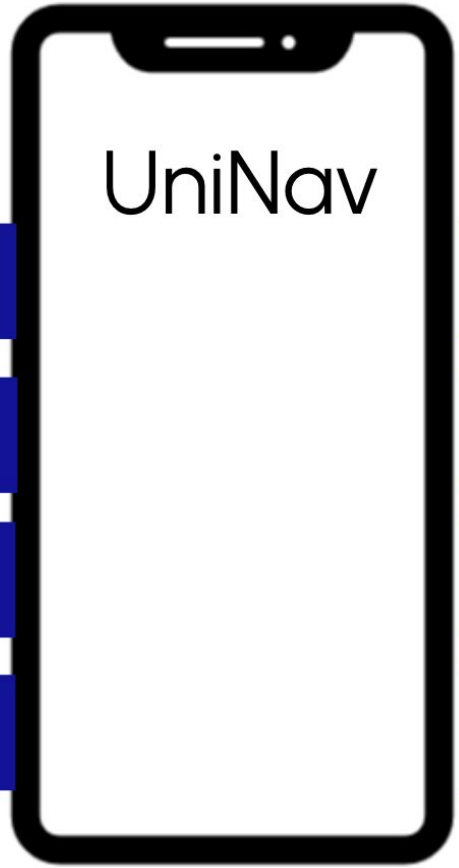
UniNav

Usability

- Task Efficiency
- Easy learnability
- User Satisfaction
- Accessibility



Responsive

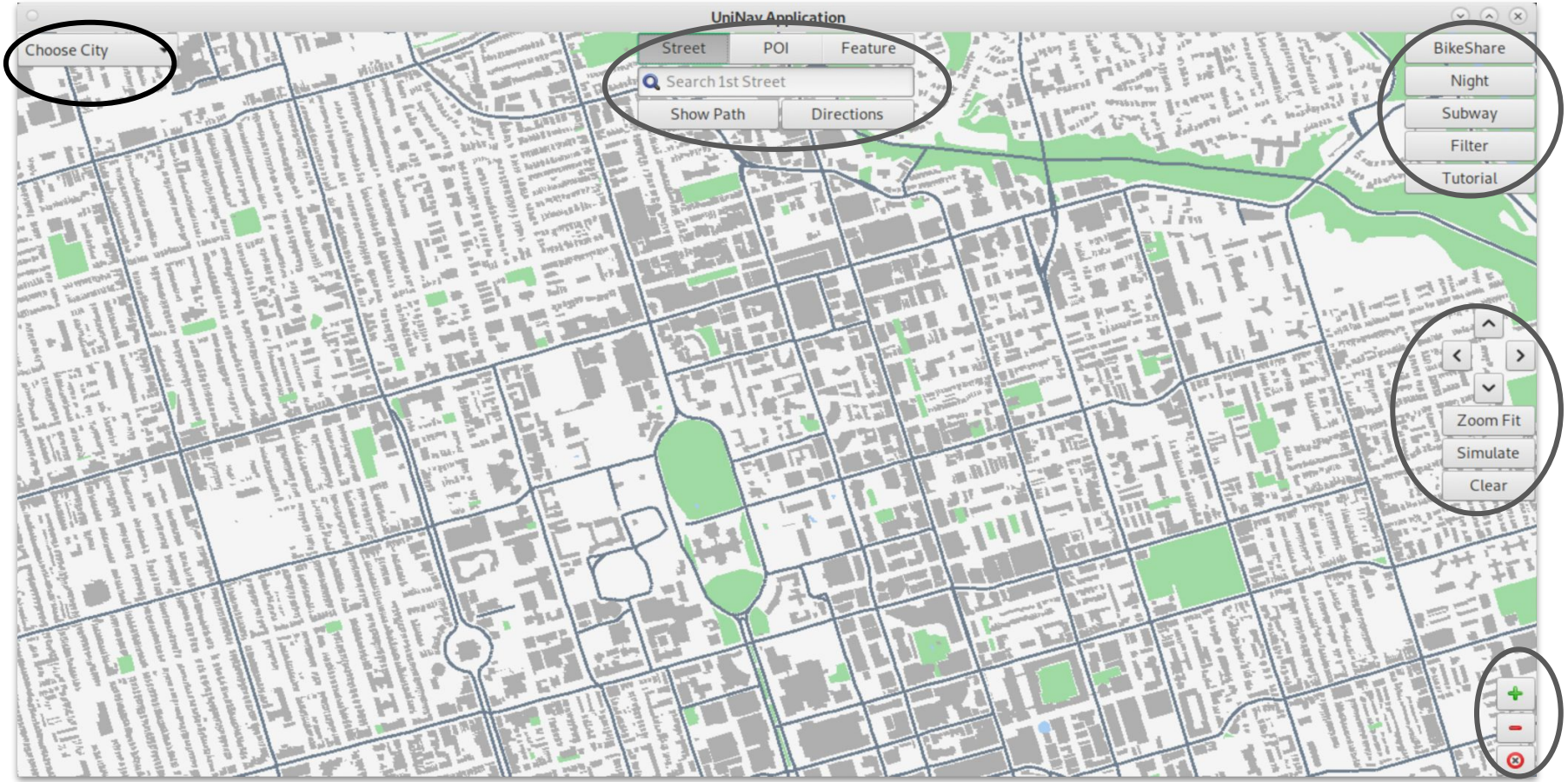
- Code efficiency
- User inputs
- Timely feedback
- Error rates

Goal

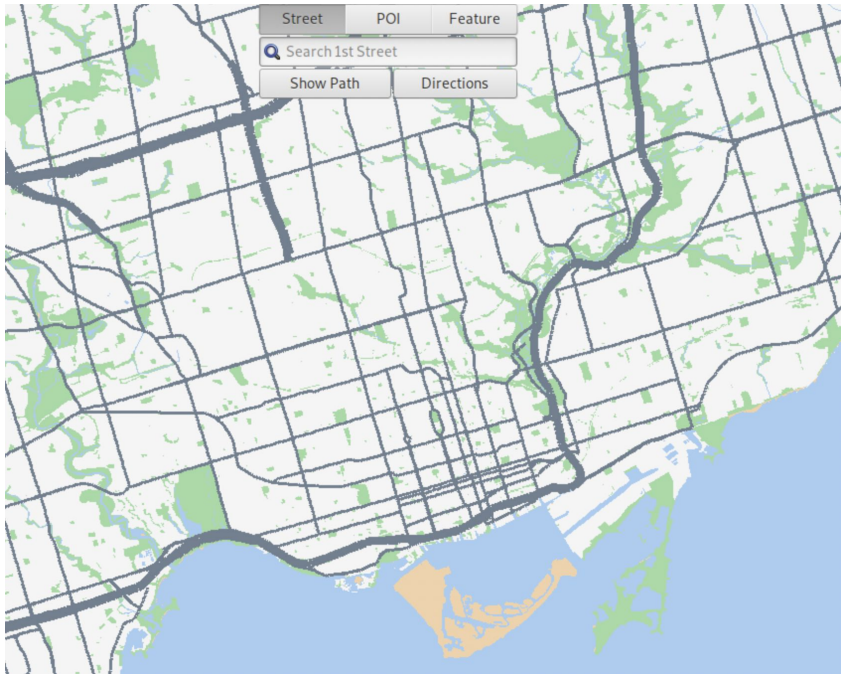
Create a usable, responsive, and accessible GIS system for international students

Usability

Placement of buttons in visually prominent areas



Color coding and aesthetics



Color coded

Varying street widths

UniNav

Color coding and aesthetics

Enhance accessibility in low light conditions

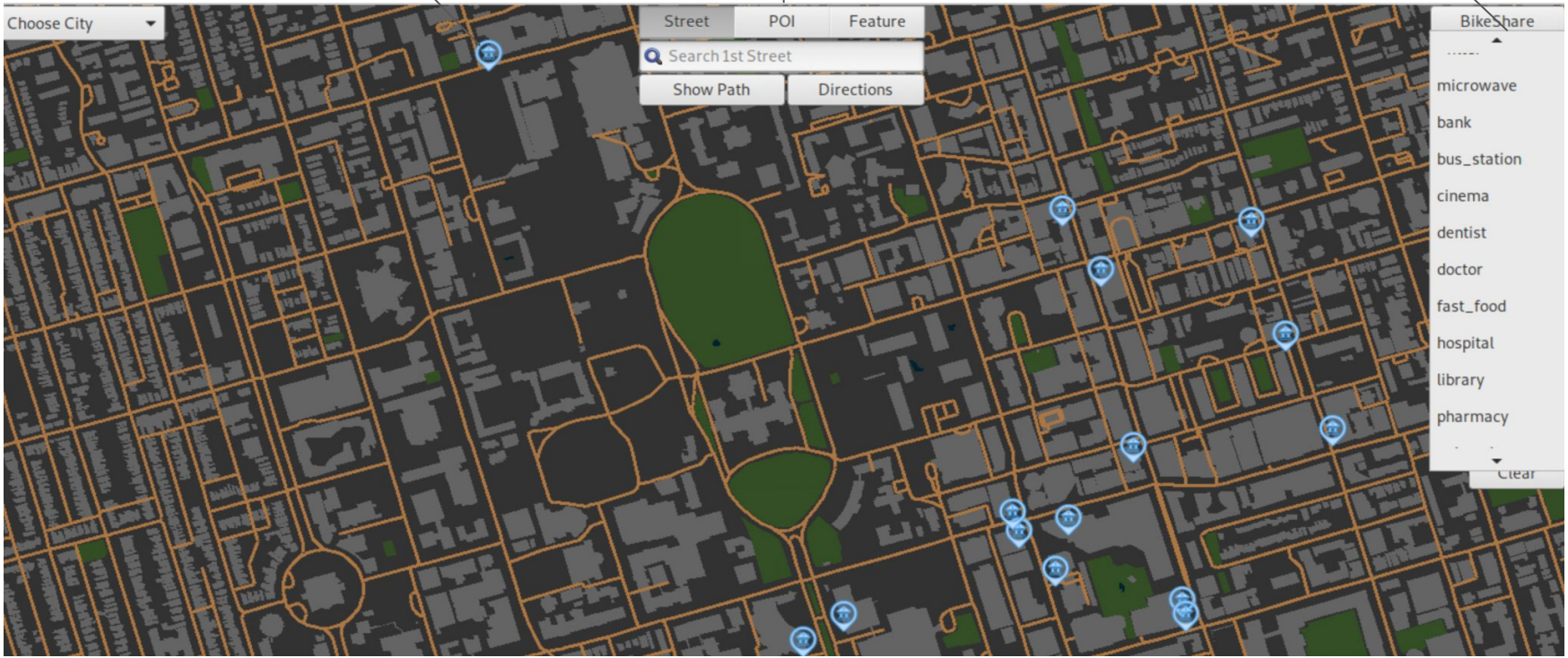
Automatically switches to night mode

Filters

Filter based icons

Search bar

Drop down menu

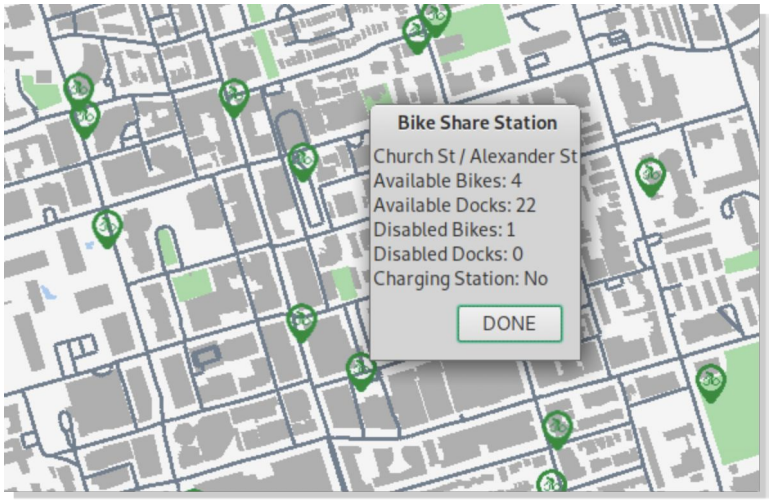


Student based filter selection

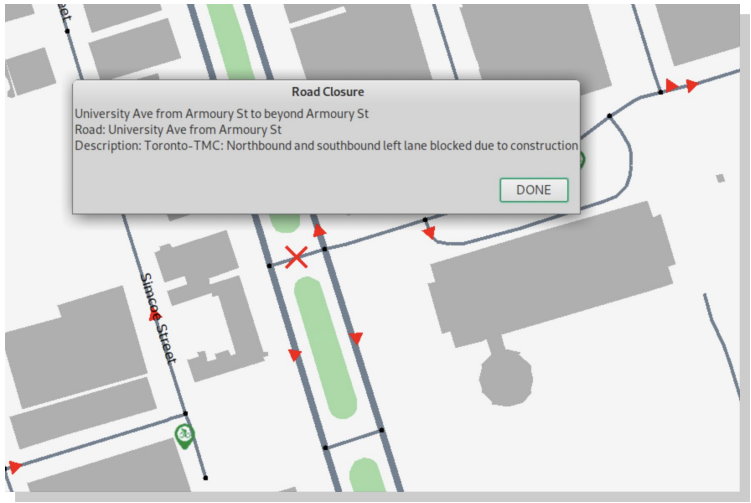
General Filters
Bank
Pharmacy
Dentist
Hospital
Restaraunts

Student Filters
Immigration offices
Microwave
Bus station
Hospital
Cheap/fast eat

Real time data



BikeShare



Road Closures

API

Zooming levels to deliver information effectively

Furthest zoom:

- large points of interest
- Highways
- Large water bodies

Middle zoom:

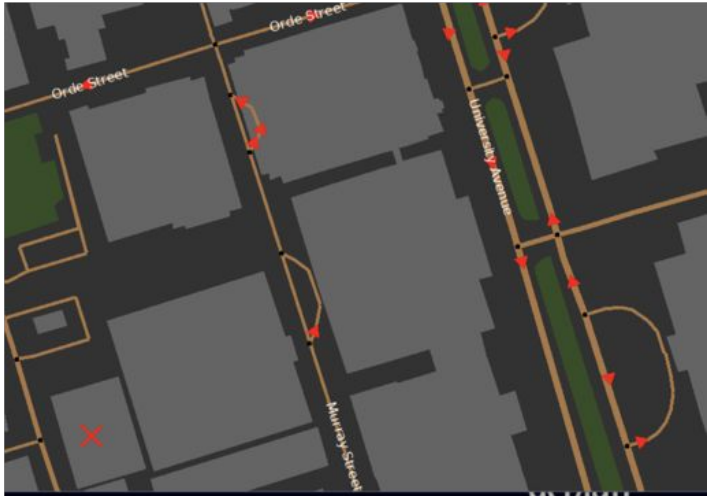
- Points of interest
- Smaller streets
- Building shape and size

Highest Zoom level convey largest detail

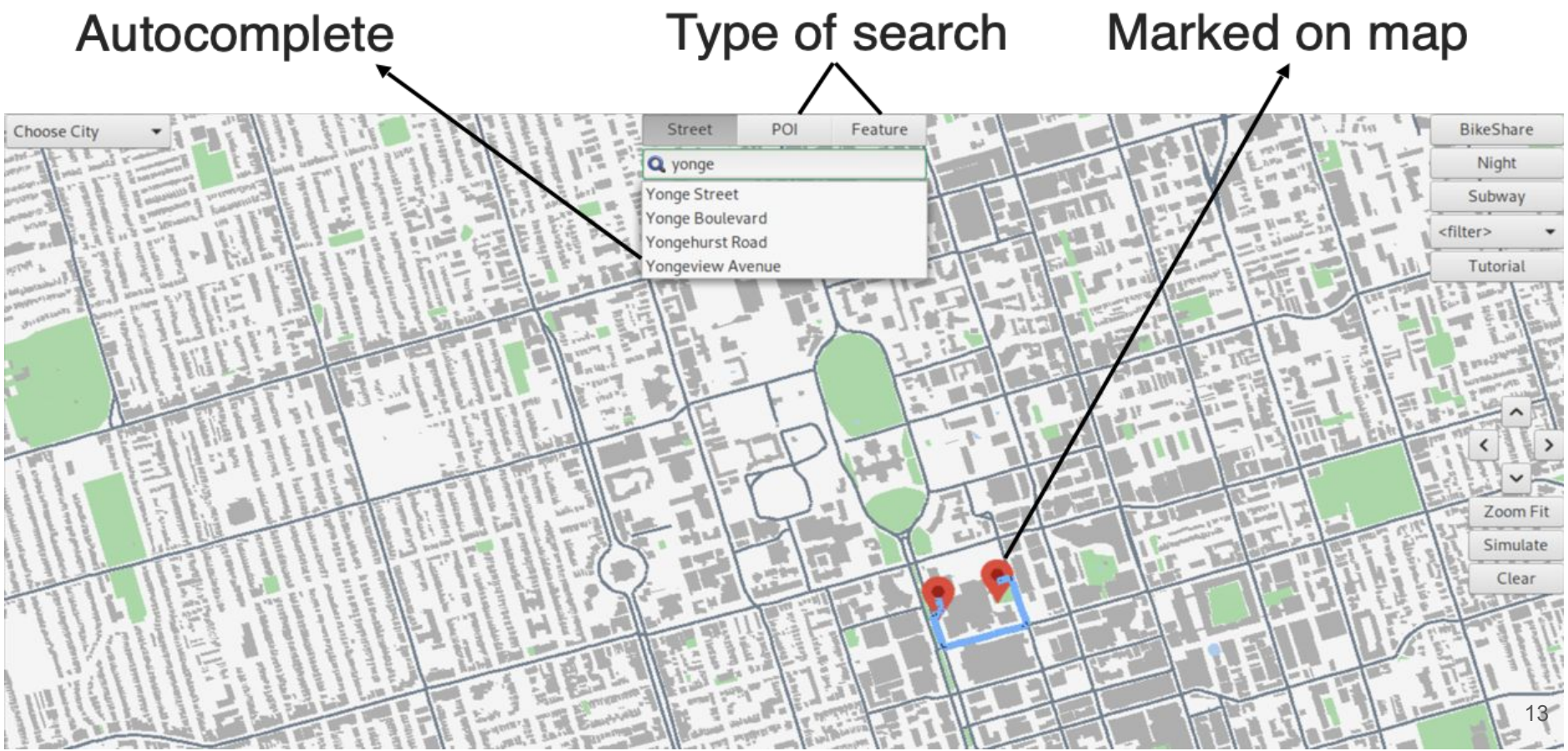
Street names

Road direction

Road closure



Search bar maximizes efficiency in navigation



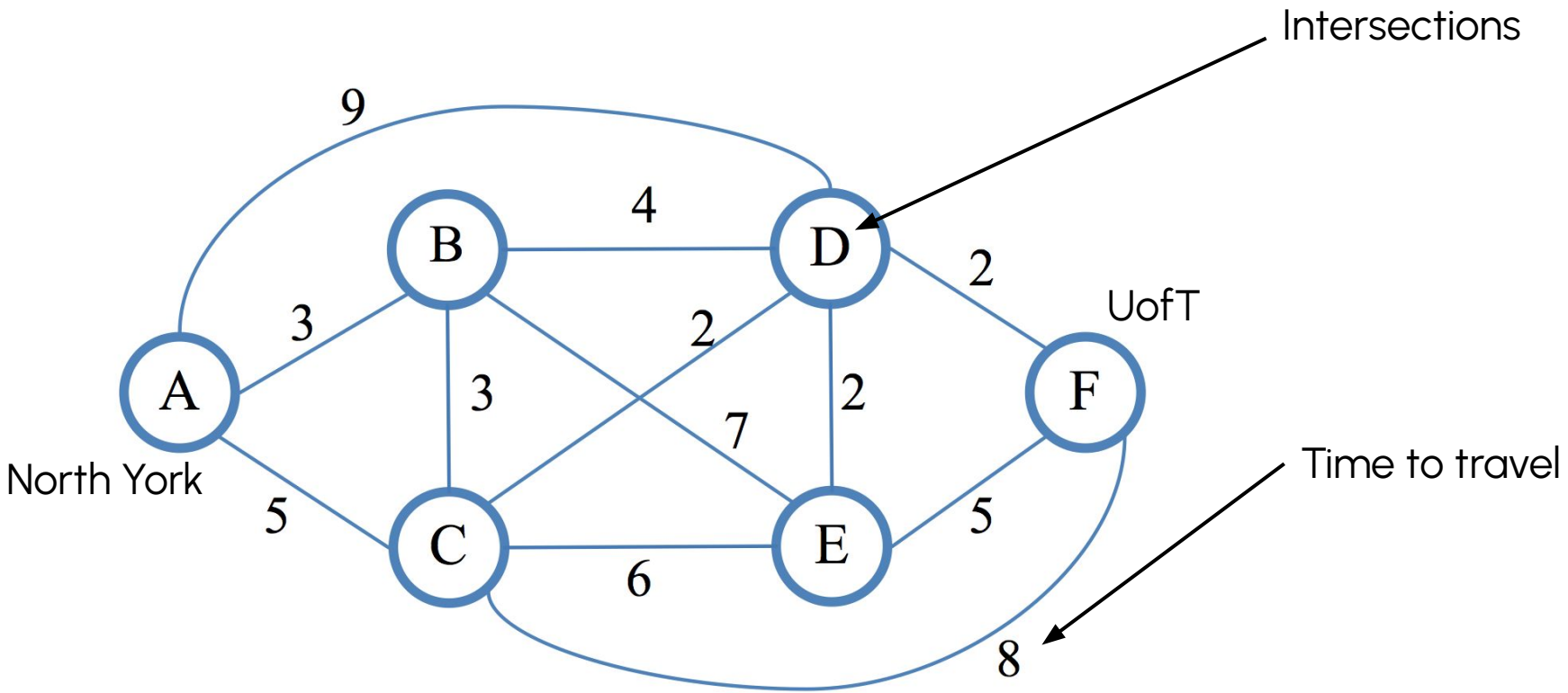
Responsiveness and algorithms

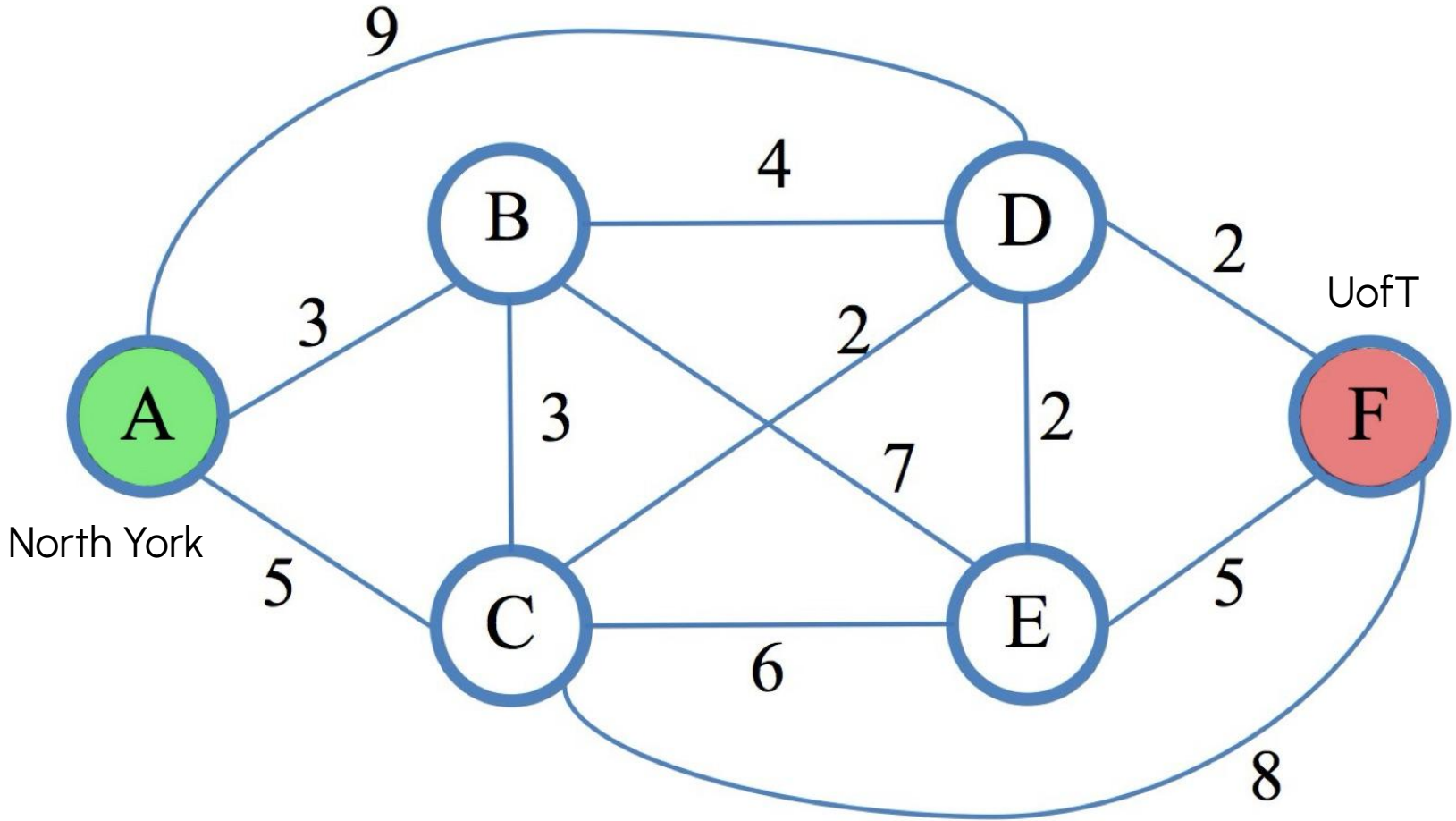
Path Finding

North York

University

Dijkstra's Algorithm




9
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North York
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C
E
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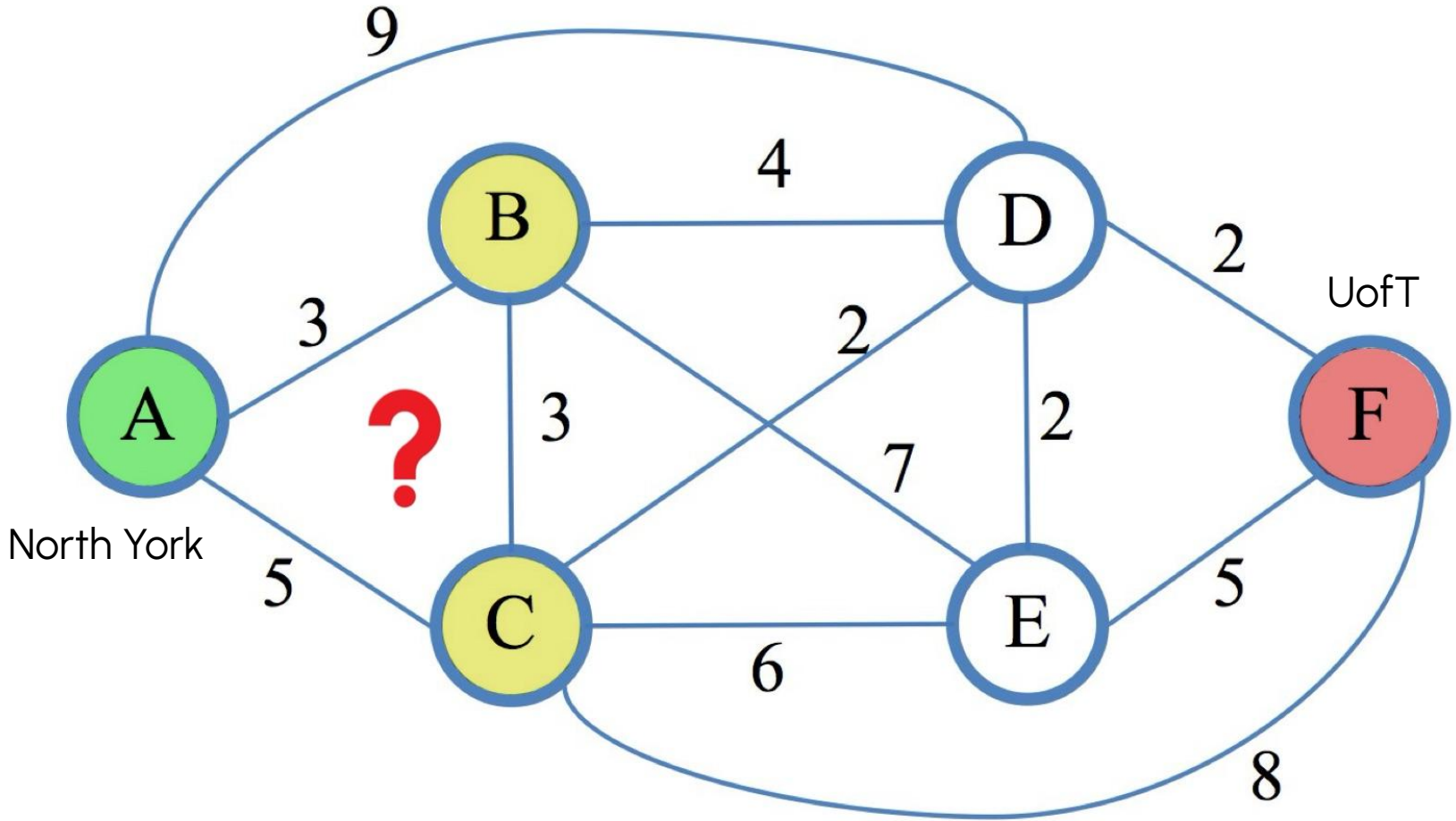
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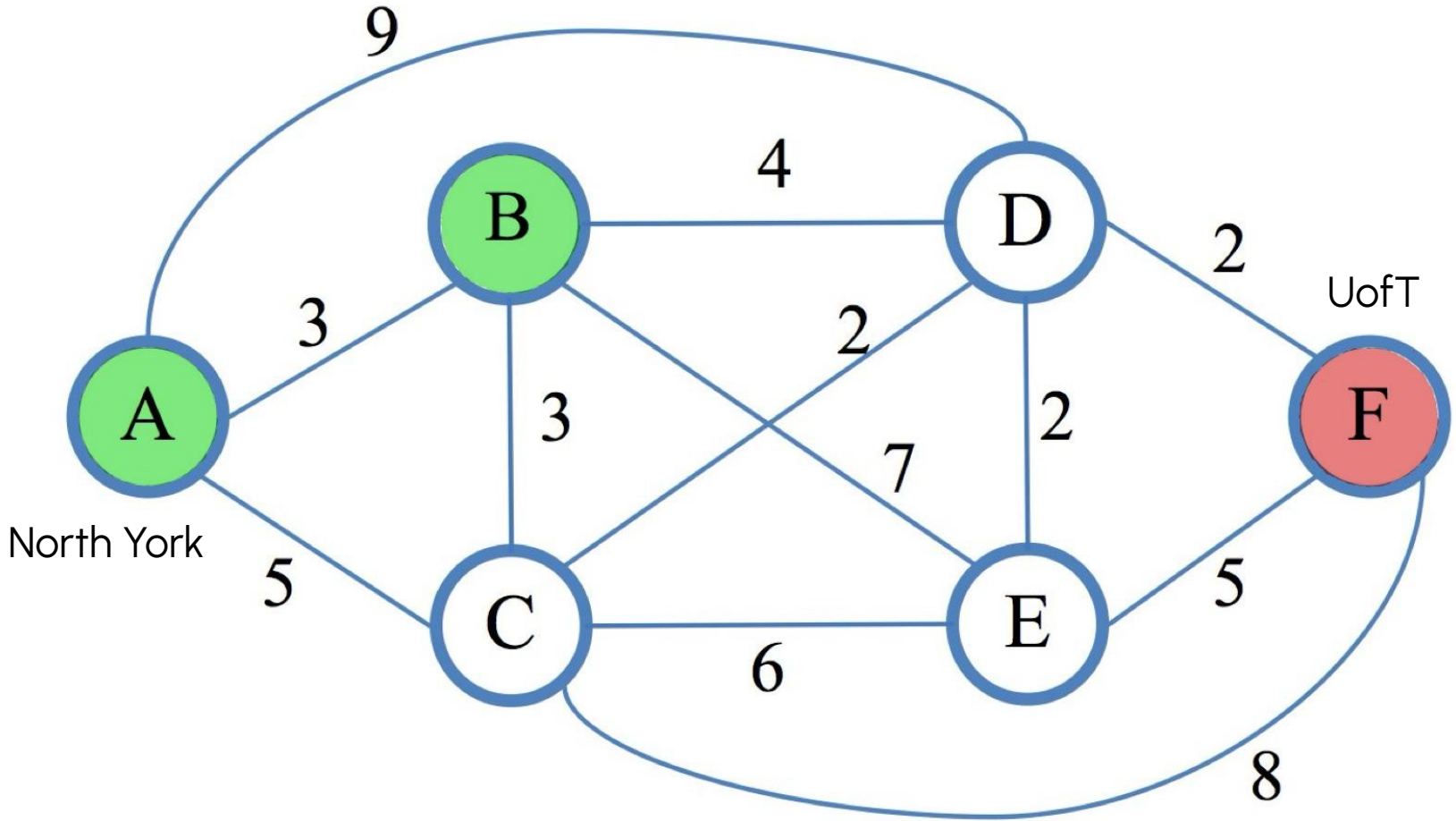
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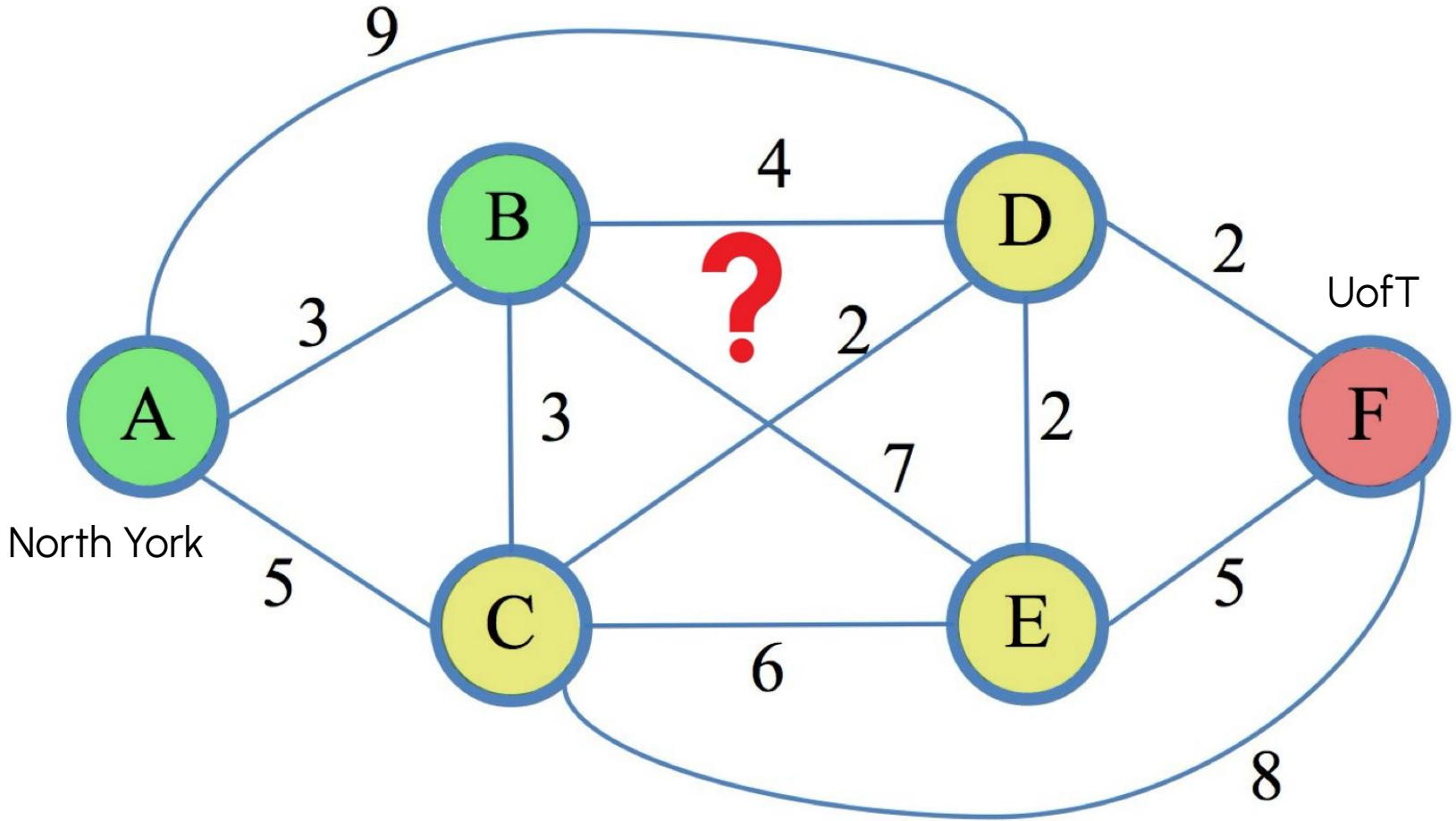
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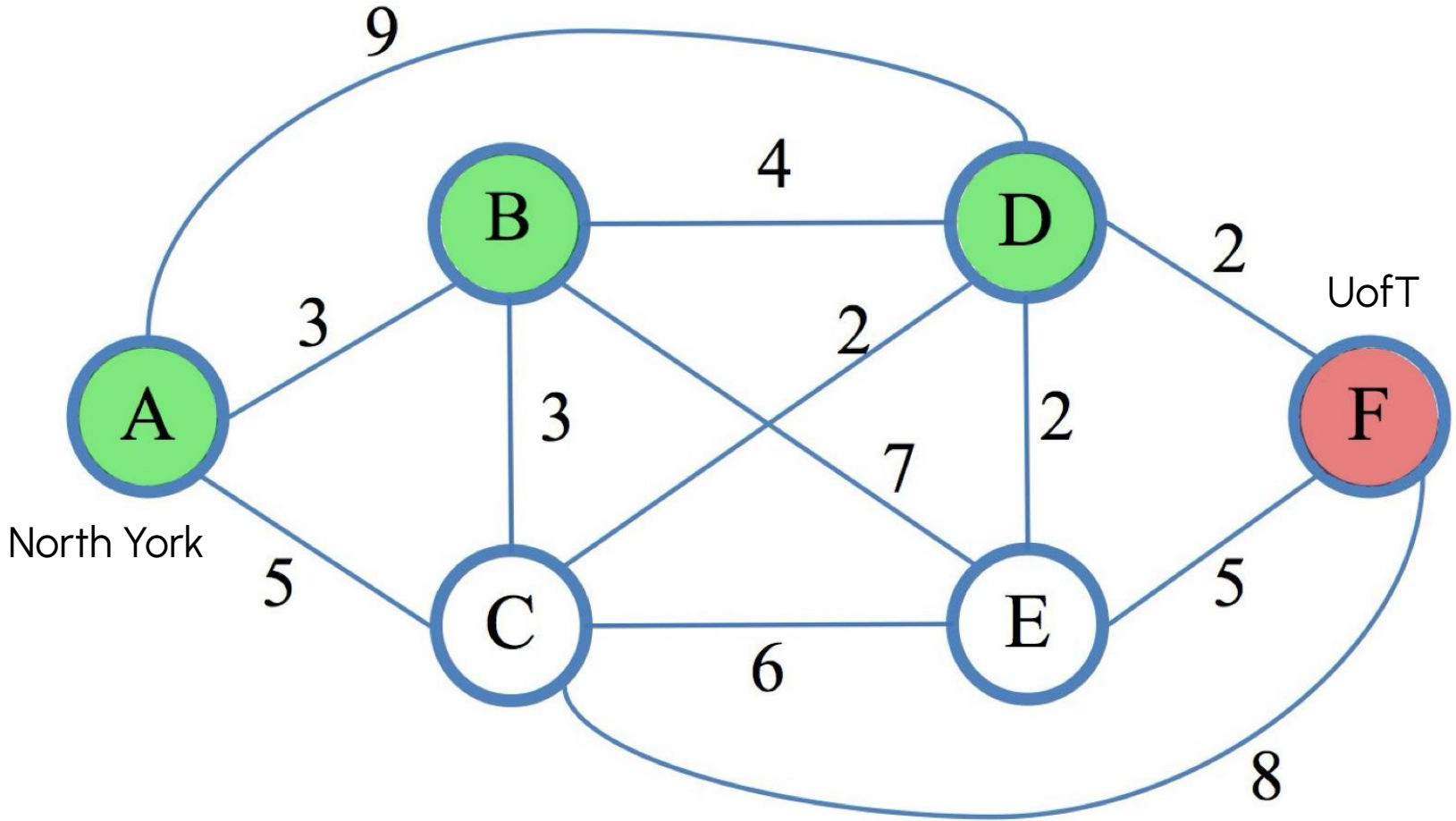
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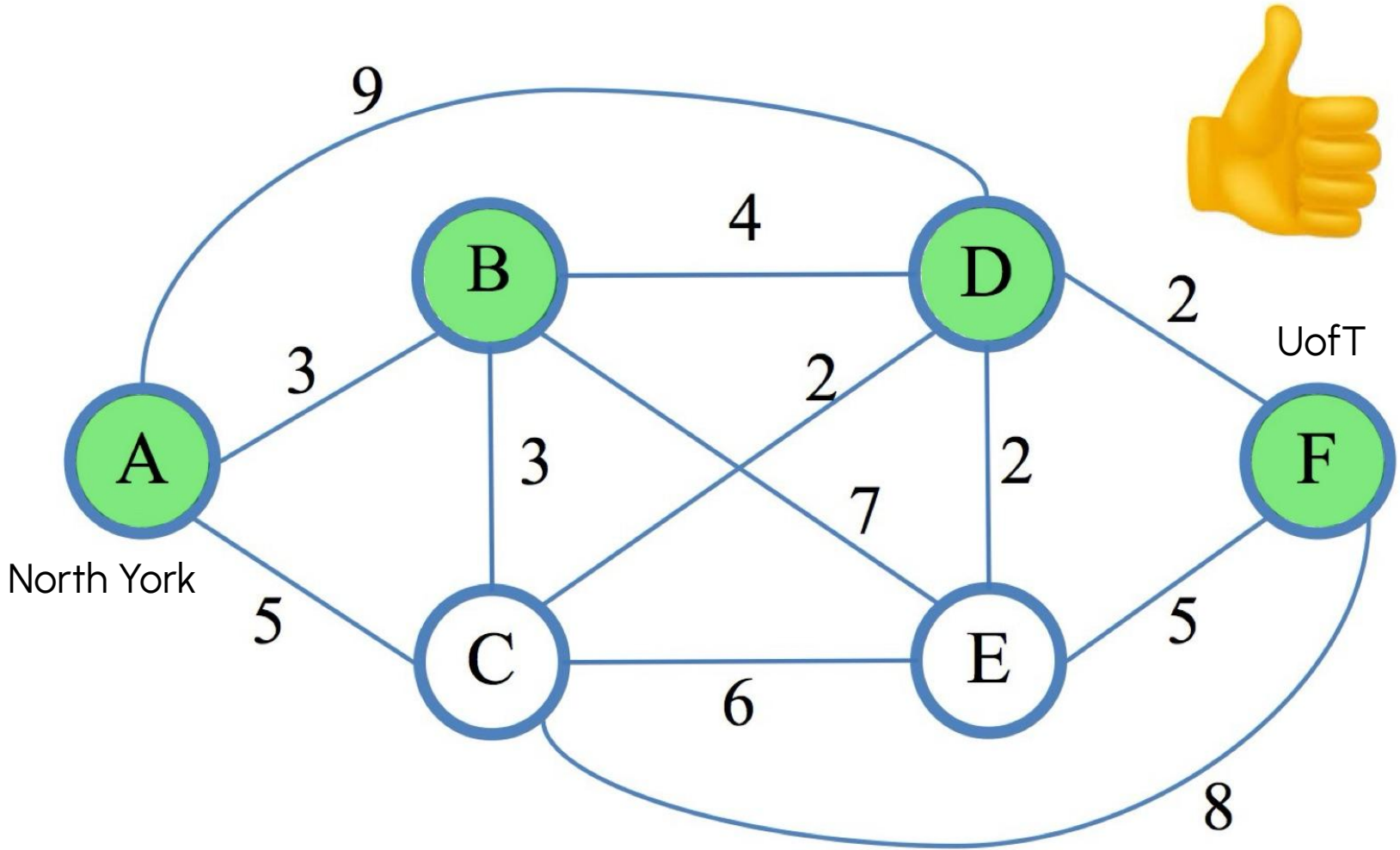
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UofT
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North York
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C
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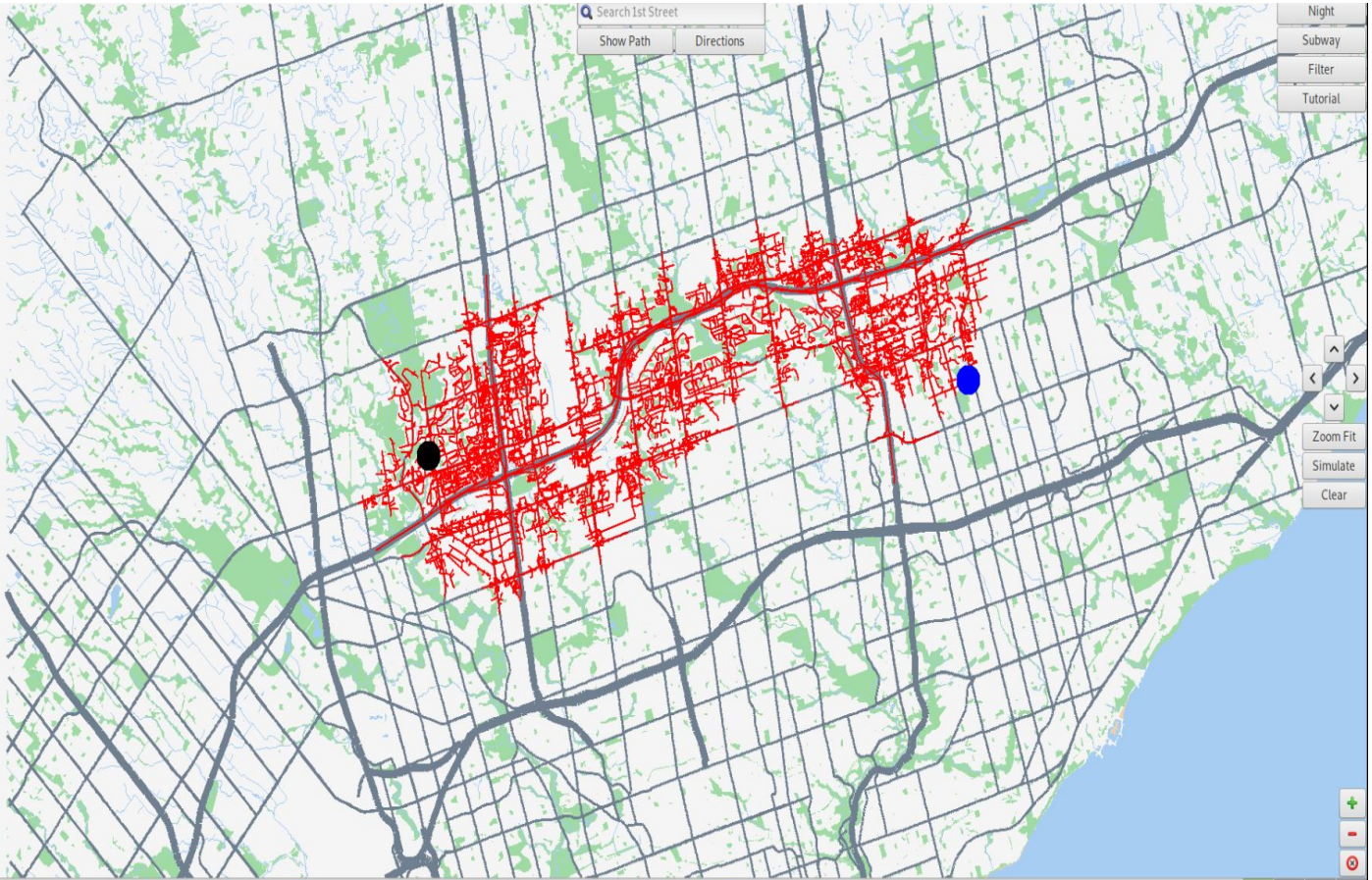
6
8

Dijkstra's Visualisation

Implementing A*- faster dijkstra



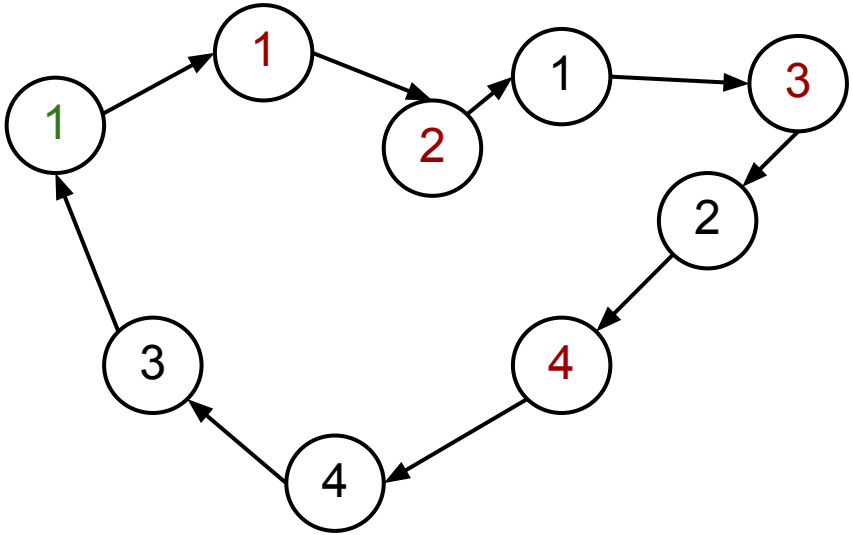
Origin

Destination

Area Explored

50% Faster!

Travelling Salesman Problem



Finding optimized order of deliveries

Green represents depots

Red represents pickups

Black represents drop-offs

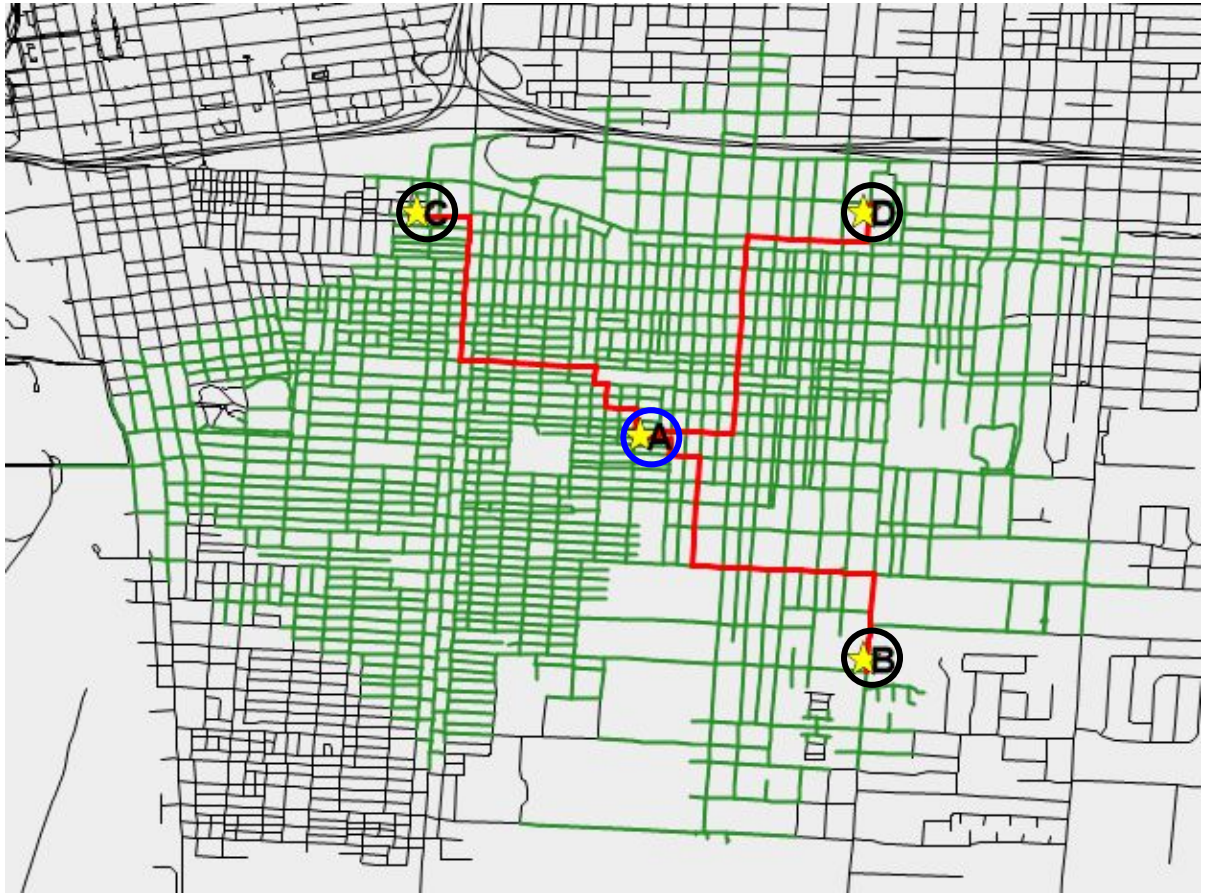
Algorithm Used

Multi-Dijkstra's

Greedy Approach

Two-opt

Multi-Dijkstra's

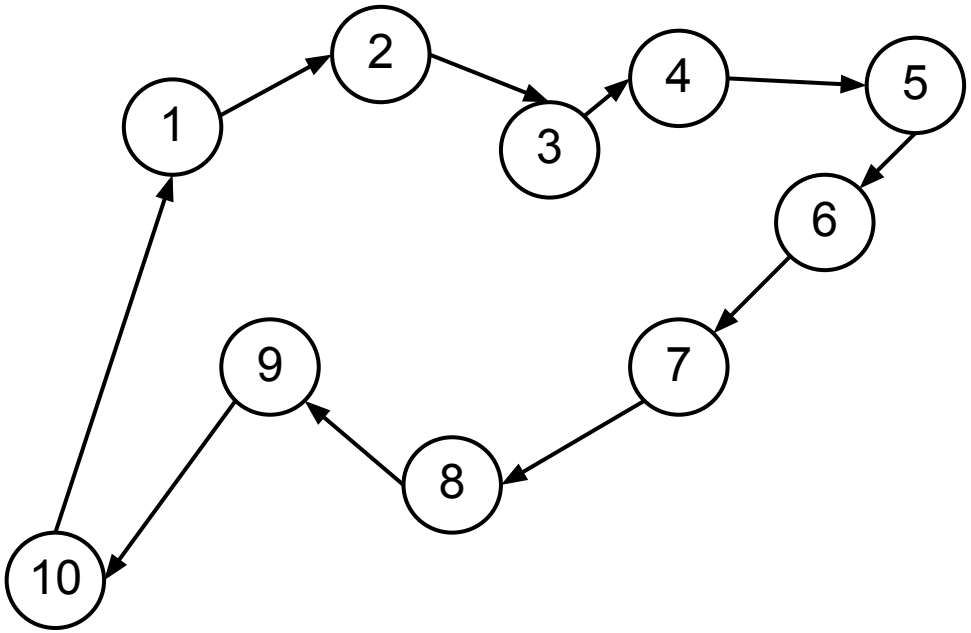


Finds path to multiple destination from one node

Blue represents the origin

Black represents the destinations

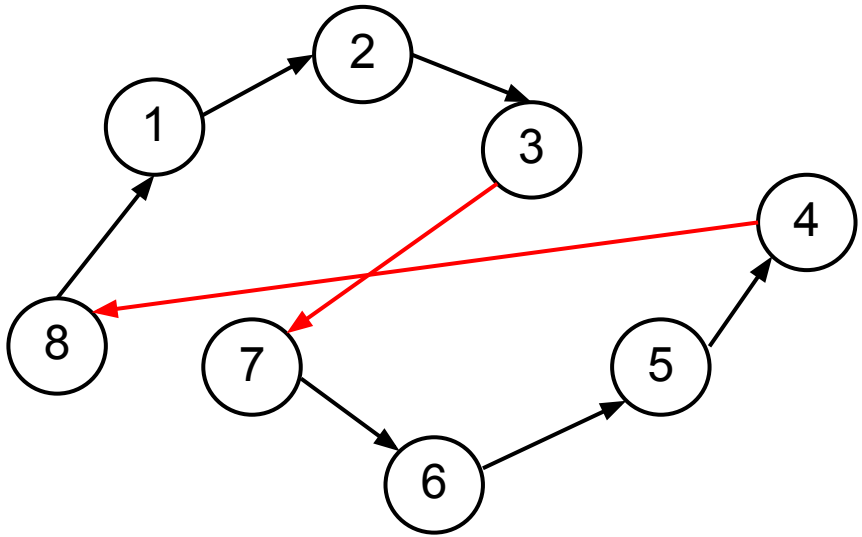
Greedy Approach

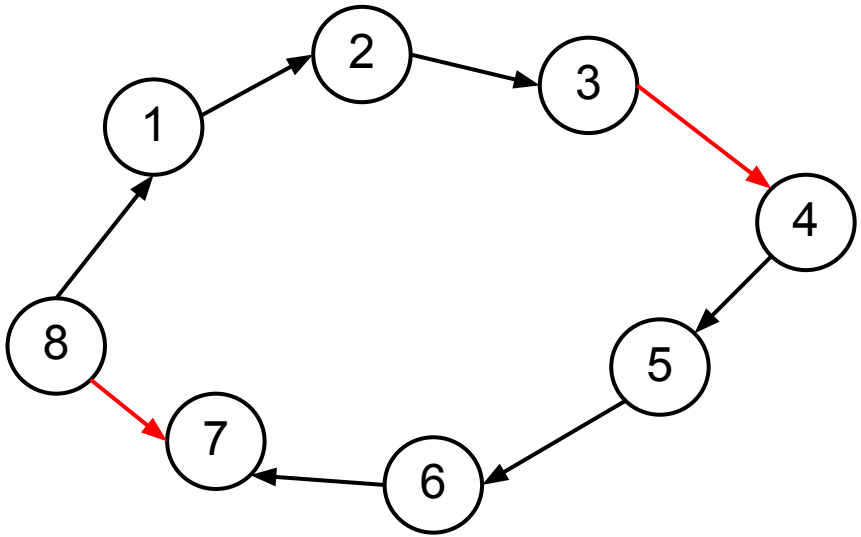


Each point represents a node

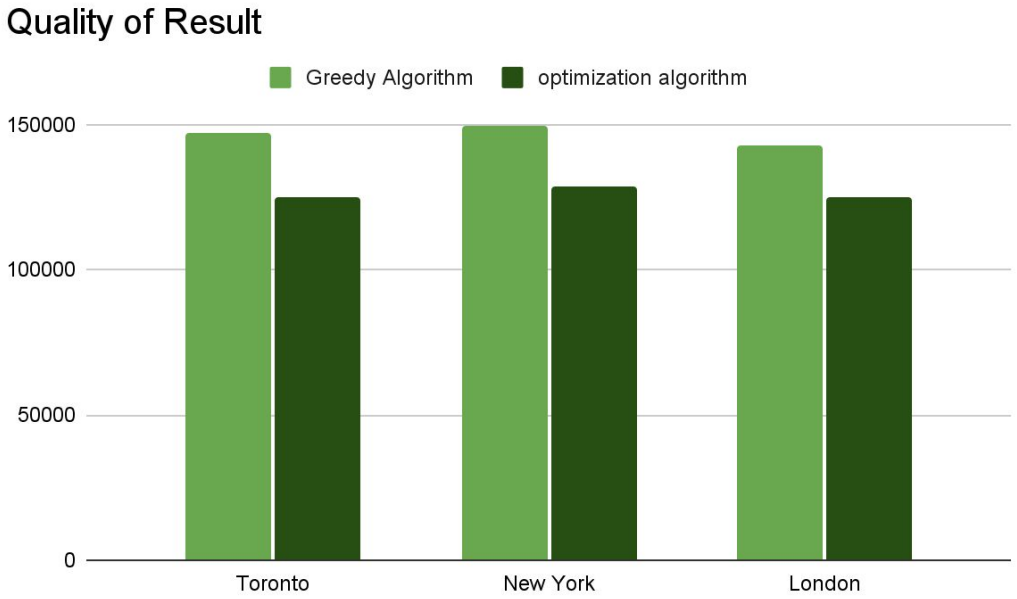
Current node gets connected to closest node

2 - Opt





TSP Performance

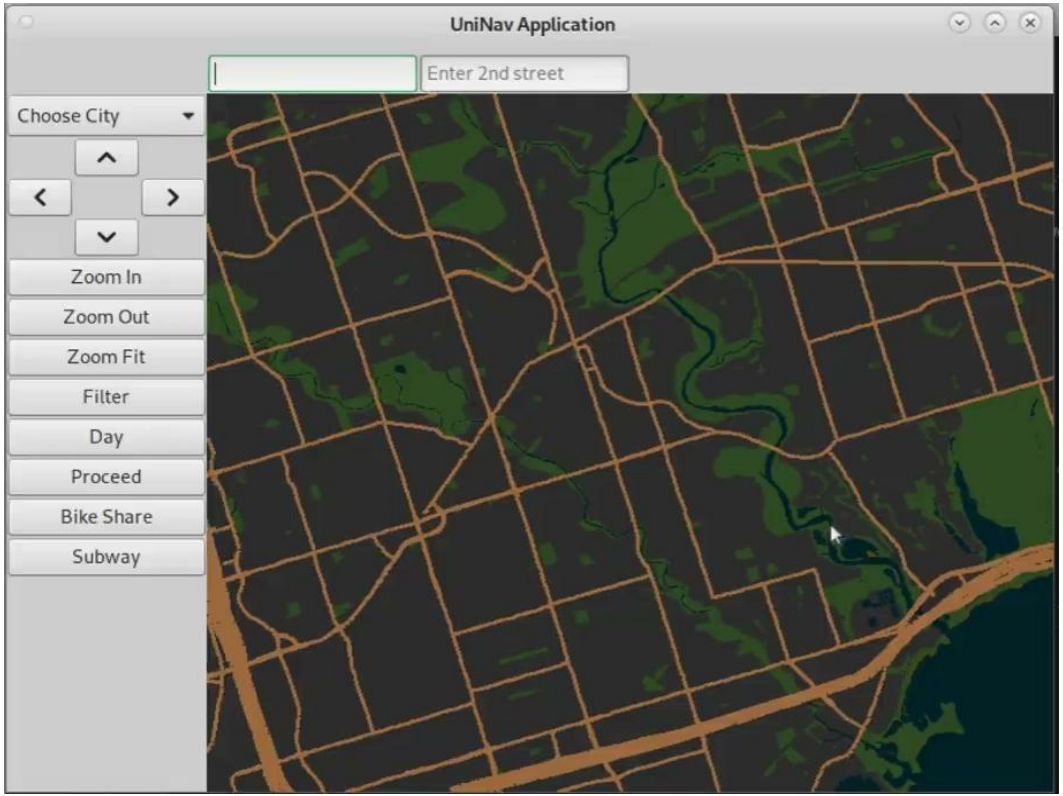


13.7% better than the standard greedy algorithm

Better than TA good algorithm

Testing

Frame Rate

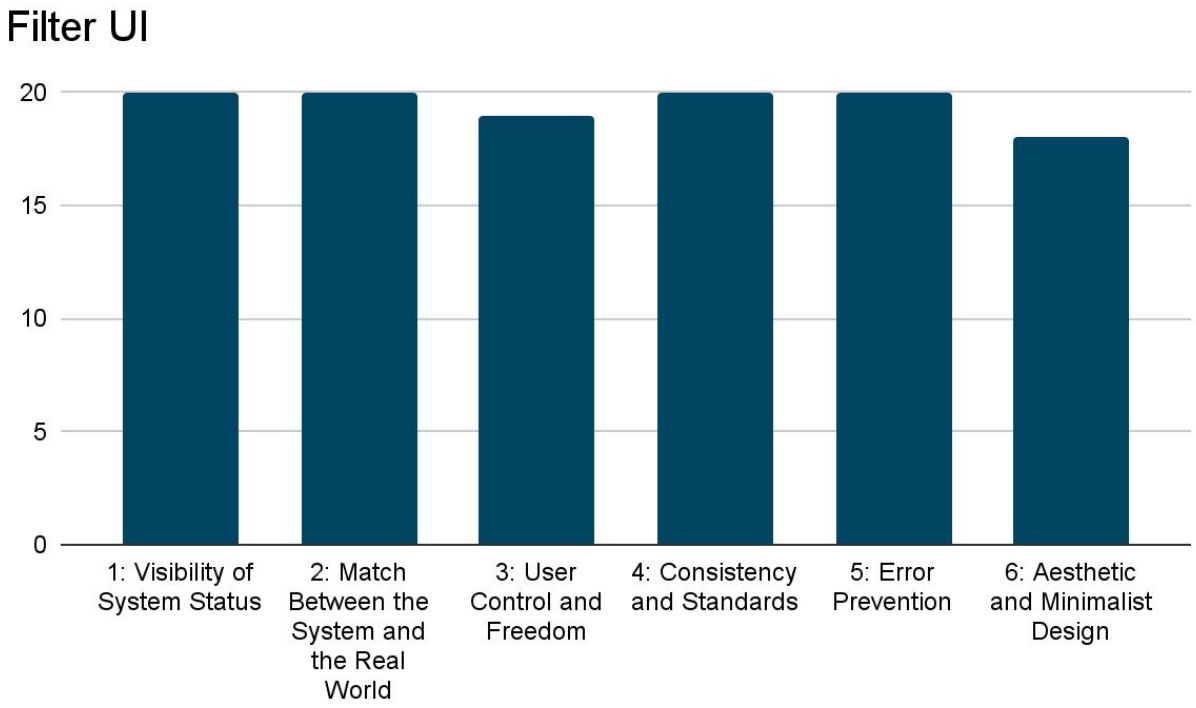


Testing responsiveness of the map

Frame rate of less than 10 FPS is an error

Frame Rate	47.6
52.6	50
47.6	45.4
43.4	37.7
58.8	34.5
50	37.7

Heuristic Evaluation



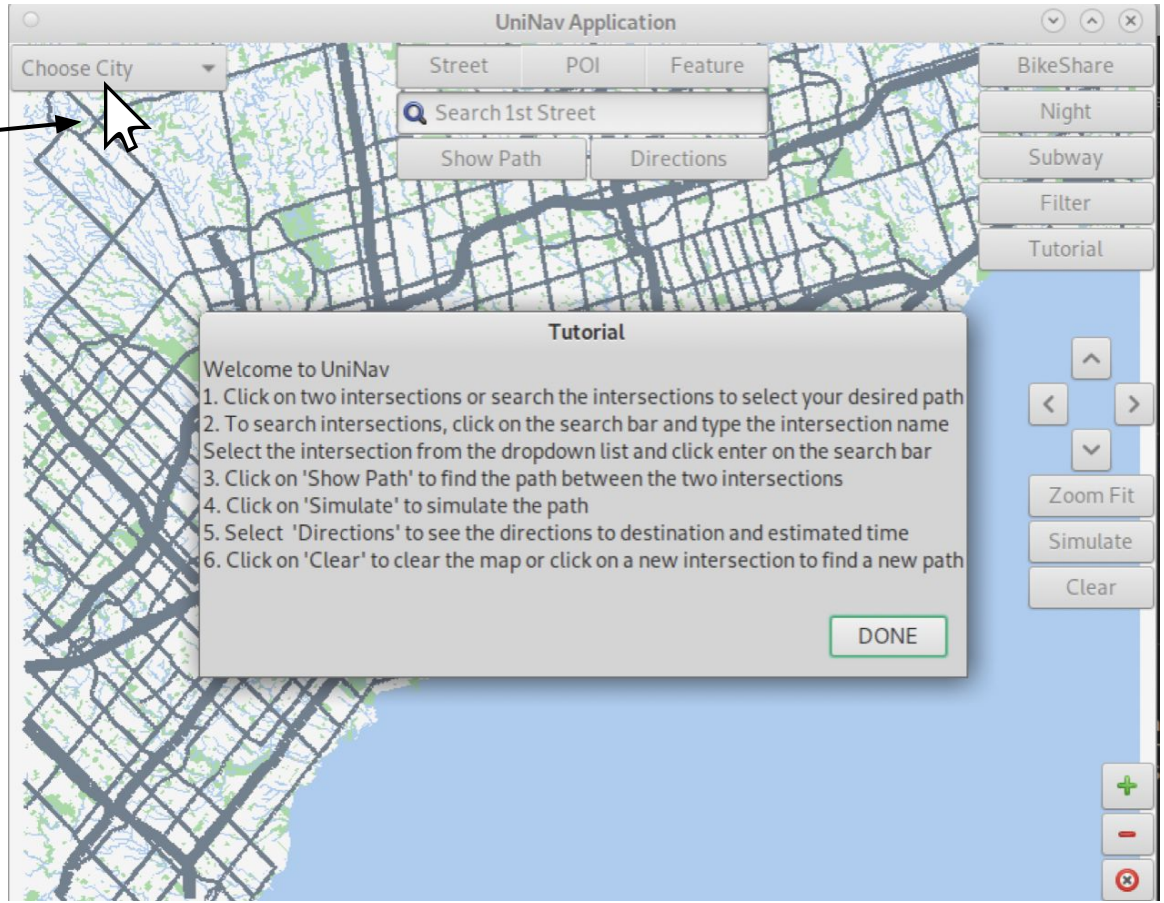
Evaluation to identify design problem

Achieved 97.5% on the evaluation

UniNav - Walkthrough

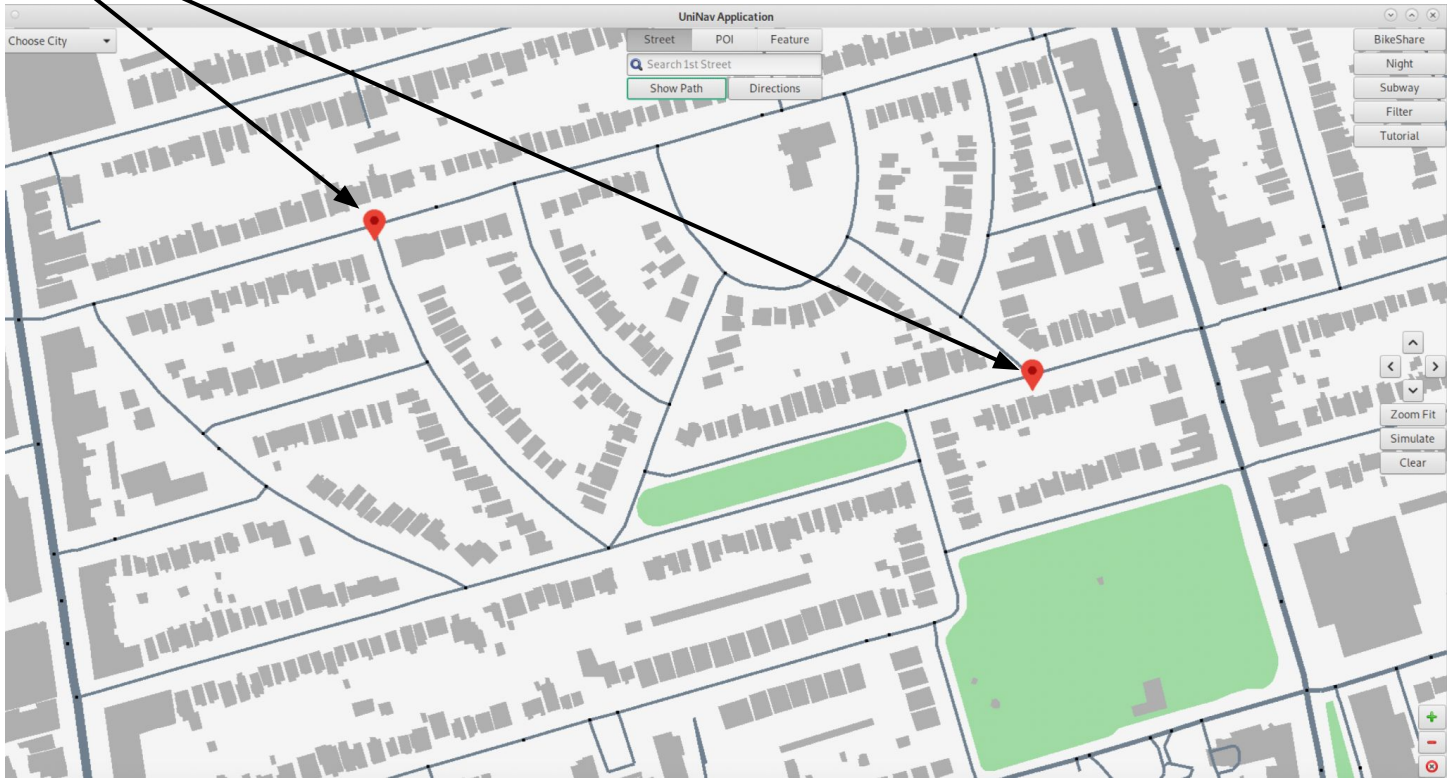
Right click to select intersections

Search Bar to select intersections

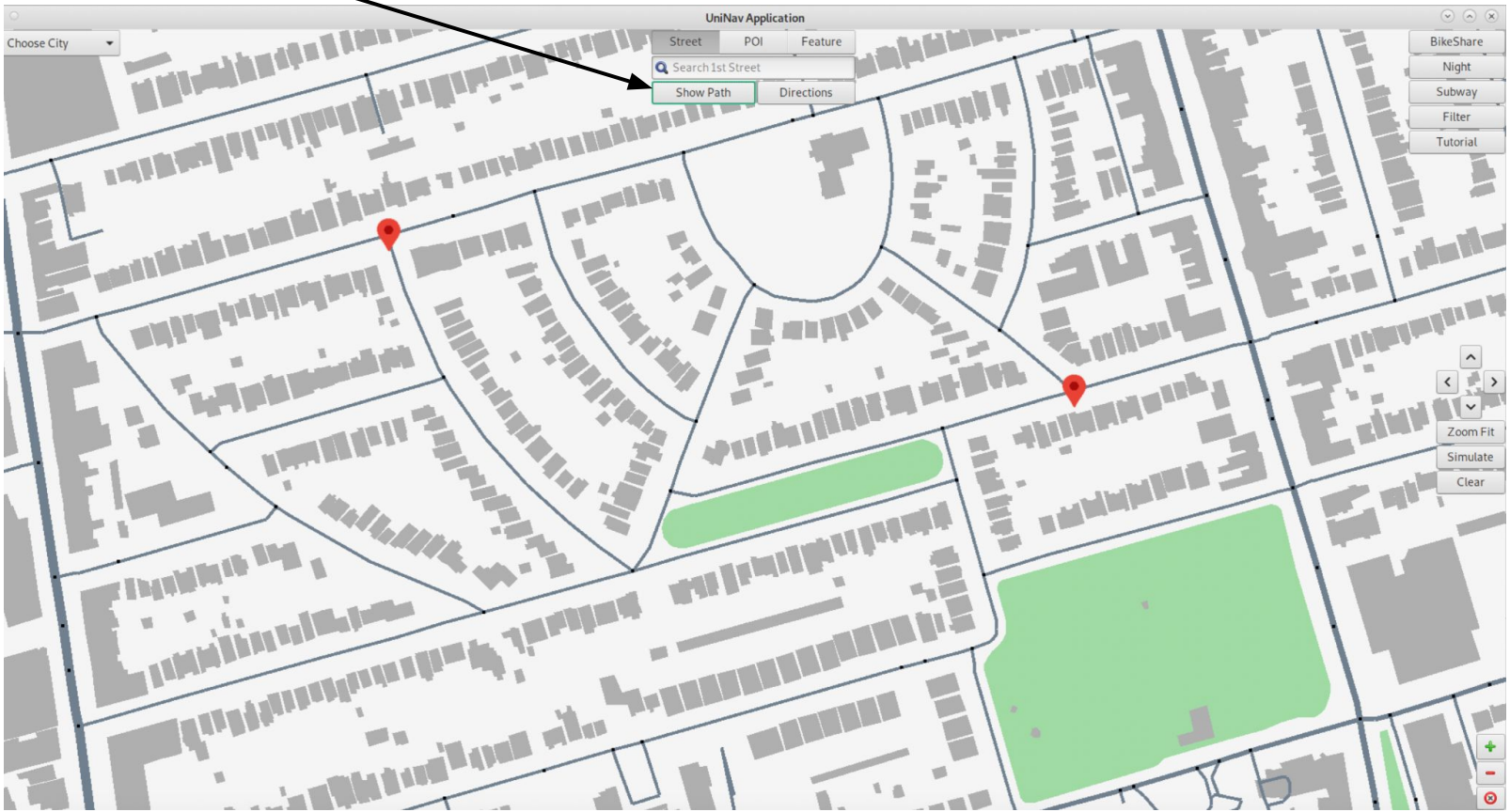


Auto-complete for street names

Pin-points to highlight selected intersections

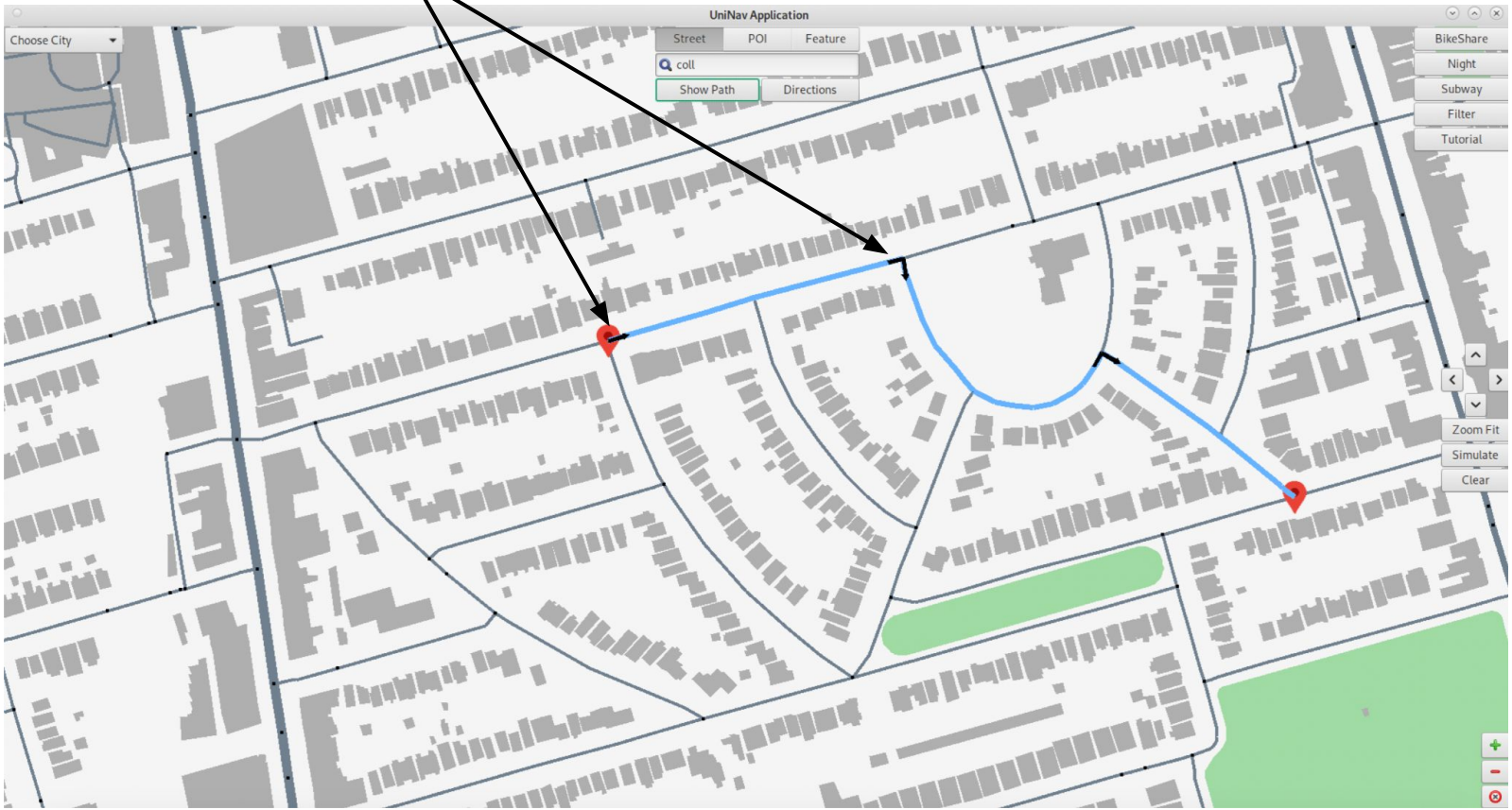


Click on show path

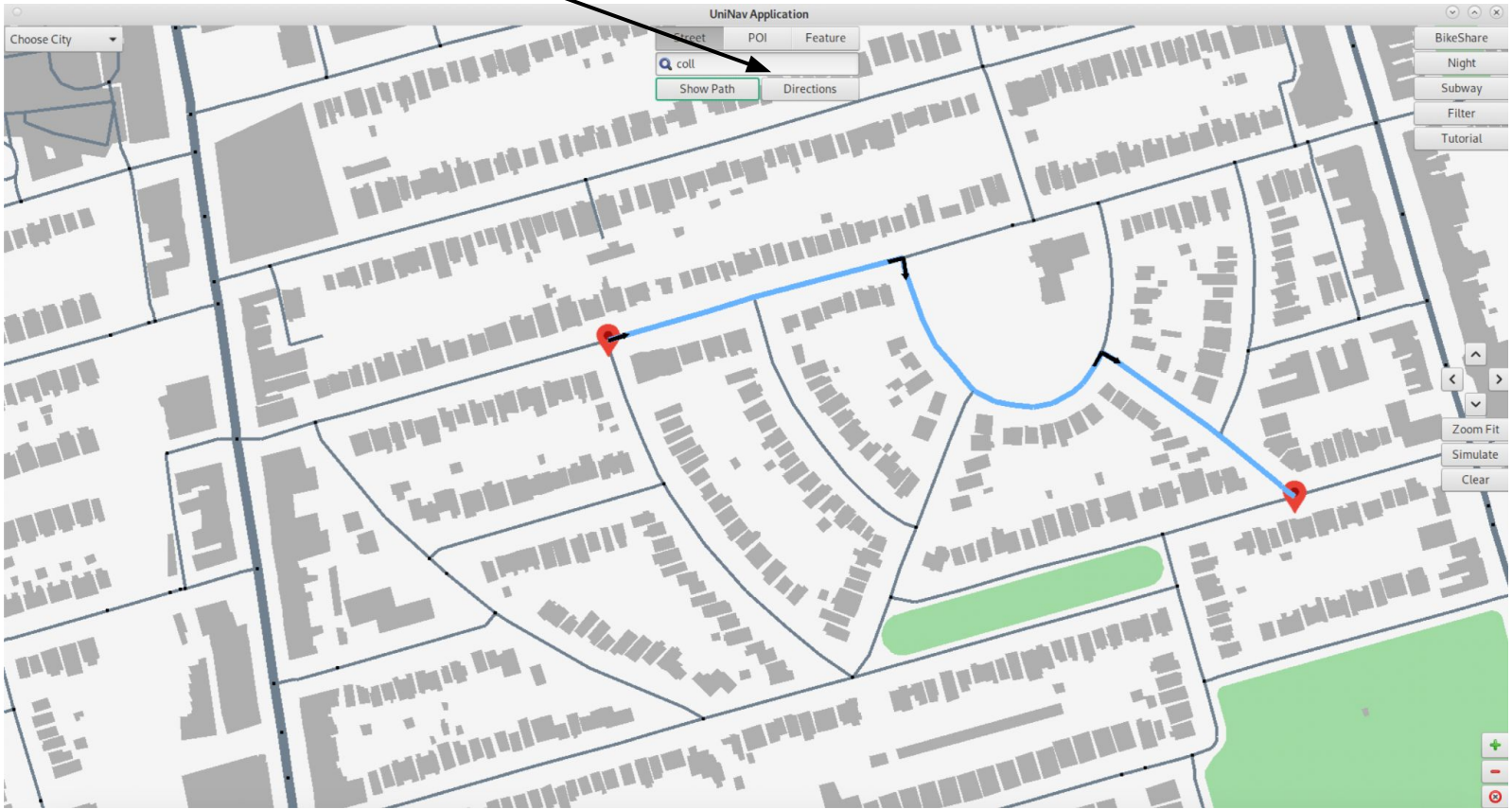


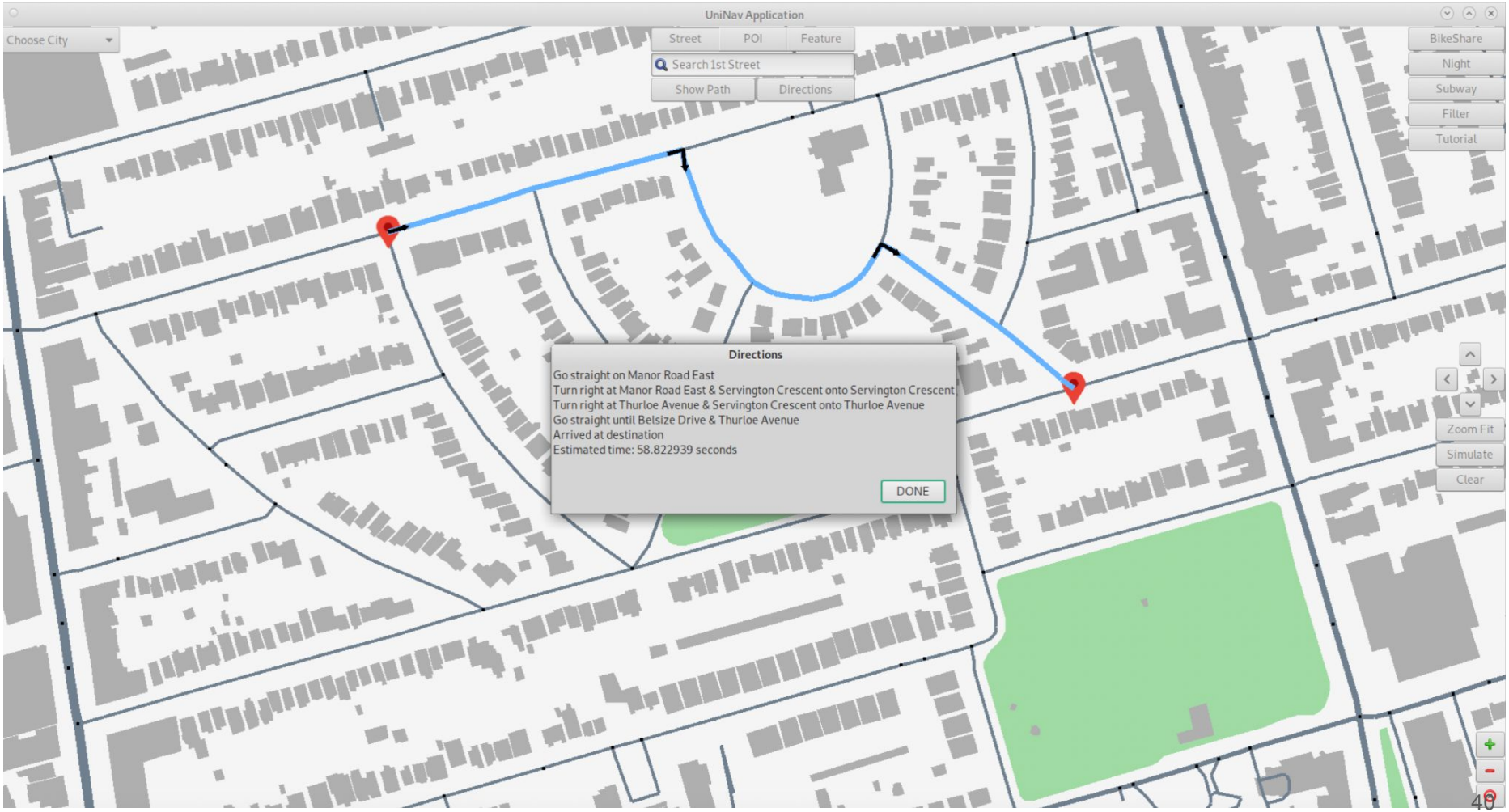
Arrows show the direction of path

Path lines

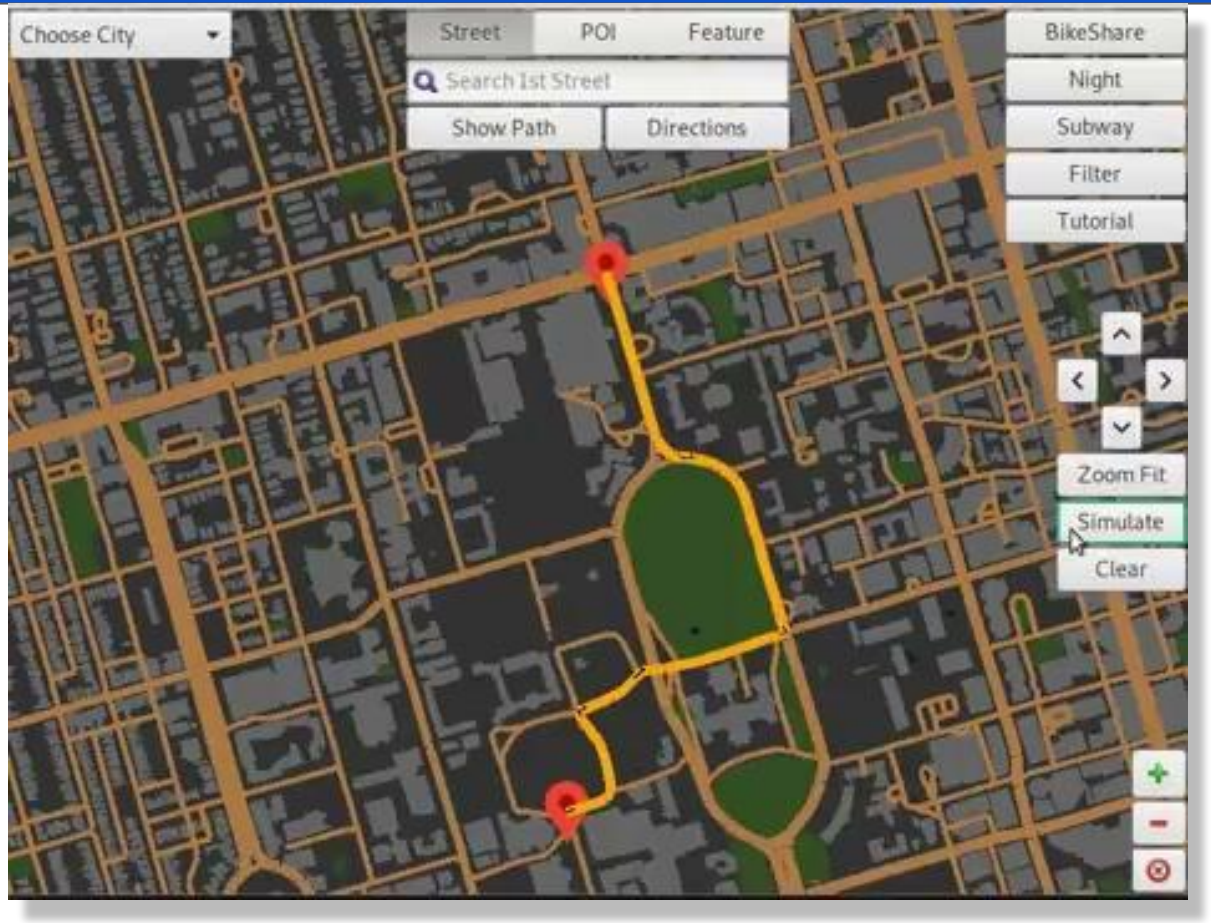


Click on directions



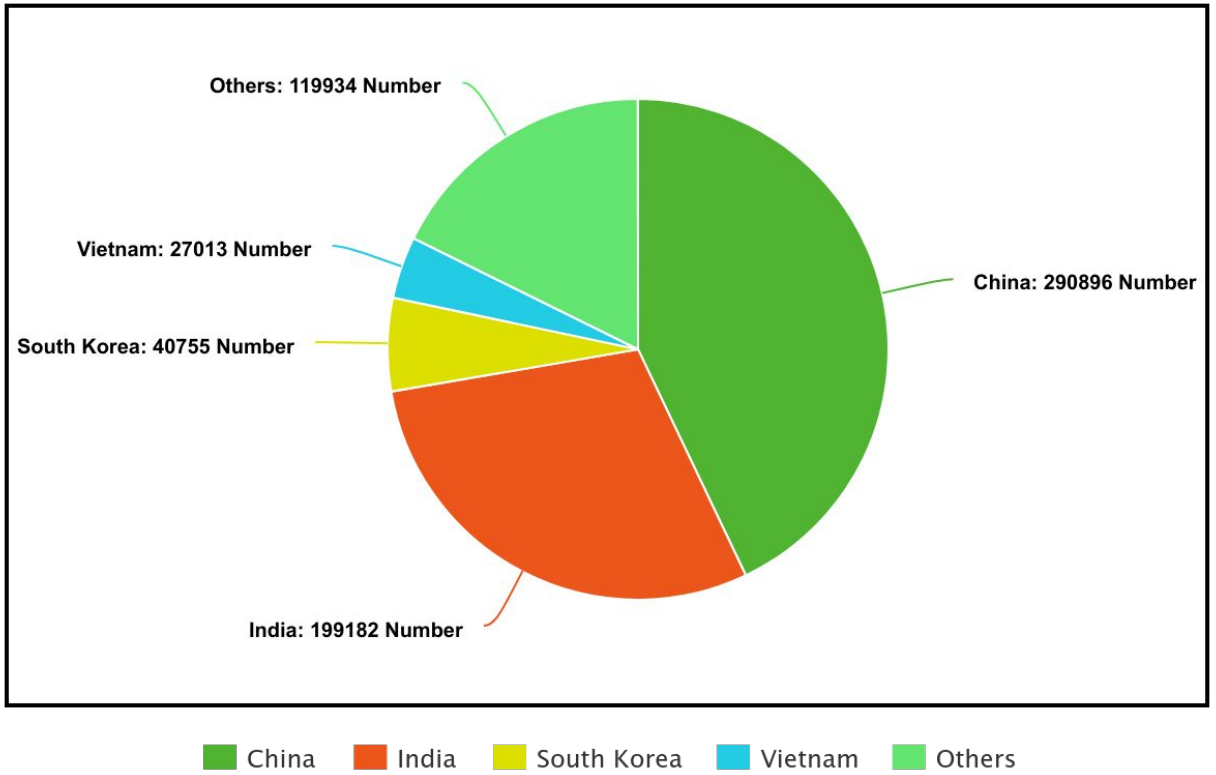

UniNav Application
Choose City
Street
POI
Feature
Search 1st Street
Show Path
Directions
BikeShare
Night
Subway
Filter
Tutorial
Directions
Go straight on Manor Road East
Turn right at Manor Road East & Servington Crescent onto Servington Crescent
Turn right at Thurloe Avenue & Servington Crescent onto Thurloe Avenue
Go straight until Belsize Drive & Thurloe Avenue
Arrived at destination
Estimated time: 58.822939 seconds
DONE
Zoom Fit
Simulate
Clear

Simulate Your Path !



Future plans

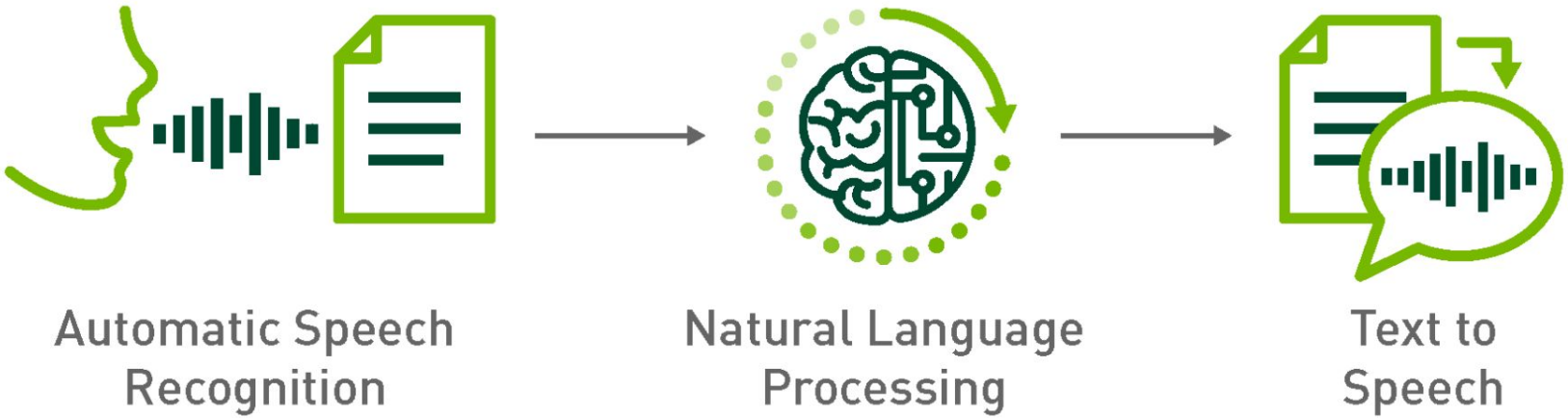
The Need



30% International Students

41% Adults use Speech recognition

Accessibility features - Speech recognition



A.I. Chatbot

Ai based recommendation

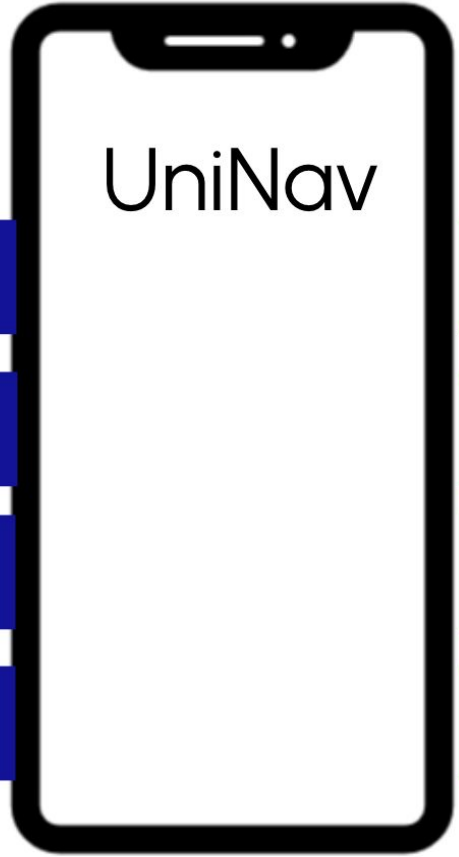
Query solver

A.I. Chatbot

Residence listing recommendations

Usability

- Carefully palced buttons
- Tutorial and simulation
- Satisfying color coding
- Accessibility



Responsive

- Wide range of algorithm
- Optimized code
- Timely feedback
- Error rates

References

[1] K. Moran and K. Gordon, "Heuristic evaluations: How to conduct," Nielsen Norman Group, 2024

https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/ (accessed Mar. 2, 2024).

[2] J. Nielsen, "10 usability heuristics for user interface design," Nielsen Norman Group,

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[3] J. Y. C. Chen and J. E. Thropp, "Review of Low Frame Rate Effects on Human Performance," IEEE Xplore, 2007

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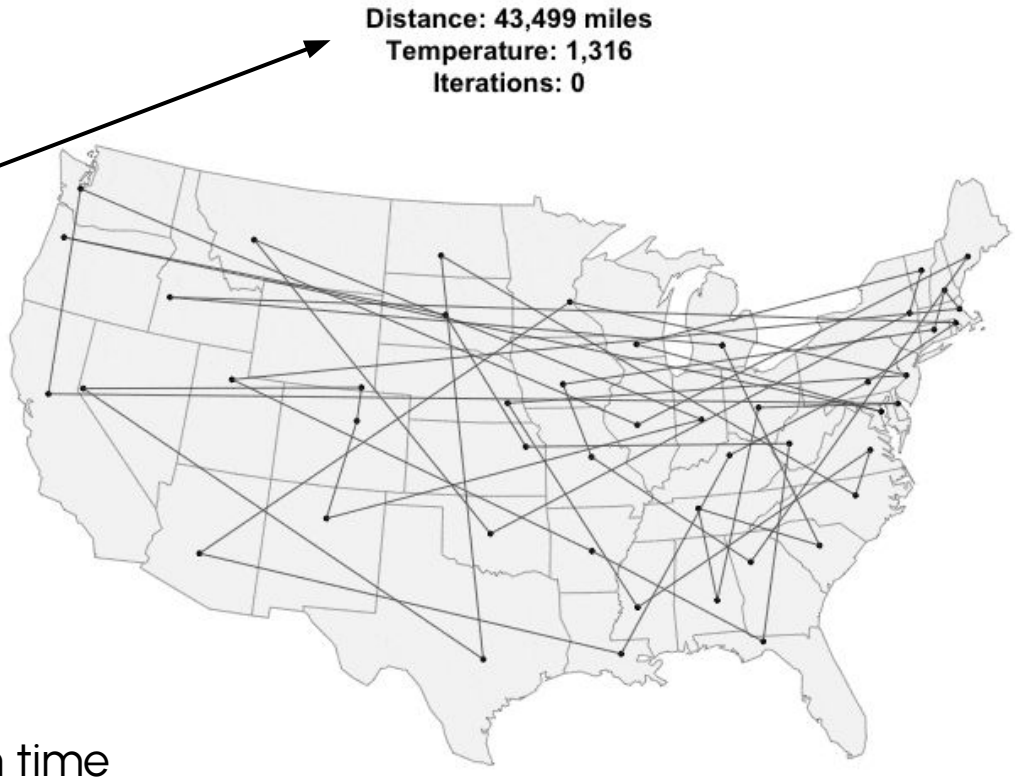
[9] B. S. J;, "Points of view: Where do we look when we watch TV?," Perception, https://pubmed.ncbi.nlm.nih.gov/19227380/#:~:text=How%20is%20our%20gaze%20dispersed,distribution%20peaked%20near%20screen%20center (accessed Apr. 30, 2024).

[10]DBS Interactive, "Voice Search Statistics and Emerging Trends," DBS Interactive, https://www.dbswebsite.com/blog/trends-in-voice-search/ (accessed Apr. 30, 2024).

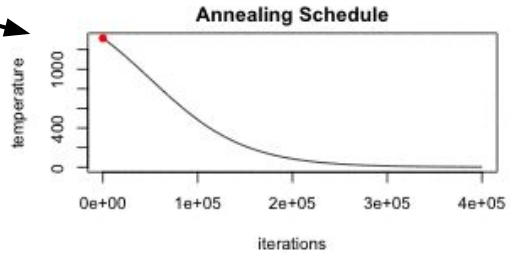
Appendix

Simulated Annealing



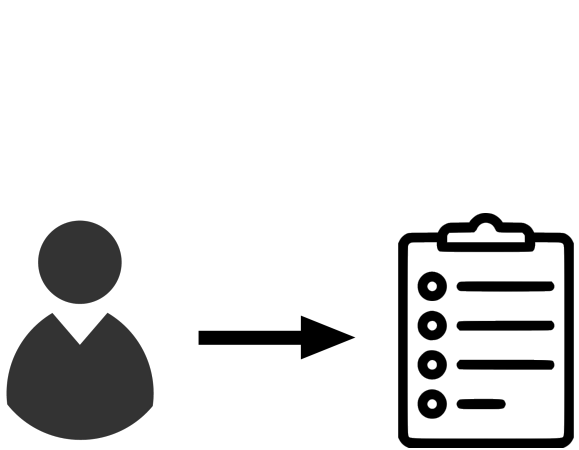
Distance decreasing with temperature

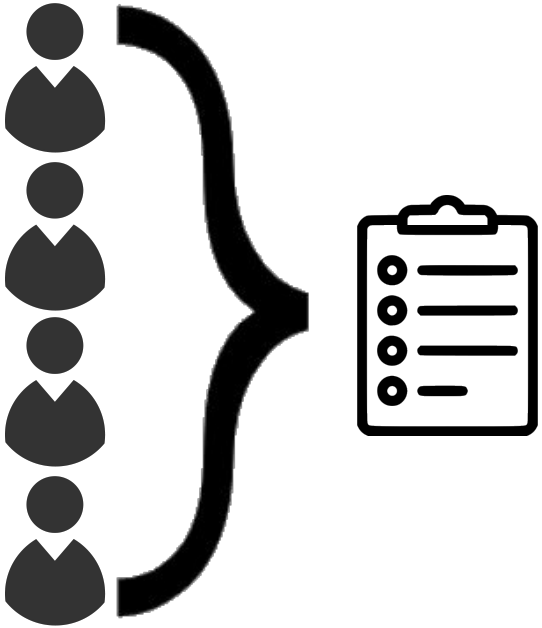
Temperature decreasing with time



Multi-Threading

Single Thread vs Multiple Threads

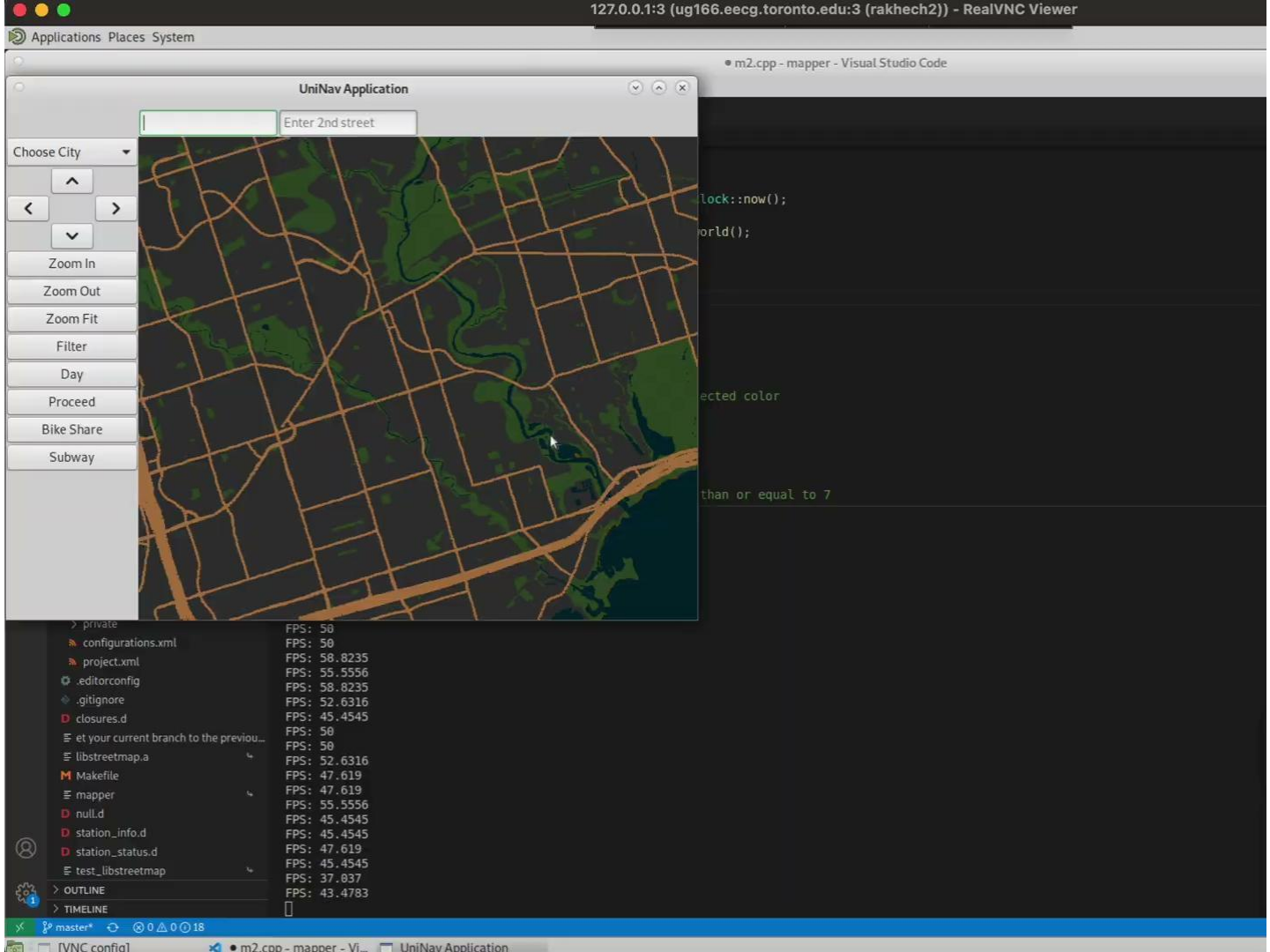




Single thread: 56.5868 sec

MultiThreading: 11.0916 sec

More than 5x Faster


127.0.0.1:3 (ug166.eecg.toronto.edu:3 (rakhech2)) - RealVNC Viewer
Applications Places System
m2.cpp - mapper - Visual Studio Code
UniNav Application
Enter 2nd street
Choose City
Zoom In
Zoom Out
Zoom Fit
Filter
Day
Proceed
Bike Share
Subway
lock::now();
orld();
ected color
than or equal to 7
private
configurations.xml
project.xml
.editorconfig
.gitignore
closures.d
et your current branch to the previou...
libstreetmap.a
Makefile
mapper
null.d
station_info.d
station_status.d
test_libstreetmap
OUTLINE
TIMELINE
FPS: 50
FPS: 50
FPS: 58.8235
FPS: 55.5556
FPS: 58.8235
FPS: 52.6316
FPS: 45.4545
FPS: 50
FPS: 50
FPS: 52.6316
FPS: 47.619
FPS: 47.619
FPS: 55.5556
FPS: 45.4545
FPS: 45.4545
FPS: 47.619
FPS: 45.4545
FPS: 37.837
FPS: 43.4783
master*
[VNC config]
m2.cpp - mapper - Vi...
UniNav Application

Heuristic Evaluation

Heuristic Evaluation for UniNav

Parameters for heuristic evaluation:

1: Visibility of System Status: The design should always keep users informed about what is going on, through appropriate feedback within a reasonable amount of time.

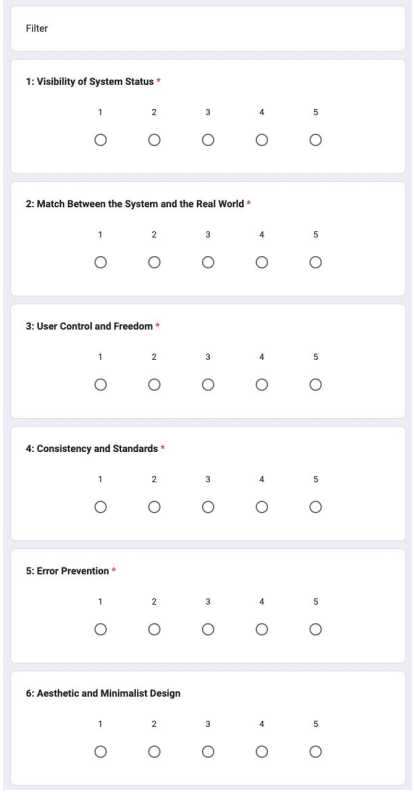
2: Match Between the System and the Real World: The design should speak the users' language. Use words, phrases, and concepts familiar to the user, rather than internal jargon. Follow real-world conventions, making information appear in a natural and logical order.

3: User Control and Freedom: Users often perform actions by mistake. They need a clearly marked "emergency exit" to leave the unwanted action without having to go through an extended process.

4: Consistency and Standards: Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform and industry conventions.

5: Error Prevention: Good error messages are important, but the best designs carefully prevent problems from occurring in the first place.

6: Aesthetic and Minimalist Design: Interfaces should not contain information that is irrelevant or rarely needed. Every extra unit of information in an interface competes with the relevant units of information and diminishes their relative visibility.

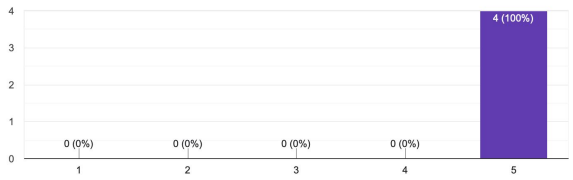


Evaluation to identify design problem

1: Visibility of System Status

Copy

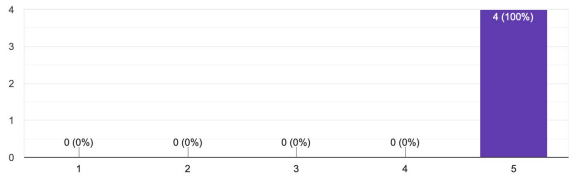
4 responses



2: Match Between the System and the Real World

Copy

4 responses



3: User Control and Freedom

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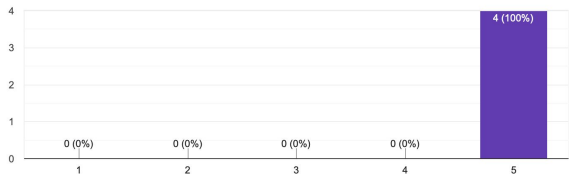
4 responses



4: Consistency and Standards

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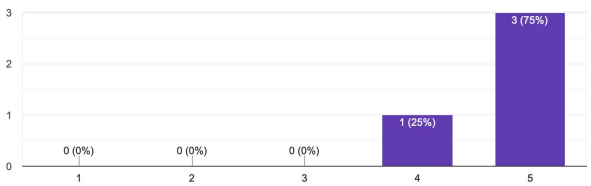

5: Error Prevention

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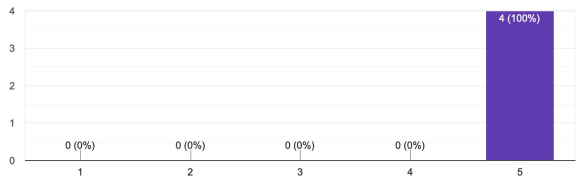

6: Aesthetic and Minimalist Design

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4 responses