# Feasibility Study

## The Team

Avinash Thangali - at553@cornell.edu
Brendan Fox - bf264@cornell.edu
Ivana Terziyska - it76@cornell.edu
Jeen Yan Toh - jt547@cornell.edu
Jiahua Li (Cathy) - jl3253@cornell.edu
Martin Eizayaga - me393@cornell.edu
Mishcat Ibrahim - mi243@cornell.edu
Quadri Bada - qb26@cornell.edu

## The Client

Dan Cogan, Chief of Staff, City of Ithaca - dcogan@cityofithaca.org
Ducson Nguyen, Software Engineer - dnguyen@cityofithaca.org

## Task Overview

The project is to develop a mobile app that will help the City of Ithaca encourage Ithaca residents to shovel snow off of street corners in order to make it safer for residents to walk, especially after snow storms. There will be an interactive map of street corners and users can see which corners still need to be shoveled out and when each corner was last shoveled. Users can also subscribe to corners in order to get notifications about them.

The project consists of three main parts:

1. developing an interface with a map of the corners in Ithaca that will allow users to subscribe to corners - including all corners along a route and/or a set of individual corners
2. developing a database that will store information about each corner such as its location and shoveling status, and also store information about users such as the corners they've shoveled and the corners they've voted on.
3. developing a UI to allow users to determine which corners need to be shoveled, vote on whether another user has properly shoveled out a corner, and mark corners as needing to be shoveled.

## Benefits

Currently, Ithaca residents have trouble walking outside after snow storms because street corners are not cleared well.

The proposed application would show a map of all Ithaca street corners and show the last time these corners were shoveled in order to inform users which corners may need to be shoveled.

The proposed application would allow users to subscribe to corners and/or a route in order to get notifications when someone claims that the corner is in need of shoveling or when another user has shoveled out the corner. When a user claims to have shoveled a corner, other users will have the opportunity to vote on whether the corner is actually cleared.

The proposed application would feature a leaderboard of top shovelers in order to incentivize Ithaca residents to compete with one another and shovel out as many street corners as they can.

The gamification model of this app, through the use of a voting system, notifications, and a leaderboard, will encourage Ithaca residents to engage in friendly competition to make sure that the street corners are cleared, making walking conditions safer for everyone in Ithaca.

# Preliminary Requirements Analysis

After meeting with the client, we've determined that the mobile application needs to have the following features. We talked to the client and determined that we would split these features into two versions. In the first version, we would incorporate the fundamental parts of the app, and in the second version, we would integrate the remaining features to strengthen the app.

## Version 1

1. Leaderboard
    - Must display the top users per day, per storm, and per season
2. Map Interface with corners
    - All Ithaca corners must be visible on the interactive map
    - Users must be able to click on corners and make reports about the snow conditions of corners
3. Subscription/Notifications
    - Users must be allowed to subscribe to corners to get notifications about them
    - Users can choose to subscribe to corners along a route and/or choose individual corners
4. Voting
    - Users can vote to decide whether another user has properly shoveled a corner

## Version 2

1. Track location and time of users

    - Must track the location of the user when they claim to have cleared a corner to ensure that they are at that corner
    - Must keep track of how long the user has spent at that corner to ensure that they've actually cleared it
2. Points system - weight different corners
    - Must give weights to corners based on whether they are on priority routes and/or what weight the administrator gives to them
3. Menu with tips
    - Must show the proper shovel to use
    - Must show disclaimers, such as reminding users not to lift very heavy snow at once
    - Must remind users to dress warmly when going outside
4. Hosting
    - Must host the application on a server
    - Must host the database on a server
5. Login/Register
    - Must allow users to register for the app and log in
    - Must save users' information on server

After meeting with the client, we have noted that the mobile application may have the following features. The client specified that they are still undecided about them though:

1. Pictures
    - Users might have the option to upload a picture when notifying the app that they have shoveled a corner

# Suggested Deliverables

The following suggested deliverables will be delivered to the client to satisfy their requirements to optimize snow shoveling by residents of Ithaca:

## Technical Deliverables:

1. *Mobile Application run in Android and iOS*
    a. This is one of the core deliverables for the client. It will consist of a mobile interface that keeps updated with the snow shoveling progress of the city corners. It will be well-tested and should be able to run on both Android and iOS.

    Main Functionalities:

    b. **Map with corners**: The application will include a map of the city's corners, and will have status updates of the snow shoveled at each corner
    c. **Voting and Subscription**: Users of this application will be able to vote and subscribe to a particular corner of the city. Voting for a corner allows all users to be aware that said corner is in need of shoveling. When a user subscribes to a

corner, they will be able to keep track of the corner's snow status through notifications.

d. **Leaderboard**: This application will keep track of the number of corners each user has shoveled and produce a regular leaderboard of all users.
e. **Menu with Tips:** This application will feature a tips section that will give users important tips such as to dress warmly, not carry heavy loads at once, and use a metal shovel instead of a plastic one.

2. *Database Linked to Server*
    a. This is the second of the core deliverables for the client. While the mobile application is an interface designed for its users, this database will keep track of all data recorded in the application.
    b. Information stored in this database about each corner can include: Location of corners, Snow status, Voting status, Number of times shoveled
    c. Information stored in this database about each user can include: Corners shoveled, Voted corners, Subscribed corners, Leaderboard ranking

### Management Deliverables:

1. *Requirements Analysis*: a document and presentation for the client with specifics about the formal requirements of this project. This will ensure that the client and the team are on the same page with what the team will produce. The client will be able to look over this analysis and modify or add requirements should they see fit.
2. *Design Document:* a document or demonstration that will be presented to the client about the design of the system. This includes the mobile application and database and the technical requirements that go into developing those deliverables. It will be based on the requirements analysis as mentioned above.
3. *Documentation for Use and Demonstration for Client:* On the completion of the technical deliverables, the team will provide documentation for use so that the client is able to maintain or include additional developments for the technical deliverables. The team will also demonstrate the use of the mobile application to the client so that the client can understand its interface.

## Technical Feasibility

The technical feasibility assessment is focused on gaining an understanding of the present technical resources the organization has/wants and how it fits the needs of the proposed system. It is also an evaluation of the software and how it meets the needs of the proposed system. In all, it clearly outlines the type of technologies needed to make the project successful while satisfying the client's requirements.

1. App Development:
    - Our app will be developed using the javascript framework React Native. We chose React Native because of its ability to natively render mobile applications

for iOS and Android; which was a feature our client required. React Native will be a great fit for this project given the fact that most of the engineers in our group have very limited experience in app development. Moreover, now we can write mobile applications, from the comfort of a JavaScript library that we already know.

2. Database:
    - The proposed system will use the database Postgresql. PostgreSQL is an object-relational database management system with an emphasis on extensibility and standards compliance. One advantage of using Postgresql it's financial feasibility because it's a free open-source project with no strings attached if you stick with the standard version. Lastly, unlike many databases, Postgresql has a stellar reputation for its efficiency and reliability in the software industry.
3. Geographic Information system (GIS):
    - GIS is a framework for gathering, managing, and analyzing data using the science of geography. In other words, GIS is digital data that contains location based information. Tompkins County GIS provides relevant GIS data and mapping resources to assist departments and municipal stakeholders on an ongoing basis. From this resource we would get all of our data regarding destination points of corners that need shoveling.
4. Google Maps Api (Display points and description of points)
    - Google Maps API allows us to build customized experiences to our users with static and dynamic maps, Street View imagery, and 360° views. In addition, it will allow us to display a map with the street corners that need to be shoveled in Ithaca. With Google Maps, users will have an easy visualization for finding places to shovel because it's a platform they're most likely used to.

## Process to be Followed

For this project, our team decided to follow an iterative refinement approach. Most of the team has little experience with app development so having a process whose purpose it is to get something working as quickly as possible will be highly beneficial. We are likely to encounter many obstacles in our requirements and implementation phases. The iterative refinement model will help us in this respect because we will be reviewing phases several times as opposed to just once.

We will begin by dividing the team into people that will work on the database and people that will work on the front-end of the application. The first features that will be targeted will be the leaderboard, the map with corners, and voting/subscription. At each iteration, the scope of each of these required features will be increased. Subsequent features will be added later depending on the review portions of the iterated process detailed below.

## Outline Plan - Principal Activities

Database

- Set up a table for users
- Set up a table for corners
- Integrate the app to this database

Map and corners

- Look at the GIS data outlining the corners in Ithaca
- Figure out how to use the Google Maps API
- Put points on the map interface to mark corners
- Incorporate data from the database onto the map

Voting

- Create notification system that will spark notifications when someone votes
- Make UI display the number of votes

Subscription

- Figure out how to create a notification
- Set up feature that allows users to subscribe to corners in a certain radius and/or along a route and/or a set of individual corners
- Make UI display a notification when someone in your region votes

Leaderboard

- Use the database user table to create a UI display of a leaderboard of top users on the application

## Outline Plan - Milestones

### I. Milestone 1.0 (2/8)

An initial feasibility report and requirements analysis will be outlined after meeting with the client about expectations for the project.

### II. Milestone 1.1 (2/22) - 2 weeks later (before Feb break)

The team will research and learn about the technical requirements for their subgroup. A two paper prototypes of the user interface will be created and will undergo user testing. The second prototype will be an adjustment from the feedback of the firstAn initial database will be created using sample GIS data for testing.The requirements analysis should be revised according to client and user input and a document detailing both components of the system will be prepared.

### III. Milestone 2 (3/6) - 12 days later **Presentation**

The requirements and design documents will be refined based on team review of feasibility and client input. The frontend and backend components of the application will be integrated into the prototype. Initial prototype functionality of required features that do not contain all proposed functionality yet will be implemented such as a simple user

interface with the ability to interact with the map, receive user-independent notifications, and view a static leaderboard. A progress report will be written discussing the status of the team and prototype. The product up to now will undergo user testing. We will write down feedback for the next iteration.

### IV. Milestone 3 (3/27) - 21 days later (3 weeks) **Presentation**

The design document will be modified and finalized based on the team's experience developing the prototype resulting from Milestone 2. The required features will be enhanced during this milestone with added functionality, such as specific notifications based on subscription and a dynamic leaderboard. The final design concept as well as the revised prototype will be demonstrated to the client. A progress report will be written discussing the status of the team and prototype. There will be user testing on the coded prototype to help us with the next iteration.

### V. Milestone 3.1 (4/19) - 14 days later

Even though the design document would be finalized by Milestone 3, we will be able to make any necessary adjustments depending on how our progress is going. The team will continue to implement and review for the next iteration. The team aims to do user testing and revise the prototype to achieve a functional version of each required feature by Milestone 4. Upon review, the feasibility of further features can be assessed. If the team is progressing well, we will add features to our "Principal Activities" list above. By this milestone we will be expecting the app to be able to successfully communicate between the user interface and the database.

### VI. Milestone 4 (5/1) - 12 days later

The entire application, including required and optional features should be thoroughly tested and debugged. The client will have the opportunity to release the app and test it for its intended purpose. A presentation demonstrating all required functionality of the final prototype to the client will be prepared.

### VII. Milestone 5 (5/16)

Minor changes may be made after the app is initially released in Milestone 4. Documentation for every component and feature will be written so that the clients can maintain and extend the code base for future use. All source code and documentation will be shared with the client. A summary report will be written analyzing the development process and result of the project.

## Visibility Plan

Visibility is key to a project's success and to ensure that all requirements are met and all risks are thoroughly considered. All team members agree to keep in close communication with each other and with the client(s) and report challenges and progress at the earliest opportunity.

### Within the Team

The team's main means of communication is Slack, which offers the advantages of high desktop and mobile accessibility and integration with services such as DropBox, Google Drive, and GitHub. Slack also allows team members to easily share code and form new conversations (channels) within the main workspace.

Beyond text communication, the entire team convenes for a weekly meeting to review the past week's performance, accomplishments, and challenges. All meetings will be documented via a shared Google Doc or voice recording for future reference. Because time for whole-team meetings is severely limited due to schedule conflicts, all topics addressed during these meetings will be of broad or critical nature.

Subsets of the team will meet regularly outside of this time frame to address other topics not covered at the entire-team meeting. These topics may include and are not limited to: technical details, marketing strategies, etc.

### With the Client

Additionally, the team will communicate with the client(s) through a separate Slack channel and schedule meetings immediately after each milestone date. Exact meeting times will be determined as the milestone nears. Again, the content of these meetings will be recorded with similar means as stated above, and meeting minutes will be shared with both team members and the client(s).

During these meetings, team members will demonstrate and communicate any new progress and challenges to the client(s).

## Risk Analysis

### Time Constraint Risks

Throughout the project, one must keep in mind the semester-long time constraint imposed on project development. There is an associated risk that certain planned features of the app may prove infeasible to implement within the allotted time frame, leading to not only a less-than-satisfactory product, but also a diversion of effort and time from other features that would otherwise be practical to implement.

*Management Strategy:* The team anticipates that the best way to continuously update our assessments of what is and what isn't feasible given the remaining time available is to begin work on as large a breadth of features as is possible concurrently at any given time. Therefore, the team plans on following an iterative development process, rather than a sequential one, to ensure that any deceptively difficult features are discovered as early as possible in the semester so expectations and plans can be adjusted accordingly. Additionally, the team plans on adhering to a strict visibility plan with the client.

## Objective Risks

As the development of the app unfolds, it is possible that objectives may change due to novel insights or unforeseen obstacles and opportunities. Additionally, certain objectives may be abandoned in favor of alternatives in order to achieve the desired end-user functionality. These changes may be initiated at the suggestion of either the client or the team members, and if adopted may necessitate changes to remaining plans. Finally, there exists the risk that misunderstandings between the client and the team with respect to certain objectives may occur.

*Management Strategy:* The team plans to utilize the visibility system detailed earlier in this report in order to continually verify the team's understanding of all current objectives with the client, to ensure comprehensive review. This will be undertaken after all meetings, and immediately after the team collectively decides to suggest any changes to the current set of objectives.

## Resource and Technology Risks

The nature of the project necessitates the use of various mobile app development tools. Fortunately, all such tools considered for use by the team during development are available open-source, but the risk still remains that later during the development process it is discovered that non-open-source tools must be used for development.

*Management Strategy:* If we discover that we are in need of certain technologies that are licensed, we will discuss options with the client and either adjust functionality objectives accordingly, or inquire about Cornell-sponsored licenses from the Computer Science department.

# Business Considerations

As Cornell students the team owns the copyright in the software that we create. The team agrees to transfer ownership of the copyright to the client after work is done.

In the event that we need access to any proprietary information, team members are willing to sign non-disclosure agreements.

No part of the system is foreseen to be eligible for any patent applications. However, if upon a later date, a part of the system is found to be patentable, the team reserves the rights to the uncontested patent and any derivative works based therein, while the client will automatically gain non-exclusive rights to use the system, and will have full rights to the use and modification of the system regardless of any patent rights held by the team.

# Conclusion

From the team's analysis of the project requirements, we have determined this project to be feasible regarding Version 1 features. Some revision of the functional scope of the optional features may be necessary based on challenges the team encounters with the technical requirements, thus we concede that not all of the optimal features are guaranteed to be implemented given the time constraints of the project. However, we believe that we possess the adequate skills, resources, and team organization to begin development of this project according to the procedure.