Innovative Mapping

IPRO 303 Final Report

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Team Members: **Aric Austermann, Jacob Ernst, Pallavi Gupta, Anam Khan, Aaron Komoroski, Mark Michael, Scott Mochinski, Ameena Payne, Ernesto Ramirez, Peter Sanborn, Piyush Sinha**

Sponsored By: NAVTEQ

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1. Executive Summary

NAVTEQ, the sponsor of this project, is one of the largest digital mapping companies in the world. They are in a constant phase of self-improvement. This semester, NAVTEQ asked IPRO 303 to focus on pedestrian navigation, using the new approach of "micro-landmarks": the creation and implementation of prominent, easily distinguishable fixtures that pedestrians can use as meeting places or waypoints for navigation. The goals of this semester were twofold: confirming the public's interest in the project and developing a mock interface for reporting the landmarks.

After forming the two subgroups that make up the structure of IPRO 303, the team began working right away on planning out the semester. The result of this was a definition of what needed to get done and in what time frame. There were two clear phases of work: research and design.

The research phase lasted nearly all semester; the team conducted surveys to gauge general interest in micro-landmarks and interviewed local officials to determine who would report micro-landmarks. The team discovered that people are generally receptive to the new concept and city officials are surprisingly willing to help.

Using this information, the team designed a mock reporting system used on a handheld device, i.e. cell phone or PDA. After some discussion and refinement, the final interface was created and presented to NAVTEQ. Any implementation of this interface onto an actual device or marketing of this idea is left as a subject for next semester's team to work out with NAVTEQ.

2. Purpose and Objectives

The sponsor of our project is NAVTEQ, a Chicago-based provider of Geographic Information System (GIS) data - a dominant company in providing the base of electronic navigable maps. Our sponsor is one of the largest digital mapping companies in the world. Currently, NAVTEQ's focus is on how to make their technology more community and pedestrian friendly.

NAVTEQ has presented our group with the challenge of finding an easy, user-friendly way for pedestrians to incorporate local knowledge into NAVTEQ's map data. This interaction between pedestrians and NAVTEQ will come in the form of user-suggested updates as well as input regarding "micro-landmarks," a term coined by NAVTEQ. A micro-landmark is defined by the company as a meeting place, road sign, or any sites known to locals as a place of interest.

Our goal is to construct a practical, innovative, and simple solution to the problem at hand. Our project consists of the following four objectives: 1) define micro-landmarks (which includes establishing criteria), 2) determine micro-landmark data providers, 3) establish a reporting process for NAVTEQ to authenticate data/information, and 4) develop a prototype.

The proposed solution will be testable to improve its usability and ensure that it is in accordance with out team goals and vision.

3. Organization and Approach

The team was faced with many challenges. With only a concept and the as-of-yet undefined term from Navteq, **'micro-landmark',** the team first had to develop the concept of what would constitute a micro-landmark. After visiting two different sites and back-and-forth discussions between all team members, four equally weighted criteria for what constitutes a micro-landmark were established. From this, a formal definition of the word micro-landmark was established.

The research team then conducted surveys to establish whether or not the general public thinks that micro-landmarks would be a valuable feature to their navigation systems. Survey participants were also asked whether or not they would be willing to contribute data regarding micro-landmarks to NAVTEQ. Based on these surveys as well as on team collaboration, the team then had to address the issue of who should be the providers of data to NAVTEQ. The issue of data authentication was also addressed by the team. The issue of data authentication was also tied in to ethical issues that arose regarding the use of the data that would be provided.

3.1 Team Structure

The task consisted of multiple parts; those aimed at creating and forwarding the NAVTEQ user feedback system and those aimed at formulating its business strategy. Consequently, Innovative Mapping divided into two sub-teams defined as the Development Sub-team and the Research Sub-team.

a. Sub-team description

Each of the sub-teams worked closely with each other to ensure that proper communication was facilitated and that there was minimal wasted effort toward an idea that another group might find unreasonable to pursue. The close communication facilitated better-quality ideas that work toward creating a successful user feedback system.

Sub-teams were responsible for their own documentation. Leaders were responsible for managing the progress of their sub-teams. Additionally, the sub-team leaders were responsible for ensuring constant communication between sub-teams, co-team leaders, and the project advisors.

b. Research

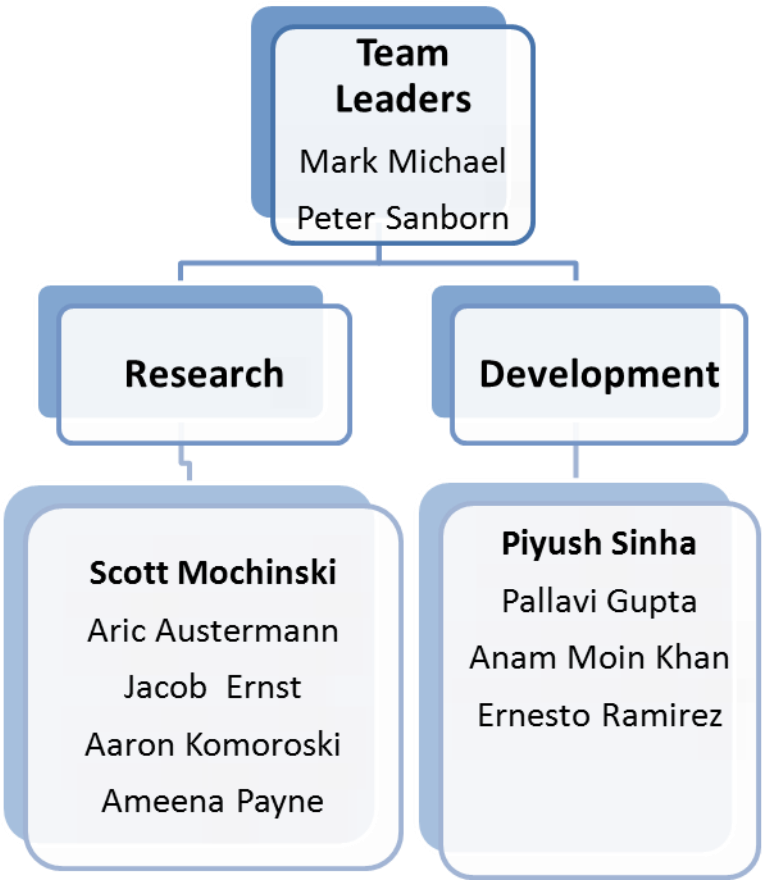
The Research sub-team was assigned to conduct research to find who the vested users will be. The Research consisted of various stages, where each stage depended on the results from the earlier surveys. Through the first survey they were able to determine the most common way of transportation and also who will be most likely to provide data. The following step the research team took was to contact district representatives to gather information as to what they consider to be micro-landmarks.

c. Development

The Development sub-team was responsible for developing potential solutions. They created two plausible solutions out of the many ideas the entire team came up with. The solution they took to develop the feature was to have different members find possible routes and use the micro-landmark feature as guidance for the route. They took data found from the research team to develop a rating solution for the micro-landmarks found on the map. They also compiled a report of all their findings and presented their information accordingly.

d. Presentation

This sub-team was created specifically for creating the IPRO presentations to the IPRO Office and to the sponsor, NAVTEQ. Because these were important presentations, whoever was needed for that presentation was on the team, so the amount of people on the team was able to change according to sub-team.



3.2 Team Meetings

The Spring 2010 Innovative Mapping team met every Tuesday and Thursday afternoon. Meetings were utilized as a forum for members of the Innovative Mapping project to present reports on recent developments, to address obstacles faced within the sub-teams, and to discuss what these meant for the entire group. Solutions were then brainstormed and discussed until a final result is achieved. Additionally, time in class was spent reviewing and revising the set schedule of events to make sure the issues outlined were relevant and realistic based on progress to that point.

3.3 Activities

The team researched how and what would be required in the gathering of data to provide to NAVTEQ. A group of activities are involved in this process. These activities fit into two chronological phases:

- Phase I (January until Mid-April) - Research phase. During this phase the team:
    - Studied the requirements that were given by NAVTEQ
    - Conducted site visits
    - Conducted surveys
    - Discussed research/surveys results
    - Defined "micro-landmark"
    - Defined the ideal end user
    - Defined the micro-landmark data provider
    - Met with chamber of conferences and alderman to gauge interest in providing data
    - Defined the requirements
    - Proposed achievable and realistic solutions

- Phase II (April) - Development and Testing phase. During this part of the project the team:
    - Develop a template for "micro-landmark" reporter
    - Develop a template for "micro-landmark" user
    - Propose methods for validation

4. Analysis and Findings

4.1 Initial Definition

The first thing that the team decided to do was to come up with the definition and criteria of the micro-landmark. It is not a term that is found in the dictionary so the team had to come up with a definition that would be clear to anyone.

Micro-landmark: A specific site, or prominent object, of unique visual importance that a pedestrian may find useful or significant for precise navigation.

The criteria for something to be classified as a micro-landmark are given below:

- Permanent
- Unique to the surroundings
- Easily observable
- Culturally unbiased

After setting up the definition, the team broke into two groups and researched two locations to determine whether the definition was complete. Two site surveys were done. One team went to IIT and the other to O'Hare United Airlines Terminal. They came back with suggestions regarding the criteria. The consensus was that the criteria needed to be granulated. Using suggestions from the team, a more descriptive criterion was set up.

Thus the definition of a micro-landmark was changed to any object that satisfies all of the following four equally weighted and essential criteria:

1. **Unique** - the object must be unique to the immediate surroundings. Thus, a tree would not be considered a micro-landmark if there were other trees in the immediate area.

2. **Easily Observable** - the object must be easily observable to PEDESTRIAN traffic. The micro-landmark should fall in the normal field of vision of the average pedestrian. Thus, an object that might be visible at a distance from the freeway while traveling in a car, but not visible to a person walking down the street, would not be considered a micro-landmark. Likewise, an object that is 500 feet up in the air would not be considered a micro-landmark.

3. **Permanent** - the object must have been placed at its location with the intention of it being in that location permanently. In other words, there should be no set plans to remove the object in the future at the time the object is placed. The intention of permanency allows for the understanding that relatively few things are eternal. Thus, an inflatable snowman placed in front of a business during the holiday season, not intended to be there all year long, would not be considered a micro-landmark.

4. ***Culturally Unbiased*** - the object itself, or the designation of the object must be culturally unbiased to reflect that different cultures have different concepts and names for various objects. Thus, a mailbox would have to be named something else to be considered a micro-landmark since the word "mailbox" is not universal nor is the concept of what constitutes a mailbox.

4.2 Surveys

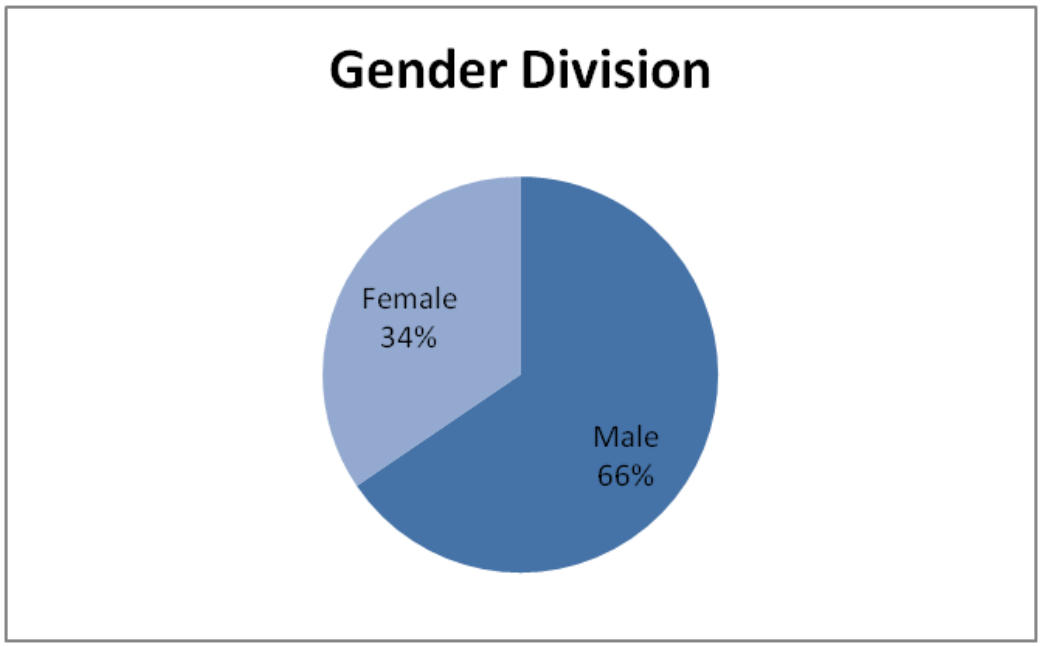
Next, a survey was setup to see how many people would be interested in the using the feature of micro landmarks. We got a response from 58 people. Sixty-five percent of the survey takers were male, and thirty-five percent were female. Survey takers ranged between the ages of 16 to 70. According to the survey, the two most common modes of transportation within Chicago are the Chicago Transit Authority (CTA) and personal cars, respectively. After parking their cars or getting off at train/bus stops, these types of commuters all become a part of the pedestrian pool.

When asked how they direct people to locations, most survey takers responded that they use web maps, GPS, or phone applications. Street intersections and landmarks were the next priority, respectively. Once introduced to the idea of micro-landmarks, a vast majority of survey takers thought that such information would be useful to them; however, a few commented that they would like to see an implementation of the idea in order to come to a decision regarding the product.

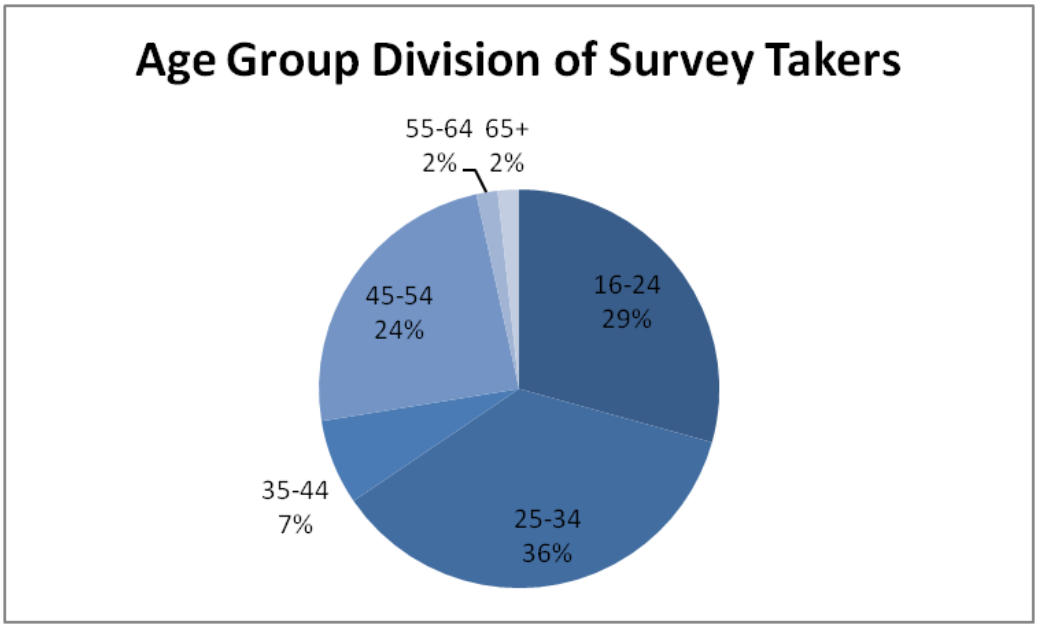
Sixty percent of survey takers were willing to provide NAVTEQ with information regarding micro-landmarks. The three options they would choose for reporting were texting, web or phone applications. People weren't open to the idea of paying for the application and thought it should be free since Google already provides it for free and they do not feel it is a good idea to put a price tag on a public service since the information is provided by the public.

A detailed question by question survey analysis is found on the following pages.

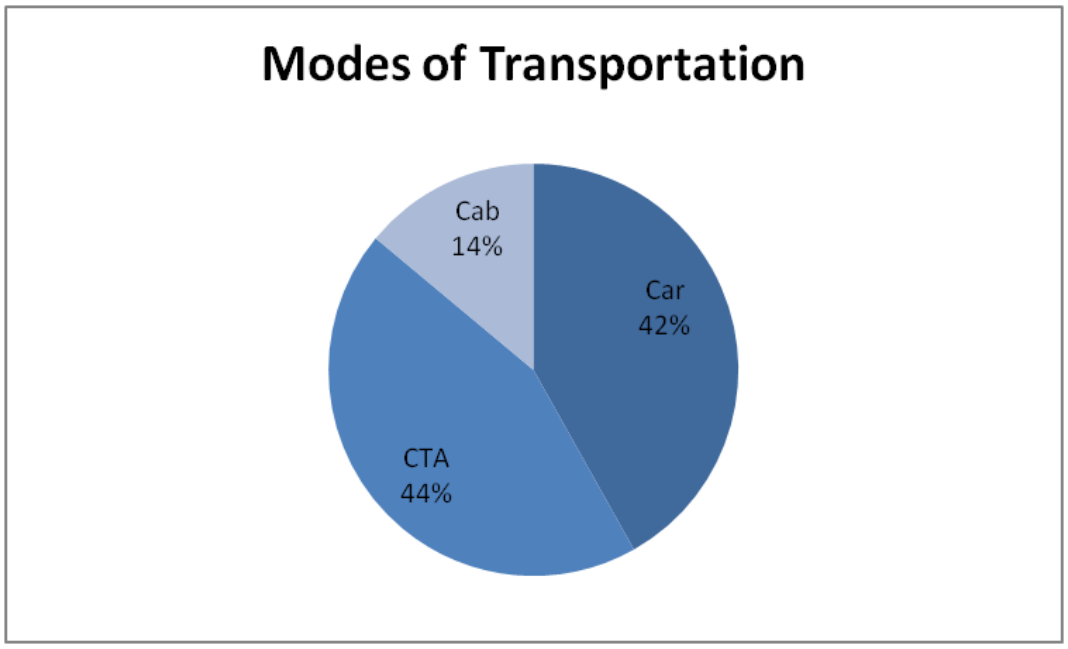
Question 1:



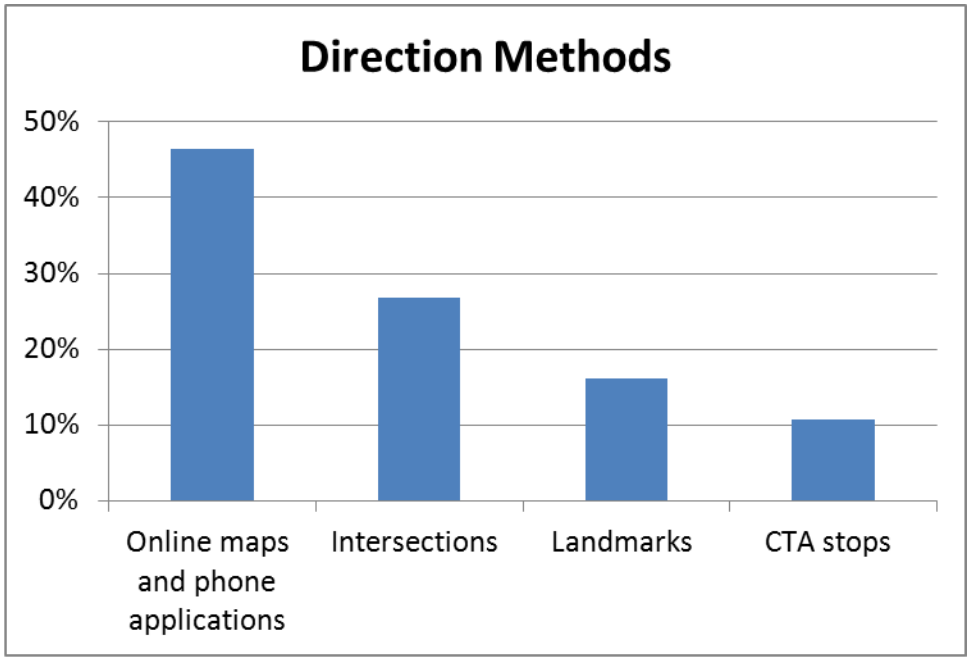
Question 2:



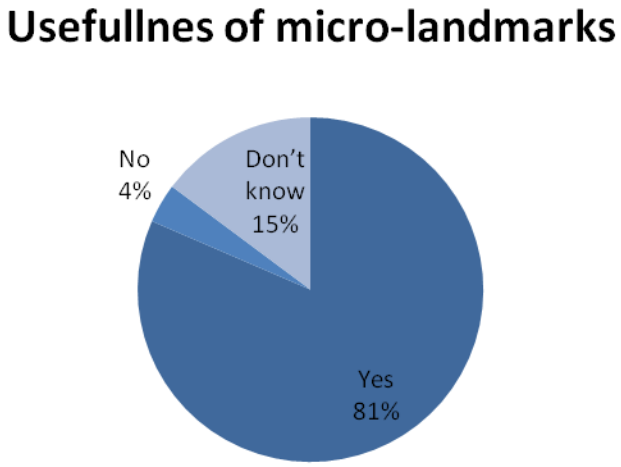
Question 3:



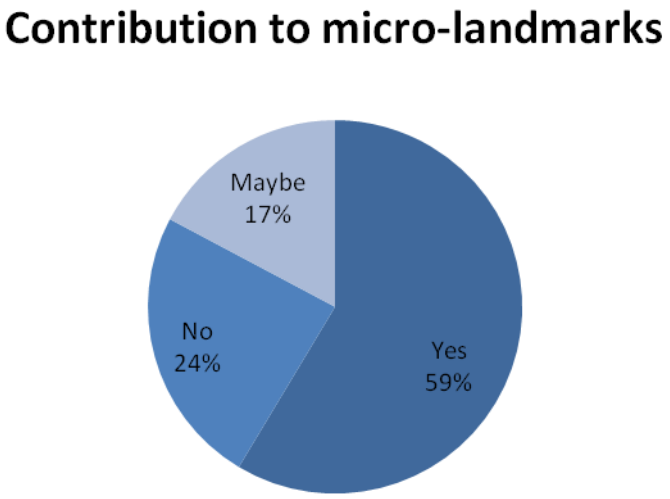
Question 4:
How do people direct other people for locations?



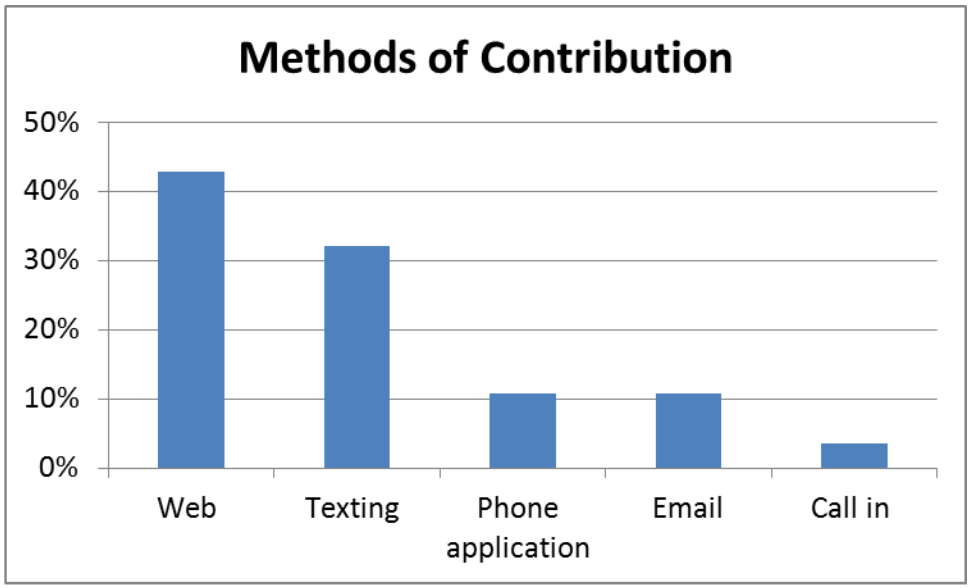
Question 5:
How useful would you find the micro-landmark feature?



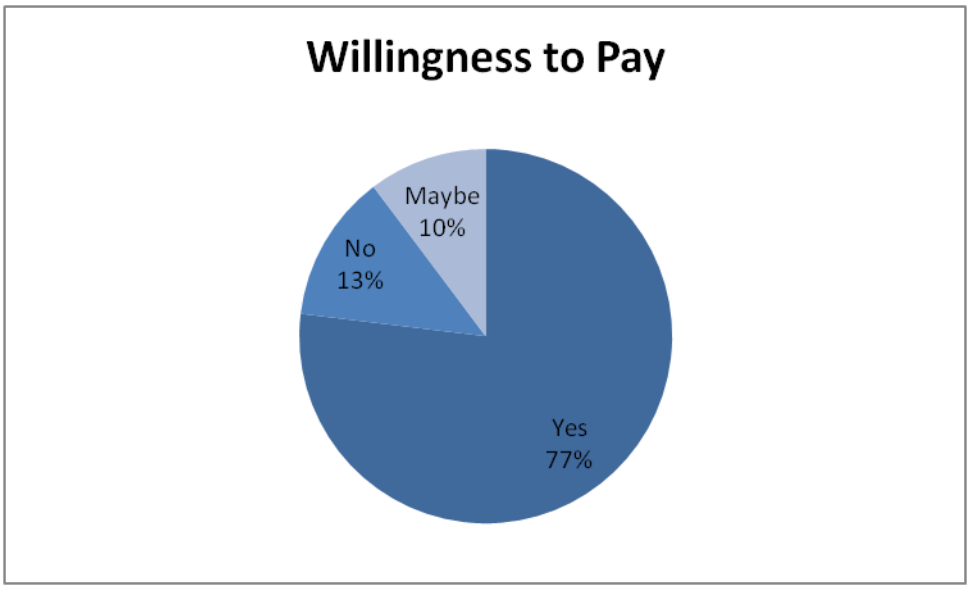
Question 6:
Would you contribute to the feature?



Question7:
What method of contribution would you like the best?



Question 8:
Would you pay for the feature?



4.3 Micro-landmark Data Providers

In order to figure out who would be the best suited for providing the team with data for micro-landmarks in Chicago, they started out by having some of the members contact Chicago-area Chamber of Commerce organizations, particularly one in Bridgeport. There they found out that it would be a better idea to try contacting alderman of the different City of Chicago districts, as each has local knowledge of their area, which would help them to come up with the data they required about the different micro-landmarks.

The aldermen would be reliable since they are responsible for the well-being of their community. This would help locals in the area to navigate more easily on foot, as well as being able to help out their community. In addition, some of the wards contain neighborhood associations that may be willing to participate in providing data for us. They started by contacting the aldermen individually by email and then by phone to set up face-to-face interviews to explain our project and request their assistance. They were able to confirm meetings with the aldermen of Ward 32, 43, and 50.

When meeting with some of the aldermen, the team found that they seemed to be very receptive to the idea of providing the data for potential micro-landmarks for pedestrian navigation. Initially, they were unsure of the time commitment involved, so were wary of the idea as summer is nearing and there are so many summer events that they need to put together. However, once the team told them that the data they are providing would be on a periodic basis and that the frequency of the data they would provide would be up to them, they were more willing to help us. At this point, the team needs to make sure that they are willing to provide us this data about the micro-landmarks in their area of Chicago.

5. Conclusions and Recommendations

As a result of these findings, the team developed an interface that can be implemented on any mobile mapping device that has access to the Internet. Whether or not this solution is implemented or used is up to our sponsor. Innovative Mapping was successful in understanding the challenge given, identifying what we could work on as a team, and putting our diverse backgrounds and knowledge together into a solution that meets the goals of both our sponsor and our team.

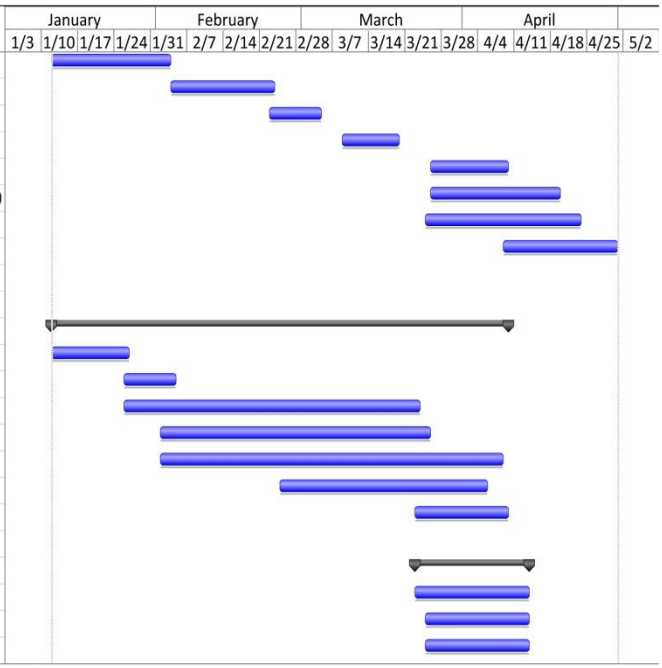
A recommendation for the continuing IPRO is to look more into identifying who the data providers for micro-landmarks would be.

- Identify and describe the micro-landmark data providers and their responsibilities.
- Find a way to authenticate the data provided and ensure that it follows the criteria.
- Ensure that the data provided is unbiased and based on local knowledge as opposed to businesses trying to advertise themselves.
- Finding how NAVTEQ would benefit from the feature monetarily.

6. Appendices

Gantt Chart

ID	Task Name	Start	Finish
1	Project Plan	Tue 1/12/10	Wed 2/3/10
2	Midterm Review Presentation	Thu 2/4/10	Tue 2/23/10
3	NAVTEQ Presentation	Tue 2/23/10	Thu 3/4/10
4	Ethics Bowl	Tue 3/9/10	Fri 3/19/10
5	Final Project Report (Draft)	Fri 3/26/10	Fri 4/9/10
6	Poster/Brochure	Fri 3/26/10	Mon 4/19/10
7	Final Presentation	Thu 3/25/10	Fri 4/23/10
8	Final Project Report (Final)	Fri 4/9/10	Fri 4/30/10
9			
10			
11	**Research**	**Tue 1/12/10**	**Fri 4/9/10**
12	Study Requirements of NAVTEQ	Tue 1/12/10	Tue 1/26/10
13	Site Visits	Tue 1/26/10	Thu 2/4/10
14	Define "micro-landmark"	Tue 1/26/10	Tue 3/23/10
15	Define ideal end user	Tue 2/2/10	Thu 3/25/10
16	Define data providers	Tue 2/2/10	Thu 4/8/10
17	Surveys	Thu 2/25/10	Mon 4/5/10
18	Alderman Interviews	Tue 3/23/10	Fri 4/9/10
19			
20	**Development**	**Tue 3/23/10**	**Tue 4/13/10**
21	Template for use	Tue 3/23/10	Tue 4/13/10
22	Template for submission	Thu 3/25/10	Tue 4/13/10
23	How data is validated	Thu 3/25/10	Tue 4/13/10



Budget

The following is a list of materials and cost that were used to complete the project:

Item	**Total Cost**
Team Building Event	$ 300.00
IPRO Day Booth	$ 40.00
Total	$ 340.00

Team Roster

In the beginning of the semester the team created a roster which easily explained how each team member would be an asset to IPRO 303. After creating the list of available assets, the team was able to create a process that took full advantage of all asset and create a solution for Innovative Mapping IPRO. The team roster also gave the team the ability to look at the available skills and created tasks that were specifically tuned for each team member included.

Aric Austermann
Year: Fourth Year
Major: Architecture
Description: Aric has experience working as a part of a team and doing research projects. His researching insight will ensure that the team covers all aspects while compiling data obtained from their own research. He has experience using various navigation software and hopes he can contribute by making applications more accurate and user friendly. Aric hopes, through this IPRO, to create a more precise and larger catalog of map locations and directions.

Jacob Ernst
Year: Fourth Year
Major: Architecture
Description: Jacob has participated in many research projects and thus has honed his presentation skills. These skills will be invaluable once the time comes to present the finished product to the users and to NAVTEQ. He has worked with GPS software and car navigation systems. He is interests include developing a communication link between software users and the NAVTEQ via this project.

Pallavi Gupta
Year: Third Year
Major: Electrical and Computer Engineering
Description: Pallavi is strong in the area of technical problem solving. She has a background in circuit and software implementation which will be beneficial to the project. She is looking forward to working with this multidisciplinary team of fellow students and together, come up with a satisfying solution for our team sponsor, NAVTEQ.

Anam Moin Khan
Year: Third Year
Major: Electrical and Computer Engineering
Minor: Business Management
Description: Anam wishes to use her knowledge of computer engineering and programming to help make software that will change the GPS system of today to be more accurate and user friendly. Her minor in business will also help her create a system that will encourage customers to provide feedback and gather data towards improvements they would like to see.
Working within an interdisciplinary team, Anam is certain that they can come up with a viable solution.

Aaron Komoroski

Year: Third Year
Major: Psychology
Description: Aaron worked as a co-team leader on the same IPRO during the fall 2009 semester and understands the workings of both NAVTEQ and the IPRO office. He has a computer science background which helps him bridge the gap between the technical and non-technical aspects of an issue. Aaron wishes to use his analytical skills to understand both how NAVTEQ and the end users view the concept of micro-landmarks. Aaron has experience in public speaking and giving presentations.

Mark Michael
Year: Third Year
Major: Computer Information Systems
Minor: Mark is the co-team leader of this IPRO and has played a key role in this project since its inception. He is currently an IT Consultant for a local helpdesk company which gives him access to many people in the target group of this project. Mark has previous experience with programming languages C++, C#, Java, ASP.NET, and SharePoint development. He also has experience developing several different web applications.

Scott Mochinski
Year: Third Year
Major: Psychology
Description: Scott's background experience with respect to this project primarily falls in the category of pedestrian and GPS end-user for 10 of the last 15 years here in Chicago. He was a long-distance truck driver for 5 years during which time he relied heavily (exclusively) on GPS navigation on a daily basis. Scott is comfortable with computers and programming, and his study of psychology gives him insight into conducting interviews and surveys. He has significant leadership experience which includes being a contract negotiator and union organizer for the International Brotherhood of Teamsters. He intends to use these skills to help the team
achieve the utmost success.

Ameena Payne
Year: Third Year
Major: Business Administration/ Specialization in Marketing
Minor: Sociology
Description: Ameena's background in marketing includes using ethnographic/demographic research to determine target consumers and their buying behaviors with respect to this product. She is very personable, communicates well with others, and wants to use these
strengths to give presentations, conduct focus groups, and contribute to public speaking aspects of IPRO 303. Her job experience has helped her hone her leadership capabilities and she knows how to work as a part of a team.

Ernesto Ramirez
Year: Third Year
Major: Computer Engineering and Computer Science
Description: Ernesto wishes to use his knowledge of programming to help develop software that will be user friendly. He is a part of an Illinois Institute of Technology and Dominican University joint program. This will broaden the demographics of the project research base. Researching different demographics will provide the team with valuable information

regarding the demands of software users in different regions and also increase the overall research base of the project.

Peter Sanborn
Year: Fourth Year
Major: Psychology
Minor: Architecture
Description: Peter is the co-team leader of this IPRO and hopes to use his leadership qualities to keep the team on track and to obtain the objectives for the semester. His background in psychology will provide a strong foundation for developing user interfaces, while knowledge and interest in architecture, computing, and other various technologies will assist in general functionality.

Piyush Sinha
Year: Third Year
Major: Computer Engineering
Description: Piyush has worked as a part of this IPRO from its inception and thus understands the aims and objectives of this program completely. Piyush has a strong background in technology. He has good analytical and design abilities. Piyush finds GPS mapping technology quite interesting and has experience using products that incorporate NAVTEQ mapping
technologies. In addition to contributing to this IPRO, Piyush is interested in developing his team skills.