



I²PRO 305:

User-Generated Map Content

Project plan -Fall 2010



Project Sponsor: Wei-Yeh Lee

NAVTEQ

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ILLINOIS INSTITUTE
OF TECHNOLOGY 

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Team Information

Team Roster



Arjun Kumar

Year: Junior

Major: Electrical Engineering

Description: Arjun is originally from Lake Zurich, IL but currently resides in the loop in Chicago, IL. Over the past several years, he has used NAVTEQ maps countless times in multiple formats ranging from Google Maps to the Trapster application on his Android phone. Because of his experiences using NAVTEQ maps and applications, he finds that NAVTEQ devices are quite user-friendly and easy to navigate. With his social personality, his skills will be best utilized with the community groups in this project. He thinks of himself as an innovative thinker and manager, and he is confident that he can motivate community groups to help the team expand maps and make it fun for them at the same time.



Krystian Link

Year: Senior

Major: Mechanical Engineering & Engineering Science

Description: Krystian considers himself to be a “people person” and has a strong interest in marketing. Both skills will be of great value as the team tries to create groups that will gather data, as well as analyze what drives a community to create data. Since he was a child, he has enjoyed creating maps with relevant data, which creates a foundational interest in what NAVTEQ is trying to accomplish through point of interest (POI) data gathering. He interned over the summer at Navistar Engine Group, which placed heavy emphasis on project management, working under deadlines, and being a member of a team. Krystian’s skills and experience will be invaluable to this IPRO team.



Nilesh Malpekar

Year: Senior

Major: Computer Engineering

Description: Nilesh has experience in Software Development Life Cycle (SDLC) application development and interacting with software end-users. He is familiar with various software technologies (such as .NET, Java, TIBCO) and is well-versed in analytical skills. He believes that a better process leads to a better product and allows for individual growth. His leadership skills and past experience in conducting software user group meetings will assist him in successfully completing this project.



Xufeng Miao

Year: Senior

Major: Business Administration

Description: As a business major student, Miao is always interested in observing and analyzing business around him as well as collecting useful data, such as unique success factors. He has experience working in the risk management department of a bank and also attending to challenges related to researching and collecting data. He is also familiar with using office and graphics software. He hopes the team will provide NAVTEQ an outstanding outcome with every team member's effort.



Michael Mongillo

Year: Senior

Major: Applied Mathematics

Description: Michael has experience working as part of research groups to both produce and collect high quality data. He is familiar with statistical techniques and the concerns related to obtaining representative data samples. He also has a background in programming. He hopes that these skills will contribute to providing NAVTEQ with pilot communities to test its new crowd-sourcing model.



Razieh Nilforooshan

Year: Senior

Major: Architecture

Description: As an architecture student who is required to evaluate her situation as the first step toward any decision, Razieh has a background in researching environmental and urban issues. This gives her the ability to collect data which seems essential to architectural research. She is skillful in using different design software such as AutoCAD, 3D Max, Photoshop and Design Illustrator. She hopes to be able to use her data collecting, analyzing, and designing skills in this IPRO.



Michael Palarz

Year: Junior

Major: Electrical & Computer Engineering

Description: Michael has spent much time in many different forms of community-based environments through the internet. This includes social networks (Xanga, Myspace, Facebook, etc.) and a variety of forums and message boards. This has given him insight as to what drives these types of communities, especially in the way that there is always something that compels the user to constantly be a part of them. He also has an exceptional understanding of data collection which he has obtained throughout his educational career. Additionally, he is familiar with a variety of different navigation software, such as MapQuest, Google Maps, and a variety of different mobile GPS systems. With a combination of his knowledge of community groups, data collection, and navigation software, he hopes to make a solid contribution to a viable solution for NAVTEQ.



Nicholas Paradiso

Year: Junior

Major: Electrical & Computer Engineering

Description: Throughout his life he has used many different GPS map sources including MapQuest, Google Maps, Garmin, TomTom, and Bing Maps. While using Google's maps, he has created a foundation of what is available on the maps and what he would like to see that is not provided by the maps. With this foundation, he will be able to assist the IPRO team with ideas of what to include in NAVTEQ's mapping data. He is only on Facebook and does not use any other social networking website. He has a strong understanding of the gaming community and what motivates them. He also follows sports (especially Chicago sports), and enjoys following changes in the leagues. He is always thinking, and there is not a minute of the day that he is not thinking of new ideas. He is always looking for ways to innovate, and this mentality will prove useful to this particular project where everyone needs to be innovative.



Vivek Sharma

Year: Senior

Major: Physics

Description: Vivek has had a varied research experience at Fermi National Accelerator Lab, Argonne National Lab, and MIT. He has also worked on researching patents and legalities for market analysis. He has been a part of a team conducting focus group studies for a startup. In this project, he is poised to partake in market analysis by conducting focus group studies to investigate the viability and the efficacy of various motivations that might actuate users to contribute to map information to NAVTEQ. In the coming semester, he looks forward to conducting extensive field work and implementing statistical analysis to assess feasible motivations in crowd-sourcing¹.

Team Identity

Name: Community-Generated Map Data

Motto: Communiity Maps

Logo:



¹ Crowd-sourcing is the act of outsourcing tasks, traditionally performed by an employee or contractor, to a large group of people or community (a crowd), through an open call.

Team Purpose

Team Vision

To assist community groups in generating high quality map data using NAVTEQ tools and to determine the best incentives to induce crowd-sourcing.

Team Goals

NAVTEQ, the sponsor of this project, is one of the largest digital mapping companies in the world. NAVTEQ seeks to provide accurate data in the GPS maps that they provide to their customers. Currently, NAVTEQ sources data from its vendors. NAVTEQ would like to move forward by leveraging crowd-sourcing and helping community groups generate map data specific to their area of interest. NAVTEQ wants to determine the optimal methods for incenting the community groups to produce high quality user-generated map data.

The first goal for this IPRO team is to engage user communities in generating point of interest (POI) map content in the Chicago metropolitan area. The second goal for this team is to create a list of the incentives which will best motivate community groups to generate POI map content.

Team Objectives

- Identify 4-5 viable community groups of 8-10 people each
- Liaison with these communities and teach them to use NAVTEQ tools for generating POI map content
- Collect and analyze community generated map content
- Determine proper incentives for community groups

Background Information

Company History

NAVTEQ is the sponsor of this IRPO. They are recognized as being the leading global provider of all data consisting of maps, traffic, and locations. These data are applied in a variety of different digital services including navigation, location-based services, and mobile advertising around the globe. Their content is also the driving force behind many automotive navigation systems, internet-based mapping applications, and solutions for both businesses and the government [1]. NAVTEQ has an immense collection of data that provides digital map coverage spanning over 78 countries in 6 different continents thus far. Their database contains 260 different attributes of road data, ranging from addresses and POIs (points of interest) to signage and the geometry of the road itself. The company was founded in 1985 by Barry Karlin (who was originally from South Africa) and Galen Collins. Both of the gentleman had the same thought that “Wouldn’t it be nice if I had someone sitting next to me in the car who knew the way?” [2].

Company Challenges

NAVTEQ has challenged this team to locate 4-5 different community groups that will be able to find and verify map data (a.k.a. crowd-sourcing). NAVTEQ has initiated this challenge by turning data collection into a game where the community groups would be able to earn points for gathering data. The game is an application on a mobile device (provided by NAVTEQ), and each of the community groups will play the game in order to collect the data and accumulate points. The challenge lies not only in identifying the community groups, but also in determining if there is an additional incentive which can increase the frequency of data collection. Another goal of the research is to analyze which incentive works best for a specific type of community group. The data that is entered also needs to be inspected in order to determine whether or not it is viable.

Technology and Solutions

The technology that is involved in this IPRO is the mobile device provided by NAVTEQ and any digital services NAVTEQ is willing to provide during the course of the semester. These digital services include NAVTEQ’s global positioning system (GPS) technology and the “King of the Road” application. The mobile device that is to be used during data collection is the Nokia N97.

Ethical Dilemmas in Research

Potential ethical issues arising from this research consist of respecting the community groups' rights and privacy as human test subjects, as well as maintaining NAVTEQ's right of non-disclosure with respect to its proprietary information and technology. Furthermore, all necessary paperwork and permissions associated with human test subjects must be filed.

Sociological Effects and Costs

Because the proprietary application ("King of the Road") is being used to conduct the research is still prototypical, effort must be taken to provide user-support throughout the duration of the research. Time must be allocated to troubleshoot problems which may arise from using this software, reviewing the POI data, and assessing the quality of the POI data as it is collected. If the proprietary application is not user friendly, or if community groups' questions are left unanswered, community group users may become less interested in collecting POI data. This in turn would defeat the purpose of conducting the research. To improve the community groups' desire to gather POI data, incentives will be provided. This may or may not entail a fiscal responsibility to the community groups upon the completion of the research (i.e., if a prize for the top-scoring group is offered). Inquisitions must be made to NAVTEQ with respect to what incentives (and values) are acceptable to incentivize the gathering of data. In addition to these concerns, added care must be taken by the research team to make certain that all NAVTEQ-provided smartphones are being used for research purposes and are well-maintained (i.e., minimize wear-and-tear on the phones as much as possible, etc.) by all parties.

Proposed Implementations

1. Recruit four community groups, each consisting of eight to ten people who share a common interest.
2. Provide smartphones which have a data plan and the proprietary application "King of the Road" to each member of the community groups.
3. Train community groups in how to utilize the smartphones and the "King of the Road" application to gather POI data.
4. Incent the community groups to collect various forms of POI data via rewards (monetary, redeemable point system, etc.)
5. Review POI data collected by community groups and assess the quality of the data being gathered.
6. Conduct a survey of the community groups to assess which reward is best to incent the gathering of POI data.

As of this project plan preparation, the IPRO team is in contact with two community groups for their possible involvement with this IPRO. One of the community groups is the

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Downtown Evanston Group (www.downtownevanston.org), which is looking forward to generating map data pertaining to tenants in the SSA #4 district in downtown Evanston.

Team Values

Team Ethics

The team must abide by all policies promulgated by the Illinois Institute of Technology and national regulations. Team members should attend all class sessions in order to maintain communication with the team and continue project development. All team members are required to sign the “Student Confidentiality and Invention” agreement stating that they understand and agree with the Illinois Institute of Technology’s non-disclosure terms. Team members should also attend events outside of the team meetings, including interactions with NAVTEQ or the community groups. Team members are expected to have a mature and professional attitude throughout the course of this project.

Conflict Resolution

The following are procedures provided to help address and resolve any conflicts:

- Each team member is required to participate in all team activities.
- All members are required to communicate via iGroups and e-mail on a daily basis.
- All work will be evenly distributed among the individual team members.
- Each team member is responsible for submitting documented progress and any assigned work in a timely matter.
- All team members will be respected and treated equally.

Work Breakdown Structure

Problem solving process

Chapter 1: Establish Community Groups

1. Identify Community Groups
 - a. Determine community groups to target based on: group passion, availability, and geographical location.
 - b. Begin the preliminary interaction process with the specified community groups.
2. Finalize Community Groups
 - a. With the help of faculty and NAVTEQ, select the community groups for this semester.
 - b. Provide the plan of action for each community group.
 - c. Finalize a *Memorandum of Understanding* (MoU) with each community group.
3. Train Community Groups
 - a. Establish custom data types for each community group.
 - b. Distribute mobile devices to community groups.
 - c. Train community groups to use the necessary tools (mobile device-based applications).
 - d. Discuss different incentive methods with the community groups which would lead to optimal (quantity and quality) user-generated map data.

Chapter 2: Community Support and Data Collection, Processing, and Analysis

1. Support Community Groups
 - a. Provide support (technical, general, etc.) to community groups.
 - b. Set up periodic meetings with community groups.
 - c. Survey community groups with respect to device functionality, appropriate incentives, and report results to NAVTEQ.
2. Collect Data
 - a. Track community-created map content on a weekly basis.
 - b. Analyze and assess community-created map content and report results to NAVTEQ.
 - c. Identify trends or common occurrences with community groups in terms of mobile device usage.
 - d. Determine if there is any correlation between community groups' usage of the "King of the Road" application and incentives offered.

Chapter 3: Moving Forward

1. Finalize Interaction
 - a. Retrieve mobile devices from community groups and distribute prizes or awards to the "winners" of games, challenges, etc.
 - b. Survey community groups on their experience (device usage, suggestions, ease of access, mapping in general, user experiences, etc.).
 - c. Discuss potential motivational techniques and incentives for future users and future IPRO research.

- d. Establish norms, identify which groups were best served via crowd-sourcing, and collaborate with any community groups that could serve as resources in future IPRO projects with NAVTEQ.
- e. Submit Final Report to NAVTEQ.

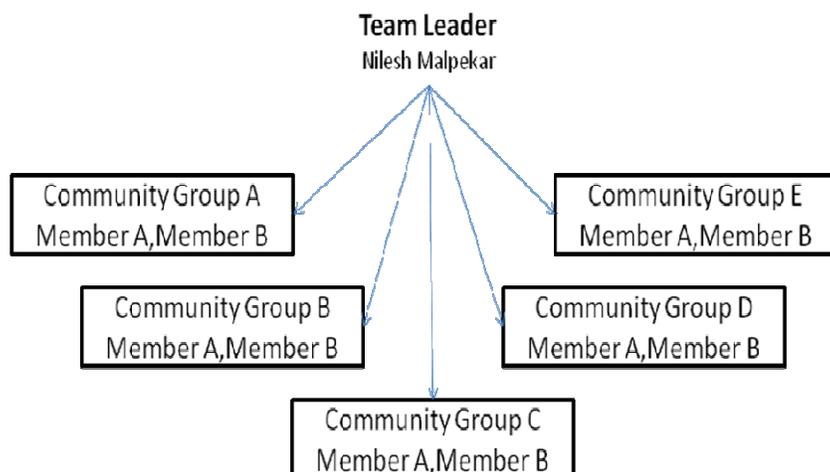
Team Structure

NAVTEQ's project model allows for an open-ended team structure. The team will not be split into a few specific categories. Instead, small internal teams will be created to interact with community group. The team leader will pay attention to these smaller teams' successes and possible improvements.

As a team, potential community group involvement is determined through basic brainstorming sessions which will be held during our weekly scheduled meetings. Once a group is identified, two team members will be chosen to oversee that community group. These two members will be chosen based on their interest and knowledge of the specific community interest. Team members may be assigned to more than one community group, but are generally limited to a maximum of two community groups (exceptions may be granted by the team leader). Once data is available from a community group, the two team members that are overseeing that group will analyze the data and present it to the team when necessary.

It is the team leader's responsibility to make sure that the team is aware of deadlines. The leader will reference these deadlines via the Gantt chart, which is presented later in this section. In addition to this responsibility, the team leader must also direct conversation focus during scheduled team meetings. This is to ensure that all goals of the project are being addressed and that every topic receives its required focus time during team meetings. The team leader must also be mindful of community group performance. If necessary, he or she may suggest a reworking of the problem solving process for the given community group. Though the team leader is responsible for much of the decision making, working out issues as a team is strongly encouraged. More perspectives on a given issue offer a better chance of reaching a formidable solution.

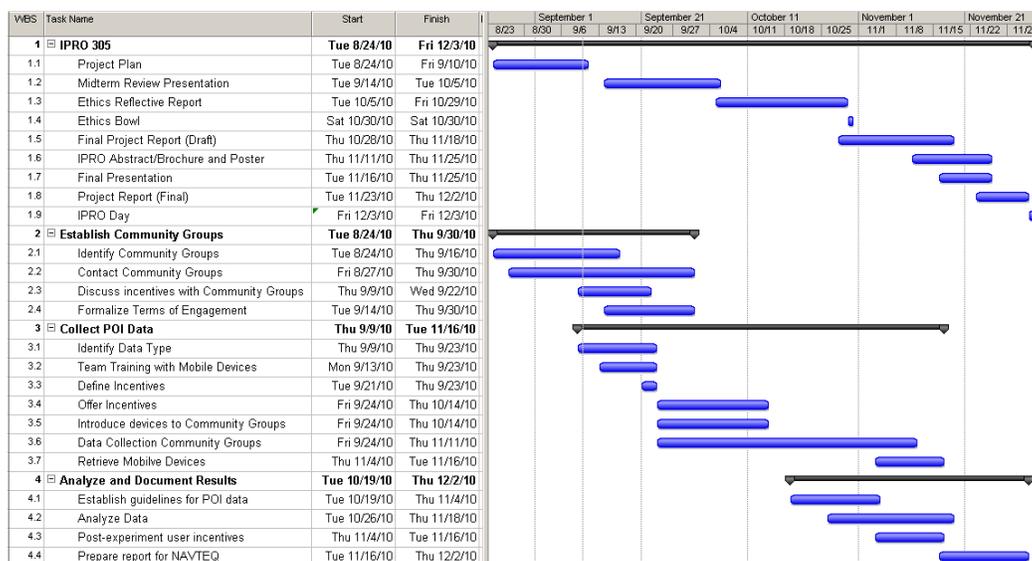
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Meeting Times

The IPRO 305 team meets every Tuesday and Thursday afternoon in the Fall 2010 semester. The agenda for each team meeting will be set in advance to utilize group meeting time effectively. Team members will work collaboratively to discuss the team’s weekly tasks, achievements, and issues (if any) during these weekly meetings. During these weekly meetings, tasks will be assigned to each team member for the next meeting, deadline, etc. Necessary changes to the project plan will be made during these meetings, if required.

Gantt chart



Expected Results

Expected Activities

The research that is conducted as part of this IPRO is divided into different categories as follows:

Implementation:

- Recruit four or five community groups consisting of eight to ten people in the Chicago Metropolitan area.
- Meet with community groups regularly throughout the research process to assess their reactions to the research and answer questions arising from the data gathering process.
- Provide smart-phones, given by NAVTEQ, to the community group members.
- Train users in how to utilize NAVTEQ's "King of the Road" game for POI data gathering purposes, creating new data types, etc.
- Create an incentive system (monetary, competition, etc.) which will generate desire in the users to gather POI data.
- Maintain a database which collects the POI data gathered by the community groups.
- Establish a user-driven data validation mechanism for verification of data gathered through crowd-sourcing.

Analysis:

- Create a POI data quality rating system based on quality of data gathered by community groups.
- Research which POI data types are the most popular via POI data analysis, surveys, etc.
- Discover which form of incentive is the most beneficial for crowd-sourced data gathering.
- Assess user reactions to the "King of the Road" application (ease of use, general user feedback, etc).

Research and Testing Results

The core pursuits of this research are a balance of analysis and implementation. The researching aspect includes what types of POI data are most desirable in various community groups, and what kinds of incentives are most productive to incent these groups to gather POI data. To process all of this data, the team hopes to create a streamlined method of reviewing the gathered POI data, thus maximizing the quality of POI data. The implementation portion of this research involves testing NAVTEQ's "King of the Road" application in a real-world setting among sample community groups to see if users will gather POI data for a certain incentive. Building community groups, improving user-receptivity of the application, and

analyzing what each community group deems to be an acceptable incentive for gathering data will be at the forefront of the research process.

Potential Project Tasks' Outputs

The research team hopes to discover a viable method for initiating crowd-sourcing of POI data. This includes the implementation of the “King of the Road” application and an incentive system which would encourage community group members to gather POI data. By creating sample crowd-sourcing teams, future IPROs which pursue this research will be able to draw upon our prototype crowd-sourcing methodology. This entails creating a viable data gathering solution for NAVTEQ which minimizes cost, and creating an entertaining and useful method of gathering data for the consumer.

The Deliverables

The team has identified seven deliverables as follows:

- Project Plan to be followed during this research.
- List of community groups with descriptions.
- Interview questionnaire for community groups.
- List of incentives.
- List of data types developed by community groups.
- POI data gathering results.
- Final project report (including brochures, poster, etc.) on IPRO day.

Project Challenges and Constraints

The primary challenge for the group is to provide NAVTEQ with user-generated POI data which is reliable and up-to-date. The group's main challenge is to define encouraging incentives for the community groups so that they will provide the desired data for NAVTEQ according to their interest. Based on each group, the incentives may vary due to the fact that one incentive may not work for another group. Additionally, since NAVTEQ is a leader in providing data and maps to many different companies (MapQuest.com, GARMIN, BMW, etc.), the reliability of data is important. The IPRO group needs to find a way to evaluate the quality and assess the reliability of the data.

The primary issue of concern is to find four or five interested community groups (of eight to ten people each) who are interested in the project. In order to assess different community

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incentives, the IPRO group will meet with the community groups. These meetings may include requesting feedback via questionnaires, brainstorming sessions, etc). All of these constraints must be resolved within the fifteen week period in which research will be conducted.

Results as a Solution

Community-Generated Map Data will deliver to NAVTEQ at least three working incentives. By discovering three viable incentives, NAVTEQ will be able to proceed with the development of its crowd-sourcing project. Additionally, NAVTEQ will be able to draw on the research of this IPRO team to create a prototype application of a viable crowd-sourcing methodology.

Project Budget

The following is a summary of all expenses that will be required to complete this project. Mobile devices will be provided by NAVTEQ and returned upon completion of this project. Meeting with the community groups will incur transportation expenses. User incentives will be required for experiments to assess which incentives most effectively motivate users to contribute data.

BUDGET IPRO 305	
FALL 2010	
Equipment	
Mobile Devices ²	\$0
Field Research	
User Incentives ³	\$400
Transportation	\$150
Office Supplies	\$100
Team Building ⁴	\$150
Total	\$800

² Provided by NAVTEQ

³ User incentives are rewards that motivate the contribution of POI data as described in the project description

⁴ Team-building events conducted to promote fellowship amongst IPRO 305 team members

Designation of Roles

Minute Taker: Krystian Link

Responsible for taking attendance as well as recording the decisions made in every meeting. Shortly after each meeting, the minute taker uploads the meeting minutes to iGroups for use as a reference by the team.

Team Leader: Nilesh Malpekar

Responsible for providing the team with direction and guidance. Monitors the progress of the team and insures that project goals are met.

NAVTEQ Point of Contact: Nilesh Malpekar

Responsible for communication with NAVTEQ. Conducts all communication between team members and NAVTEQ employees.

Community Coordinator: Arjun Kumar

Responsible for scheduling meetings between team members and community groups. Ensures that all goals which require meetings with community groups are completed in a reasonable timeframe.

Experimental Process Controller: Michael Mongillo

Responsible for maintaining a consistent experimental methodology between different community groups. Ensures that the team members conducting meetings with each community group follow the same methodology.

Data Analysis Leader: Mike Palarz

Responsible for ensuring that data analysis goals are met. Coordinates data analysis efforts among the team.

Technical Consultant: Nicholas Paradiso

Assists community groups by answering and solving technical questions and problems related to the mobile devices and data gathering software.

iGroups Moderator: Razieh Nilforooshan

Responsible for insuring that all IPRO deliverables are completed on time and uploaded to the iGroups website. Ensures that all relevant iGroups tasks are created and maintained. Organizes files on iGroups to maintain accessibility and ease of use.

Presentation Organizer: Xufeng Miao

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Responsible for organizing project ideas and results into a presentable format for the mid-term and final presentations. Ensures that all presentation materials are completed and delivered prior to presentations by the team.

Works Cited

1. "NAVTEQ Corporate - About Us." (2010): n. page. Web. 4 Sep 2010.
<<http://corporate.navteq.com/>>.
2. "NAVTEQ." (2010): n. page. Web. 4 Sep 2010.
<<http://en.wikipedia.org/wiki/Navteq>>.

Appendix

Contact List - Students

Name	Major	E-mail	Telephone Number
Kumar, Arjun	Electrical Engineering	akumar54@iit.edu	████████
Link, Krystian	Mechanical Engineering & Engineering Science	klink@iit.edu	████████
Malpekar, Nilesh	Computer Engineering	nmalpeka@iit.edu	████████
Miao, Xufeng	Business Administration	xmiao1@iit.edu	████████
Mongillo, Michael	Applied Mathematics	mmongill@iit.edu	████████
Nilforooshan, Razieh	Architecture	rniforo@iit.edu	████████
Palarz, Mike	Electrical & Computer Engineering	mpalarz@iit.edu	████████
Paradiso, Nicholas	Electrical & Computer Engineering	nparadi2@iit.edu	████████
Sharma, Vivek	Physics	vsharm12@iit.edu	████████

Contact List – Faculty, Sponsor, Community Groups

Name	Role	E-mail	Telephone Number
Burstein, Jim	Faculty Advisor	Burstein@iit.edu	847-687-2944
Lam, Christopher	Faculty Advisor	lamchri@iit.edu	312-404-2430
Lee, Wei-Yeh	Corporate Sponsor	wlee@navteq.com	312-894-3848
Dellutri, Carolyn (Executive Director, Downtown Evanston)	Community Group	cdellutri@downtown evanston.org	847-570-4724