Background: In response to climate change, recent scientific studies using forest inventory data have suggested that climate change impacts can be seen by comparing the northern edge of species ranges for mature trees and younger trees. Younger trees were found farther north than the mature trees, as would be expected if climate is permitting northward range expansion. In this app we will provide a tool for collecting and uploading information about the distribution of mature and young individuals of different tree species. This information will be fed into a central website where they will be collated into a database and map of the range distribution of these two age classes of trees, permitting citizen scientists to contribute to monitoring and research on the effects of climate on tree ranges.

Group4 Members:
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HCI & Usability Instructor: Dr. Robert Pastel
1 Tree Walkers Design Description

The Tree Walkers is designed to enable the citizen scientists’ contributions in forest data collection at the northern US continent. This Android-based mobile system aims to facilitate the participants navigating the forest, building the long term interests, collecting and submitting the plot-based tree data to the central data warehouse, in the meantime receiving the real-time or stored local information help or troubleshooting advice from the central updates. In this project phase, the App used for the field data collection is the main focus and the team is considering re-name it as Tree Plotter App.

After initial meetings with the forest ecology scientist and analyzing the stakeholders and goals, the project team met again to discuss the design paper prototype along with the focused use scenarios. The Walkers team talked about some usability goals and concerns relating to this initial design stage, and a cognitive walkthrough was presented to a group of other non-TreeWalkers project teams in the HCI & Usability class for a quick feedback on Monday, Feb 10th. According to the lecture notes, this cognitive walkthrough is an inspection method for evaluating the design of a user interface, with special attention to how well the interface supports exploratory learning for the first time users without knowledge about the application[1]. The class members and instructors questioned the Walkers team with their initial impressions and also provided the comments in writing later. The recording was sent for the scientist’s review and can be viewed online through (http://cs4760.csl.mtu.edu/2014/water-level-and-thunder-bay-cognitive-walkthrough-video-recordings/). The slides of the cognitive walkthrough for the initial design is filed and available publicly at
The graduate student observed the team’s initial paper prototyping process, briefly touched base with the design team before the classroom cognitive walkthrough, and received the paper prototypes along with the walkthrough slides after the team’s presentation. The heuristic evaluation is conducted at this stage of the design. This is an inspection method for finding certain types of usability problems in a user interface design and usually involves having one or more usability specialists individually examine the interface and judge its compliance with recognized usability principles[1]. The goal of heuristic evaluation is to find the usability problems in the design so that they can be attended to as part of an iterative design process[1, 2]. In this heuristic evaluation report, the independent views from the graduate student will be listed in the following section. To maximize the design contributions, the report will also include the aggregated evaluations from in class comments and instructors’ feedback notes as a supplement. Such a combination will do rather well for this class project, even when the evaluators consist of only three to five people[3].

2 UI Domain and Description

According to the 2012 ACM Computing Classification System (CCS), the Tree Walkers – Plotter App belongs to the following UI domains:

Human-centered computing
  Ubiquitous and mobile computing
    Ubiquitous and mobile devices
      Smartphones
      Mobile phones
      Mobile devices
    Personal digital assistance
    Handheld game console
  Ubiquitous and mobile computing design and evaluation methods

In particular, the Tree Plotter App will utilize the Android framework to develop the multi-touch mobile application. According to the Android, it provides a world-class platform for creating apps and games for Android users everywhere, as well as an open marketplace for distributing to them instantly. The API-UI Guides for Android include a variety of pre-build UI components such as structured layout objects and UI controls that allow building the graphical user interface for the app. Android also provides other UI modules for special interfaces such as dialogs, notifications, and menus[1, 4].

In this Tree Plotter App, the citizen scientists need a UI to allow them effectively express and record information. Sleek, simplicity, powerful and engagement will be the prime aspects when interacting directly with the capabilities of the Android phone experiences. The team defined the target devices to be the recent models(Kitkat, Jelly Bean, Ice Cream, Honeycomb and Gingerbread). There are also other physical interactions involved in measuring, plotting, navigating, sampling and walking for a user to gather plot-based group data successfully. It depends on the further technology development of the tangible computing.
### 3 Heuristic Usability Principles and Usability Problems

*Generated from the Heuristic Evaluation*

The fundamental principle of heuristic evaluation is to have the rules logical and intuitive for any evaluator to judge what means to be a good product[2]. Nielsen’s popular ten principles have been in the system product evaluation for over twenty years, for the project these guidelines are chosen for the initial assessment. The literature reviews for ubiquitous and mobile computing UI domains with a citizen scientist topic in mind are consulted and discussed in section 3.2 below. In addition, there are some principles floated up during the initial evaluations and these are listed in section 3.3.

#### 3.1 Nielsen’s Ten Usability Heuristics Applied to the Mobile App

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<th>#</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>Visibility of system status:</strong> Does the system always keep users informed about what is going on and provide appropriate feedback within reasonable time?</td>
<td>With the current Android phones, most have the signal connectivity, battery status, temperature status available on the home screen or the top through the status bar. However it is still very important to have some indications or reminders to the field users before they can finish the tasks. These can be considered during the development of necessary app’s system messages.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Match between system and the real world:</strong> Does the App speak the users’ language and follow real-world conventions, making information appear in a natural and logical order?</td>
<td>The terms of Instruction, Help, Reference, Resources, Support and Description appear in the prototype many times. There is a need to refine the boundaries of these information and carefully adapt the presentation of information accordingly.</td>
</tr>
<tr>
<td>3</td>
<td><strong>User control and freedom:</strong> Does the App allow users to emergency exit without going through an extended dialogue?</td>
<td>Currently the App uses the Android’s default navigation bar at the bottom to exit the App. This design strategy needs to be reviewed. If the App needs to have an immerse view for better utilizing the screen size and user engagement, the native App navigation needs to be explored. Navigation Drawer might be a choice.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Consistency and standards:</strong> Does the App follow Android convention and be consistent with the wordings?</td>
<td>Android UIs are built on top of views and view groups. The design needs to have a consistent layout, selections of themes and style guides for all text, input and selection widgets.</td>
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<td>5</td>
<td><strong>Error prevention:</strong> Does the App actively prevent a problem from occurring in the first</td>
<td>Error analysis has not been well discussed in the cognitive walkthrough phrase. This needs to be iteratively discovered</td>
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place? through. The design miss the note fields for both the forest and tree views. It needs to be added. Some errors might be coming up such as the note taking errors in compromising the speed, user levels ill-selected, etc.

6 **Recognition rather than recall:** Does the App make objects, actions, instruction, and options visible? For new users, this might not be that intuitive since the App has many views. It takes some mental loads to sort these out what are the required and what are the options.

7 **Flexibility and efficiency of use:** Does the App adapt and be tailored to both inexperienced and experienced users? The App does not seem considering this at this stage. For the first time users, what are the options. For the returning users, what can be skipped or updated.

8 **Aesthetic and minimalist design:** Is the App visually appearing and language concise? The visually appearing of the App prototype needs to be enhanced.

9 **Help users recognize, diagnose, and recover from errors:** Does the error message in plain language and be constructive? Toast messages, color inversion, suggestive, friendly and cute reminders for the error corrections would be smart choices for the citizen scientists App.

10 **Help and documentation:** Is the documentation and help available, searchable, focused? The App will receive the central updates and interleaving information on a schedule. The periodical updates of the App is visible and needed. All information and help needs to be dynamic, well structured or mobile web embedded.

### 3.2 Heuristics Principles From the Literature Reviews

While most Nielson’s heuristics apply well in judging the interface generally, they do not consider comprehensively the characteristics of mobile phones in regard to their physical sizes, usage goals, features, time, infrastructure and resources as well as environment and user characteristics[4-6].

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<td>1</td>
<td><strong>Good ergonomics:</strong> Does the App provide a healthy design in means of color, position, and other choices?</td>
<td>The size of Android needs to be hand-held comfortably and robust enough for the field work. The current design does not utilize the screen real estate well, some screens are lose and some are tight.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Ease of input, screen readability:</strong> Does the App provide easy ways of inputting the data and text/image</td>
<td>The citizen scientist might use the App in different weather and light condition. A design for a quick reading</td>
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</tbody>
</table>
viewability? is necessary. The size of buttons and lists, etc needs to be touchable for all types of fingers.

3 **Personal devices and personalization:**

**Does the App provide a personal experience, allow user to tailor/personalize frequent actions, and protect the privacy as needed?**

Most Android phones are personal devices. Although the App requires the unique identifier such as GPS or time stamp for the activities. Does the setting of the App allow disabling certain function and use the App itself as a sandbox for the novice user before submitting the first set of data?

4 **Multi-interaction models:**

**Does the App provide the interactions beyond the traditional interaction model WIMP (Windows, Icons, Menus, Pointer)? Are the voice, gestures, sensors, and location data recognizable?**

The scientist requested the notes field for the plot view and individual tree view. The design App is missing these components. Some input can be channeled through the voice to text, and gesture to image, etc.

5 **Social aspects of mobility:**

**Does the App have social capabilities such as awareness, presentence and advocating?**

The App is used for collecting more data, therefore spreading the words about the mission/vision/involvement is always important aspects. Does the App provide the tweet, foursquare, fb or other social activities.

3.3 **Additional Heuristics Principles Generated from the Conversations**

While applying the popular heuristics from famous or adopting heuristics from the literatures about the mobile and ubiquitous computing UI in general, the most fun part of the citizen scientist project probably is its users population and their characteristics. Here are some unique heuristics generated from the initial

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<td>1</td>
<td><strong>Engagement:</strong> How often does the citizen scientists use the App? What’s the retention rate and the promotion guidelines?</td>
<td>The App defines three levels of the experience, and with default setting for all as novices. The team needs to find a mechanism or reasoning for level promotion to ensure the data quality requirement.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Scientist interests and Citizen scientist’s interests:</strong> Does the App cover interests for all stakeholders?</td>
<td>Some data might be interest to the citizen scientists’ favor for local App enrichment, while some might be needed as required for the formal business by the scientist. The team needs to refine some of these distinguishes.</td>
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</table>
3 **Broad impact:**
Can the App be used for other regions of the US continent?
The App is defined for the US northern continent. However the system could define a capability to adjust for other regions, etc.

4 **Device conversions:**
Does the App only run on certain devices?
The team needs to clarify the supported devices and the resolutions for previous versions of Android devices.

4 **Critical Usability Concerns**

The critical usability concern for the current paper prototype is the navigation. First as the layout of the New Tree Plot, Update Plot, Personal settings and Measurement Ref on the home screen, it becomes a flat view and increases the mental load for the initial users. Otherwise the App needs to provide streaming of messages, “no, you have to start to here or there.” “blah, blah and blah.” However such a layout is good for the advanced users to get quick access to the needed functions like a miniature dashboard. In addition, the design uses the Android default navigation bar at the bottom. This reduces an immerse experience and creates time strains in a field setting.

5 **Illustrate the Critical Usability Concerns with a Short Story**

Imaging a one hundred acre of woods, Walkers team started a new adventure to picture, eyebrow and measure the tree species. This was a bright day and the Tree Walkers App was just released through the Google Play(Android store) for their classes to beta test out. Walkers teammates invited Dominica, Van, Jean, Nina, Lee and Rob, and scouted into the UP Thunder Bay woods. Touching the Tree logo to start, the screen popped up along with a gentle greeting, “Welcome, you are new and a novice. Please get your profiles set up before we move on.” Everyone pulled out their devices and got their aviators up. “Where should I start?” “New Plot?” “Learn how to measure the size?” “Foursquare myself?” blah, blah and blah.

6 **References**