FootPrints

Learning your city one step at a time

ECE 1778 | Final Report

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Introduction

We move through the city without really paying attention to what is around us. We are so wrapped up in our own lives and distracted by the steady stream of information on our smartphones that we don't take time to notice or appreciate our environment. Numerous articles and reports have been written about the acceleration of contemporary society, and the detrimental impact that internet and smartphone technology are having on our attention spans (Chakrabarti 2013, Hamilton 2008, Most 2010, Shin 2014). This does not bode well for landscape architecture and urban design, both disciplines that strive to create comfortable and enjoyable spaces in the city that are animated by engaged users. Public space now needs to compete with the digital sphere for our attention. This warrants the question: How can we use digital technology to transform the way people interact with their surroundings?

The primary goal of this mobile application is to reconnect people with the urban environment, in order to enhance our experience and appreciation of the physical, sensorial, cultural and ecological aspects of our surroundings.Thus, Footprints promotes engagement with the urban landscape in a number of ways:

- by incentivizing exploration of the city on-foot
- by inviting users to take notice, record, describe and share their perceptions
- and by elucidating hidden or invisible attributes that have shaped the form and flavour of the city in some way

The secondary goal of the application is to create an evolving resource of user-generated urban perceptions to enhance urban analysis and inform urban design.

Apper Context

Within the urban realm, some of the primary aims of landscape architecture are to *engage, entertain*, *educate*, and *activate* public spaces, and in so doing, enhance their value or interest for users.

The Footprints application represents a departure from traditional landscape architecture techniques, in that it aims to achieve these goals through digital rather than spatial means, while still having relevance for spatial design. Simultaneously, the app exemplifies the adaptation of engagement strategies associated with internet culture, which have been shown to be successfully applied in other domains in which the optimization of user experience is of critical importance (i.e. museums, national parks, marketing campaigns, etc). However, these tactics have not yet been applied to user experience within the urban landscape. Thus, the app raises the question of whether landscape architecture can -or should- begin to incorporate social media and information communication technology as viable tools within our discipline.

Although much more time and testing by the public is necessary to ascertain its success in applying techniques and achieving the aforementioned goals, preliminary testing has been encouraging. It *engages* users with the urban landscape by providing incentives to explore, notice, record and share (see figures 1-2 on page 5). Marek Pacal, a test-user, stated after using the app:

> " I never look at the city like this… I walk down the street a million times but I never look up… It's like seeing the city for the first time".

It *educates* users by a) revealing layers of local cultural, historical and geological information and b) creating a crowdsourced wiki of localized trivia and experiential data (or will, once it is connected to a server in which other users can see and add content to landmarks). Finally, the app has the potential to *activate* public space by retraining urban dwellers to be more attentive to their surroundings and, therefore, more present within it.

The app's relevance for spatial design relates to the archive of user-generated data that will be created once the app is connected to a server. In our discipline, community consultation is considered to be an integral aspect of the design process – however, this is frequently done in formal town hall-type scenarios or small-scale design charrettes that are useful but are often criticized for a lack of diversity and by only gathering the opinions of a small sub-set of stakeholders. By emphasizing user

experience as the primary goal of the app, it is able to elicit authentic insights from a broad spectrum of people. As an evolving compendium of user-created content, it has the potential to elucidate the dynamic, multi-vocal perspectives, interests, and concerns of urban residents in a unique way. This will facilitate a deeper and more nuanced understanding on the part of the landscape architect or urban designer, thus enabling the creation of more culturally, ecologically and socially-sensitive design that is therefore more relevant to the community.

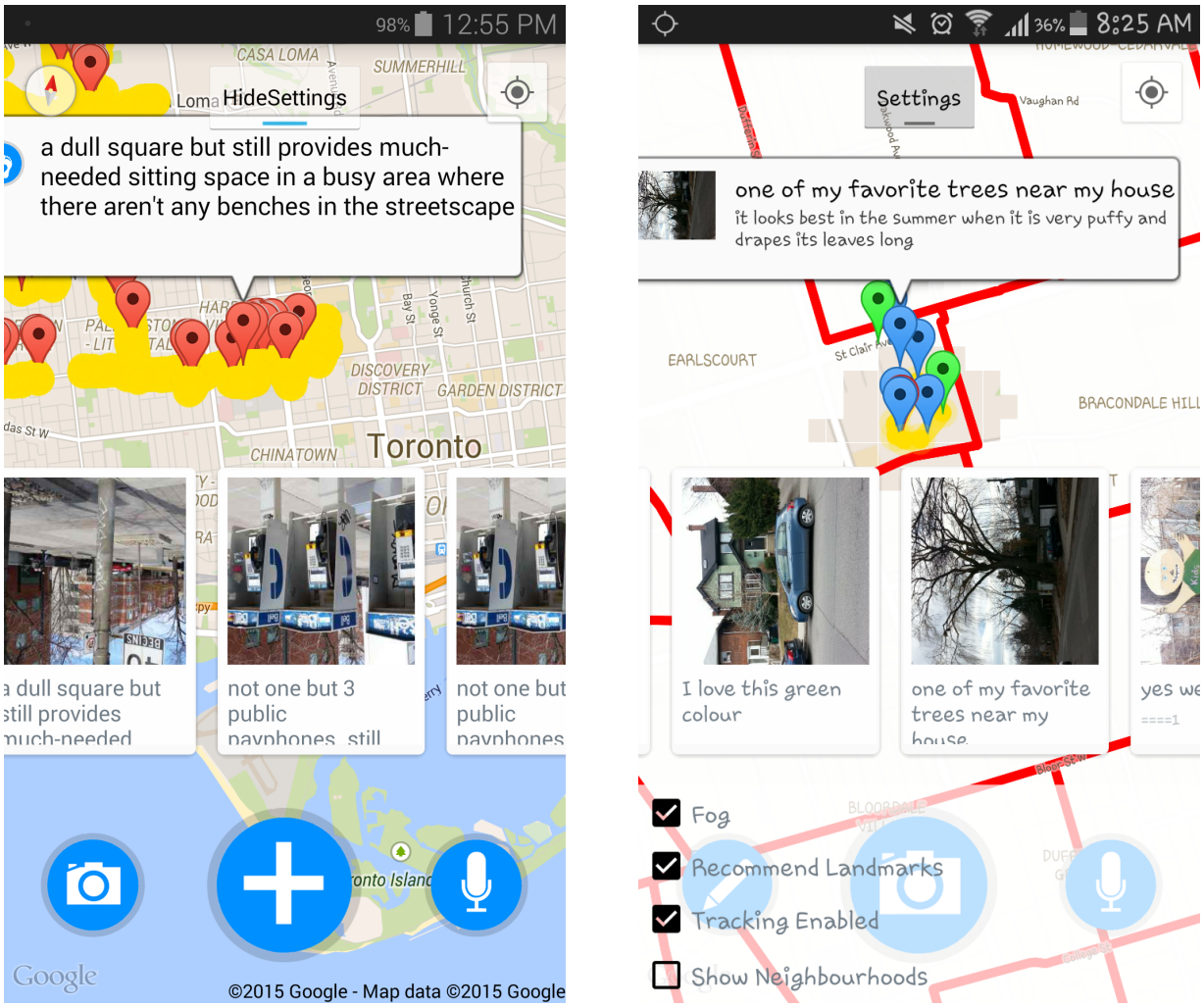
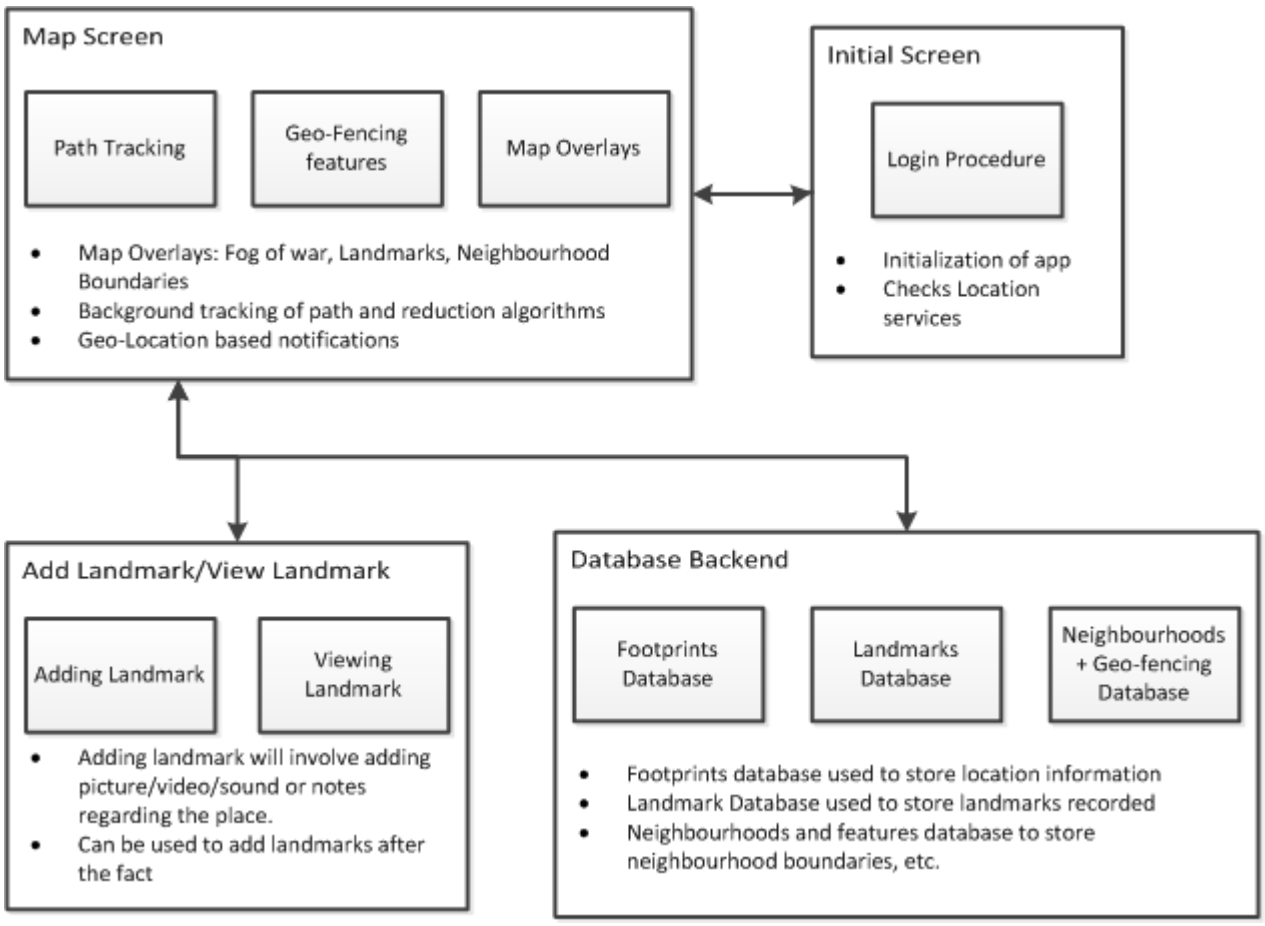


Fig. 1 Two different user's walks and perceptions suggest very different concerns and points of view.

Overall Design



Block Description

Initial Screen

This block is responsible for allowing users to login and access access the information. This block also checks to ensure the user has the right settings enabled, such as GPS.

Add/View Landmarks

These blocks facilitate the storage and interaction of the app with the landmark database and the user. The landmarks are presented in an easy to view and access method through these blocks. They are also responsible for allowing the user to add landmarks on their journey.

Map Screen

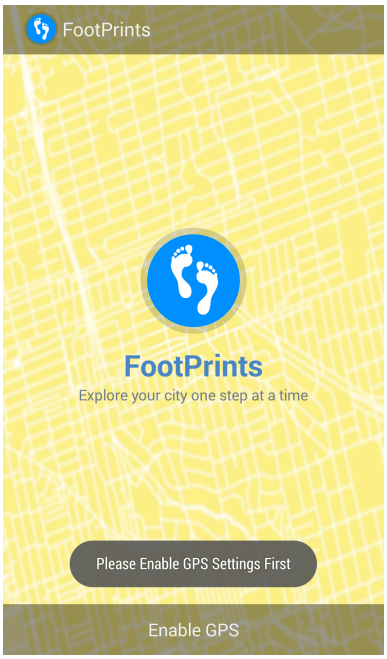
These blocks are responsible for keeping track of the “uncovered” areas explored by the user. It has two components, the updating of the map and interfacing with the database. The updating of the map will require it to interface with GPS, accelerometers before updating the map. These also include functions which handle the optimization of the data, and improve location accuracy.

Database Backend

These are SQLlite databases storing persistent information regarding the activity, landmarks and neighbourhoods. The input and output of data is called through functions contained in other blocks.

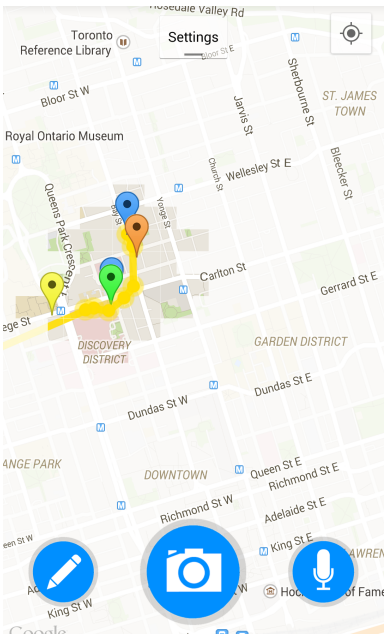
Statement of Functionality

The purpose of our app is to reconnect the users with their urban landscape. There are two ways we promote engagement. The first is by providing a tool to track the user's trails and provide a platform to record the interesting things they've experienced along the way. The second is by providing additional information on unexplored areas to promote interest. The following are the functionalities we implemented to achieve our goal.



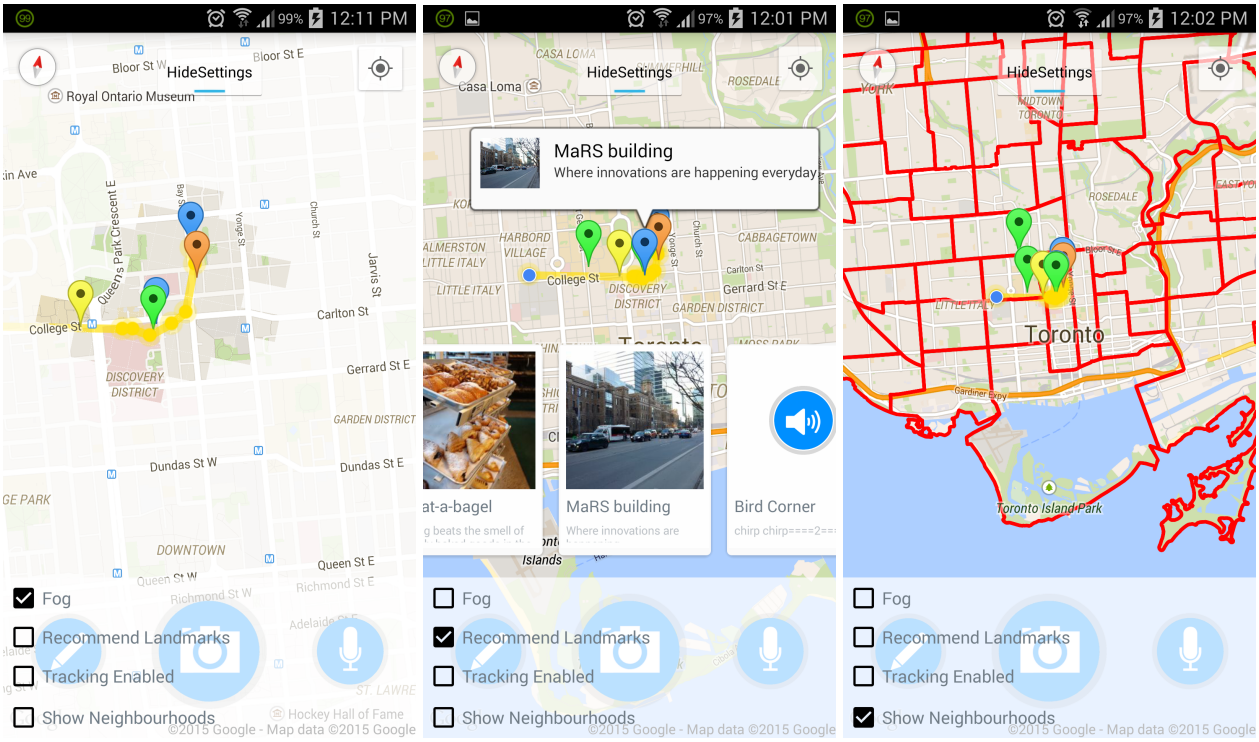
1. Login Screen

The login screen is the first screen the user sees when the application is opened. The initialization steps are started here, includes the loading of geofencing data, as well as checking for the availability of GPS. If location services are unavailable, the user is prompted to enable GPS by clicking on the button at the bottom, which would lead them to their phone's location settings. The same button becomes a login button once location services are enabled. Currently, it lacks user account controls as the application runs only on the user's device and does not communicate with any online servers.



2. Map Screen

After logging in, the map screen is loaded. This screen is the main activity screen for the application. Tracked paths and landmarks the user created are displayed on the map. The settings button located at the top center of the screen toggles the setting menu, which allows the user to enable/disable recommendations, fog-of-war overlay, location tracking, and geo-fencing. The blue add landmark buttons, as well as long click on the map allows user to add marker at the current or clicked location.



2.1 Fog-of-war (Fog)

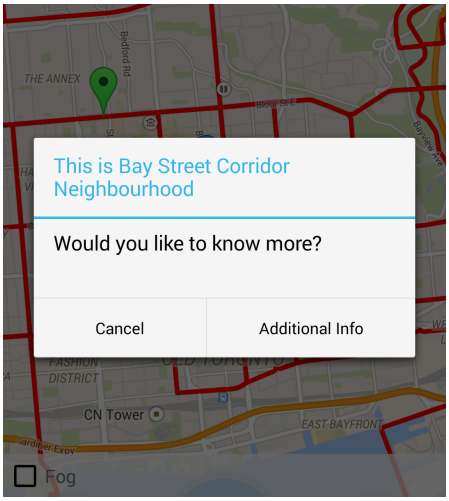
The fog covers all the user's unexplored regions. By hiding those areas, there is contrast created between explored and unexplored areas, which makes it easy to gage the amount of the city the user engages with. This knowledge and drive to expand into the unknown promotes further exploration. There is a slight delay while the fog is generated; the delay proportionally increases as the number of location tracking points increase, which may take away from the user experience.

2.2 Landmark Recommendation

Individual landmarks as they are seen on the default map view is very limited in the amount of information they provide to the user. The recommendation scroll bar is an easy way for the user to quickly browse through the existing markers. When clicked, the associated marker is centered on the map, where the user can view more details for the landmark. The recommendation is currently sorted by the time each landmark was added. To enhance the functionality to user, additional filtering options such as by distance or by tag can be implemented.

2.3 Geo-fencing (Neighborhoods)

When enabled, this feature shows the neighbourhood boundaries in red and allows user to explore information regarding the area. This feature has two inefficiencies caused by the large number of points used to represent the neighbourhood boundaries, and drawing all the neighbourhoods. Future implementations should reuse the point reduction algorithm to pre-process the neighbourhoods and reduce processing time. While also utilizing an algorithm to selectively draw the on screen neighbourhoods only.



2.4 Backend Path Tracking

The path tracking algorithm is initiated whenever a location is updated by the GPS. The locations are pre-processed by only saving points that are better (based on the relative time, speed, and accuracy). There is an additional system that also looks at the speed of phone and pauses the GPS when the speed is slow. The GPS updates are resumed if there is a significant motion detected. The locations from this pre-processing is then saved in the database.

The saved points are then filtered by vortex cluster reduction and Douglas-Peucker algorithm in order to return a clean polyline for the path (Sunday, 2012). Unfortunately, these algorithms do not eliminate inaccurately traced points by the device's location services. In fact, these algorithms create vertices around the inaccurate points and accentuates the error. To get around this, an algorithm was implemented to eliminate sudden jumps in location. The resulting path is much cleaner and faster to load but still not perfect. Google web services can be integrated into the application along with other algorithms to improve the trace in the future.

2.5 Backend Geo-fencing boundary detection

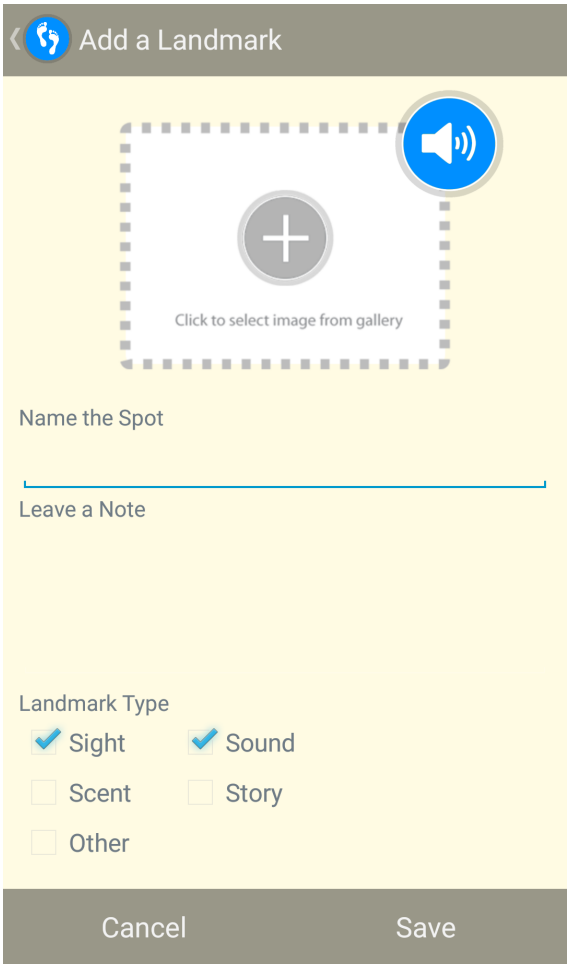
The backend boundary detection takes the saved point and uses a Ray-Casting algorithm to determine which neighbourhood it is in. Currently, the algorithm is extremely fast despite the need to go through all the neighbourhood, and it works well in determining boundary crossings. There is a slight accuracy issue along the boundary of neighbourhoods, however, this isn't an issue due to the inherent inaccuracies of GPS being more significant.

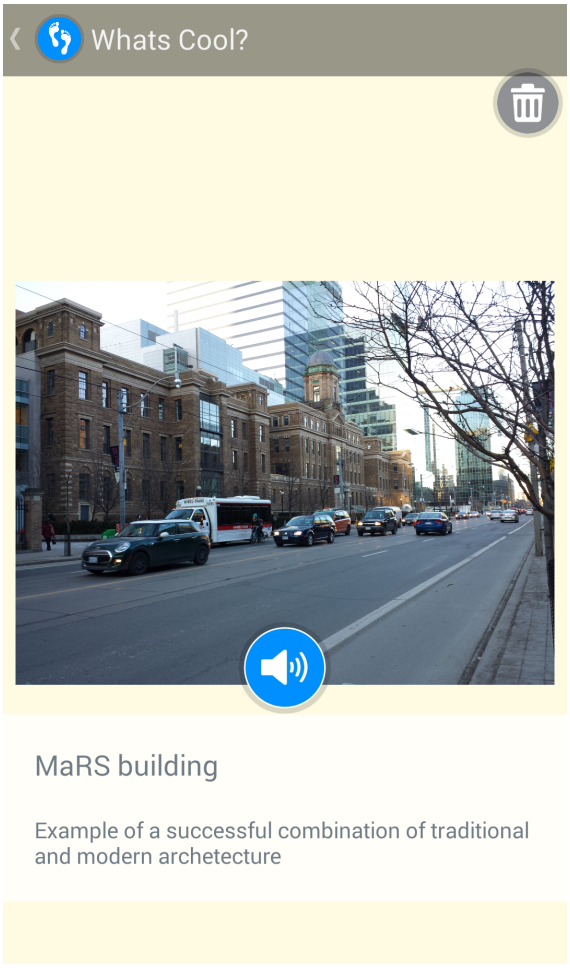
3. Add Landmark Screen

This screen allows the user to review captured media, such as pictures and audio, or attach an image from the photo gallery on their phone. The tags are selected automatically depending on if an image or sound has been recorded; however, the user can change the associated tags as they see fit. The application prompts for a name for the landmark in the case the user does not enter one before saving.

4. View Landmark Screen

This screen is accessed by clicking on the information button for each marker. Here, the user can view the image and notes associated with the marker, playback audio clip if any, and delete the marker.





Key Learning

Keiming:

The main purpose of this application was to develop an application that would enhance user experience. As such, there were many design decisions that needs the consideration of the user scenarios. One example is the requirement of user location before being able to save landmarks. This was a small issue that provided much more friction in the day to day usage. As all apps interface with users, it becomes imperative to plan ahead features and how it will affect the user. This was a major learning as most applications I have dealt with previously required little user interfacing.

Cathy:

Through working on this project, I have learned the importance of building applications in spirals, starting with the minimally viable product and the core functionalities. To have the basic services running smoothly before jumping into more supplementary features. I have also learned the capabilities and limitations of the Google Maps Android API as well as location services.

Rachel:

Due to the app's emphasis on user experience, it needs to be tested by several/many people, and to have both the user experience (of the app itself and of the urban landscape) and the collected data needs to be analyzed to see if it is achieving its goals. Although the three of us tested it amongst ourselves once the main functions were up and running, it was only in the past few days that I have begun testing it with other users. This has provided useful data and feedback that would have been beneficial earlier in the design process. I have learned the importance of testing engagement strategies in order to improve on them with each spiral.

Contributions

Kei-Ming:

- Local databases to keep track of user information (location, markers, etc)
- Geofencing and geo-location based notifications/features
- Location tracking services
- Media recording (Camera + Voice)
- General debugging.

Cathy:

- Fog-of-war system based off user locations
- Path generation algorithms (also reduces number of points stored)
- Graphical user interface
    - Layout, coding and implementation of different ways to present the information in an easy to access manner.
    - Marker info, detailed view, and recommendation scroll.
- Audio Playback

Rachel:

- researching precedents and methods of engagement for enhancing user experience within the urban landscape
- sourcing, editing and converting data sets (neighbourhoods, heritage conservation districts, buried streams and the historic shoreline)
- app testing
- mockups
- presentation and report assembly and design

Future Work

There are several additional functions that would be beneficial to enhance the experience of the urban landscape and make the app more interesting for users.

We would like to implement additional additional engagement features such as:

- visibility of more invisible layers/boundaries in the urban landscape such as:
    - heritage conservation districts
    - Toronto's historic shoreline
- keyword, time and date filtration to allow users to create customized routes based on themes they are interested in (i.e. history walks, sounds of the city, street art, favourite views, etc)
- visibility of other users' landmarks
- the ability to share your routes with friends in your social network
- reward system that enhances the gamification aspect of the app and gives further incentive for exploration (i.e. users can become experts on certain areas of the city that they have explored in-depth)

Finally, we would like to implement the database of user-generated content in order to achieve the secondary goal of the app, which is to improve landscape architecture and urban design by providing a unique source of qualitative urban analysis.

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