The City of Letterkenny

Snow Plow Route Optimization

Request for Proposal

Version 1.1

January 21st, 2020

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Project Version 1.0

Document History

Version	When	Who	What
1.0	2020-01-14	The City of Letterkenny	Initial proposal draft
1.1	2020-01-21	The City of Letterkenny	Initial proposal final

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1.0 Problem Overview

Unlike other Canadian cities, the City of Letterkenny is not well equipped for snow storms. A lack of snow removal resources means the city must use the few resources it has in a highly efficient manner. Without proper snow plow routes, the city is at risk of having its roads covered in snow for longer than necessary, creating a number of issues, including:

- Roads that are unusable or unsafe for drivers, especially motorists
- Emergency services not being able to respond to calls quickly
- A weight on the local economy as workers and customers are unable to reach businesses

With a new snow plow routing system we hope to minimize the impact of snow on the roads for drivers by monitoring live snow plow and snowfall data to improve route efficiency .

2.0 Project Objectives

The objective of the project is to create a program that will monitor the roads based on weather reports, the amount of snowfall in an area, and the recent plowing of snow that has happened. Using this data, we can improve the snow plow routes , as well as better inform citizens of road conditions. The Snow Plow Route Optimization Plan must meet the following objectives:

- Improve safety for all road users
- Track live snow plow locations
- Inform public of plowed roads
- Improve accessibility of roads
- Dynamically assign and adjust routes to snow plows

These objectives should be met through the implementation of three modules: a dispatch interface, a driver interface and a public interface.

1.1 Dispatch Interface

The dispatch interface should provide the following information to dispatchers and managers:

- Snow plow locations
- The driver of each snow plow
- Snow plow resources (e.g. salt, sand)
- Driver time on shift
- When each street was last plowed
- When each street was last sanded or salted
- Predicted accumulation on each street over the next 12, 24, and 48 hours
- User reports of road conditions overlayed on a map with the report's location

Additionally, the interface should allow dispatchers to easily assign routes to each snow plow driver.

1.2 Driver Interface

The driver interface should provide plow drivers with turn-by-turn navigation of their assigned route. The interface should also provide user reports of conditions overlayed on the map to warn the driver of any upcoming hazards. Additionally, the interface should allow drivers to easily make a geotagged report to dispatch of any hazards or other special conditions they may encounter on the roads. Since some routes are completed after dark, the interface must include a night mode that automatically turns on at sunset.

1.3 Public Interface

The public interface should provide a website that displays a map view of the city, with an overlay that displays the road statuses. Roads that are unplowed, plowed, or in progress should be marked. If a road is unplowed, then an estimated time of when the road will be clear, or if the road is not expected to be cleared, it should be marked as such. Users should also be able to report areas that may have hazards or special conditions.

3.0 Current System

Majority of our system is manual, and done through paper documents that are physically distributed between dispatch and drivers, or verbally communicated when necessary.

3.1 Dispatch System

The team currently determines snow plow routes internally, based off of high-traffic areas in the city. All routes are confirmed the day before routes are to be plowed to account for

recent weather changes. Any urgent modifications to the route will be called in to the driver by dispatch as soon as possible, and will be documented on the corresponding change request form.

3.2 Driver System

Drivers are given a paper copy of routes with written directions and a map with the route overlayed on it. Drivers must check in with dispatch every 4 hours to report or receive any route changes along with a status update. Each snow plow has a built-in touchscreen computer that is currently functional, but not in use.

3.3 Public System

The public interface the city currently has implemented is a web page off of the city's main website that provides the Snow and Ice Control team's contact information, including the department's email and phone number. Users can report areas that contain hazards by calling or emailing the Snow and Ice Control team, with reports being reviewed within 2 - 8 hours.

4.0 Intended User Interaction

There will be three types of users interacting with the system:

- Dispatchers
- Snow plow operators
- Citizens of Letterkenny

Dispatchers will need to review routes that the system generates prior to them being assigned to the snow plow operators. They should also be able to validate user reports of dangerous conditions or hazards. They are the main point of contact for snow plow operators, and ensure the operators' safety as well confirm they are on the correct routes.

Snow plow operators are the drivers of snow plows that clear the snow from roads. Their job is almost entirely done inside a snow plow, and need to be informed of their routes and changes through the built-in computer system of the snow plow.

Citizens need to be informed of snow plow routes through a web interface that is optimized for both desktop and mobile. Users should also be able to submit hazard reports through the web interface using a selected location, or their current location.

5.0 Outside System Interactions

The system will rely on current weather conditions and weather forecasts. This weather data is to be retrieved from Environment Canada. The mapping and directions are currently taken from Google Maps. Any solution must use an accurate and reliable mapping service, but is not restricted to using Google Maps.

6.0 Known Development Constraints

There are three major constraints to the system outlined below. These constraints are important to keep the efficiency and integrity of the operation intact.

- Require little to no maintenance, as the city does not staff software engineers
- Keep implementation time within 1 year
- Keep implementation cost below $1,000,000 CAD

7.0 Project Schedule

ID	Task Name	Start Date	End Date	Duration	Assigned To	Percent Complete
1	Release RFP to Market	14-01-2020	01-21-2020	7 days	City of Letterkenny	100%
2	Requirement Specification 1.0 (Developer Win Bid)	28-01-2020	18-02-2020	21 days	Developer (Group 10)	0%
3	Requirements Specification 1.1 (Refine RS 1.0)	18-02-2020	20-02-2020	2 days	City of Letterkenny	0%
4	Requirements Specification 2.0	20-02-2020	03-03-2020	12 days	Developer (Group 10)	0%
5	Prototype Demonstration	03-03-2020	09-03-2020	6 days	Developer (Group 10)	0%
6	Prototype Feedback	10-03-2020	10-03-2020	1 day	City of Letterkenny	0%

7	Requirements Specification 3.0	10-03-2020	19-03-2020	9 days	Developer (Group 10)	0%
8	Requirements Specification 3.1 (Refine RS 3.0)	19-03-2020	23-03-2020	4 days	City of Letterkenny	0%
9	Final Demo	23-03-2020	30-03-2020	7 days	Developer (Group 10)	0%

8.0 Project Team

The City of Letterkenny's Snow and Ice Control team consists of six motivated individuals and can be contacted at the following email and website:

Email: snowclearing@letterkenny.ca
Website: https://nilay.sondagar.com/seng321/

Elmer Martinez

- *Role:* City Councillor in Charge of Public Safety
- *Description:* In charge of implementing safety protocols in times of severe weather and other natural calamities, and ensuring the safety of the public at all times.

Nilay Sondagar

- *Role:* Communications Director
- *Description:* In charge of updating the citizens of Letterkenny on new projects from the Snow and Ice Control Team. Also responsible for handling any and all public relations including press releases, keynote speeches, and promotional materials.

Noah Clarke

- *Role:* Head Snow Plow Driver
- *Description:* Snow plow driver on the Snow and Ice Control Team. Also responsible for driver training and represents the Snow and Ice Control Team in communications with management, city employees, and other outside parties.

Michelle Aleman

- *Role:* Head Dispatch Operator
- *Description:* In charge of assigning snow plow routes to Snow and Ice Control Team drivers at least one day before they are cleared. The head dispatch operator is also responsible for communicating any urgent updates to routes to the affected drivers through the dispatch system.

Paige Loffler

- *Role:* Mayor of Letterkenny
- *Description:* Responsible for overseeing all projects approved by the city. Approves funding for projects. Final approval on all completed projects must be given by the mayor.

Hailam Nguyen

- *Role:* Environmental Conditions Specialist
- *Description:* In charge of monitoring the impact of snow on Letterkenny, identifying the environmental issues and proposing some solutions. Also maintaining distinct records related to research, data of permits and inspections to improve the living conditions of the city.

9.0 Glossary

Dispatch: The office responsible for managing snow plows and snow removal in general.

GPS (Global Positioning System): A satellite based system which provides users with their current location given they have the appropriate hardware to receive GPS signals.

Turn-by-turn navigation: A navigational aid which displays the route to be driven on a digital map along with distance, location, and direction of the next turn. The map also displays the driver's current location using GPS data. Additionally, audio reports of upcoming turns are given.