SOFE 3720/ CSCI 4610: Introduction to Artificial Intelligence/ Artificial Intelligence

Winter 2019

Dr. Sukhwant Kaur Sagar

Assignment 1: Shortest Path

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Introduction

In this assignment, the main goal was to use streets and elevation from a particular area in the city of Oshawa, and find the optimal or shortest path from one start point to an end point which are two OSM nodes. For this assignment we picked region between Dundas Street East and As the data sets, we used an OpenStreetMap XML file which has the routes of the area we had chosen, and a BIL file which has the elevation map.

Area

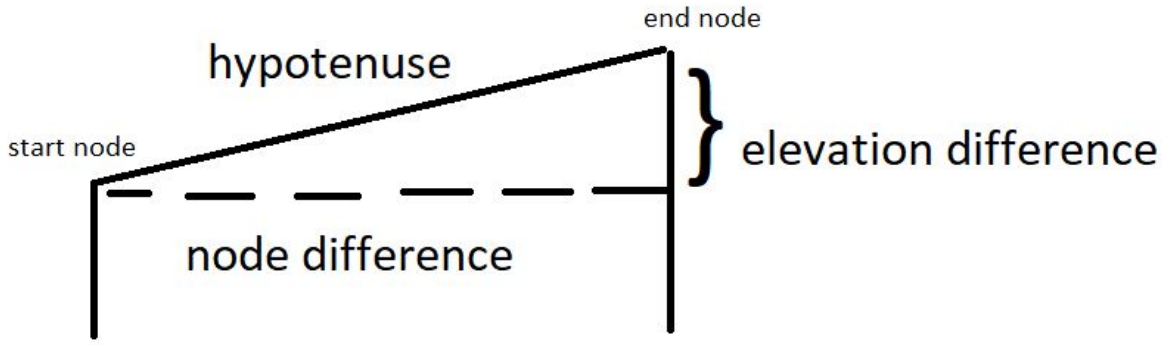
Starting: Dundas Street East and Thickson Road
Ending: Thornton Road South and Gibb Street

Approach

The basic approach we took to generate the ‘shortest path’ was the A* algorithm which is a improvement on the Dijkstra algorithm. The A* algorithm takes into account the cost of the path from starting point to some point ‘n’ and the estimated cost function which is computed by heuristic. The function is f(n) = g(n) + h(n). From any node that has been chosen as the beginning, the A* algorithm takes into account all the different paths that can be taken from the starting point. With the A* algorithm, each different possibility is compared to see which path from starting point to the particular node associated with the path gives the least distance.

To take into account the elevation difference that might occur in a path, the heuristic function uses the pythagorean theorem in its attempt to find the cost from one node to another using the slope between those nodes. As mentioned, the heuristic function uses the pythagorean theorem to see if there is a rising slope because of difference elevations. We take the distance from the first node and the second node along the x-plane and multiply that by the meters per degree of latitude. We also take the distance of y and multiply it by the meters per degree longitude at 42N for the y-plane. We then find the horizontal distance using pythagorean theorem and the vertical distance by finding the difference between the two nodes elevations. Using these two numbers of horizontal distance and vertical distance, we find the heuristic function by performing the pythagorean theorem.

Heuristics Drawing



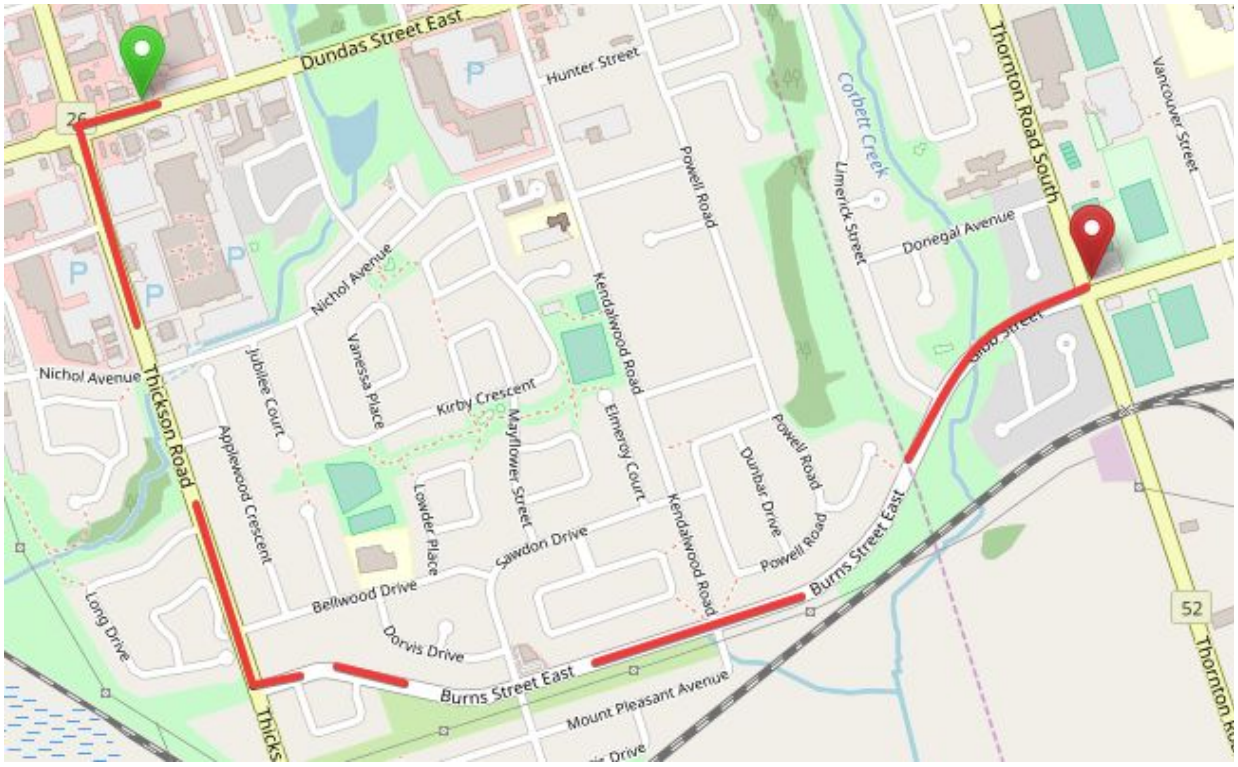
***Note: We made a use of OpenStreetMap’s website to draw the path the algorithm would take, we have not developed a graphical solution.**

Output - 1

start node = (43.8868806, -78.9114097)
end node =(43.883945, -78.8901085)

```
PROBLEMS 2   OUTPUT   DEBUG CONSOLE   TERMINAL

PS C:\Users\100619029\Documents\AI Assignment> python ai.py
Path found, time will be 39.2891003898  minutes
Visit the following roads...
Dundas Street East
Thickson Road
Burns Street East
Gibb Street
Thornton Road South
PS C:\Users\100619029\Documents\AI Assignment>
```

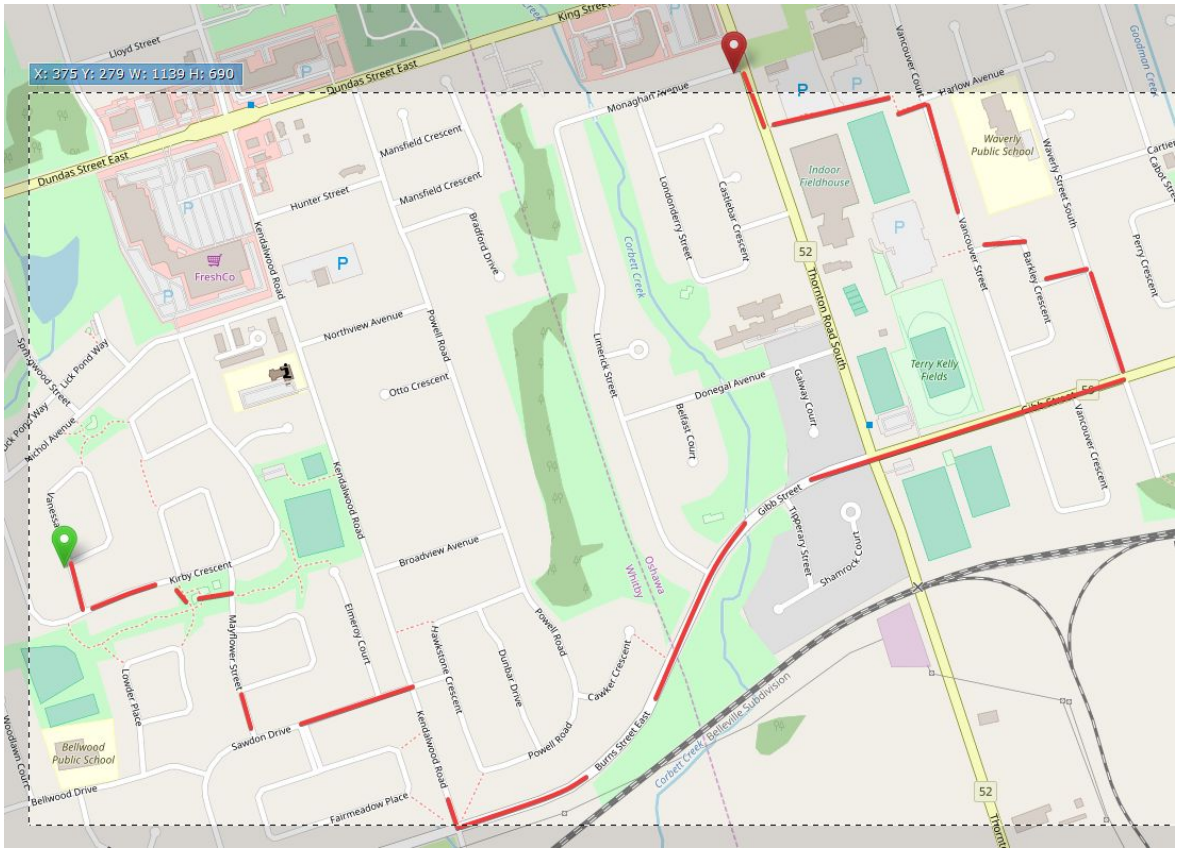


Output - 2

start node = (43.8822914, -78.906245)
end node = (43.8895115, -78.892649)

```
PROBLEMS 2   OUTPUT   DEBUG CONSOLE   TERMINAL

PS C:\Users\100619029\Documents\AI Assignment> python ai.py
Path found, time will be 46.4733082264  minutes
Visit the following roads...
Vanessa Place
Kirby Crescent
unknown road
Mayflower Street
Sawdon Drive
Kendalwood Road
Burns Street East
Gibb Street
Waverly Street South
Saturna Avenue
Barkley Crescent
Vancouver Street
unknown road
Thornton Road South
PS C:\Users\100619029\Documents\AI Assignment>
```

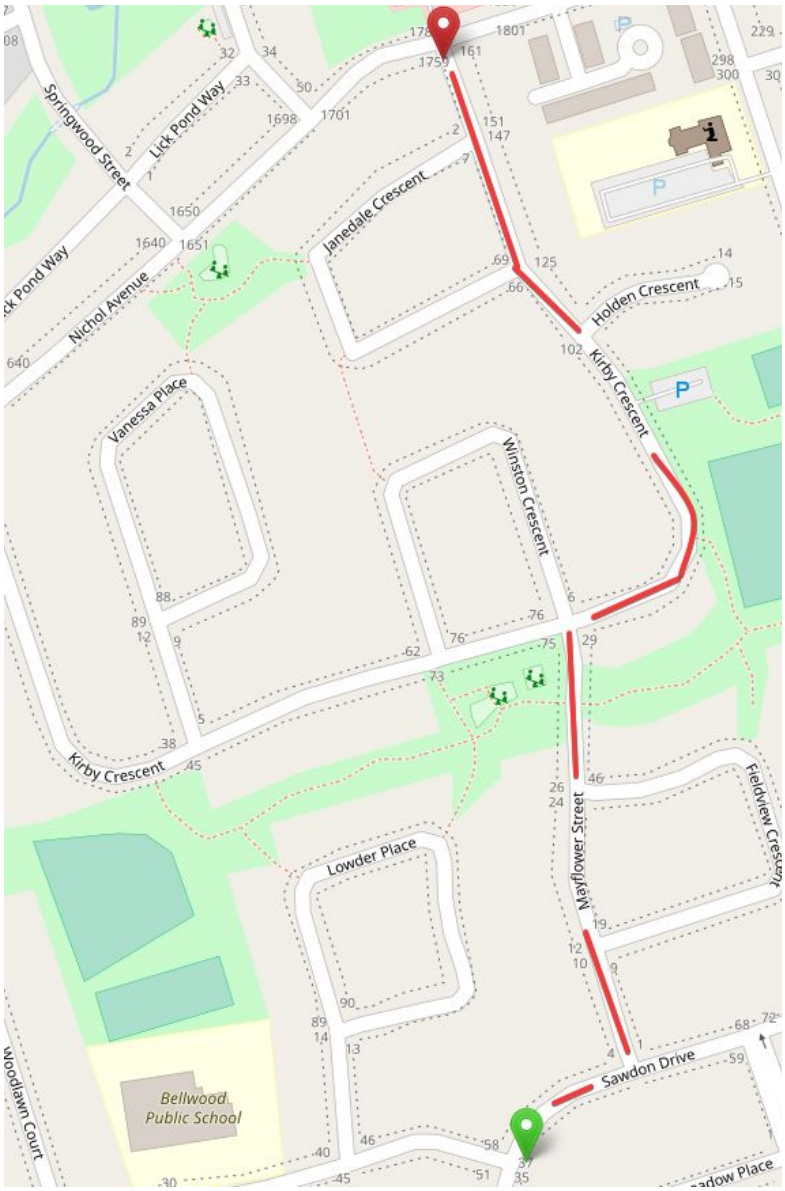


Output - 3

start node = 43.8792082, -78.903459
end node = 43.8855935, -78.9040196

```
PROBLEMS 2   OUTPUT   DEBUG CONSOLE   TERMINAL

PS C:\Users\100619029\Documents\AI Assignment> python ai.py
Path found, time will be 9.33420190426  minutes
Visit the following roads...
Sawdon Drive
Mayflower Street
Kirby Crescent
PS C:\Users\100619029\Documents\AI Assignment>
```



Github Link:
https://github.com/karanj798/ai_assignment1