

A Map for Work...

... A Map for Life

Sheng (Zak) Zhao
Yuwen (Echo) Zheng
Anna Shi

cd-026

Sophie, our courier

8:00 AM

5:00 PM

10:00 PM

Working hours



<https://www.shutterstock.com/video/clip-4376276-stock-footage-delivery-courier-woman-giving-package-wearing-blue-uniform-woman-courier-smiling-happy-on-white.html>



After hours

<https://economictimes.indiatimes.com/magazines/panache/looking-for-a-new-job-how-about-shopping-for-someone-else-at-rs-25000-per-day/articleshow/60188028.cms>

Presentation Overview

1. Pathage
2. Guiding principles
3. Path finding algorithms
4. Navi-Safe
5. Take-away

Pathage - A path for your package



<http://www.cristazone.com/packages/>



Efficiency

Learnability

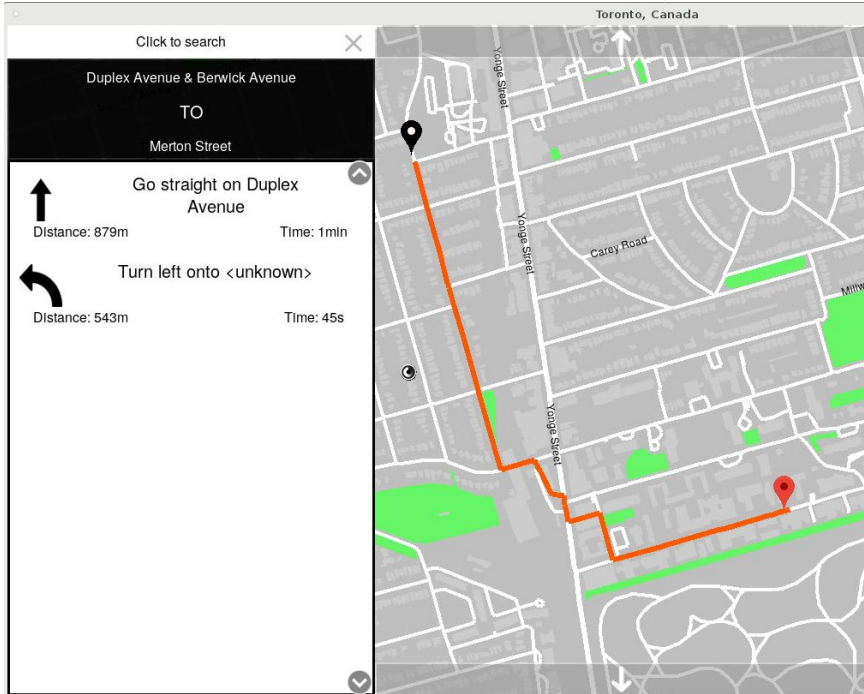
Usability

Productivity

Usefulness

Efficiency of information

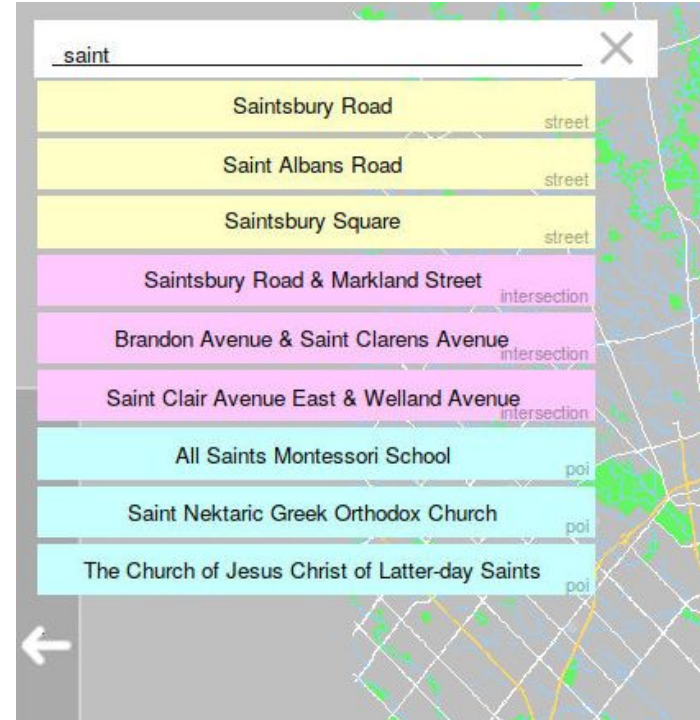
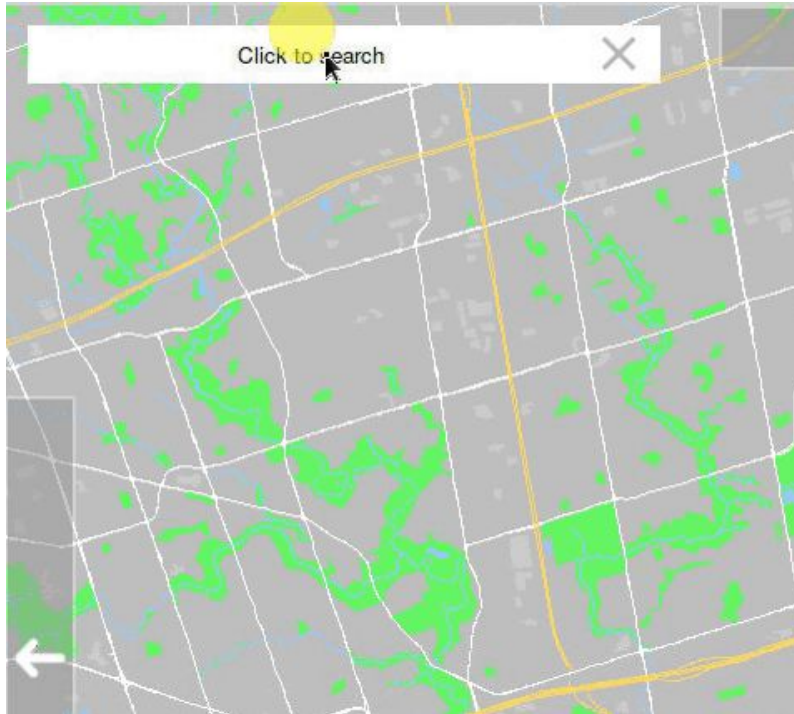
- Is it easy to find the information you need?



https://docs.optaplanner.org/7.4.1.Final/optaplanner-docs/html_single/index.html

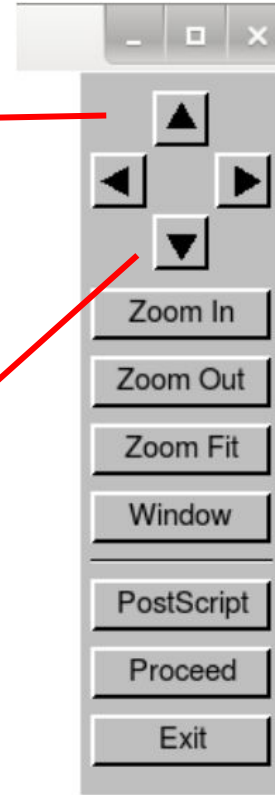
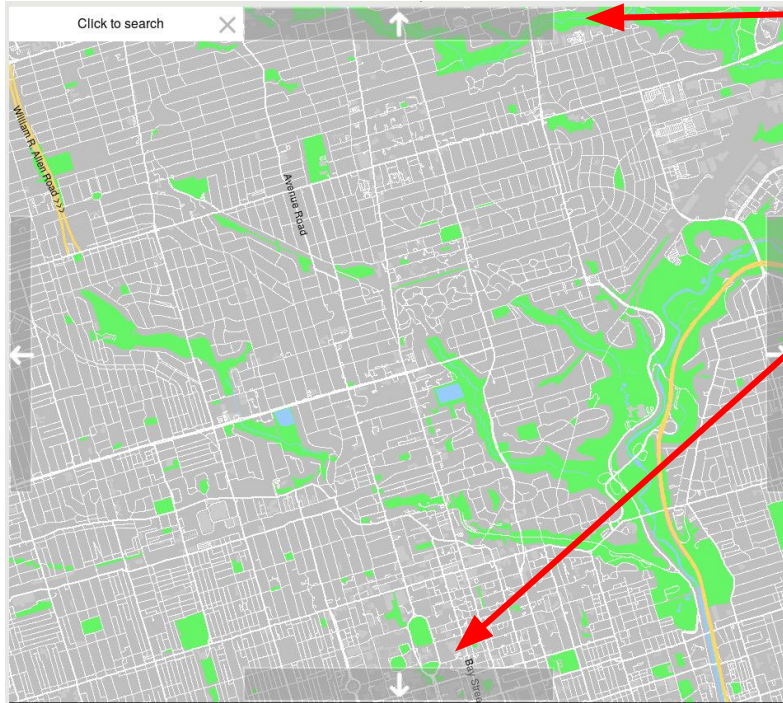
Learnability

- Is it intuitive?



Learnability

- Is it intuitive?



<http://www.eecg.utoronto.ca/~czajkow/ece297/EC297/assignments/easygl/easygl.pdf>

Learnability

- Is it intuitive?

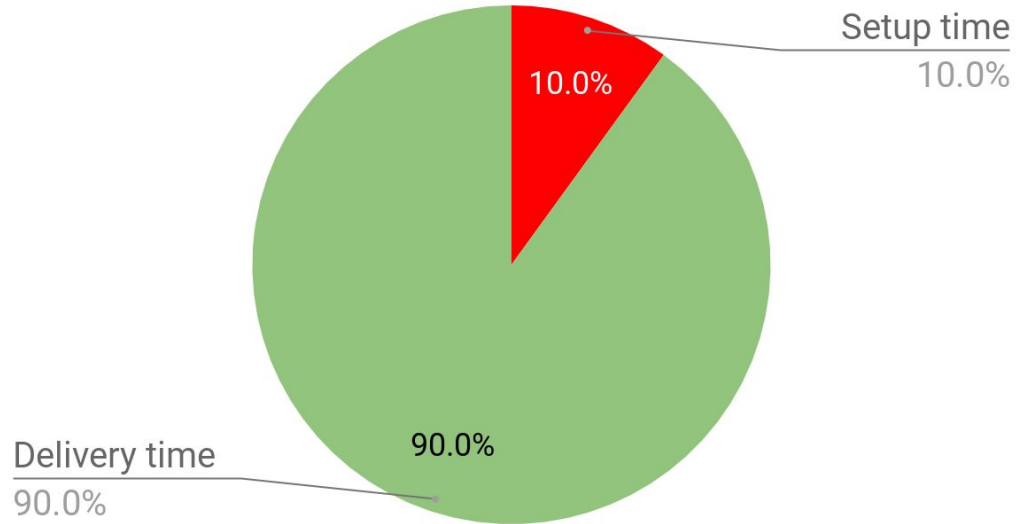


Productivity

- How quickly can you get going?

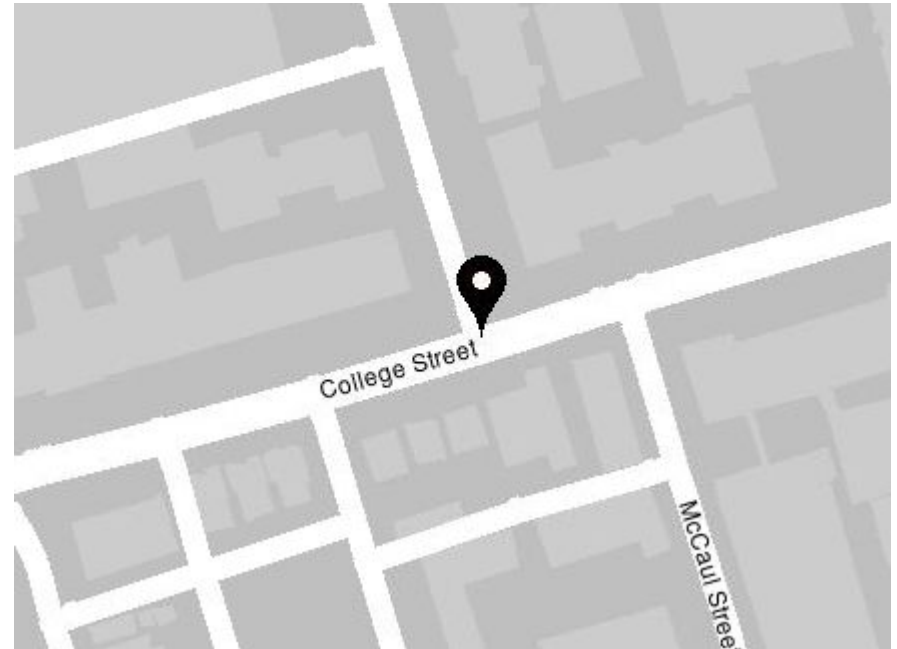
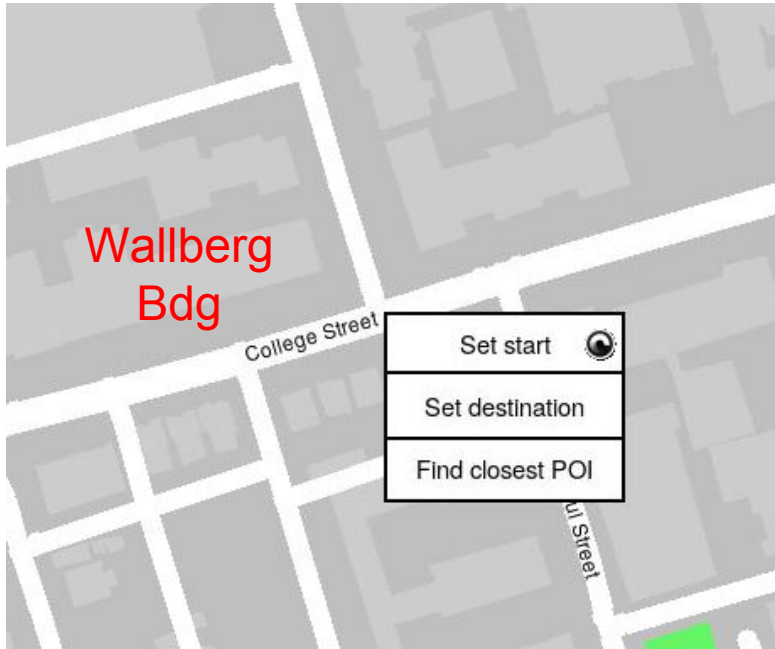
- More time in GIS = Less time doing work

Total time



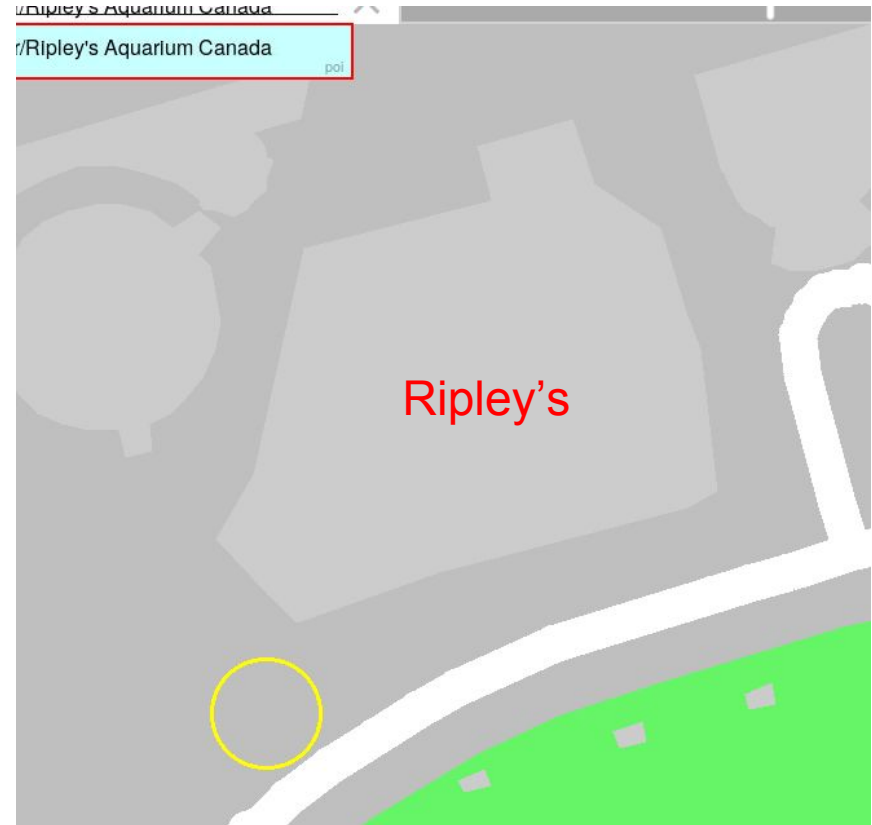
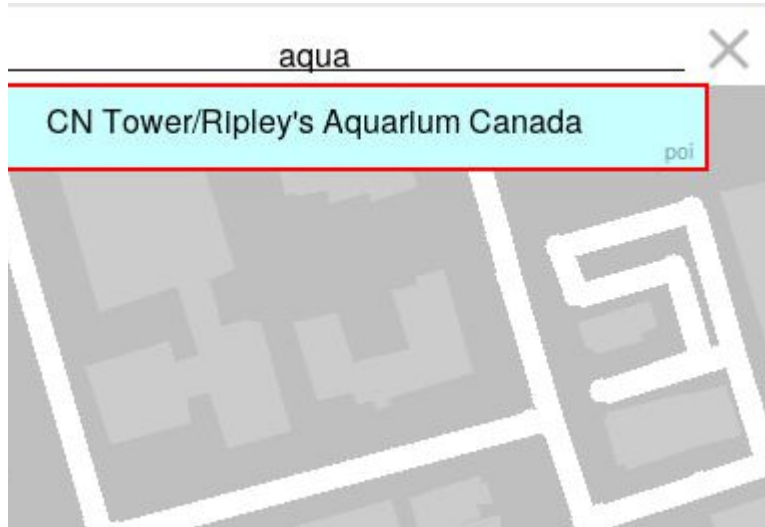
Productivity

- How quickly can you get going?



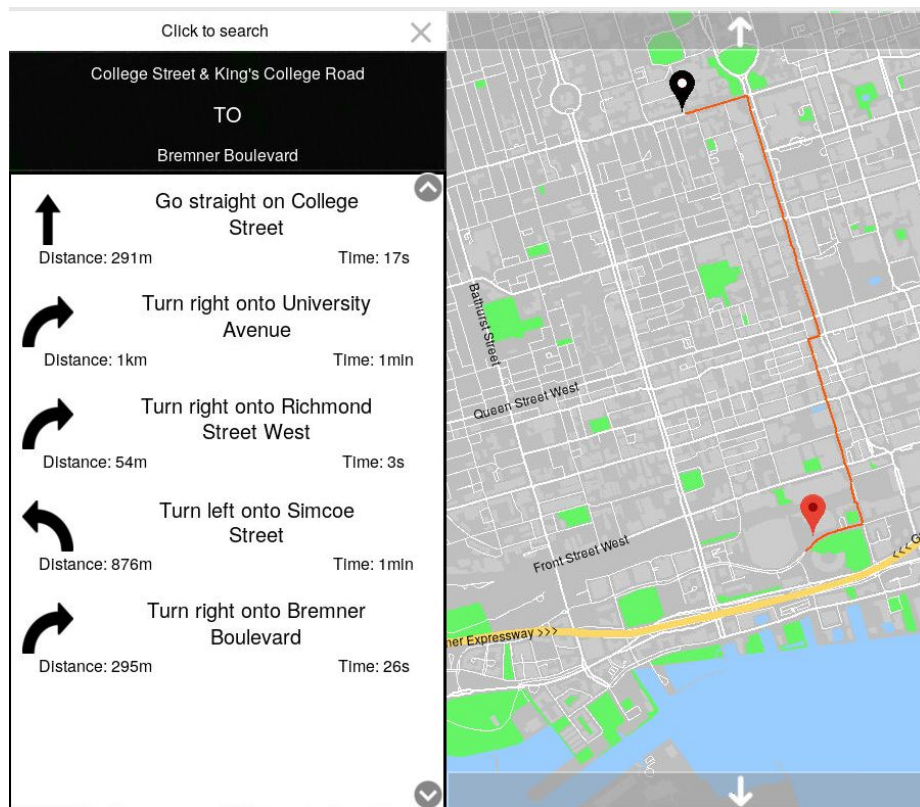
Productivity

- How quickly can you get going?



Productivity

- How quickly can you get going?



Real time demonstration

The screenshot displays a navigation application interface. On the left, a sidebar shows the destination 'TO Bremner Boulevard' and a list of five navigation steps with icons, distances, and times. The main map area shows a street grid with a red line indicating the route. A yellow pin marks the starting point. On the right, a vertical toolbar contains buttons for 'Zoom In', 'Zoom Out', 'Change Map', 'Find Path', 'Show POI', 'Exit', 'Reset', and 'Help'. At the bottom, a status bar provides the POI name, type, and coordinates.

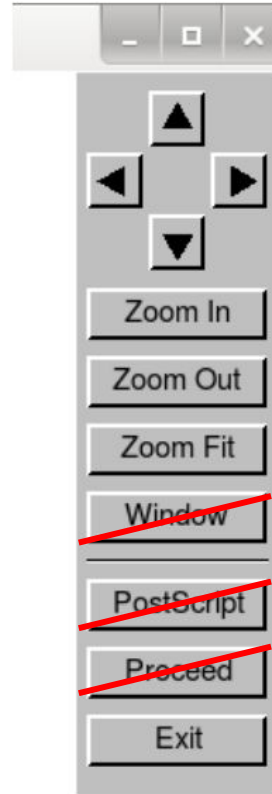
Navigation Steps:

- Go straight on College Street
Distance: 291m Time: 17s
- Turn right onto University Avenue
Distance: 1km Time: 1min
- Turn right onto Richmond Street West
Distance: 54m Time: 3s
- Turn left onto Simcoe Street
Distance: 676m Time: 1min
- Turn right onto Bremner Boulevard
Distance: 295m Time: 26s

POI: CN Tower/Ripley's Aquarium Canada Type: billboard Lat: 43.641861 Lon: -79.386673

Usefulness

- Do we need it?
 - PostScript?
 - User unlikely to print
 - Same with Window and Proceed



Responsiveness

- > 10 seconds
 - User loses attention
- 1 second
 - Does not break flow of application
- **0.1 seconds**
 - **User feels directly in control**

Pathage: 22fps -> 0.046 sec

J. Nielsen, *Usability Engineering*. 1993.



Milestone 3 - Point to Point Pathfinder

Modified version of A*

Every Point

Smallest total theoretical cost $t(n)$

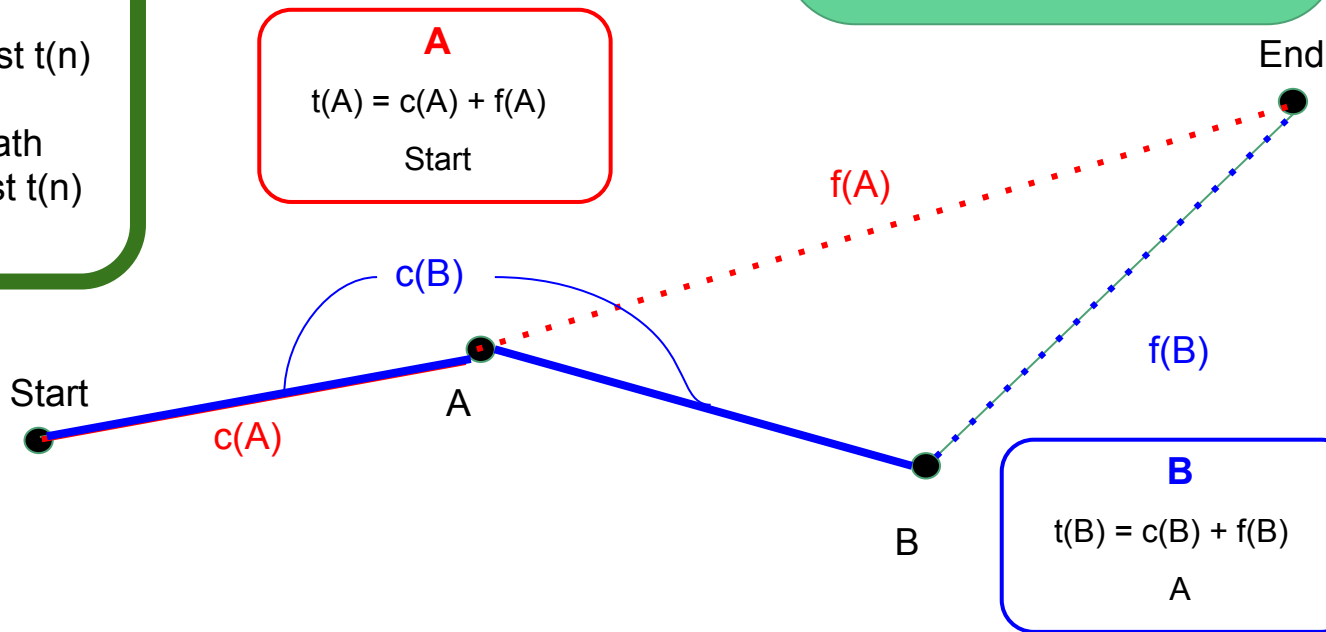
The previous point on the path which computes the smallest $t(n)$

$$t(n) = c(n) + f(n)$$

total cost

current cost from Start

future predict cost to End



Milestone 3 - Point to Point Pathfinder

Modified version of A*

Every Point

Smallest total theoretical cost $f(n)$

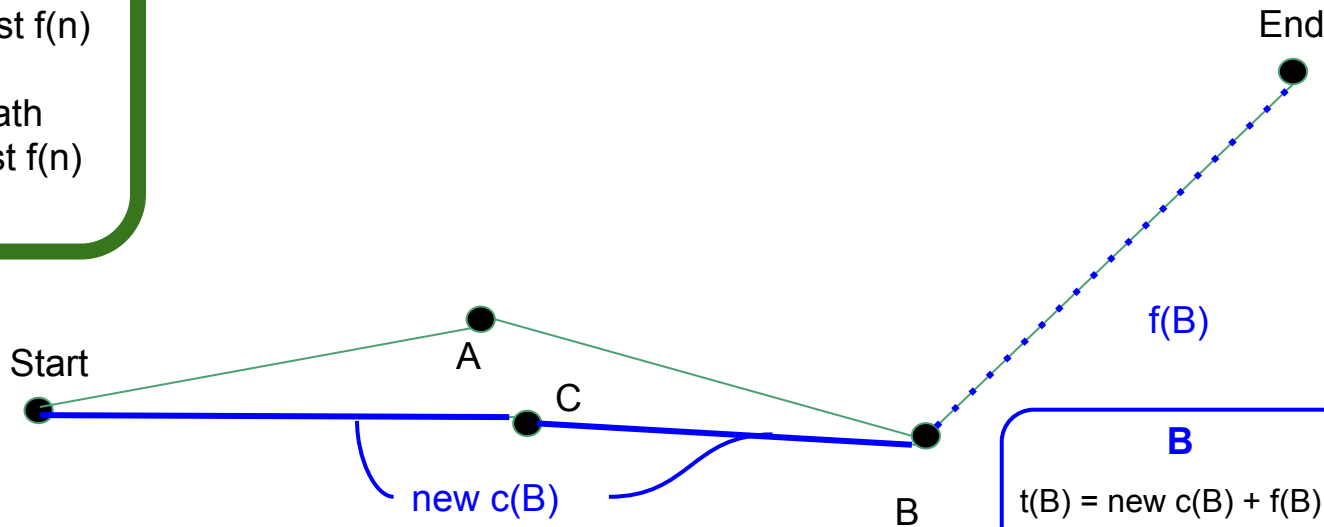
The previous point on the path which computes the smallest $f(n)$

$$t(n) = c(n) + f(n)$$

total cost

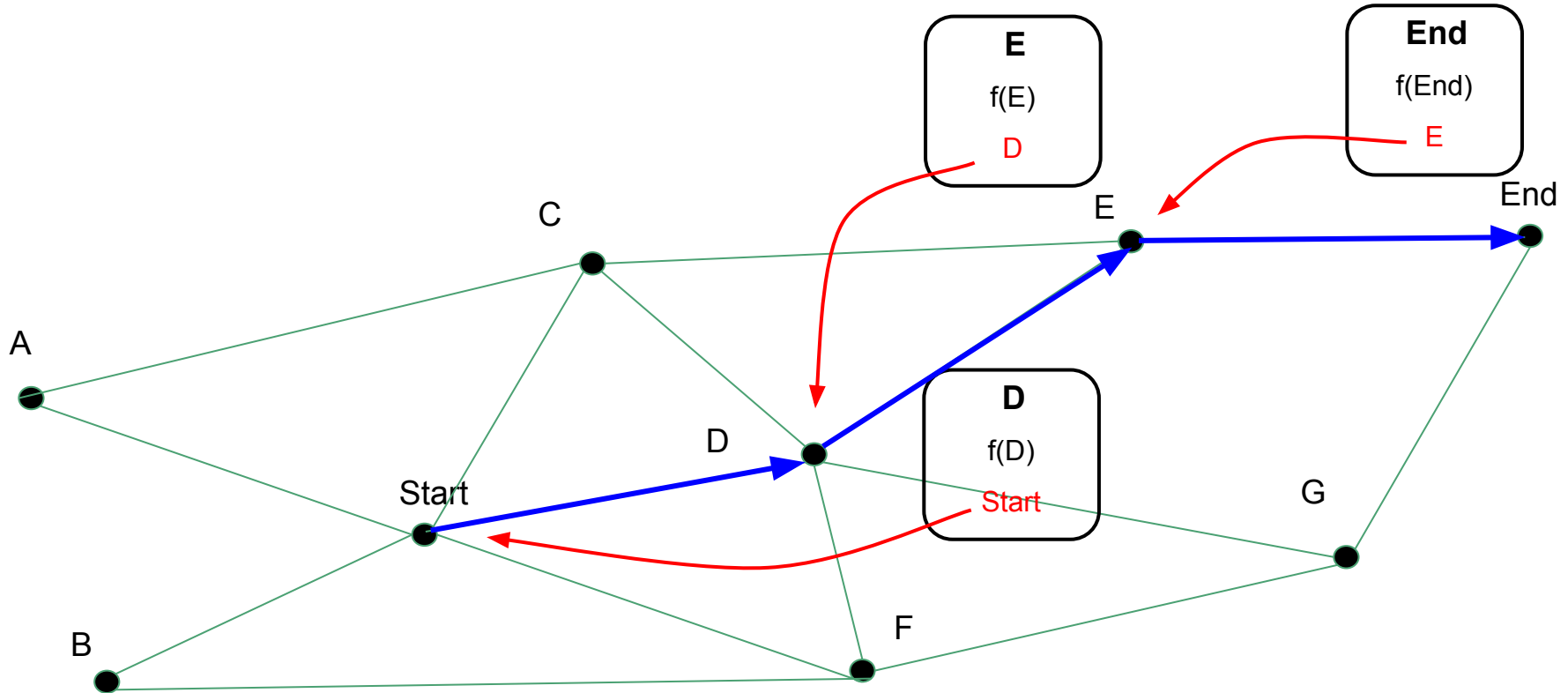
current cost from Start

future predict cost to End

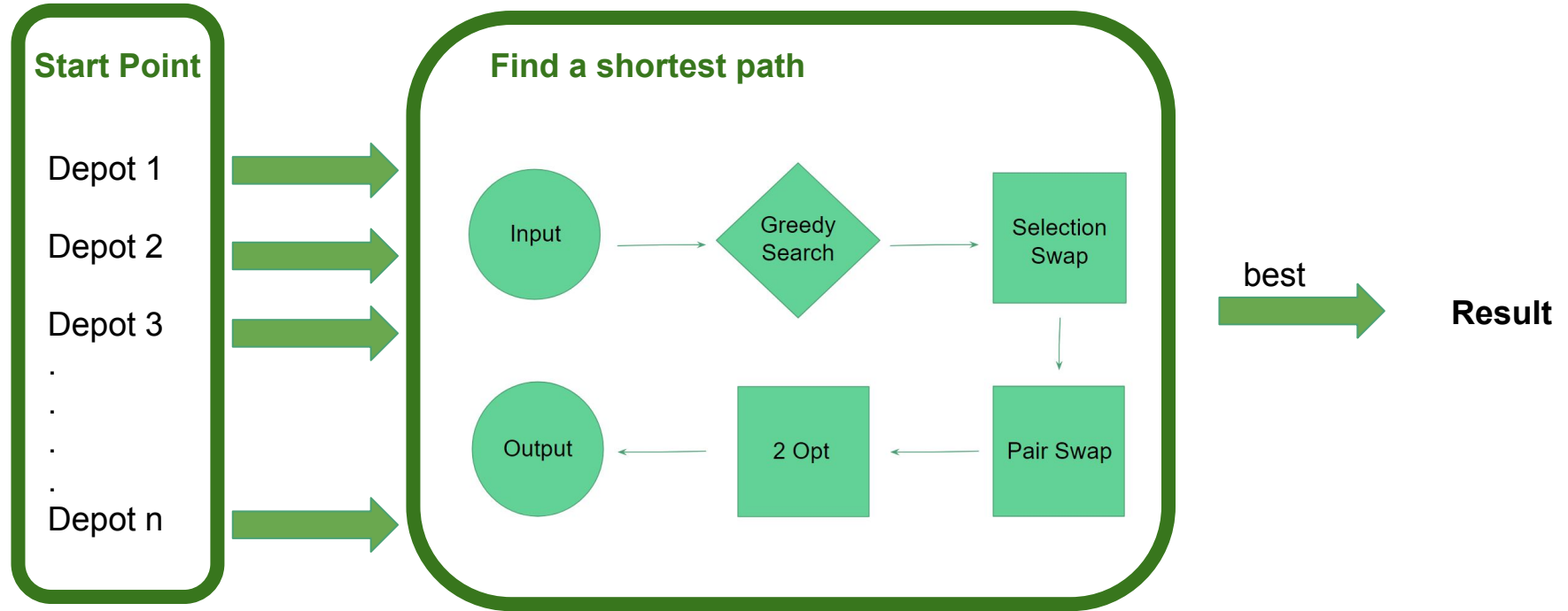


$$t(B) = \text{new } c(B) + f(B)$$

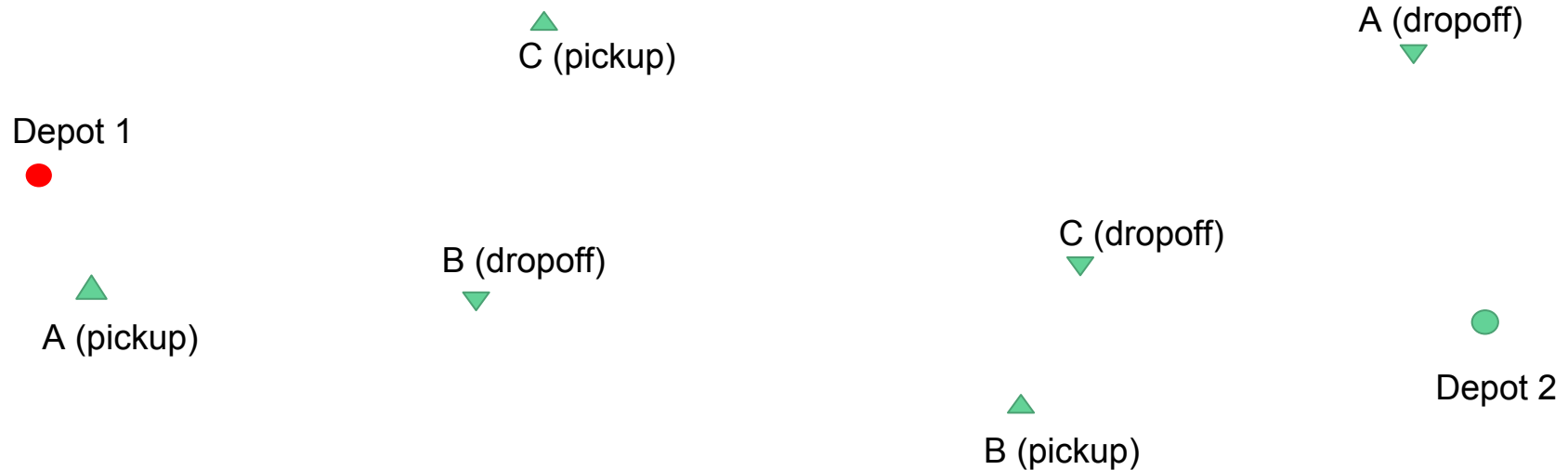
Returning the shortest path



Milestone 4 - Traveling Courier



Example - Start with Depot 1

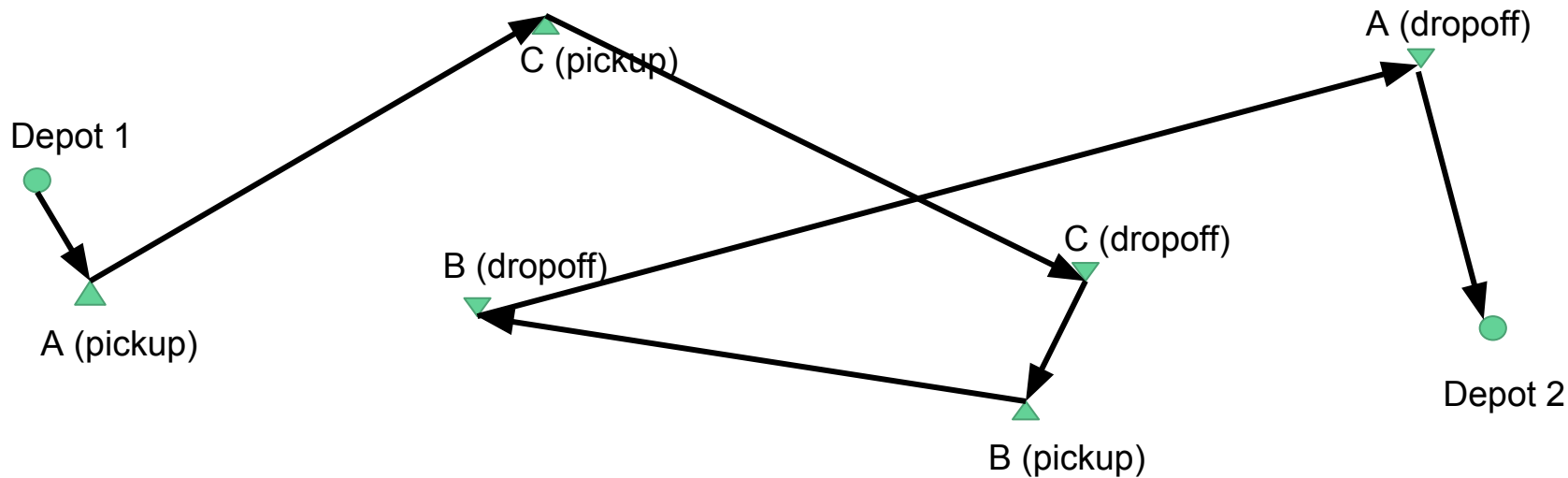


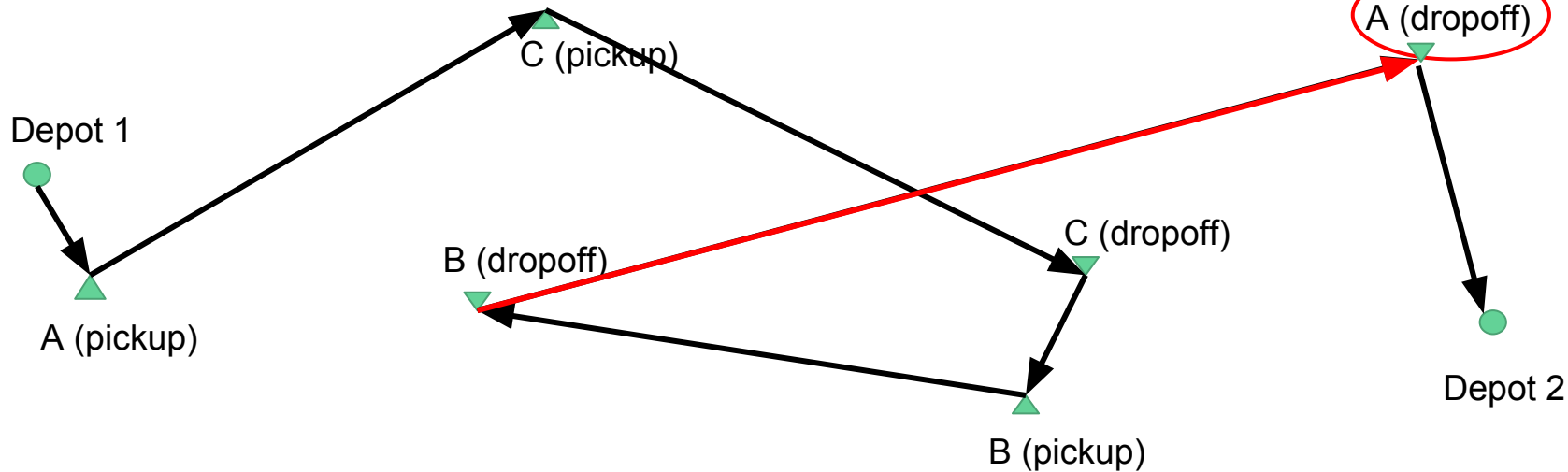
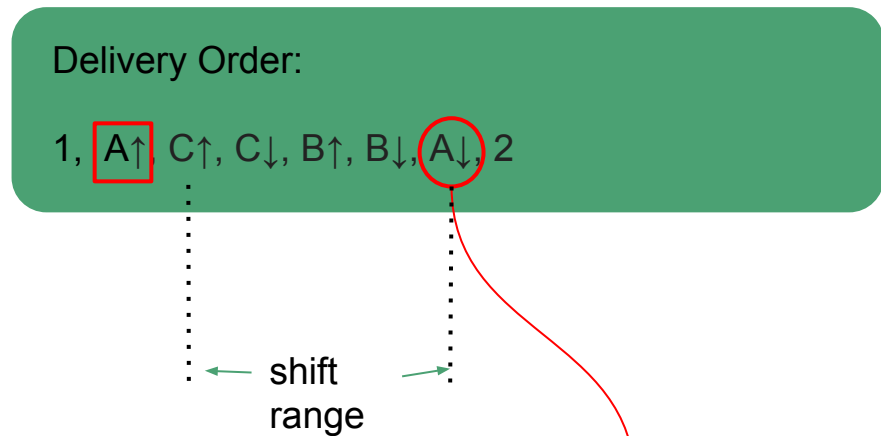
Input

Greedy
Search

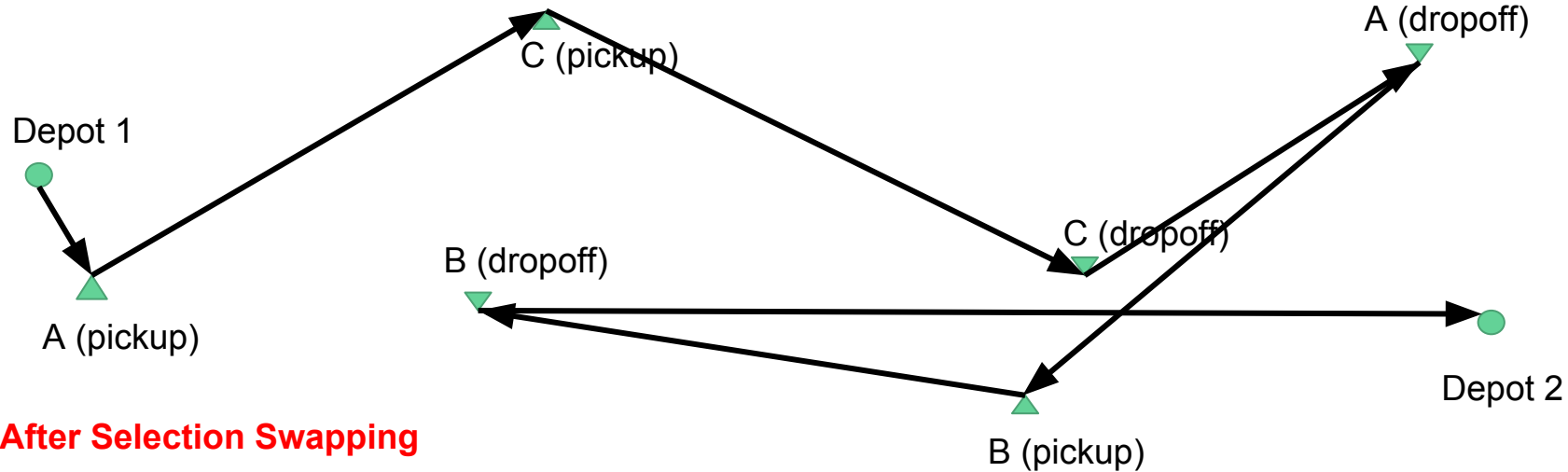
Delivery Order:

1, A \uparrow , C \uparrow , C \downarrow , B \uparrow , B \downarrow , A \downarrow , 2

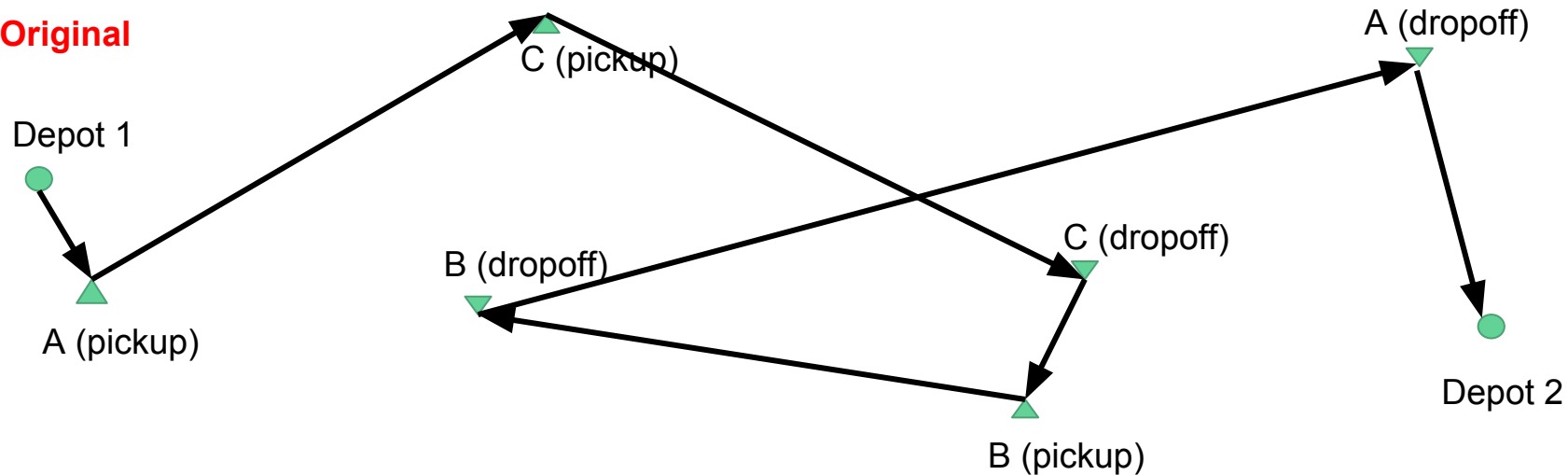


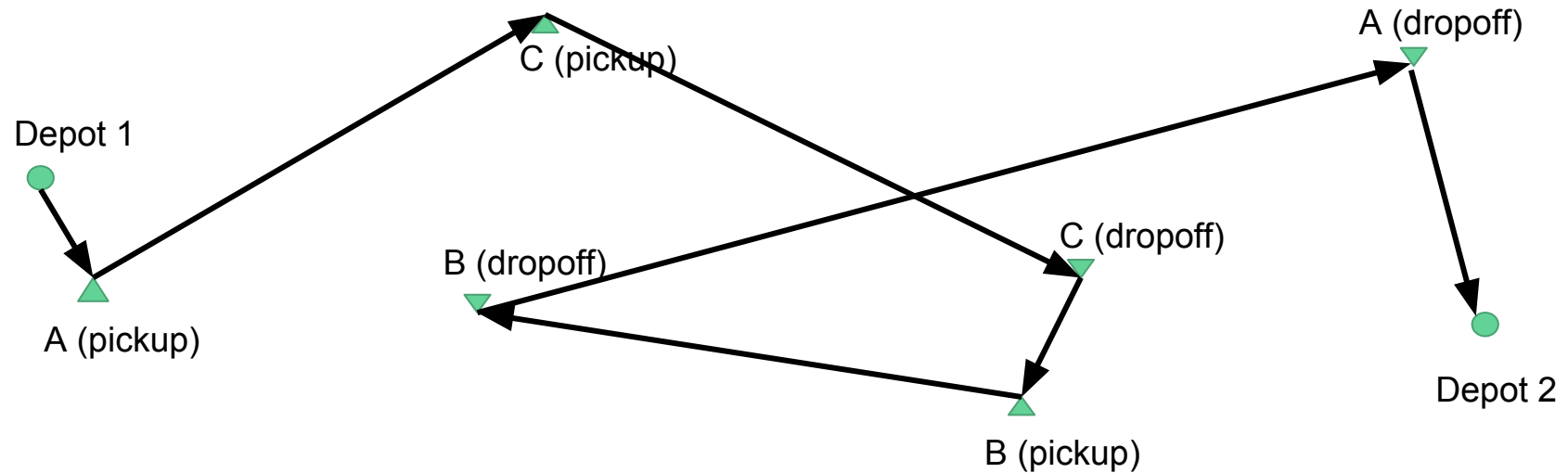
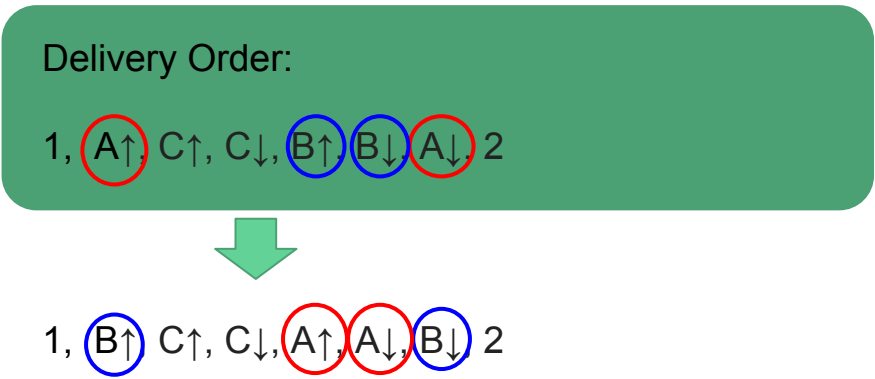
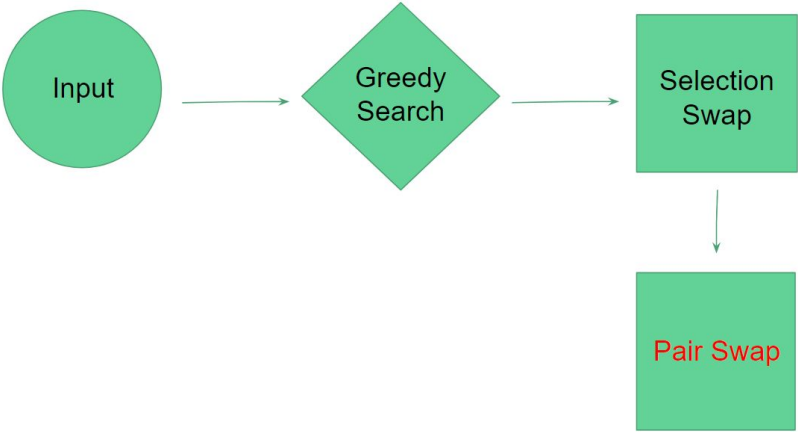


Depot 1



Original





Depot 1

C (pickup)

A (dropoff)

B (dropoff)

C (dropoff)

A (pickup)

Depot 2

After Pair Swapping

B (pickup)

Original

C (pickup)

A (dropoff)

B (dropoff)

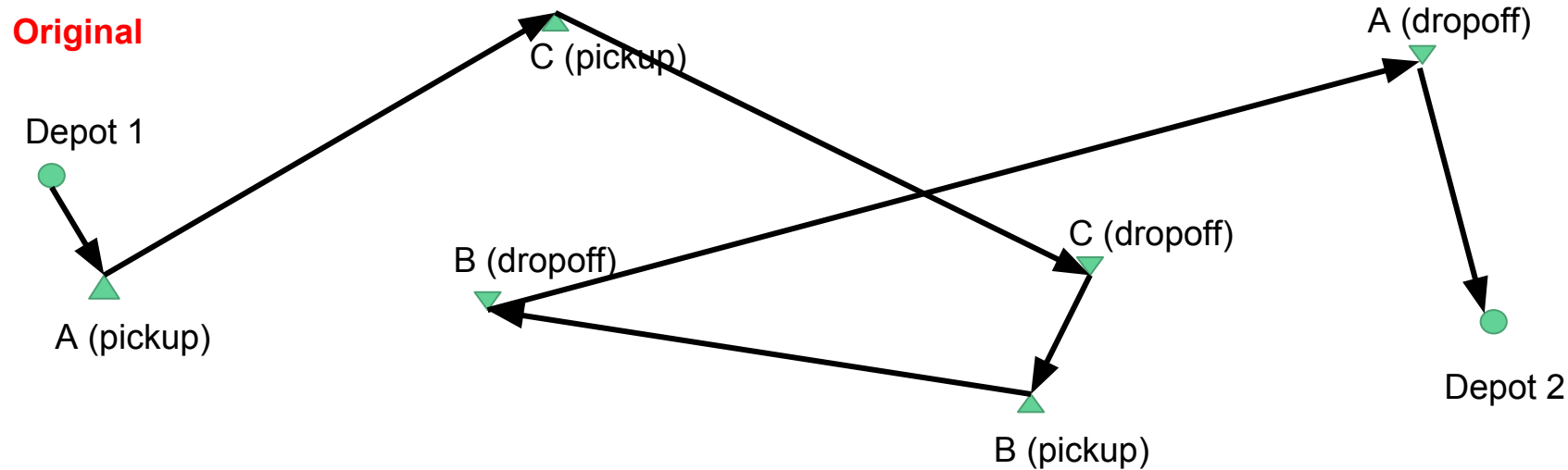
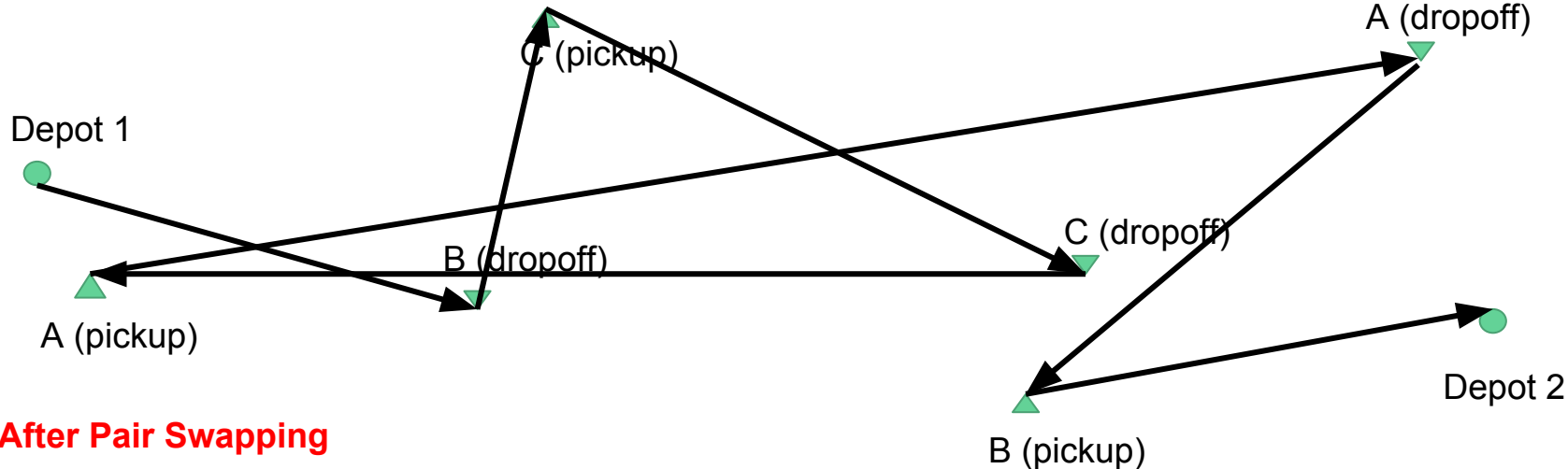
C (dropoff)

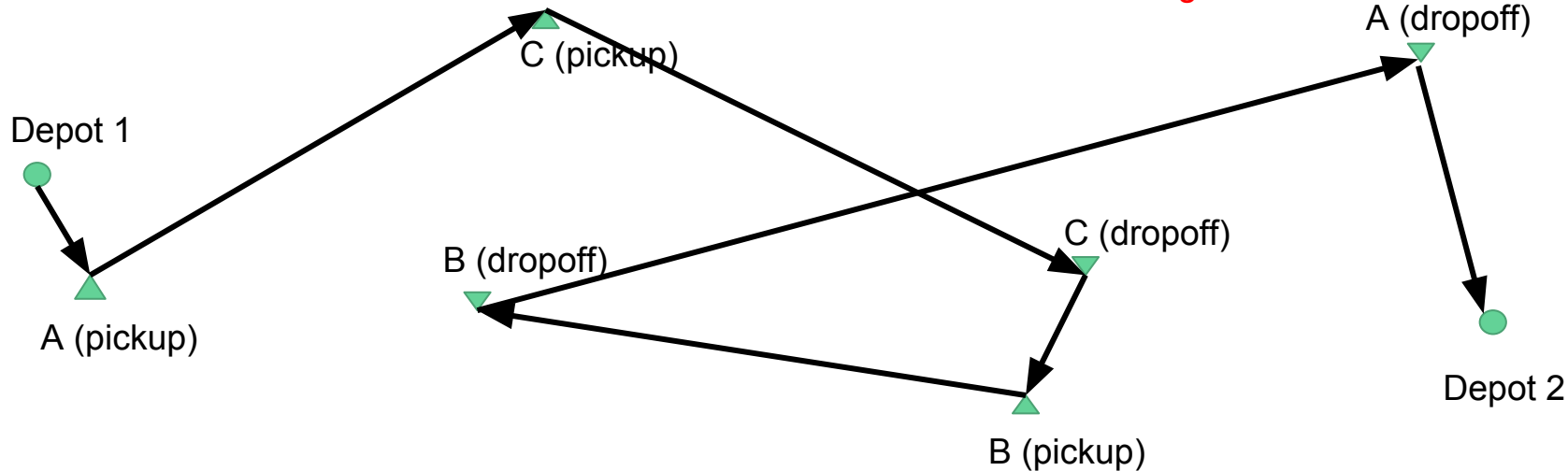
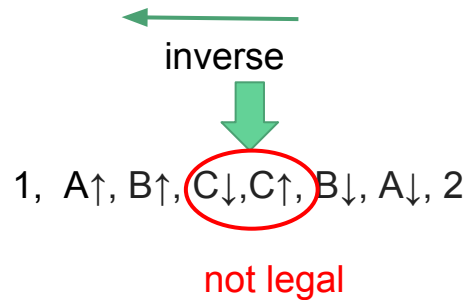
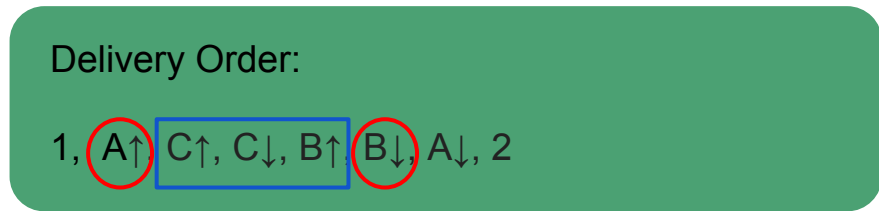
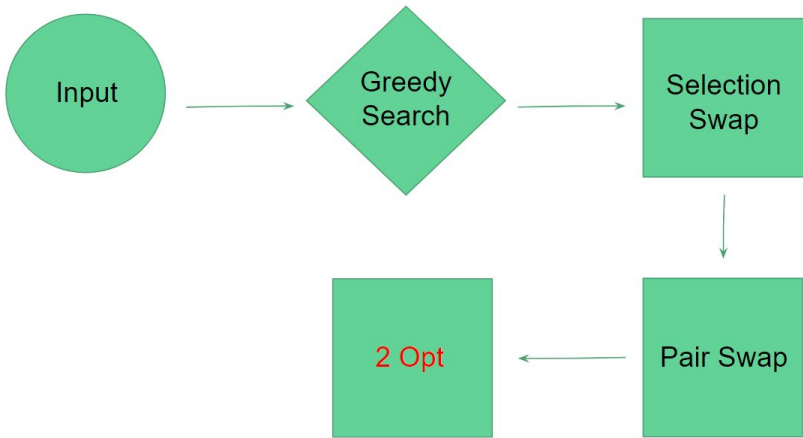
Depot 1

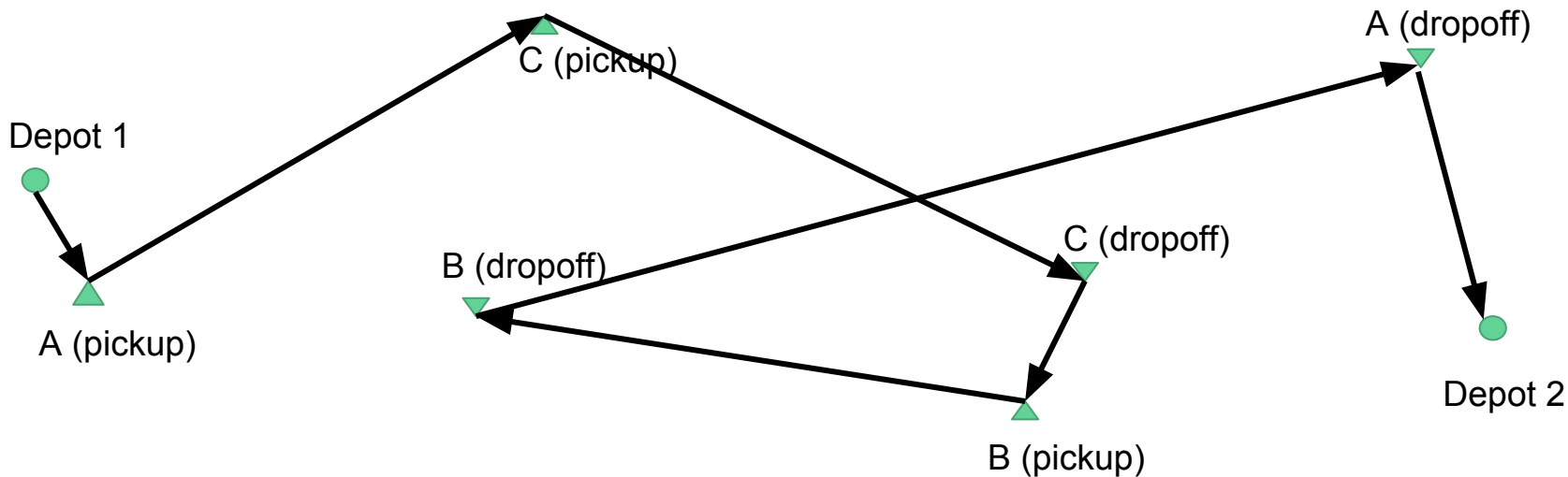
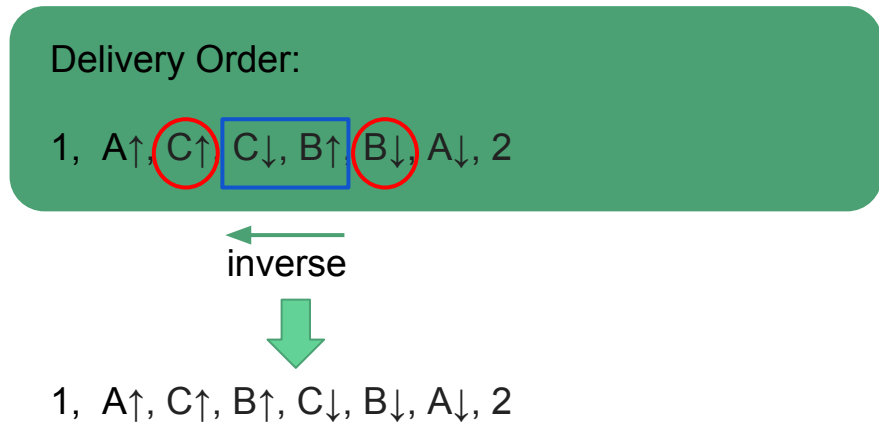
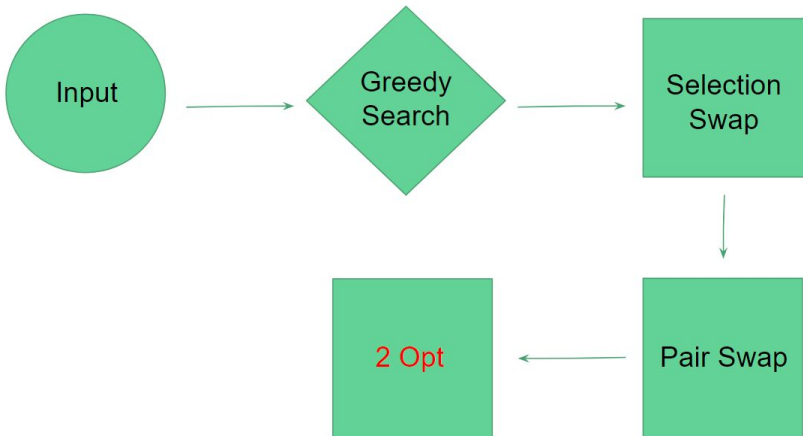
A (pickup)

Depot 2

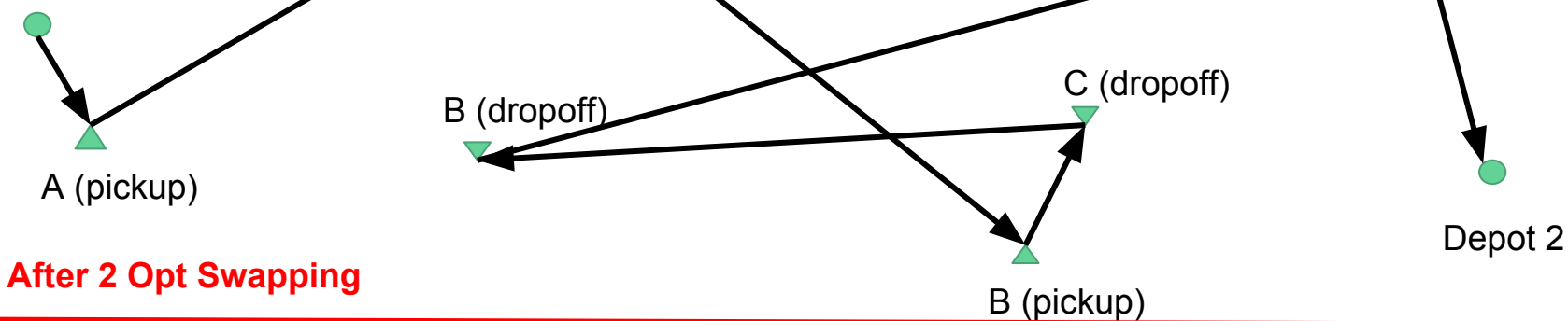
B (pickup)





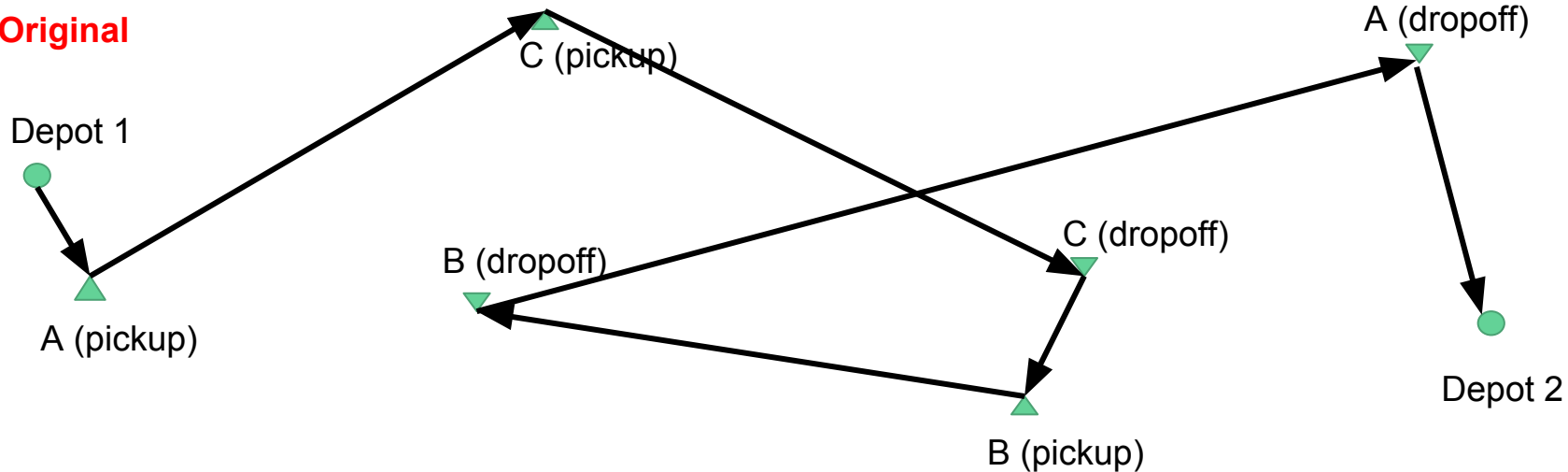


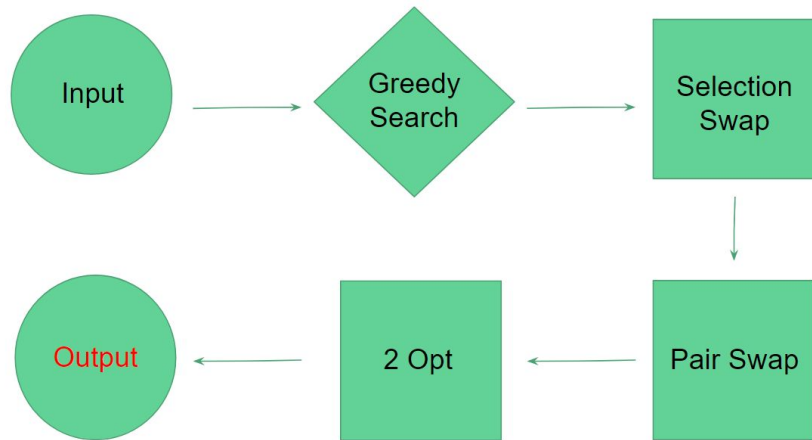
Depot 1



After 2 Opt Swapping

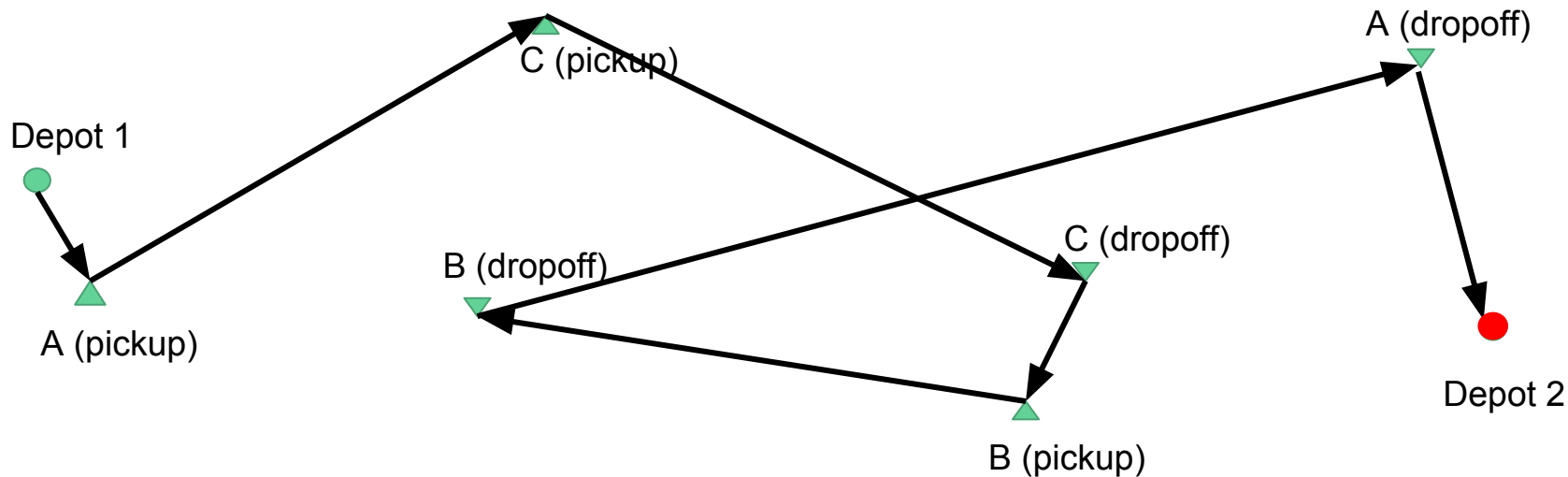
Original





Delivery Order:

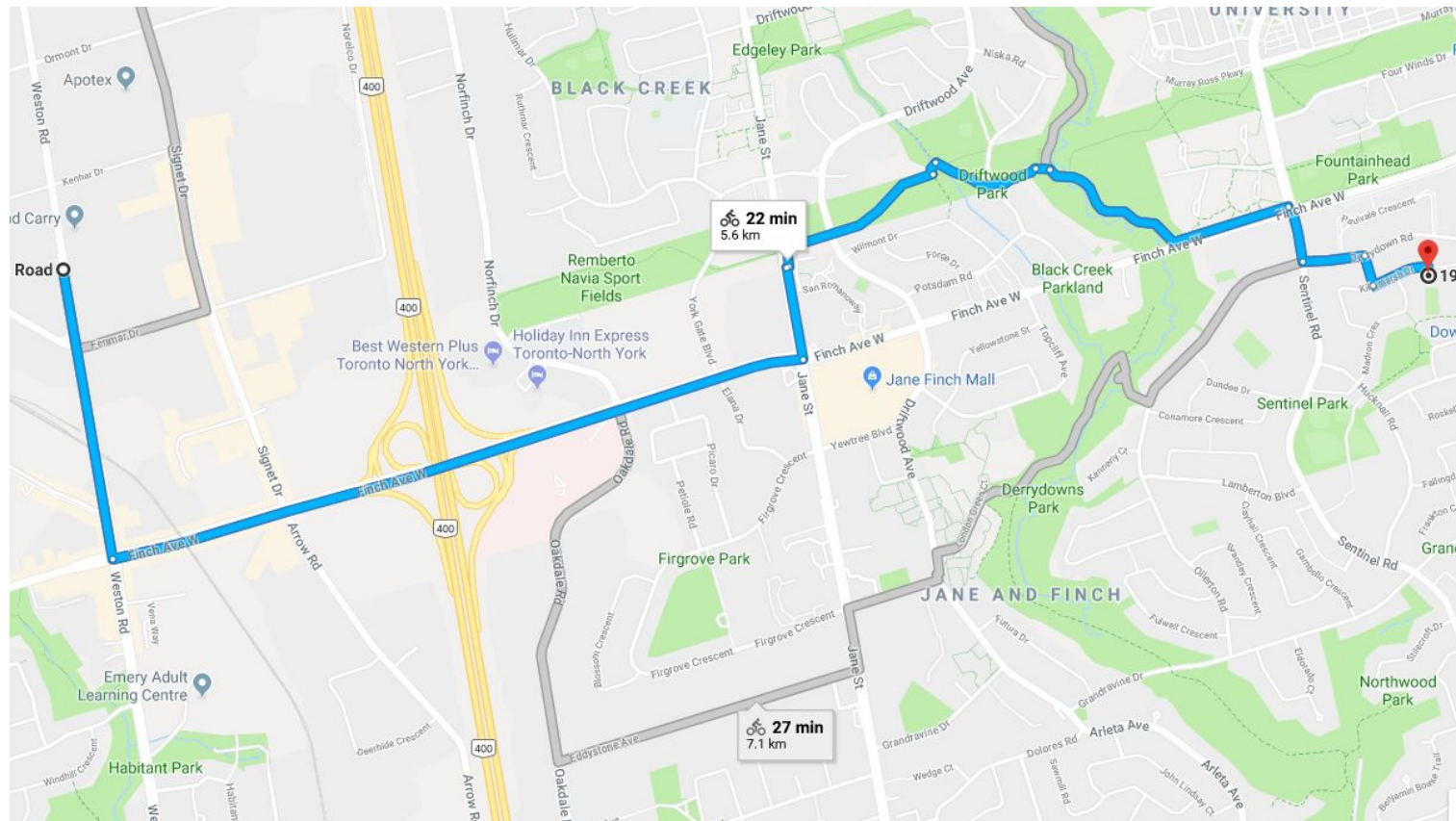
1, A \uparrow , C \uparrow , C \downarrow , B \uparrow , B \downarrow , A \downarrow , 2



Traveling Courier Outcome Example



Once Sophie gets off work...



Once Sophie gets off work...



Problem: Navigation only considers most efficient path



How can ~~we~~ Sophie & Sophie's self safe?



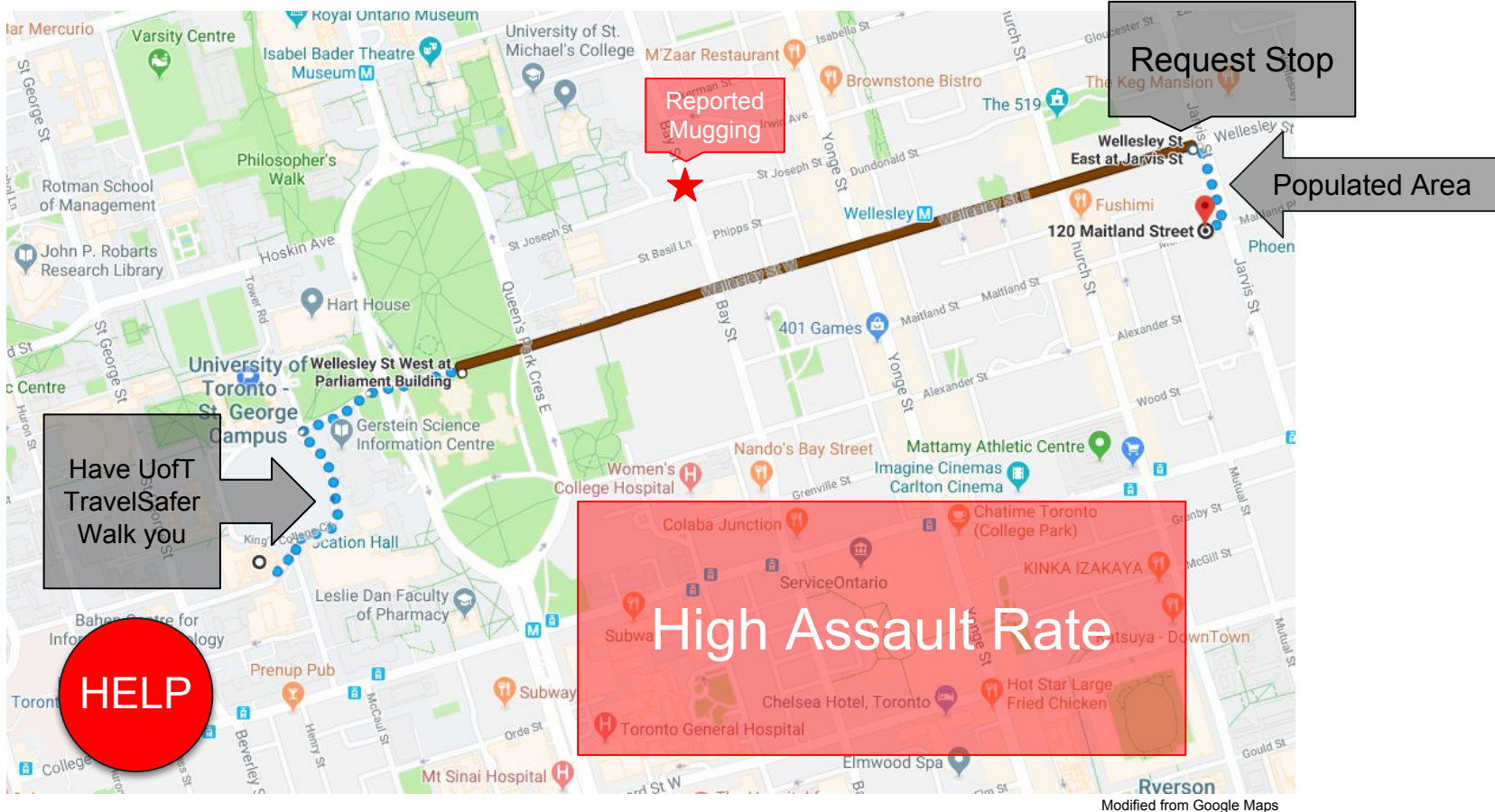
https://www.gtaust.com/news_item/category/live/id/431/White%20Night%20Festival%20Celebrates%20the%20Arts%20with%20Nexo,%20DiGiCo%20&%20RCF

<http://www.cbc.ca/toronto/features/crimemap/>

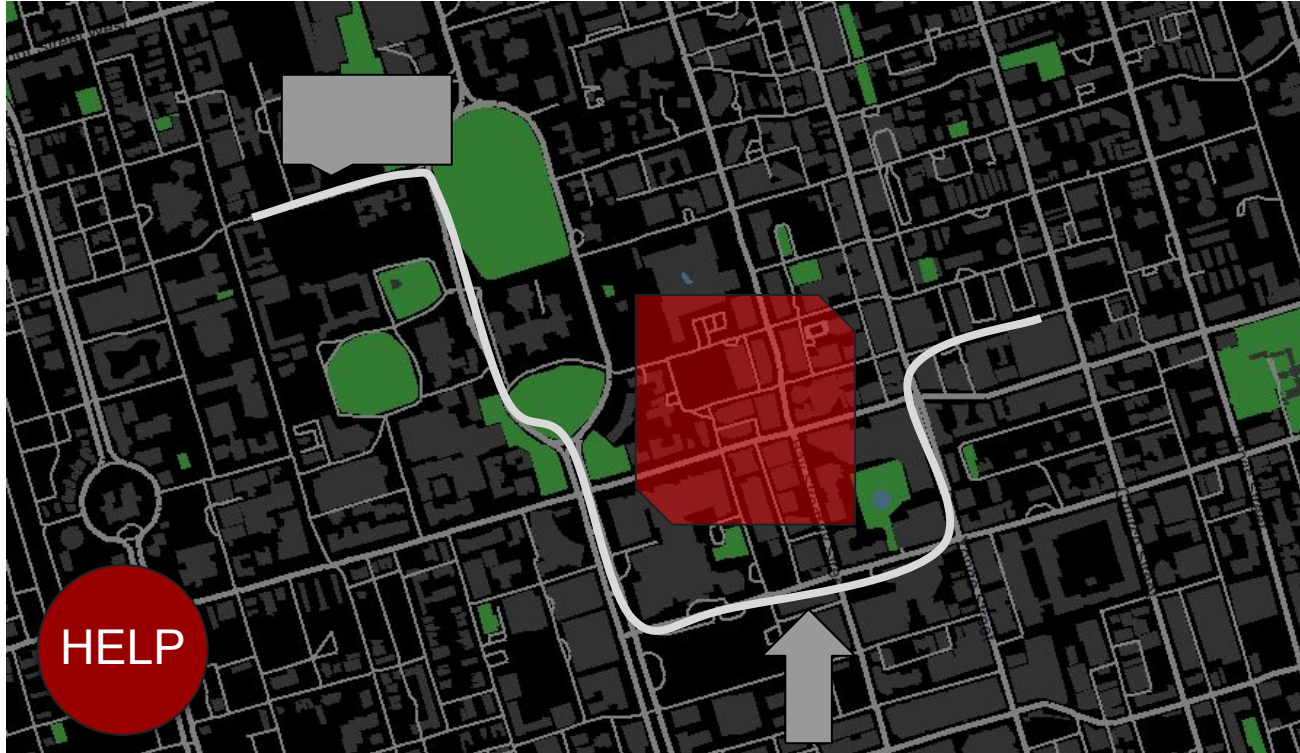


<https://www.amazon.com/Boating-Sports-Safety-Effective-Shoreline/dp/B018Y6U3ZS>

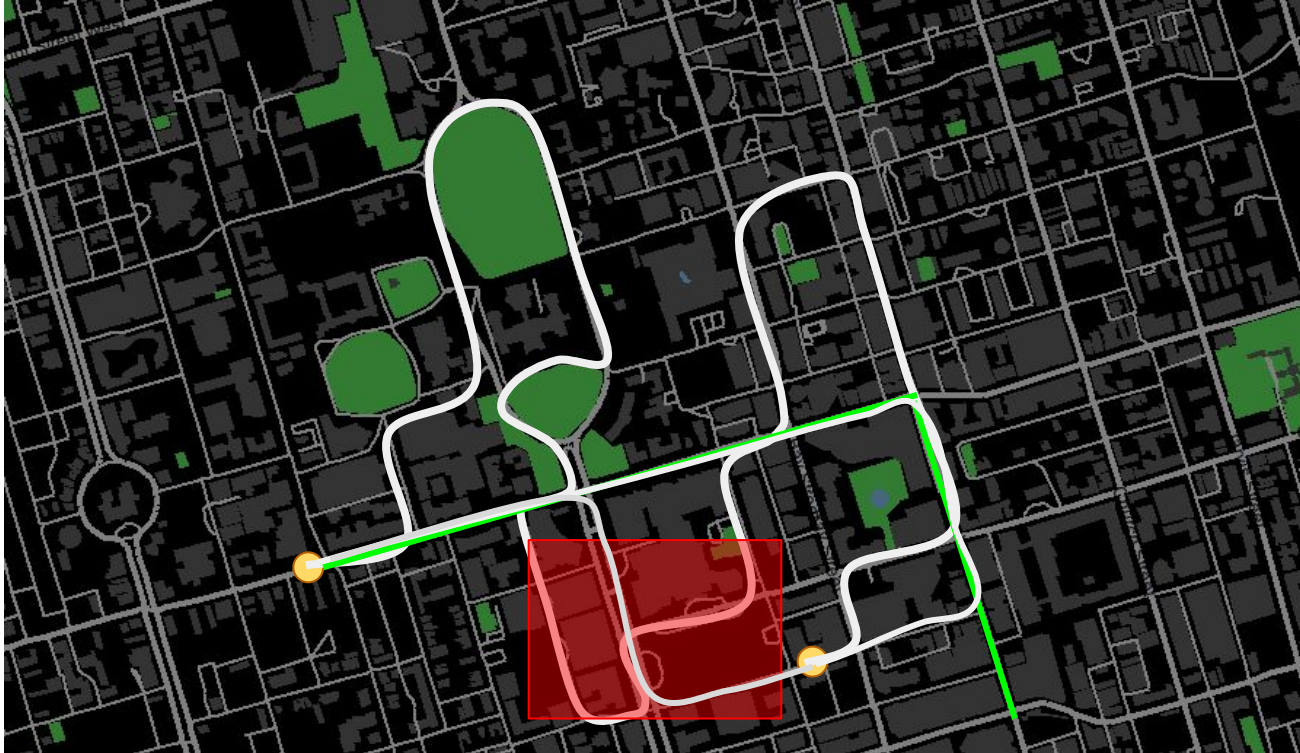
Navi-Safe integrates all these features together



A user interface designed for usability

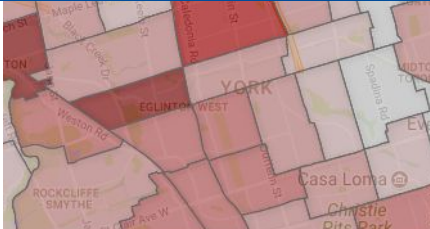
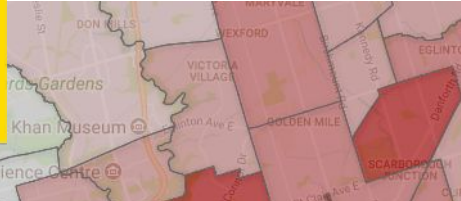


Navi-Safe navigation is like Pathage navigation



Integrating with other systems is a new challenge

Ryerson
University



Toronto Police OPS @TPSOperations · 3h

Police responding to sounds of gunshots in The West Mall & Sherway Dr. area.
We are o/s investigating. #GO650309 ^gl



4



11



3



REQUEST STOP

- The **REQUEST STOP** program is available to **women** travelling by bus between 9:00 p.m. and 5:00 a.m. **REQUEST STOP** allows a woman to get off the bus between regular TTC stops.
- The request should be made at least one TTC stop ahead of the desired location.
- The driver must be able to stop safely in order to meet your request.
- Exit the bus via the front doors, the rear doors will remain closed.

Hide the Request

"We're serious about your safety."



YORK
UNIVERSITÉ
UNIVERSITY

Toronto Police Twitter



TTC

<http://www.cbc.ca/toronto/features/crimemap/>

Take-Away

8:00 AM

5:00 PM

10:00 PM

Pathage

Navi-Safe

Working hours



<https://www.shutterstock.com/video/clip-4376276-stock-footage-delivery-courier-woman-giving-package-wearing-blue-uniform-woman-courier-smiling-happy-on-white.html>

After hours



<https://economictimes.indiatimes.com/magazines/panache/looking-for-a-new-job-how-about-shopping-for-someone-else-at-rs-25000-per-day/articleshow/60188028.cms>

Q & A