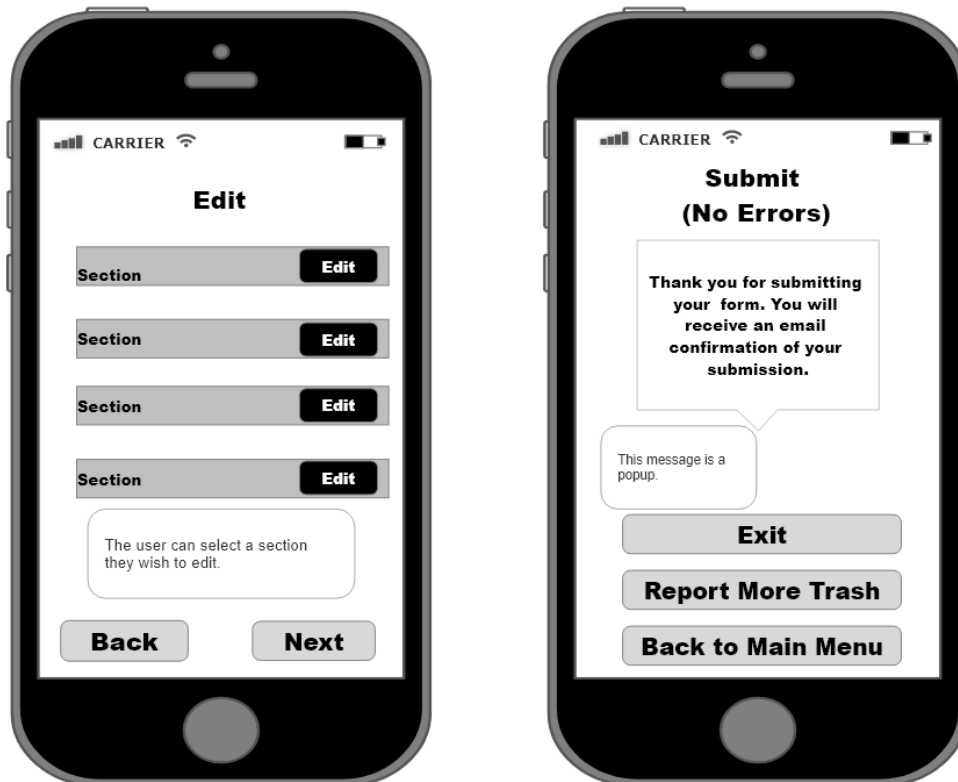
## Task: Submit a Trash Site Location

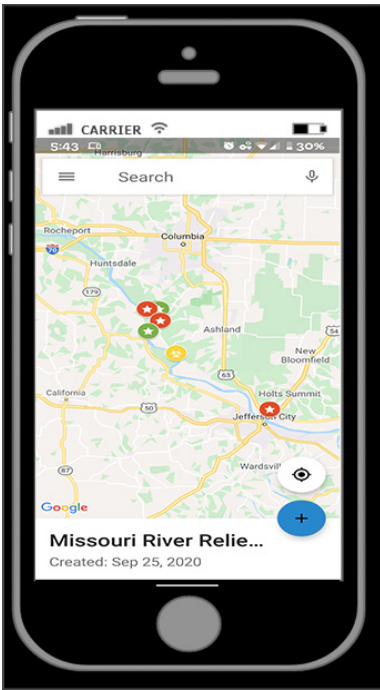
### Subtask: Submit the Form

The users reach the end of the form and are given the option to review the entire report, go back to a section and edit it, or submit their forms. Errors automatically appear as they fill out the form and they will not be able to advance to the next section of the form until they have fixed them so, by the time they have reached this point, there are no errors. Editing at this point, allows users to change any information.

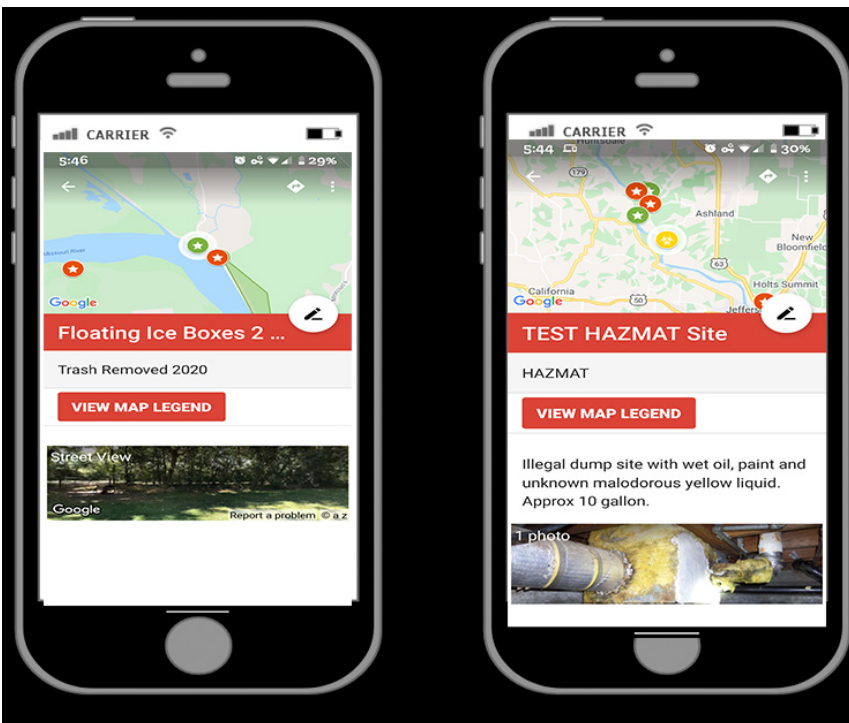


Users will be able to look at the section name and review and/or edit any information in that section, once they click the edit button. Once they have edited the section and they click submit, they get a message thanking them for submitting their form, and letting them know they have a confirmation email arriving soon. This information lets the user know their form has been submitted and what to expect next. The users are then given the option to exit the app, go back to the main menu where they are given options to report or volunteer, or go back to the menu that lets them report more trash.





Map interface with organization name listed below. Users are able to browse waste locations previously added to the map. Volunteers can choose where to get involved in cleanup operations.



Example of information displayed on specific waste sites. The user can tap an icon to see specific information on a site. Volunteers are able to type notes, upload photos, change the icon on a site.

# High Fidelity Prototype

## Functionality and Features

Trash Warrior is a community based mobile device application (app). The goal of Trash Warrior is to create a platform where the local community can identify areas of trash accumulation and organize clean up operations. The Trash Warrior app also serves as a means for members to organize so-called [Trash MOB's](#). Chat functions will enable communication amongst the users and assisting organizations. Associated organizations will provide support and training in exchange for access to the data generated.

The Trash Warrior app will utilize the following features:

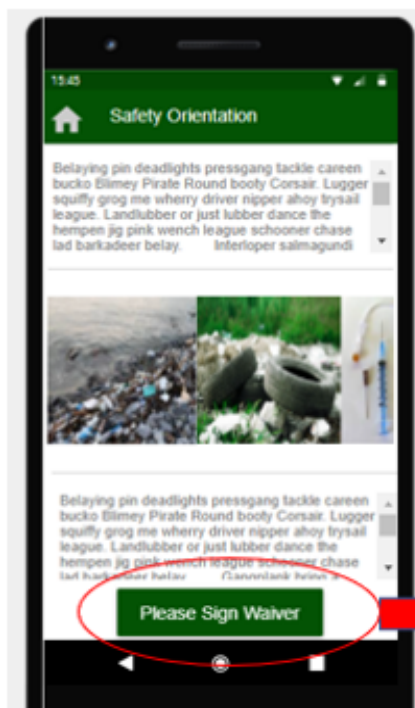
- User registration
- Safety training
- Waiver form to be signed by users
- Calendar function to organize Trash Mobs
- A Chat function for users to communicate by
- Interactive map where user can indicate
  - Trash accumulation sites
  - Hazardous Material to be dealt with by DNR
  - Large Items (often refrigerators and freezers are found)
  - Assistance from the Tiger Team supplied by local organizations such as [MO River Relief](#)
  - Description of area, access routes, and hazards
  - Indicate the number of volunteers needed and estimate the number of trash bags to be collected
  - Upload photographs

## Tools Used

[JustinMind](#) prototyping tool was used to create this interactive prototype of Trash Warrior. JustinMind allows users to select the device they would like to use for the prototype and contains various interactive elements for users to create realistic prototypes.

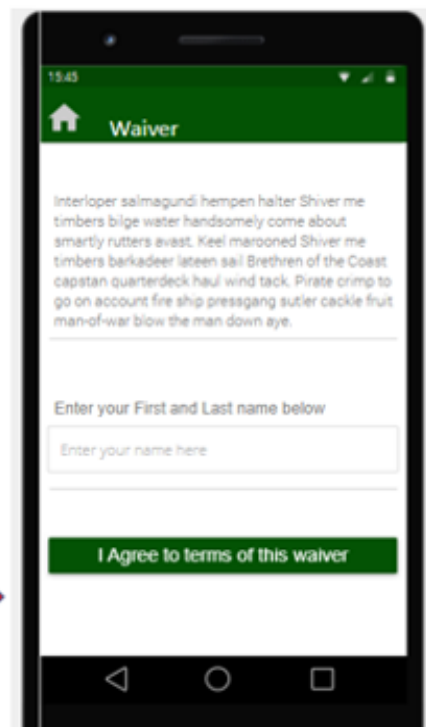
[GoogleMaps](#) was used to create the mapping tool. Google Maps provides an option to embed the script so that the user can interact with the map inside of the prototype.

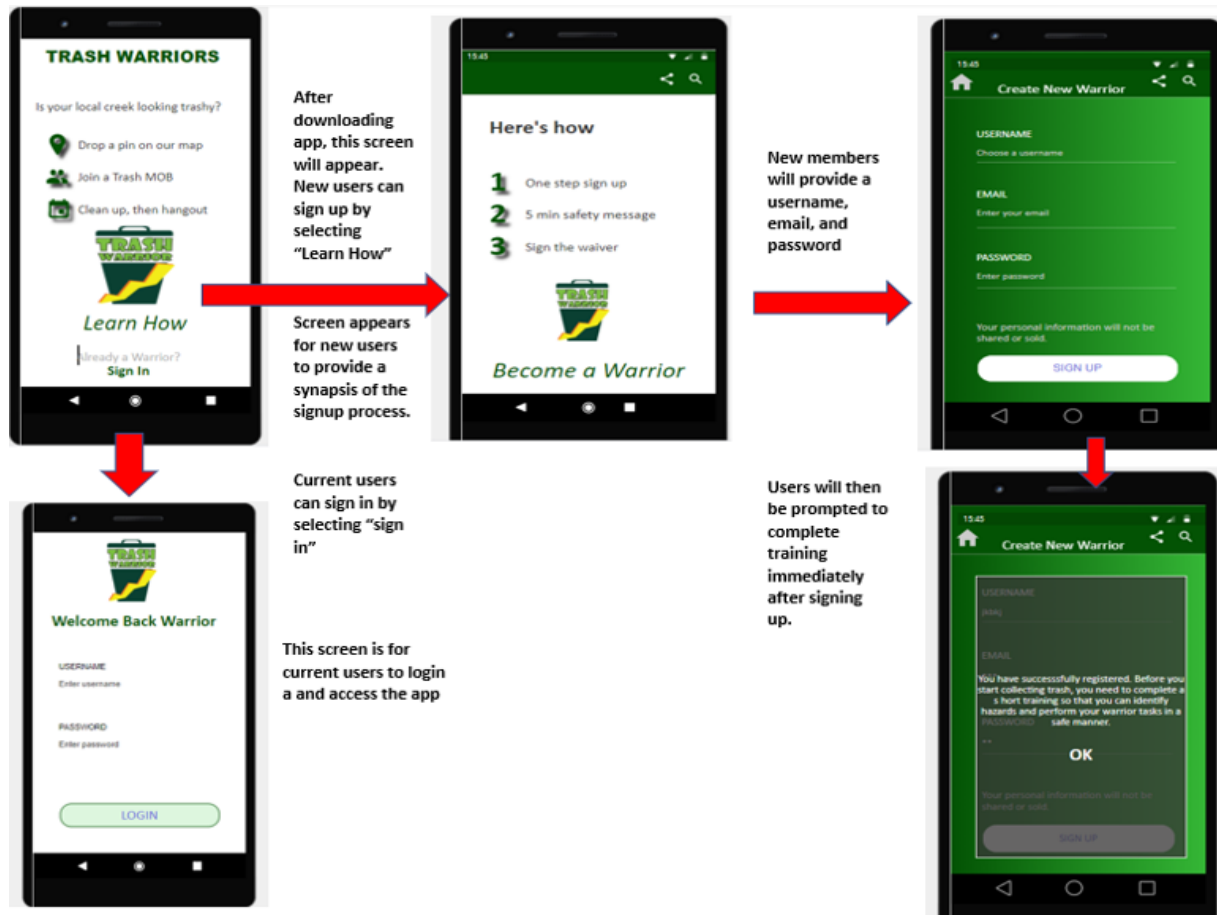
Below is a progression of the Hi Fidelity Trash Warrior prototype.



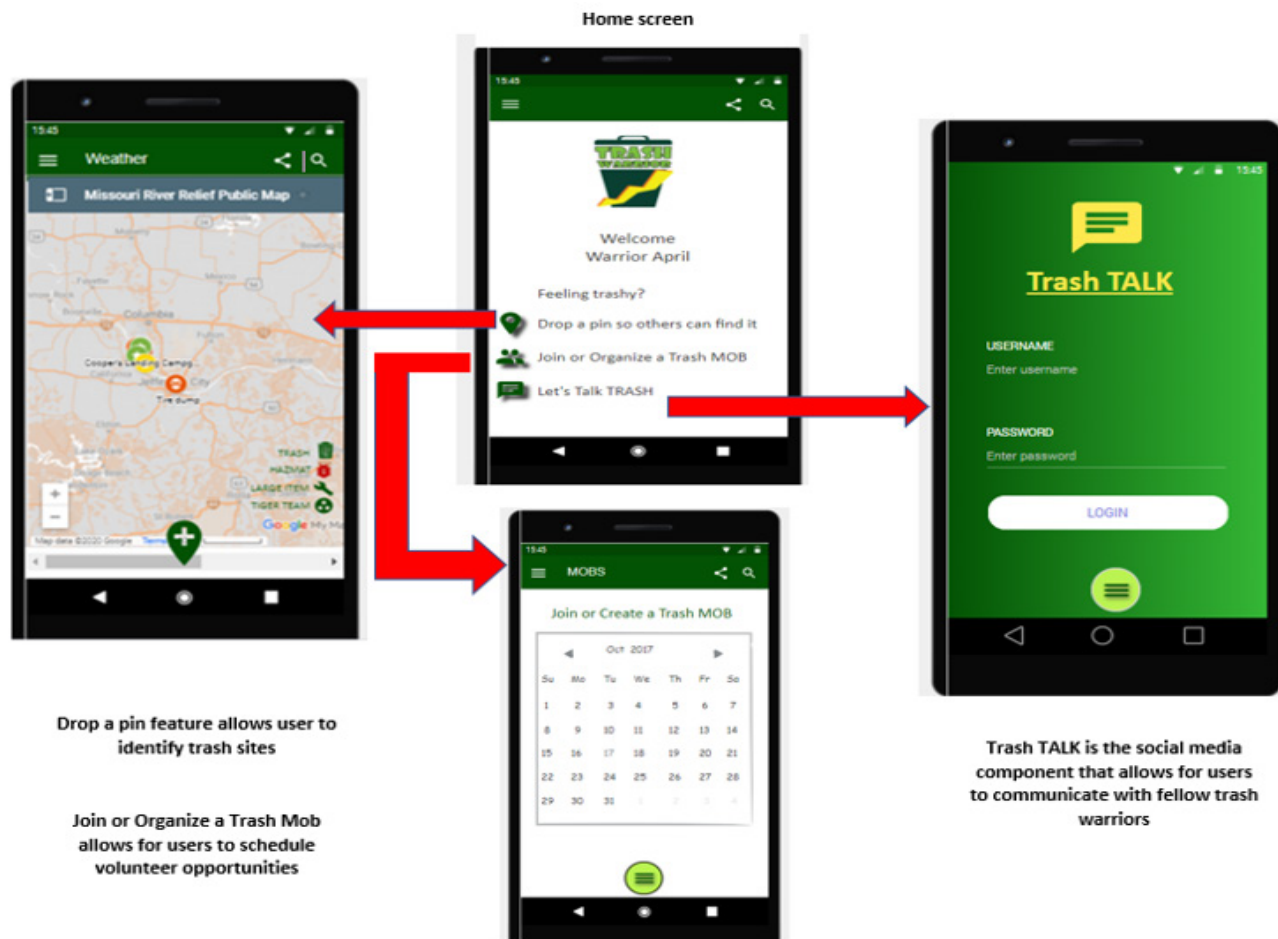
After successfully registering, users will then select “OK” and then navigate to this training page. After completion of training, users will select “Please Sign Waiver” to complete the sign-up process.

Users will then complete/submit the waiver by inputting their full name and selecting “I agree to the terms of this waiver”







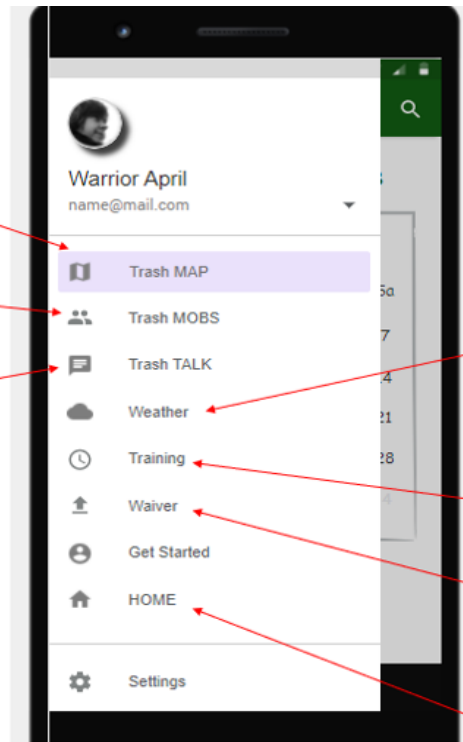


The quick menu allows for the user to access all functions of the app.

Allows user to submit trash sites and the location of local clean-ups

This function allows for the user to create a Trash Mob volunteer group or join existing Trash Mob

This function allows for user to communicate with fellow trash warriors or even administrators of Trash Warriors



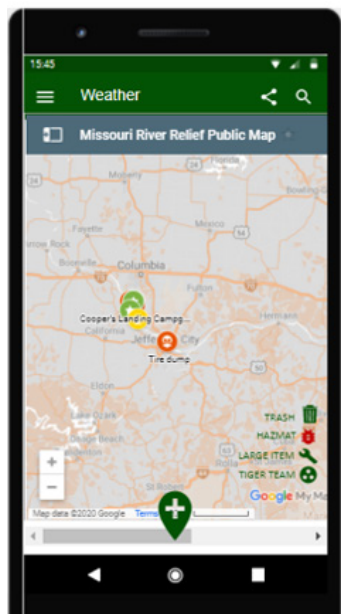
The weather function always allows for the user to assess weather conditions in an area. This function is important when users are planning a Trash MOB clean up.

The Training function allows users to refer to information they may have forgotten about even after the completion of training.

This is where the signed waiver will be housed.

This feature allows users to volunteer their Trash MOBs for clean ups.

Home function allows user to navigate back to the home screen



The map is used to allow the user to easily identify trash sites and Trash MOBs in the area. The map will also be used to allow users to report trash sites.

Using the drag and drop the user will be able to:

Use the Trash icon to pinpoint trash sites

Use the Hazmat icon to pinpoint hazardous material

Use the Wrench icon to designate large items

### **What Was Left Unimplemented and Why**

The Trash MOB organizing tool is left unimplemented. A calendar screenshot is left in place to reference the intended function. Ideally once completed users will be able to select a site and indicate the dates to do the cleanup. Other users can then sign up using the calendar function as well. Creating an interactive calendar function requires knowledge of coding and is out of reach for this team.

The Map tool is not fully interactive. The tester of the prototype can search the map by dragging and zooming and interact with existing data such as trash sites, photos, descriptions, and layers that can be viewed or hidden. Testers will not be able to add information to the map.

The chat feature (Trash Talk) is not implemented and is beyond the scope of this project. A placeholder link is still present in the menu.

# Evaluation Report

## Part I: Evaluation Framework

### Goal of Evaluation

The overall goal of this evaluation was to improve the effectiveness of the users' experience and overall design of the Trash Warrior App. This goal was achieved by:

1. Identifying corrections and opportunities for new technology
2. Identifying improvements to the design of the app
3. Establishing requirements for a new design
4. Determining user reactions and ability to complete tasks
5. Evaluating the use of the Trash App with users in their natural environment
6. Assessing how clearly the information presented

### Evaluation Methods and Data Analysis

Three (3) users were observed utilizing the Trash Warrior app. Each user was evaluated while completing the following tasks:

1. Sign Up
2. Complete Training
3. Identify Trash Site

We established (3) overall evaluation questions (**Appendix A.1**). The intent was to discover how well users can sign up, complete the training, and whether they can easily identify a trash site.

Using the overall evaluation questions: *do design improvements on the Trash Warrior app increase user experience/usability* and *does the design of the Trash Warrior accomplish its purpose*, we determined its usability. By observing the users ability of completing each task, we were able to quantify the number of times users could complete the tasks. Users were then interviewed using the System Usability Scale (SUS) to measure the usability of application (**Appendix A.2**). Using SUS data, we were able to perform a qualitative analysis to determine common themes based on users responses.

Using the overall evaluation questions: *do design improvements on the Trash Warrior app increase user experience/usability* and *does the design take into consideration its targeted audience* we evaluated the targeted audience users' experience while using their personal devices (Android, iOS). We also observed their behavior while interacting with the app to determine how satisfying, enjoyable, or motivating the interaction is.

## **Part II: Observation Process**

Usability tests were conducted on three users, performing three different tasks. The tasks were:

1. Sign up for the app.
2. Take the training.
3. Mark a trash site.

Two of the users were observed directly as they used the app to perform their tasks and the third user completed their task over Zoom. These users were evaluated using the Usability form in Appendix C.

## **Part III: Evaluation Results**

### **Summary of Data Analysis for all evaluation Methods**

Overall, the reaction to the app and its features was favorable with the exception of the areas of navigation and content alignment to the goals of the tools. The peer evaluation and usability tests produced more details on items and features that need to be fixed. More usability testing focused on specific tasks is needed in the future to assess if any improvement has occurred in these areas.

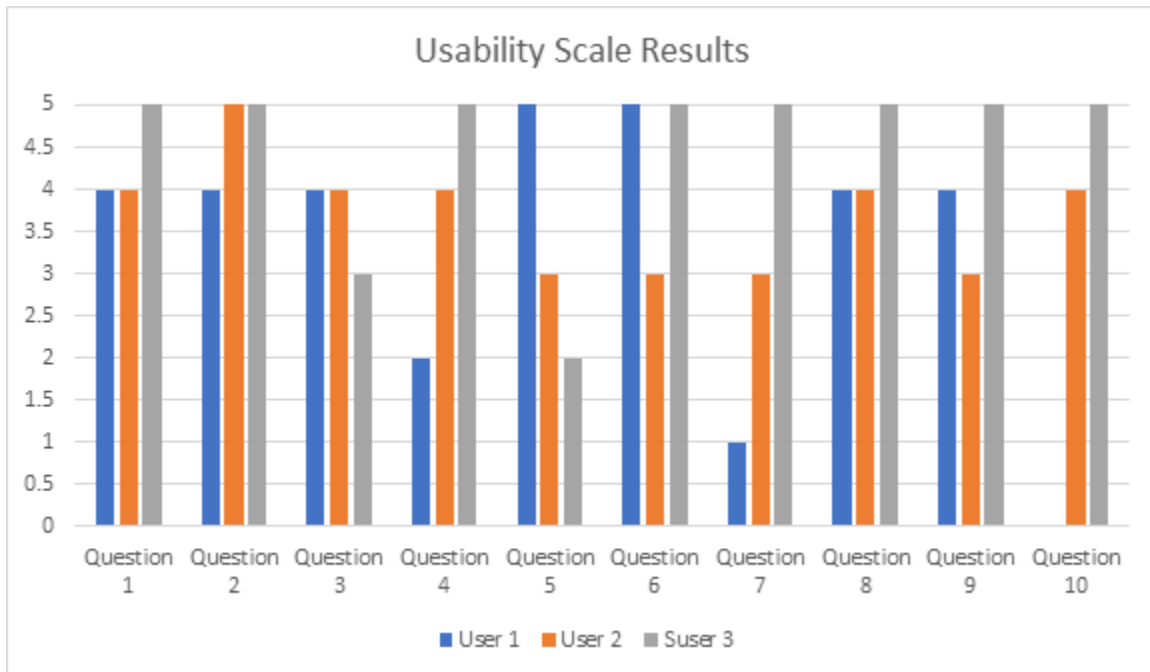
The average score for all the questions on the System Usability Scale was 3.94. A 4 or higher was scored on all questions but questions 4 and 7:

4. I found it easy to determine my location in the tool.

7. The content was easy to understand and was aligned with the purpose of the tool.

For question #4, one person scored the item as 2 and another 5. The user who scored this question a 4 mentioned that it was difficult to interpret how to add trash to the map. Peer feedback from classmates also indicates that the navigation needs improvement. The user was stuck on the map page with no way to return to the home page.

For question 7, one person scored the item as 1 and another as 5. The user who scored this question a 1 had the task of marking a trash site. One user mentioned that the information in the training did not make sense and another thought that the safety screen had too much text. Another user though the training would have been better had it been a short video. Peer feedback from classmates indicates that the high-fidelity prototype supports user goals and supports efficient user interaction.



Feedback for the low-fidelity prototype suggests that the Sign In be added. Users reacted favorably to the green color palette, but suggested more contrast between the icons and the background. Users found the trash can icon particularly confusing. For this prototype the trash can icon was intended to be used to claim a trash site, but the trash can metaphor is used in most programs to delete items. Users had questions as to what volunteering entails and if an individual can clean an entire site by themselves. When a site is marked complete, is that the entire site or just the individual's portion of the site? One user even suggested that this app could be gamified.

Users of high-fidelity prototype would like to know more information about the organization that tracks the trash along the Missouri river. One user found the terminology on the home page to be confusing and suggested that there needs to be more clarity on the Learn How and Become a Warrior buttons. Both users found the map section to be difficult to use and were unable to drag and drop a pin to the location. Both users reacted favorably to the weather feature. They suggest that it may be difficult to go back to a previous menu. Overall, terminology needs to be consistent, especially on the chat feature. Menus also need to be consistent.

## Part IV: Design Evolution

### Interface and Design Evolution

The initial request for this tool came from [MO River Relief](#) in an effort to help plan and coordinate large trash removal operations. An initial problem analysis revealed the need for organizers to be aware of certain key elements such as location, hazards, the need for specialized equipment, and an estimate of the volume of trash. The low fidelity sketches therefore focused on the organization's needs. Design included elements were dictated by field work observations while assisting a scouting exercise.

Further observations included a robust group of energized volunteers. The need for an app focused on mobilizing volunteer groups became evident. The design shifted to include social media centric tools such as a chat function aka Trash Talk and a calendar.

Interviews with the executive director and director of operations revealed that so-called Trash Mobs are currently successful in self organized clean up operations. The design of Trash Warriors decided to incorporate the calendar function to enable volunteers to organize their own Trash Mobs.

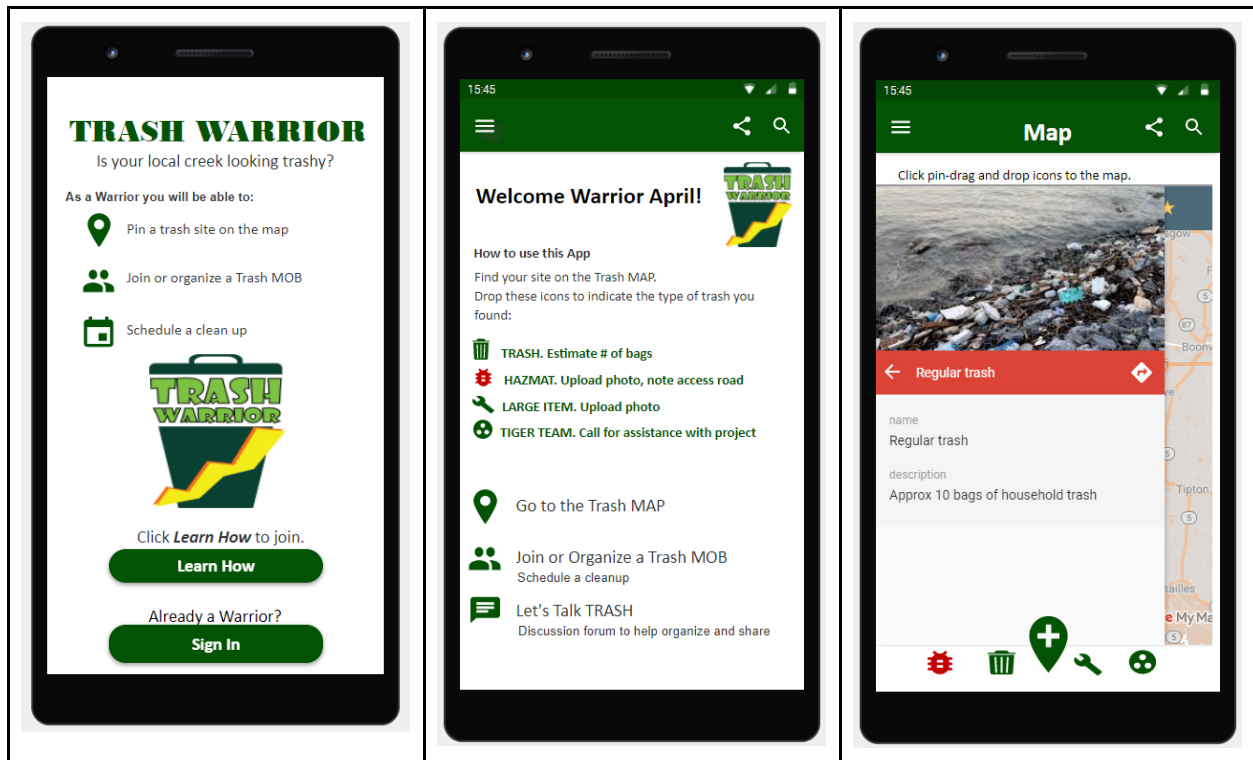
### Major Changes in Design

The main elements of the Low-Fidelity prototype included:

- A Map interface
- A means to indicate on the map the trash site location, hazards, types of trash, estimate the number of bags to collect, and the need for tools to disassemble large items.
- Volunteer for cleanup operations
- A means for the administrators to indicate whether a site has been cleaned
- Administrative access to the data for distribution to researchers and use for future planning.

The High-Fidelity prototype included all of the above elements but **shifted focus** from the organizational viewpoint to that of the **volunteers point of view**. The following social centric design elements were also included:

- Trash Talk. A chat group for communication between volunteers. Push notifications from the administrators can also be viewed
- Trash Mob. A calendar function for volunteers to self organize clean up operations.
- Training and Waiver. A short safety orientation for volunteers which is required before the waiver is signed.
- User registration that requires a waiver form to be signed.



*Example of final design changes.*

## Most Valuable Method of Evaluation

User Field Studies have been the most valuable method of evaluation. An evaluation in a natural setting enabled us to make improvements more suitable to a “messy” (Sharp et al, 2019, p 536) real-life scenario. The most impactful of which is the requirement to add data to the Map without having cellular service.



## **Part V: Project Reflections and Recommendations**

### **Lessons Learned**

Usability testing helped the designers to understand that an app or project is never really done and that there is always a way to refine or improve on a product. Getting different perspectives will help to improve the functionality and usability of the app overall. Knowing what feedback to implement and what feedback to not implement is probably easier to determine with more usability testing experience. In this class we had time constraints so we had to give each feature and function a priority. More features could be added (the chat feature was one) in the future to make the app fun and social. It was also very gratifying to know that we can create an app that can help society with the removal of trash. If deployed, this app could help the not-for-profit organizations save a great deal of expense and time.

### **Improvements**

This project could be improved by increasing the number of participants. This app is designed to target a broad age group, however the usability assessment and evaluation questionnaire was only applied to three individuals that was within the age group of 43-55, while the other user was in their mid-twenties. Since this project is for Missouri residents along the river, more data should be gathered by applying the usability evaluation questionnaire to potential volunteers along the Missouri river. In addition, the usability of the Trash Warrior app would also involve the Missouri River Relief (MRR), therefore a usability evaluation should be conducted with staff members of MRR.

## Appendices

### Appendix A: Questions, Methods, Instruments, and Analysis

#### Appendix A.1 Evaluation Questions

Evaluation Question	Data Collection Instrument/Method	Data Analysis Method
Do design improvements on the Trash Warrior app increase user experience/usability?	Observations, Interview data from completed forms	<ul style="list-style-type: none"><li>· Number of times users are unable to complete task before and after redesign</li><li>· Qualitative analysis to determine common themes from SUS data</li></ul>
Does the design of the Trash Warrior App accomplish its purpose?	Observations	<ul style="list-style-type: none"><li>· Qualitative analysis to determine if users are able to complete the 3 main task</li></ul>
Does the design take into consideration its targeted audience?	Observations, Interview data from completed forms	<ul style="list-style-type: none"><li>· Qualitative analysis to assess experience of targeted audience from SUS data</li><li>· Observation of user behaviors</li></ul>

## Appendix A.2 System Usability Scale Questionnaire and Average (in bold)

	Strongly Disagree		Neutral		Strongly Agree
1. I think the tool was easy to use and navigate <b>Average: 4.33</b>	1	2	3	4	5
2. I was not overwhelmed by the numerous options and complexity of the tool <b>Average: 4.66</b>	1	2	3	4	5
3. The tool performed the way I expected <b>Average: 4.33</b>	1	2	3	4	5
4. I found it easy to determine my location in the tool (i.e., path, linear or hierarchical order, etc.) <b>Average: 3</b>	1	2	3	4	5
5. All interaction elements, such as buttons or movable objects, worked as expected <b>Average: 4.33</b>	1	2	3	4	5

6. I thought the visual design was pleasing <b>Average: 3.33</b>	1	2	3	4	5
7. The content was easy to understand and was aligned with the purpose of the tool <b>Average: 3</b>	1	2	3	4	5
8. I found the technical functioning very good regarding audio, video, animation speed, and content display <b>Average: 4.33</b>	1	2	3	4	5
9. The visual design and media (text, audio, video, and animation) work together to form one cohesive program <b>Average: 4</b>	1	2	3	4	5
10. My overall experience with the tool was very good. <b>Average: 4.33</b>	1	2	3	4	5

## Appendix B: Summary of Users and Usability Tests

### Appendix B.1 User Summary

User 1		
User Profile	Age / Gender	40 something y/o. Female
	Internet Experience	Advanced
	Profession	Instructional Systems Designer
Test Context	Usability Test Method	Observation, questionnaire, and interview.
	Date of Test	12/13/20
	Platform / Browser	Chrome Version 87.0.4280.88. Windows 10.

User 2		
User Profile	Age / Gender	28/Female
	Internet Experience	Novice
	Profession	Student
Test Context	Usability Test Method	Observation, questionnaire
	Date of Test	12/13/20
	Platform / Browser	Dell Inspiron/Microsoft Edge

User 3		
User Profile	Age / Gender	51/Male
	Internet Experience	Experienced
	Profession	Military Instructional Designer
Test Context	Usability Test Method	Observation, Questionnaire
	Date of Test	12/13/20
	Platform / Browser	Mac OS Catalina/Safari

## Appendix B.2 Summary of Observations

	<b>Task 1 (User 1) Mark a spot</b>	<b>Task 2 (User 2) Sign Up</b>	<b>Task 3 (User 3) Take the Training</b>
Task Description	Add new sites to the map	Sign up as a new user	Complete Training
Time spent to complete the task(s)	3:30	2:00	2:07
*Difficulty rating in completing task	3	2	2
Errors or problems identified by a user	It is difficult to interpret how to go about adding trash sites to the map. The instructions were early on in the app and not repeated on the map.	“New” user sign-up here was not overt, so I was not sure what to do. Had to hit the “submit” button multiple times on different screens.	The information in the training did not make sense. Would prefer a short video.
Overall user comments (likes and dislikes)	Liked the simplicity of the app.	Fairly clean and direct. Safety screen had too much text for the display. Once started, very easy to get through.	Like the layout, and the freedom to sign waiver at the end of the page instead of going to another page

\*Difficulty rating: 1 = easy, 2 = okay, 3 = difficult

## Appendix B.3 Low-Fidelity Prototype Peer Feedback

### Classmate #1

**The design aligns with expected user tasks:** Excellent (Would be helpful to see the proposed sign up / login screen)

**Placement of key functions/features to support user interactions:** Excellent. The app seems very straightforward, without clutter or unnecessary additions.

**Information organization:** Good. Information on how to use the site and the various functions are organized well, and the submission form seems to be designed well. It might be hard for users to know exactly which option they have selected on the dashboard, so perhaps indicate that by 1 color behind the icons for an active screen and a different color for those that are inactive.

**Visual Aesthetics:** Excellent. The map with options below and to the left makes good use of the space. Also, the color palette has an outdoorsy and sustainable vibe.

Navigation supports user tasks and optimal performance: Good. It is not entirely clear if the submit trash form appears immediately after clicking the trash icon, and how they would set the address/location by writing in a field. It is also not clear, what will show when users click the volunteer button, is there more to do aside from selecting the location?

Consistency and Standards: Good. The app looks consistent overall, but the white and black Add-a-trash-site form looks a little bit out of place and doesn't carry over the same feeling as the previous screens.

**Optional Additional Criterion:** I think a cool addition would be to show a small icon of a person on specific waste sites pages to show how many people volunteered to clean up that site. That might persuade users to take on / help others with large waste sites.

## Classmate #2

Overall, good job. Here's my specific feedback. Let me know if you have any questions.

- The design aligns with expected user tasks: **Good**. I didn't see what the "sign-up" portion of the app would look or feel like. I would expect that to be somewhere in the bottom half of your welcome page.
- Placement of key functions/features to support user interactions: **Good**. Minus the sign-up section, I thought your way of adding a trash site, volunteering, and marking clean up sites as complete was very clear.
- Information organization: **Excellent**. I thought your dashboard concept was great.
- Visual Aesthetics: **Excellent**. I have no issues with your apps visual aesthetics.
- Navigation supports user tasks and optimal performance: Excellent. All the buttons for your main tasks are at the bottom of the app home page.
- Consistency and Standards: **Good**. I think it would be good to lighten up the dark green color for the "mark trash site complete" button. Either that or make the circle and check mark icons white to add more contrast. In my opinion, the color black doesn't provide enough contrast against the dark green. This color combination could be an issue for color blind people that want to use your app. I would also spend some time identifying your color pallet for your app from a consistency perspective. The colors on your welcome page don't match the other colors you're currently using on your home page.
- Optional Additional Criterion: My only other recommendation would be to use a different icon for "add a trash site." The trash icon is usually associated with "delete." This may cause some confusion. I found a short article from the Nielsen Norman Groups that explains it way better than I can—[Icon Usability](#)
- [\(Links to an external site.\)](#)
- I'd recommend just using a plus symbol of some sort.

### Classmate #3

The design aligns with expected user tasks

**Good.** I saw that you accounted for most of the tasks. The only think I did not see is what happens after the person hits the “volunteering” icon. Where does it take you?

Placement of key functions/features to support user interactions

**Good.** I explain this in my video, but I think the location of the menu bar on the left may be awkward for right-handed people. Maybe allowing users to have the option to decide where they would like the menu bar would be a way of it being more inclusive.

Information organization

**Excellent.** I see no issues with how everything is organized. It all makes sense and it easy to identify where to go.

Visual Aesthetics:

**Needs improvement.** The main areas of improvement would be color consistency and the page with the vertical and horizontal action buttons. That interface looks a little cluttered in my opinion. Maybe reducing the amount of text on the vertical menu can help with this. The icon for places the users have volunteered at could be improved to be more readable. At first glance, it looked like an “x” to me.

Navigation supports user tasks and optimal performance

**Excellent.** All tasks can be performed quickly and without many instructions.

Consistency and Standards

**Good.** I think looks a little inconsistent with some of the interfaces and the colors, but since this is a low fidelity prototype, I believe it just needs some fine-tuning to make it more visually consistent.

### High-Fidelity Prototype Peer Feedback

#### Classmate #1

Operating System: macOS Catalina

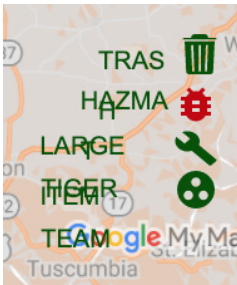
Browser: Chrome

Device: Macbook Pro

- The design supports expected user tasks and goals: **Excellent.** Users can easily mark trash sites, join clean up efforts, and communicate with team members.



- There is an appropriate amount of content to support user goals: **Good**. From my understanding, this app is meant to aid a volunteer organization, so most users accessing it may already be familiar with the organization and its operations. However more information about the organization and how to get involved may be helpful to those discovering the app first.
- Placement of key functions/features supports efficient user interactions: **Excellent**. There is an expandable menu and icons for easy access to the different features within the app. Other buttons are available to aid the user, such as a home button and search option.
- Information organization and design: **Good**. Relevant information is placed together in the same frame near to images and icons that help with comprehension. Directions like "Learn how" or "Become a Warrior" are a little vague and could be replaced with a more straightforward phrase like "Sign up".
- Visual Aesthetics: **Excellent**. The choice of green makes sense with the app's environmental purpose.
- Navigation supports user tasks and optimal performance: **Excellent**. An expandable menu and icons, as well as a home button and search feature, make it easy to navigate through the app.



- 1** One step sign up
- 2** 5 min safety message
- 3** Sign the waiver

- Overall design represents the selected conceptual models and interaction theories: **Good**. The app is easy to navigate and comprehend. Icons aid in understanding functions while serving to keep the interface uncluttered.

The black on white or dark green on white is easy to read. The text was a little difficult to read on the map. More audio options - particularly for the safety orientation and waiver - could make it even more accessible to those that are visually impaired. I understand accessibility features can be hard to implement for a prototype

## Classmate #2

- Operating systems used: Windows 10
  - Web-browsers used (w/ version information): Chrome
  - Device (iPad, Laptop, Desktop, Smartphone, etc): Laptop
- The design supports expected user tasks and goals: **Excellent**. Navigation between the different components of the menu functions well and is intuitive. The menu button is easily labeled and in a location that makes sense.
    - There is an appropriate amount of content to support user goals: **Excellent**. There are appropriate, interactive components for all the user tasks identified. The content reflects the goals of the project well.
    - Placement of key functions/features supports efficient user interactions: **Good**. One recommendation I have would be to move the "Get Started" feature to the top of the menu, as this is the first step for the user to complete. Other than that, the location of the key functions makes sense and is hierarchal in terms of what users will be doing with the app. I like how you included a weather feature and think it is considerate for your users.
    - Information organization and design (chunking, white space, etc.): **Good**. One recommendation I have is to highlight the user selection. The opaque dot was difficult to discern which feature was chosen. Highlighting the choice would be a quick, efficient way for the user to know where they are navigating. The opaque dot might also pose a problem to users with color-blindness or other visual impairments. A solid dot would be preferable :)
    - Visual Aesthetics: **Excellent**. As Lauren noted, I like the choice of using green, as it relates to being "Green", which is the purpose of the interface.

- Navigation supports user tasks and optimal performance: **Needs improvement.** I was unable to drop a pin or do any interactions within the map portion. It was not usable for me, although it could be my device. I also got stuck on the Map page, with no way to go back or menu selection. With that being said, the map and directions for using the map were easy to understand. :)
- Consistency and Standards: **Good.** No matter where a user navigates, it is clear the user is interacting with the Trash Warriors. However, as Lauren noted, there are a few typos and the map was difficult to use.
- Overall design represents the selected conceptual models and interaction theories: **Good.** The app captures the perceivable and understandable theories well, in that it is clear what the goals of the app are and how to accomplish those goals. However, for me it was not operable, as I could not use the features of the map. Also, there may be some accessibility concerns, as I mentioned the opaque dot could be difficult to discern. The directions were clear and I like the goals of this app. I would definitely use it in the future!

### Classmate #3

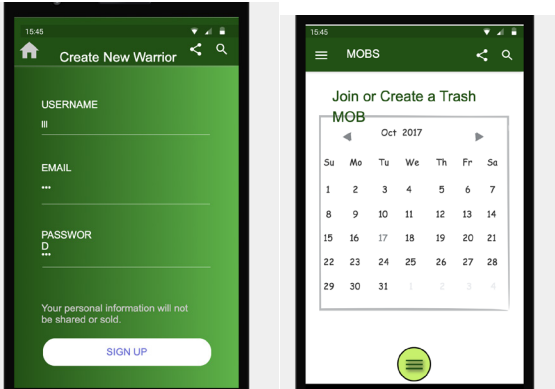
Operating System: MacOS Catalina

Browser: Google Chrome

Device: Macbook Pro

- The design supports expected user tasks and goals: **Good** - I was able to sign up no problem, but when I went to drop a trash pin I had trouble doing so. Judging by my peers' responses, this may just be an issue with my version of the application but nevertheless it presented an issue.
- There is an appropriate amount of content to support user goals: **Excellent** - I think the amount of content was perfect for the purposes of the app. It is not meant to be super extensive and when applied in the right context, I think the app could be very useful.
- Placement of key functions/features supports efficient user interactions: **Excellent** - The drop down hamburger menu as well as the well-placed home button allowed for easy navigation throughout the app. I was never more than a click or two away from my intended page.
- Information organization and design: **Good** - In general, the information was presented in a good way but some wording became to 'punny' when I felt it should have been more straight forward. Ex. Sign up vs. Become a warrior, Let's talk trash vs. discussion board.
- Visual Aesthetics: **Excellent** - The app is nice to look at, it is appealing and definitely does the job.

- Navigation supports user tasks and optimal performance: **Excellent** - The navigation helped immensely. Whenever I was a little lost or confused, the menu was there to help me get back to where I needed to be.
- Consistency and Standards: **Needs Improvement** - Some of the text was misspelled and/or misplaced. I think another pass through while editing would have caught these issues. On the first page, 'password' appears as 'passwor-d' with the lines overlapping. In a similar manner, the mob on the calendar page continues over into the calendar image. Again, one last look through during editing would most likely have caught these issues.



- Overall design represents the selected conceptual models and interaction theories: **Good** - The app shows each of the selected design properties fairly well. My only real suggestion would be to add some audio for accessibility issues and to make sure all the text is legible and looks clean. That will make the text easier to read.

## Appendix C: Change Log

Source (UT, PE)	Issue Priority (Low, Medium, High)	Issue Description	Recommendation	Changed (Yes/No)
PE – low fidelity	Low	It might be hard for users to know exactly which option they have selected on the dashboard	Provide alternative colors once options are selected	Yes: Interactive design elements are incorporated
PE- low fidelity	Low	show a small icon of a person on specific waste sites pages to show how many people volunteered to clean up that site.		No. This idea did elevate the entire design to a more social centric application.
PE- low fidelity	Low	I didn't see what the "sign-up" portion of the app would look or feel like.	Expected to see a signup button at the lower portion of the app.	Yes. Sign up process re-designed in a stepwise manner.
PE- low fidelity	High	Mark site as complete	"I think it would be good to lighten up the dark green color for the "mark trash site complete" button."	Yes. Trash sites are administered by the organizations and marked as complete, in progress, or not started.
PE- low fidelity	High	Icon for the Add Trash Site does not communicate desired input.		Yes. Icon replaced

PE- low fidelity	Low	Menu bar on left may be awkward for right handed people	Allow the option to move menu bar	No. Included main menu functions at bottom center applicable to that screen
PE- high fidelity	Low	More background information needed	Provide some information on the organization.	No. The app is not associated to a specific organization yet.
PE high fidelity	Low	Vague terminology	Terms such as Learn How or Become a Warrior should be replaced with Sign Up	No. Besides function, the terminology is also used to convey spirit and a sense of playfulness.
PE - high fidelity	High	Display issues	Formatting of certain screen elements made the prototype difficult to use	No. Beyond the scope of the project.
PE - high fidelity	High	Spelling error		Yes.
PE - high fidelity	Low	Display of text is uneven	Expand text box to width of display	No. Display issues related to adaptive display. Beyond the scope of this project.
UT - high fidelity	High	Buttons are hard to click	Navigation button has difficulty responding	No. This is an artifact of the software used and is beyond our scope to rectify.

UT - high fidelity	High	Navigation issues.	Got stuck on the map page.	Yes. Made the menu icon more visible.
UT - high fidelity	Low	Inconsistent background colors.	Two similar appearing screens, one with green and one with white background.	Yes.

\*UT= Usability Test, PE = Peer Evaluation

Note: Explain why any issues are not addressed, such as amount of time to implement, level of difficulty, beyond project scope, etc.

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