Innovative Mapping

IPRO 303 Final Report

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Sponsored By: NAVTEQ

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I. Description of The IPRO Program

The Interprofessional Projects (IPRO®) Program at Illinois Institute of Technology An emphasis on multidisciplinary education and cross-functional teams has become pervasive in education and the workplace. IIT offers an innovative and comprehensive approach to providing students with a real-world project-based experience—the integration of interprofessional perspectives in a student team environment.

Developed at IIT in 1995, the IPRO Program consists of student teams from the sophomore through graduate levels, representing the breadth of the university's disciplines and professional programs. Projects crystallize over a one- or multi- semester period through collaborations with sponsoring corporations, nonprofit groups, government agencies, and entrepreneurs. IPRO team projects reflect a panorama of workplace challenges, encompassing research, design and process improvement, service learning, the international realm, and entrepreneurship. (Refer to http://ipro.iit.edu for information.) The IPRO 303: Innovative Mapping team project represents one of more than 40 IPRO team projects for the Fall 2009 semester. [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.[2] Right now, NAVTEQ's focus is on how to make their technology more pedestrian and community friendly. Our project has two main objectives, one focusing on finding a way to increase feedback from a pedestrian map user and the other to discover the interest in what NAVTEQ termed "microlandmarks".

After forming the three 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, one of research and one of design.

In the research phase, the Market Research subteam conducted surveys and focus groups to determine what the end user would consider a simple, hassle free way to provide feedback to NAVTEQ. The Case Study subteam looked into what ideas were already established in the marketplace. The findings from this research gave us valuable insight into the need that our solution needed to fill, namely the concept of the "one touch" solution.

Using this information, the Development designed two models of what the feedback system should look and feel like. 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 to work out with NAVTEQ.

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[1] IPRO Final Report Guidelines: http://ipro.iit.edu/wp-content/uploads/ipro-final-report-guidelines.pdf

[2] NAVTEQ Website: http://www.navteq.com/

A special thanks to NAVTEQ's Ashish Tajpuria, David Holsinger, and Adam Grabowski for providing insight and feedback throughout the project, the IPRO office for all their assistance, and advisors Limia Shunia and Jim Burstein for their consistent guidance.

Purpose and Objectives

About our sponsor:

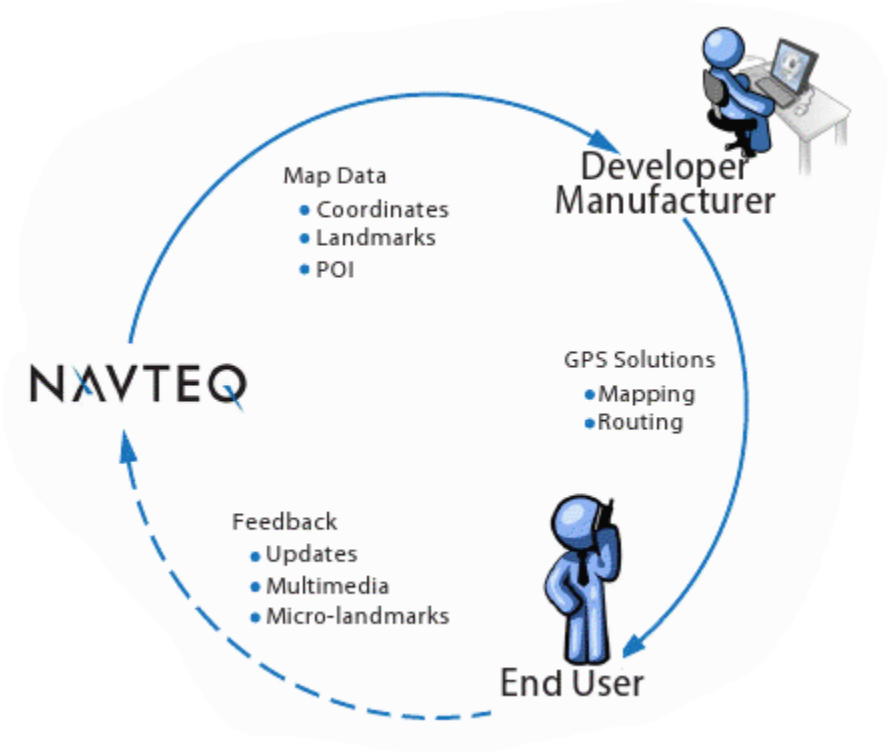
NAVTEQ is, as according to their website, " a world leader in premium-quality digital map data and content." They provide data to companies like Mapquest, Garmin and BMW for digital navigation. NAVTEQ sponsored our IPRO in order to help with two main problems

1. Target the majority of mobile device users, and give them an outlet to report any changes, mistakes or developments that have been overlooked by NAVTEQ.

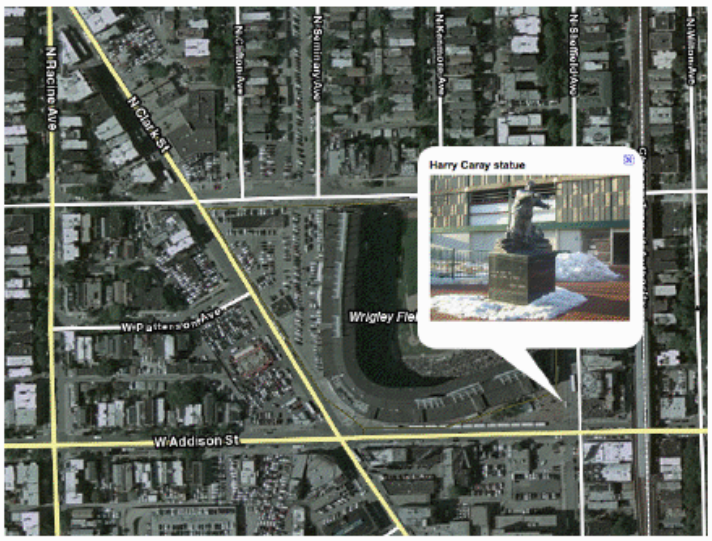
2. Come up with a solution which enables the average map user – men and women ages 18-35, students and tourists – to address these alterations in a simple, hassle free way.

NAVTEQ's entire business relies on giving their customers accurate map data. Although NAVTEQ has teams all over the world gathering data it is impossible for their teams to get every piece of information exact all the time. There could be bridges are under construction, etc. That is why feedback from pedestrians is so important. They can give insight to NAVTEQ in a way that their teams would never be able to.

Right now one of the only ways to of providing feedback is through a feature on their website called Map Reporter. Map Reporter works well if you have time to go back to your computer to report what data was wrong. Unfortantely most people do not have the time nor the deisre to do this. NAVTEQ came to us, IPRO 303, to help fix this problem. The focus was feedback from pedestrians so mobile devices were the main target. A diagram that shows the relationship among all three parties follows:



The second challenge that NAVTEQ came to IPRO 303 for was what one of their employees termed “micro-land marks.” The example given was the Harry Carry statute at Wrigley field. Wrigely field is a location that has a specific address on a map. However, the Harry Carry statue is located within that address, yet is also a valid location, ie a micro-land mark. NAVTEQ asked Innovative Mapping to do more research into this feature in addition to designing a feedback system.



Organization and Approach

1. Team Structure

The tasks consisted of those aimed at creating and forwarding the NAVTEQ user feedback system and those aimed at formulating its business strategy. Consequently, Innovative Mapping divided into three broad sub-teams generally defined as the Development Sub-team, the Research Sub-team and the Quality Control 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. Quality Control Description

The Quality Control sub team was assigned the responsibility to test the usability of the product to determine how well it fit into the user's daily routine. Also, they developed a survey to determine the 18-26 users' mindset in the existing market place.

They also conducted two focus group meetings which comprised the 26-35 and beyond market. Through the NAVTEQ focus group, the sub team was able to gain technical knowledge about IPRO 303.

The sub-team was also responsible for compiling their market research data, and gave two presentations concerning their findings.

If inadequate progress was noted, the entire team worked together to create a resolution to the issue. Then a discussion was held for each problem area and how it could have been avoided in the future.

c. Research Description

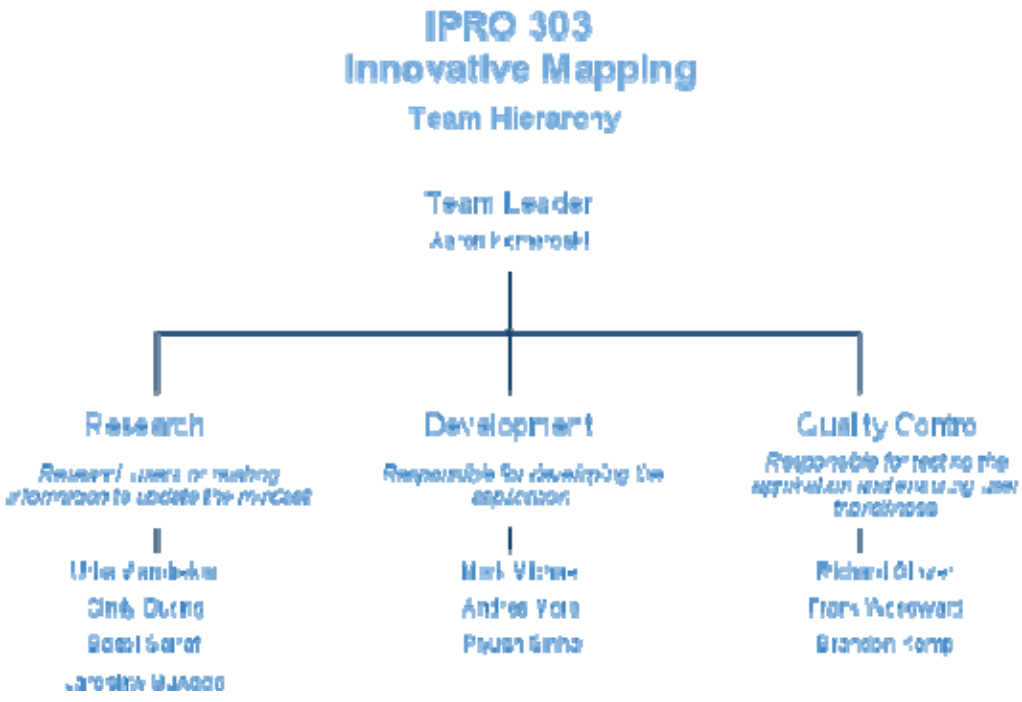
The Research sub was assigned to conduct research on existing similar solutions in the market. They researched four companies that have similar solutions. As well, they researched the pros and cons of each the ones.

d. Development Description

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. They also compiled a report of all their findings and presented their information accordingly.

e. Presentation Description

This sub-team was created specifically for creating the IPRO presentations to the IPRO office and to the sponsor NAVTEQ. Because these 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.



The established teams are organized as follows*:
Note: the first name in each sub-team is the sub-team leader

2. Designation of Roles

- **Team Leaders:** Aaron Komoroski and Basel Sarref. Provides guidance, instruction, and direction, to the team, in pursuit of realizing the expected results. Monitors the quantitative and qualitative results that are to be achieved. Creates an agenda for each team meeting, and keeps meetings on task and on schedule.
- **Minute Taker:** Mark Michael. Records events and decisions made during meetings, including task assignments or any changes. Posts them to the team's iGroups account.
- **iGroups moderator:** Brandon Kemp. Responsible for organizing the team's iGroups account and ensuring that it is used properly by keeping it up to date and having every file organized and in the correct format.
- **Sub**-team leaders: It is their job to lead the sub teams in their respective sub-teams

3. Teams Meetings

Meeting Time: Every Tuesday and Thrusday afternoon

INNOVATIVE MAPPING met every Tuesday and Thursday afternoon. Entire-team meetings were utilized as a forum for members of the Innovative Mapping project to present reports on recent developments and obstacles faced within the sub-team and what it means for the entire group. Solutions were then brainstormed and the process was repeated. 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 the current progress direction.

4. Activities

The team decided on a interface solution to present to NAVTEQ. A group of activities were involved during this process. Those activities fit in two chronological phases:

Phase I (August until October), - Research phase. During this phase the students will:

- Study the requirements that were given by NAVTEQ.
- Conduct research/surveys.
- Discuss research/surveys results.
- Reach consensus.

Phase II (November until December) - Development phase. In this part of the project the students will:

- Define the requirements.
- Propose achievable and realistic solution(s).
- In meeting with NAVTEQ representatives the students will present the team findings on a formal meeting

Below is a basic breakdown of the work process structure and the dates that Innovative Mapping to completed each step.

Work Breakdown Chart

Analysis and Findings

1. Initial Research and Navteq market focus

Our sponsor NAVTEQ initially gave us an age range of 18-38 at the beginning of the semester, along with our semester objectives. We divided NAVTEQ's target market into an older and younger age range; 18-26 and 27-38. Since our goal was to figure out what the typical map user wants and needs from technology, we created a segmenting breakdown of their unique characteristics. Overall, it appeared from the research that the older age group of 26-38 sought for better functionality out of products where the younger age group favored feature-oriented products.

Based on these varying age groups we decided to conduct a series of surveys and focus groups that would focus on the participant's past or current experience with mapping software. We figured we would conduct focus groups with the 26-38 age range and distribute the surveys to the younger participants. The focus groups were conducted at law firm Hamilton, Thies, Lorch, and Hagnell and at our sponsor NAVTEQ's downtown Chicago location. Coincidentally, the surveys of the 18-25 age range were distributed among our peers on IIT main campus.

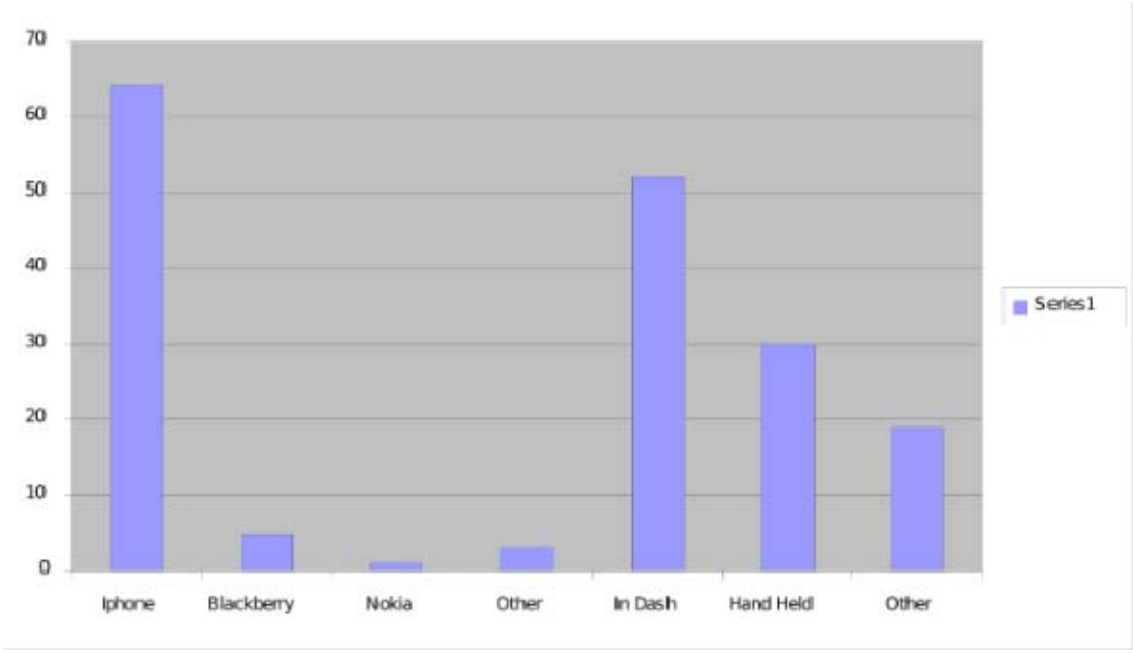
2. Survey

We chose to conduct surveys for the 18-25 age range mainly because we are conveniently surrounded by a population of these younger students on the IIT campus. Our initial market research indicates that these individuals use mapping software to aid in getting to new places or locations around the city, and they look for devices that are flashy and which contain multiple and innovative features.

a. Survey Breakdown by Question

Overall, our team was able to survey a total of 189 individuals and our results and analysis of each of the survey questions follows:

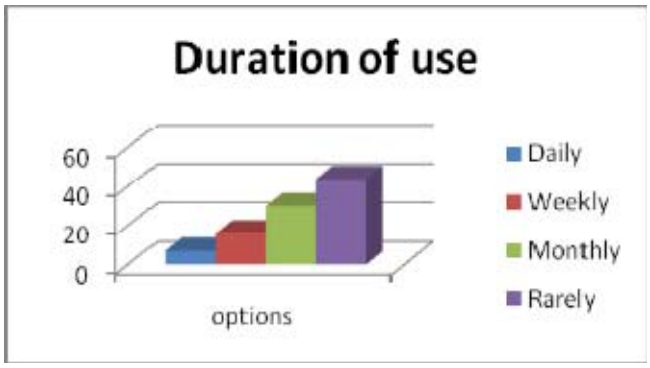
Question 2: Which GPS device have you used before?



As you can see, from the chart above, the two highest mobile platforms for GPS devices used are the iphone and in-dash units, while the lowest was Nokia (parent company of Navteq). From the research, it can be concluded that other types of mobile platforms were used with 13 out of 119 users admitting the various types of devices they use(Sprint, Motorolla, Samsung)

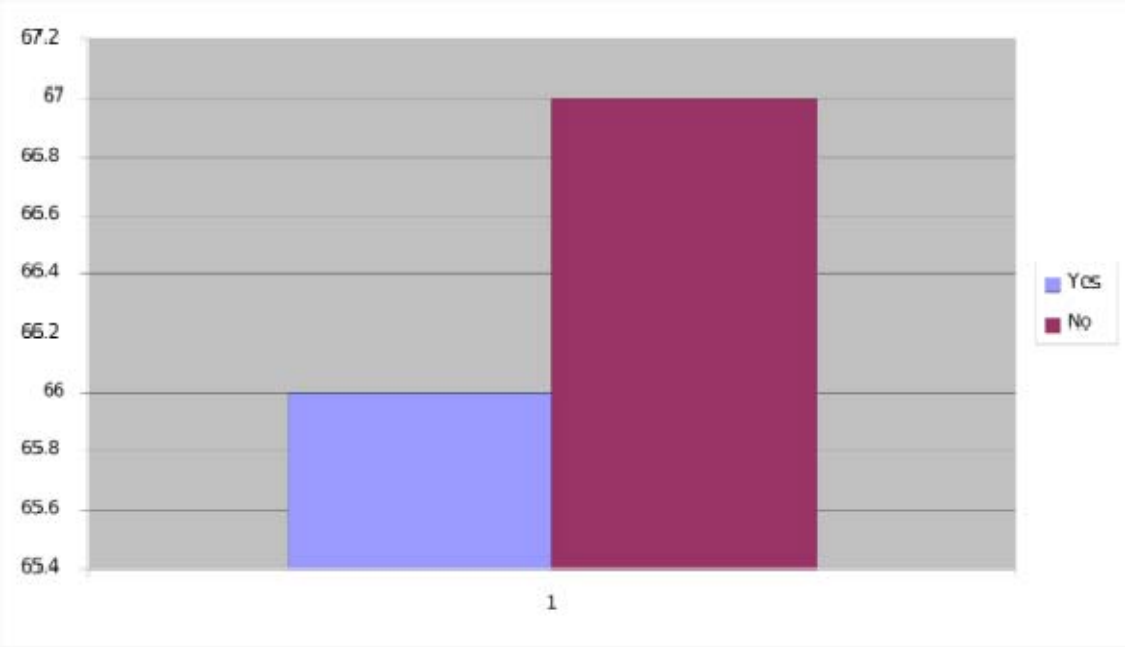
There was an issue in this part of the survey with the multiple use of the word “other” which confused people on whether they should write down a non-mobile device or different (not mentioned) mobile platform. Additionally, iphones are widely used for GPS devices, because of their popularity and the built-in Google Maps application.

Question 3: How often do you use your early mentioned GPS device?



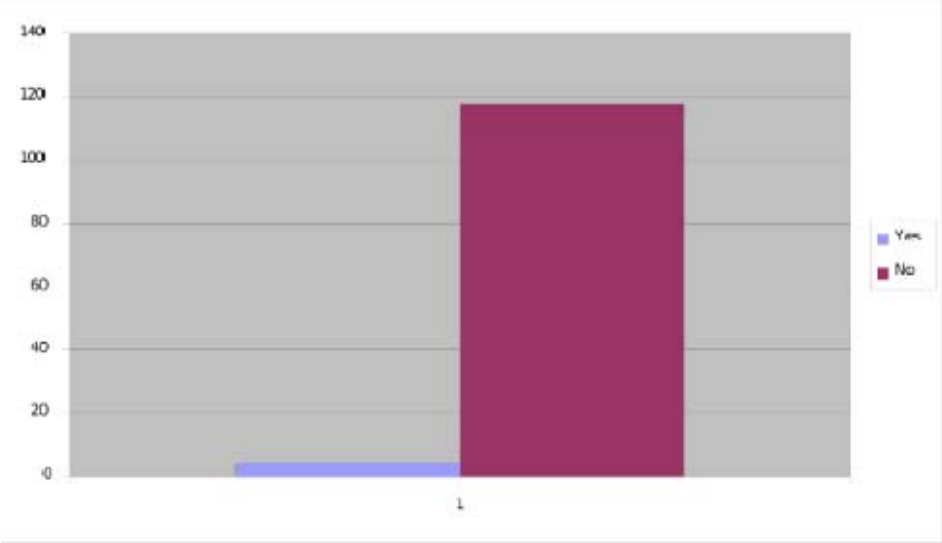
This chart shows that 45% of the users rarely use their device on an ongoing basis, while only 7% use their device daily. We now realize that a solution would have to create a need for the users to use their device in their everyday lives or they will simply eliminate the use of GPS devices.

Question 4: Have you experienced an invalid data output from your GPS device?



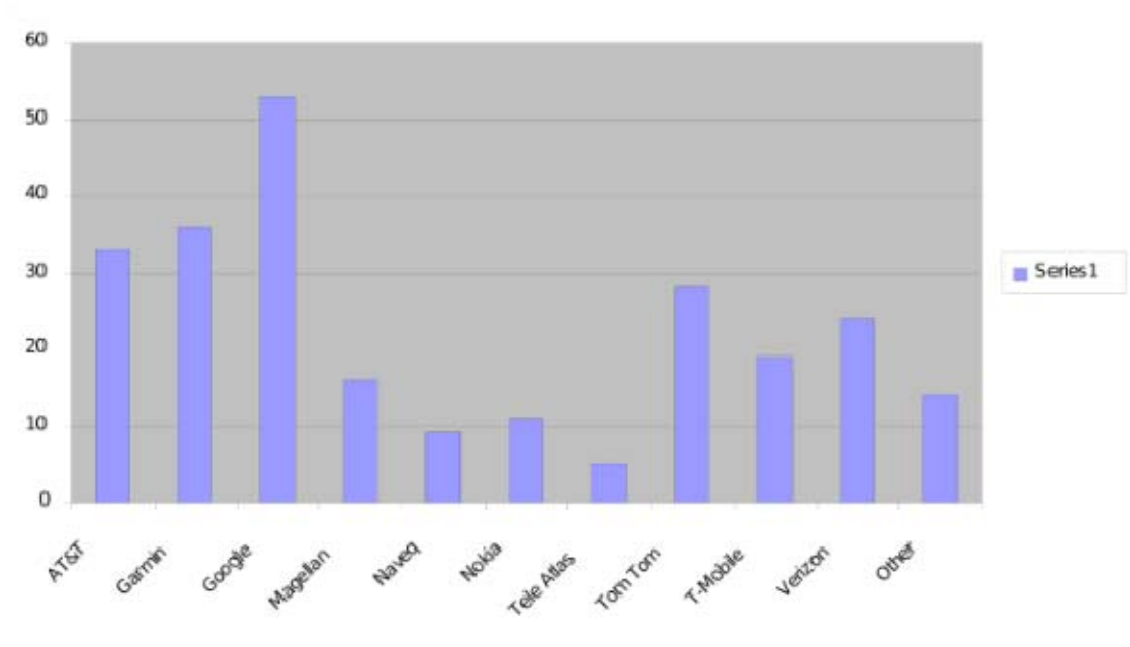
More than half of the participants indicated that they have not experienced an invalid output. We weren't sure if the results were valid for this question mainly because it asked if the users experienced problems while using a GPS or phone mapping software. The participants may have answered "yes" had the question indicated if they experienced a problem with online maps as well.

Question 5: Have you reported an invalid data to your GPS producer or GPS data provider?



The overwhelming result is that *about 85% indicated that they have not reported invalid location data output from their device while on a trip* GPS data provider. *While the results may be true from the reported answers, the users may have answered the question thinking of a trip where they used a printed map which may have had either incorrect directions or destinations.*

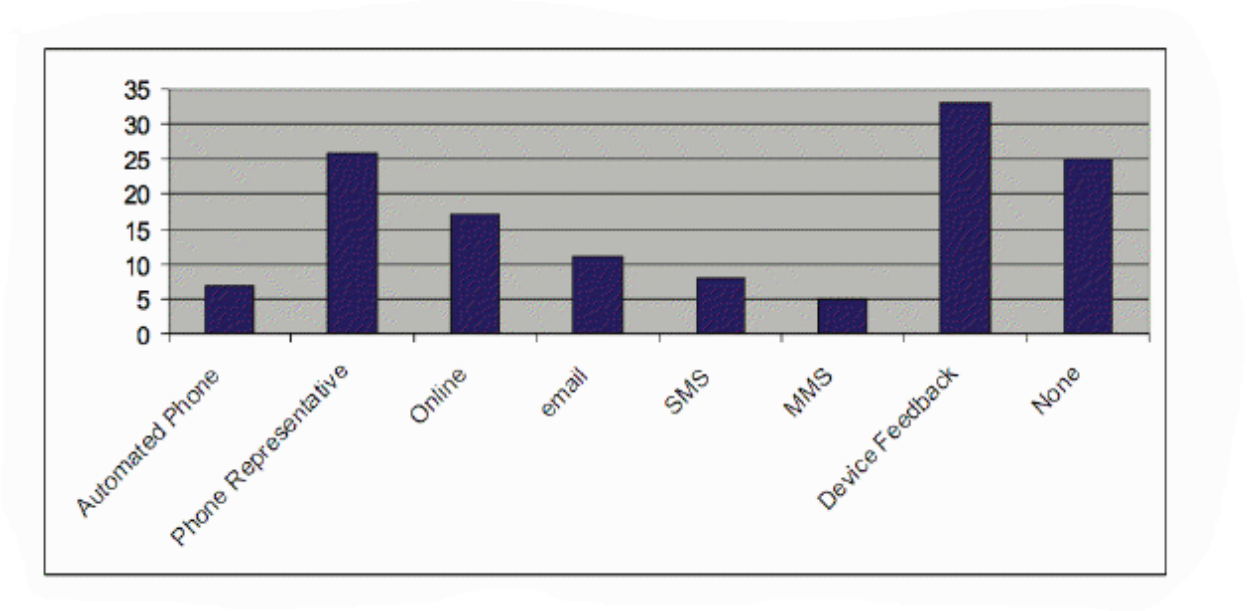
Question 7: Choose all the companies that you would report to, if your GPS device gives you an error route.



Out of all the companies who receive user feedback, Google Maps is at the forefront of the market with 60% of users admitting they report feeback to them. The group of seconds includes Navteq which would conclude Navteq is receiving mediocre feedback. At the bottom list is Tele Atlas with only three percent of users conveying they use Tele-Atlas.

This made us question NAVTEQ's ability to encourage users to submit errors? One assumption is that Google Maps is popular because it is open source and available on a popular platform (iphone)

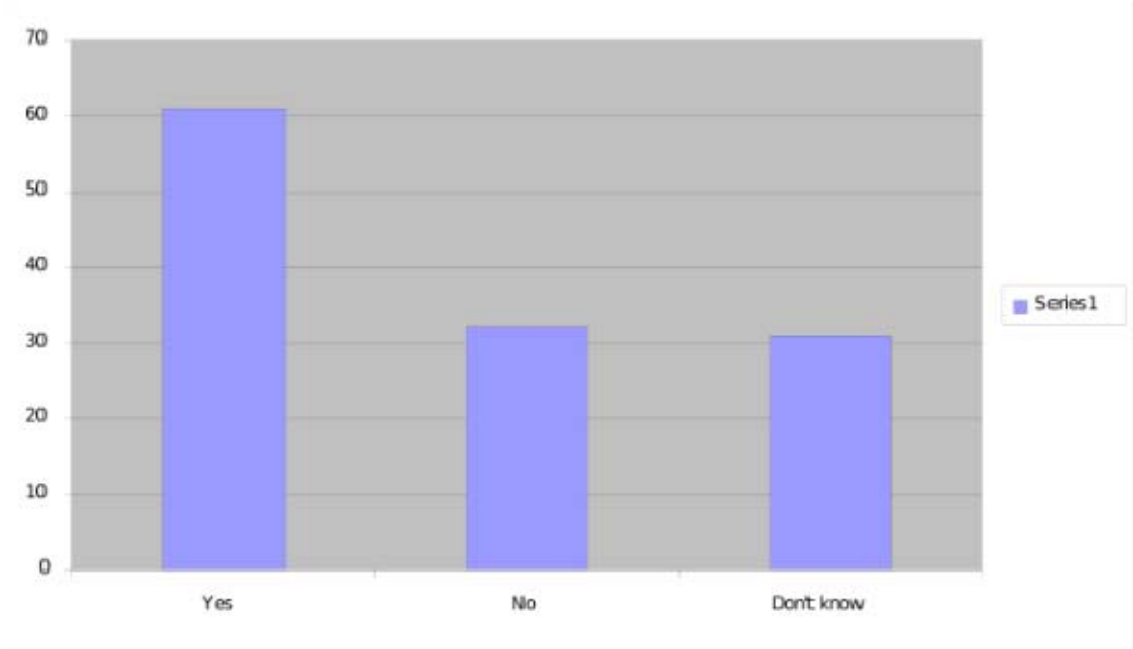
Question 8: These new and detailed landmarks are going to updated based on input from users like you. How would you like to report and describe the location of such an interesting landmark to your GPS Producer or GPS data provider?



The research concludes that a customer representative or built in application are the two most desired solutions. Although a customer representative solution received majority of the votes for the first choice, a built-in feature received the most general votes. So it would seem that both could satisfy market desire.

After looking at the data, satisfying the long-term desire will be the most effective, so the solution should be geared toward a built in feature.

Question 9: Have you used the MMS feature in your cellular phone?



This question seemed to be quite confusing to the survey participants mainly because they may not have known what MMS meant. The survey results show this above. From this, we concluded that a Multi-Media Messaging Service feature could be possible a solution with a direct connection to NAVTEQ being preferred

Question 10: Have you used Geo-tagging?

Once again, the participants were unsure what geo-tagging was and what was its use. We agreed that we would incorporate geo-tagging in our solution due to its convenience and ability to pin point locations.

After analyzing the survey data results of the 18-25 age range, we realized that this age range rarely uses mapping software in mobile products on a daily basis and that they rarely report feedback. Our solution would have to incorporate a built-in feedback queue, deliver multiple features, and create a connection between the software and the younger users so that they would feel included and inclined to use it.

b. Focus Group

From the initial market research the Quality Control team conducted, the older age group consisted of people who use mobile map products for daily travel planning, they favored devices

which had features that made things easier, and overall, they sought for better functionality out of their products.

The focus group participants had a general consensus that they would not willingly report feedback or take pictures, but would be interested in a solution to send feedback that doesn't require too much time.

Law Firm Focus Group

- They agreed that if they were map sharing between their friends to reach a common destination, then they would use that solution.
- They would be interested in having a visual image (such as a 3D structure or store-front picture) of a point of interest appear on their maps, but would not send in pictures themselves to the company.
- The participants collectively would support a solution that is quick and to the point at the touch of a button.
- They like the idea of having a virtual GPS.
- They are interested in the overall micro landmark idea, whether it be having the map direct them to a specific point of interest in a park or room in a building.

NAVTEQ Focus Group Findings

- Most of the participants uses a Nokia work phone which also has the NAVTEQ powered maps and GPS software.
- Use GPS device
- Would not want to take the time to report incorrect data, i.e. typing in data.
- Don't feel they would have a vested interest in contributing to the development of microlandmark points of interests.
- Favors the one touch/click solution, imbedded in map application.
- The use of microlandmarks appeared to be a micro concern when it came to Navteq's own employees.
- The microlandmark navigation helper would be more beneficial to either businesses or large organizations.

After analyzing the feedback from the focus groups, we concluded that the older age range favored a solution that was within the GPS map software, and that would allow them to report incorrect destination/route feedback with one touch.

c. Market Research Findings

From the analysis of the surveys and two focus groups, the team was able to come up with a solution for NAVTEQ. We decided that our solution would be built-in the actual GPS mapping software encompassing One-Click feature.

The feature would record the user's entire trip and their exact location. Then from one click the user would be able to select from a variety of options which will allow them multiple ways to send feedback, such as: sending a text message, taking a picture, drawing an alternate path, or even calling a service help desk. If the user does not want to send feedback from these possible features, they could simply just submit the data that was collected from their trip.

d. Design

The development team had the responsibility of designing possible solutions for the problem given. Before the Quality Control team conducted the focus groups and the survey the development team brainstormed and benchmarked to create various possible solutions surrounding a variety of technology used in the current economy. This was done in order to come up with unbiased solutions that were considered feasible by the members with a technical background.

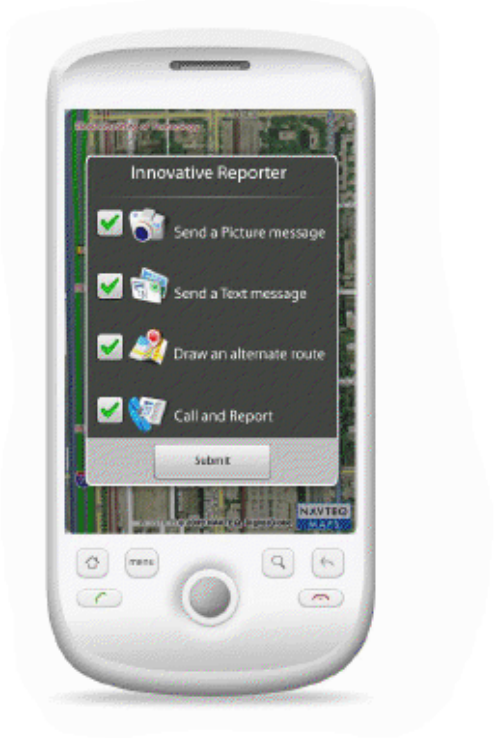
The proposed solutions included sending messages through the Short Messaging System (SMS), sending pictures and/or videos through the Multimedia Messaging System (MMS) and having a service hot-line where the user could call and report errors. These were fine-tuned after receiving the surveys and focus groups analysis results in order to accommodate them to the end user's needs. The selected proposed solutions were then integrated into a single program with a user friendly interface.

NAVTEQ let the team come up with any assumptions needed to have the idea work in order to encourage new thinking. As a result, the solution assumes that NAVTEQ will be able to market it to their customers, and that the customers would incorporate it into their routing software. The solution would work as follows:

The user would be using the routing software to reach a certain location. When that software reaches the destination, usually it would display a message similar to, "Arrive at [the destination]." At this point, the solution would be opened up and it would ask the user if they have arrived at the intended destination. The user would then submit either yes if they have, or no if they have not reached the correct location. If it is the former, then the program would exit as if nothing happened. If the latter, then the Innovative Reporter screen would be presented, prompting the user to choose a number of different methods of reporting feedback, including entering text, sending a picture, drawing an alternative route, or leaving a voicemail. The exact methods of feedback would depend on the capabilities of the device the user is using (for

instance, an in-dash GPS unit would not be able to take a picture, but could call or enter text). The user would add to the report by selecting any combination of feedback methods, including none or all, and hit submit. At this point the device would submit the data, which would include the GPS coordinates, the intended destination and starting location, as well as any additional information the user provided, to the NAVTEQ servers. The user would be thanked for their data, then asked to input their email address if they would like to receive updates on their submission. Following this, the program would close and return them to their routing software. This solution was designed to allow the greatest freedom for the user. If they were in a hurry, they would not have to input any additional data, yet still would provide feedback for NAVTEQ.

After a semester of researching and benchmarking best practices, the Quality Control team reached overall consensus of what NAVTEQ's market preferred. The users favored a "One-Touch Solution", as seen from the previous analysis, which would be a one-touch menu feature within their mapping/gps navigation application and support a wide variety a feedback buttons. A visual of how the actual program would look on a phone follows:



One-Touch Solution Menu

Possible implementations of the solution is either a standalone application which the routing software would link the user to, or NAVTEQ could have the interface built into the mobile devices as a new product to market to their customers. This is left up to NAVTEQ to

decide whether they wish to implement the design, or to let that be a focus of the Spring semester's IPRO.

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 the topic of “micro-landmarks”, and more specifically:

- Identify and describe the market
- Find interested parties in providing the information needed
- Develop a system to make this information usable

Appendix

Project Budgets

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

Item	Cost	Quantity	Total Cost
Printing Costs of Surveys	$50.00	1	$50.00
Pens for surveys	$5.00	4	$20.00
Focus Group Snacks	$40.00	2	$80.00
Food For Thought	$40.00	3	$120.00
			$500

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.

Aaron Komoroski

- Year: Third Year
- Major: Computer Science

Andres Mora

- Year: Fourth Year
- Major: Computer Engineer

Basel Sarraf

- Year: Fourth Year
- Major: Computer Science

Brandon Kemp

- Year: Fourth Year
- Major: Architecture

Cindy Duong

- Year: Fifth Year
- Major: Architecture

Frank Woodward

- Year: Fourth Year
- Major: Business; Entrepreneurship

Jerry Suwada

- Year: Fifth Year
- Major: Computer and Electrical Engineering

Mark Michael

- Year: Third Year
- Major: Computer Information Systems

Piyush Sindha

- Year: Third Year
- Major: Computer Engineering

Ricky Glover

- Year: Fifth Year
- Major: Humanities

Urba Mandrekar

- Year: Second Year
- Major: Psychology