CSQ System: A System to Support Constrained Skyline Queries on Transportation Networks

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Outline

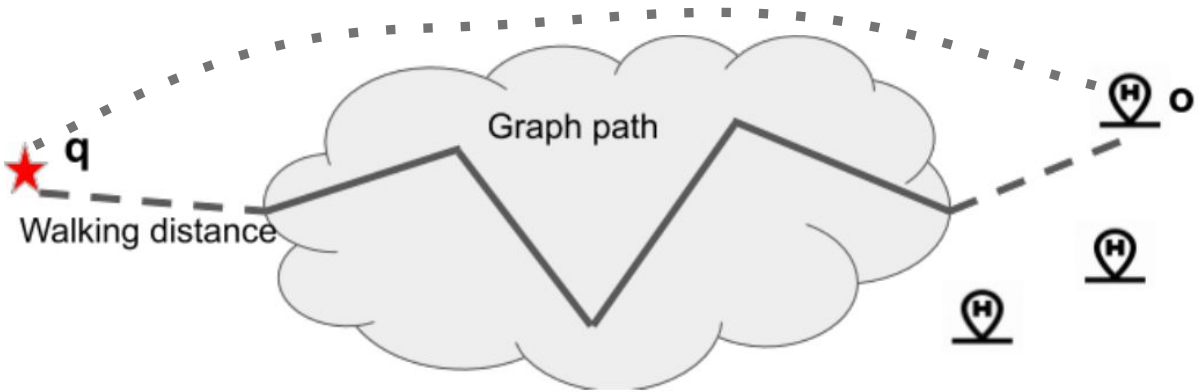
- Introduction
- System Architecture
- Experiments and Demonstration

Introduction

- Skyline query
  - On multi-dimentional dataset
  - Better than other objects on at least on dimension

- MCTN-constrained skyline query
  - MCN (multi-cost network)

    - MCTN (multi-cost transportation network)



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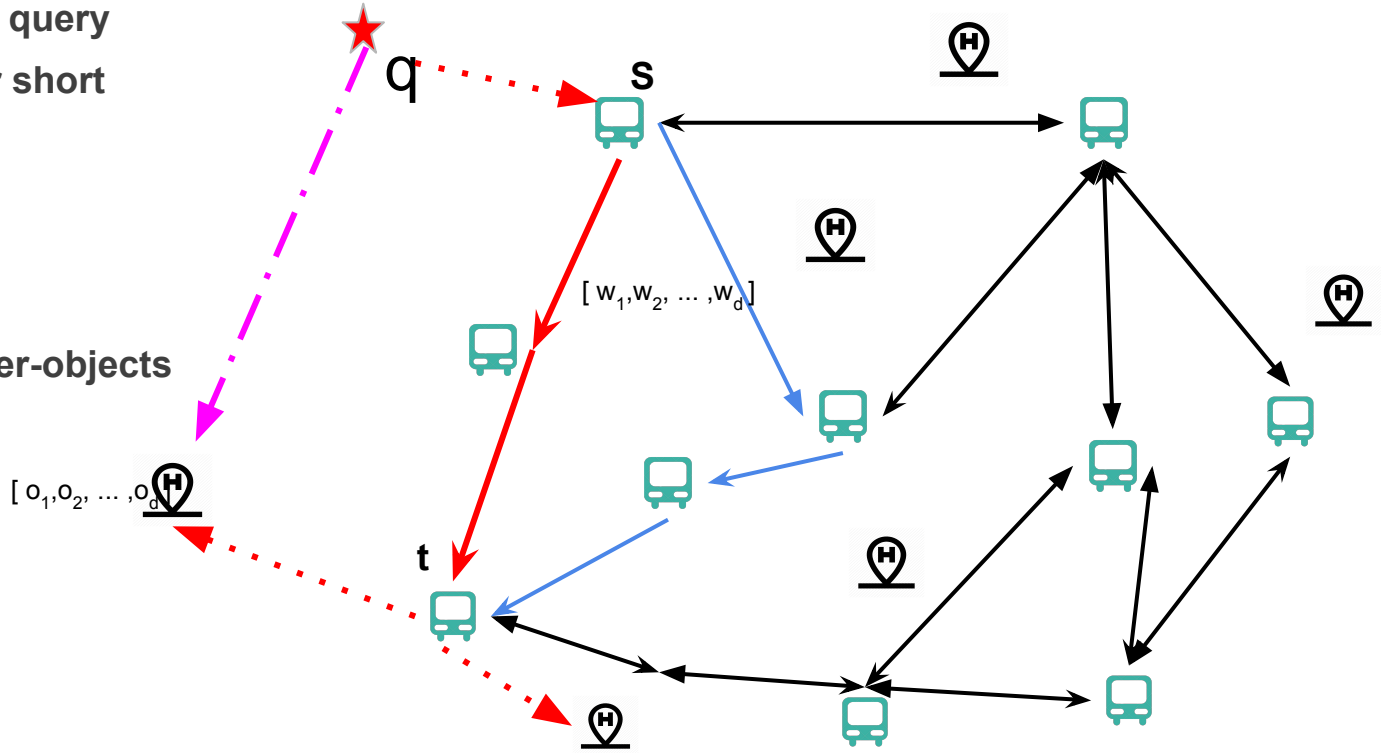
Introduction

- MCTN-constrained skyline query
  - MCTN-CSQ or CSQ for short
- An MCTN, G
- A query point, q
- A set of POIs, D

  CSQ: Return **skyline** answer-objects



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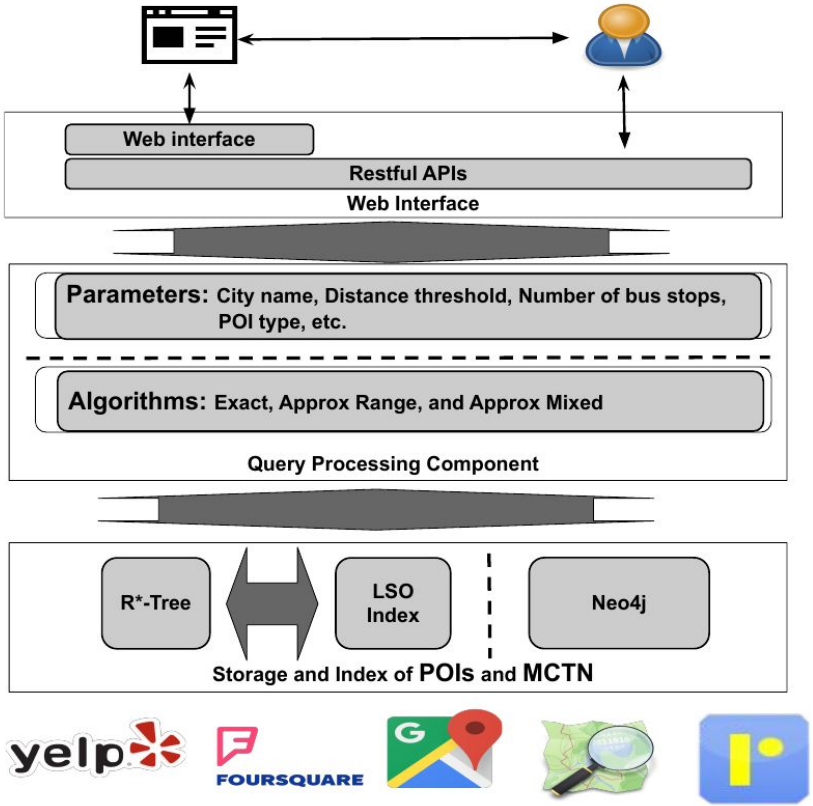
Architecture



Web Interface/ UI

Query Processing Component

Data Layer

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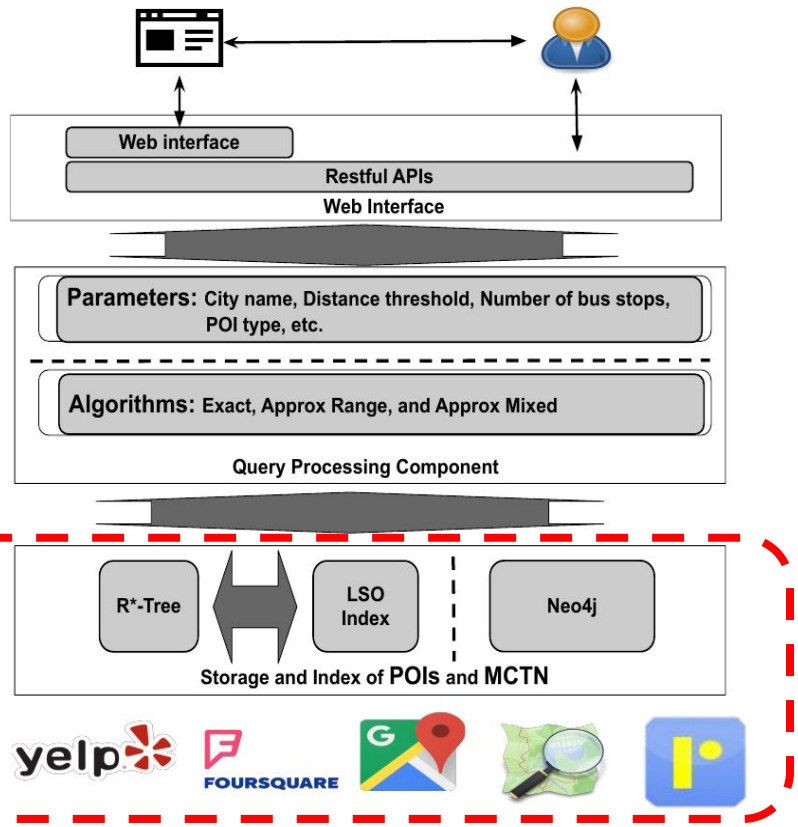
Architecture



Data Layer:

POIs:

R*-tree[2] ⟺
- **non-spatial** attrs
- Location Information

LSO Index[1] ⟺
- **Hierarchical Index**
- **Candidate objects w.r.t each node in MCTN**

MCTN:

Neo4j ⟺ ***Transportation Network***

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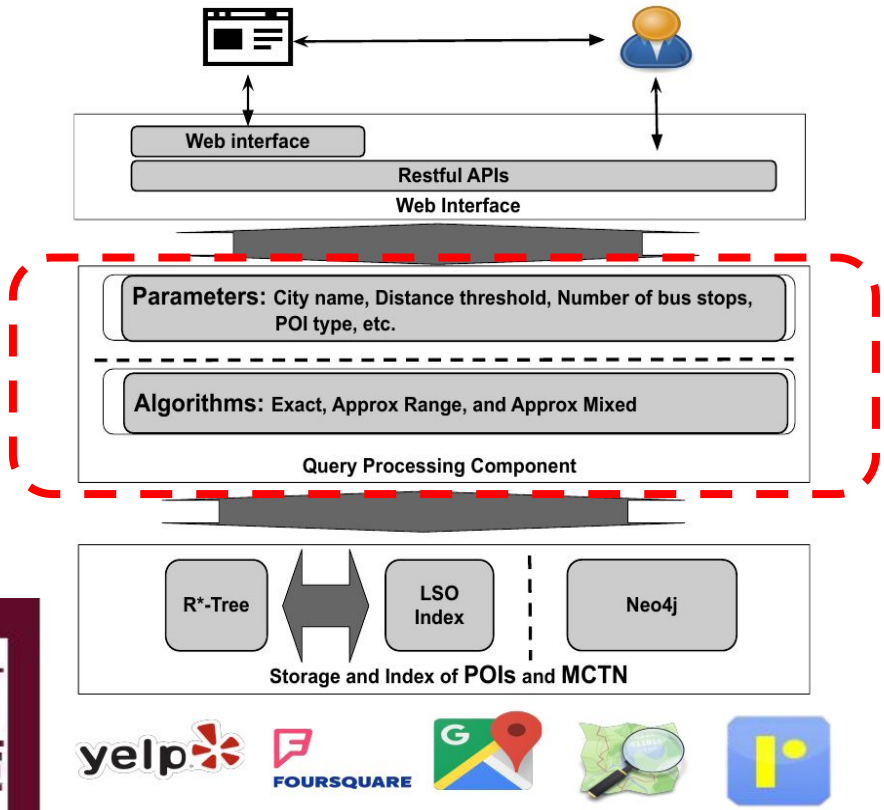
Architecture

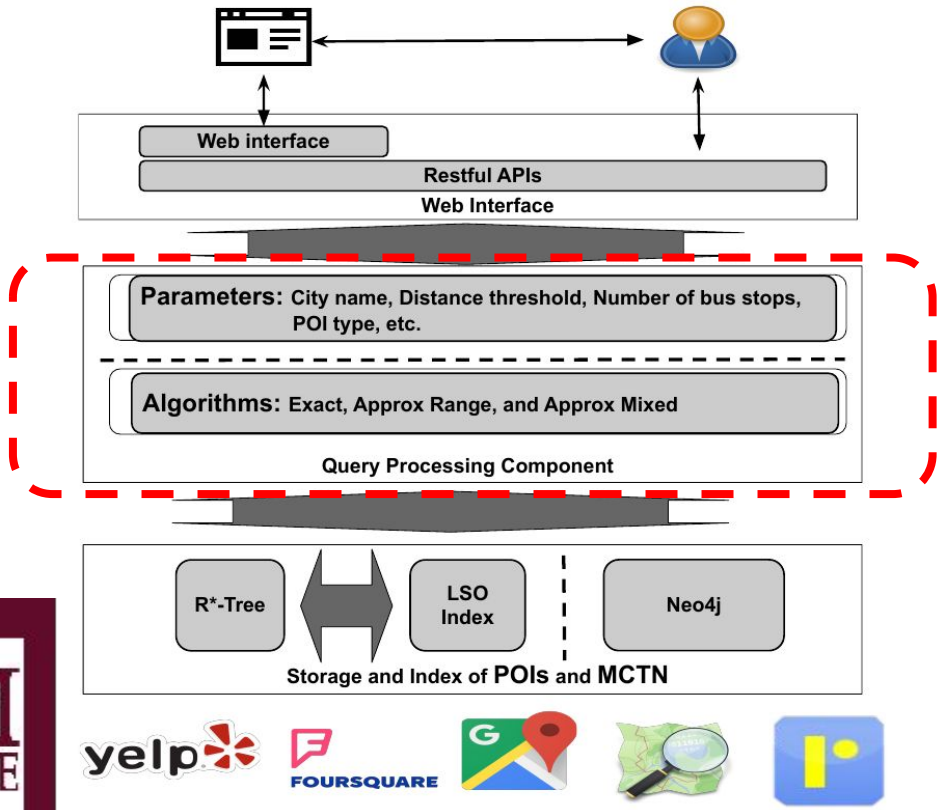


Query Processing Component:

Implemented Algorithms:

- ***Improved Exact Method[1].***
  - ***Exact solutions***
  - ***Inefficient & not practical***
- ***Range Approximate Method[1].***
  - ***Distance Threshold***
- ***Mixed Approximate Method[1].***
  - ***Minimum value expansion***

Architecture



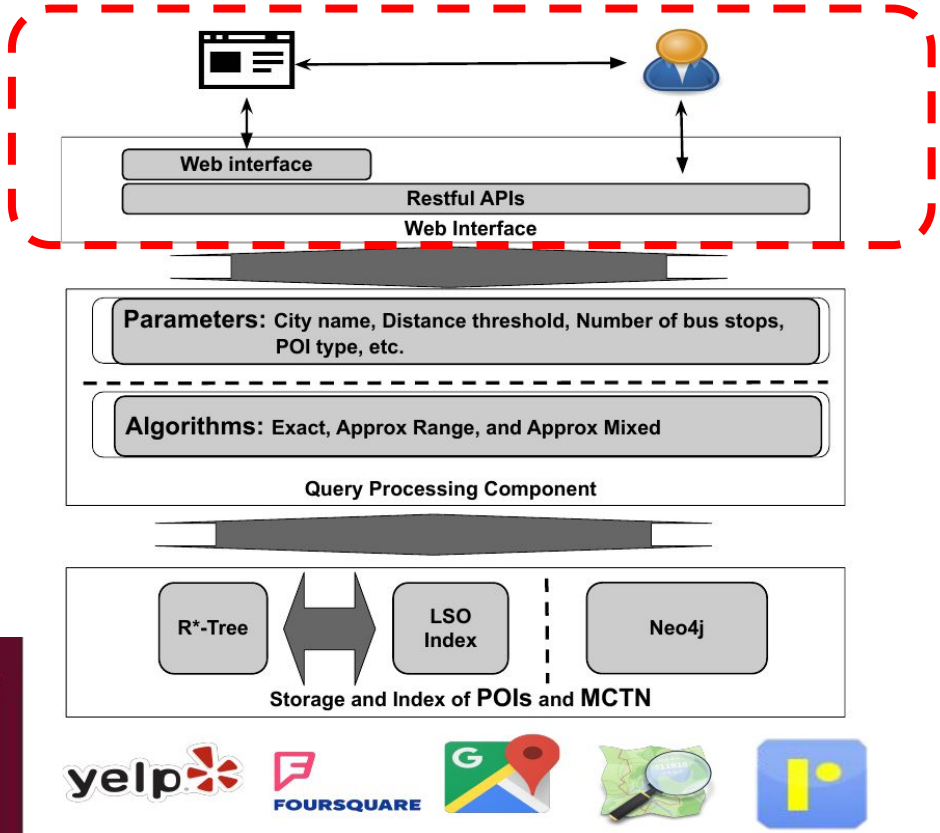
Query Processing Component:

Implemented Algorithms:

- *Improved Exact Method.*
- *Range Approximate Method.*
- *Mixed Approximate Method.*

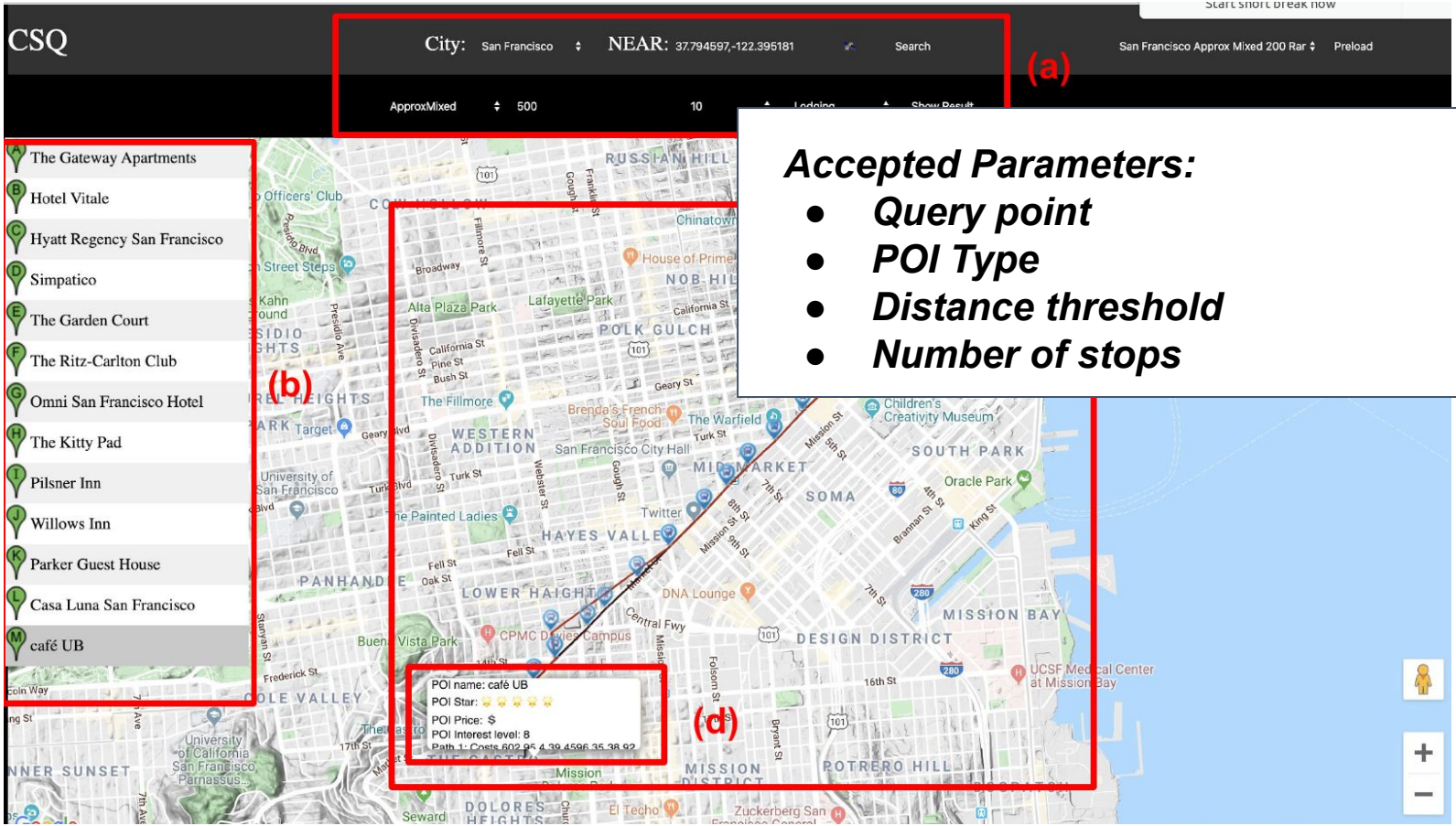
- *Accepte location query*
- *Constrain # of bus stop*

Architecture



Web Interface

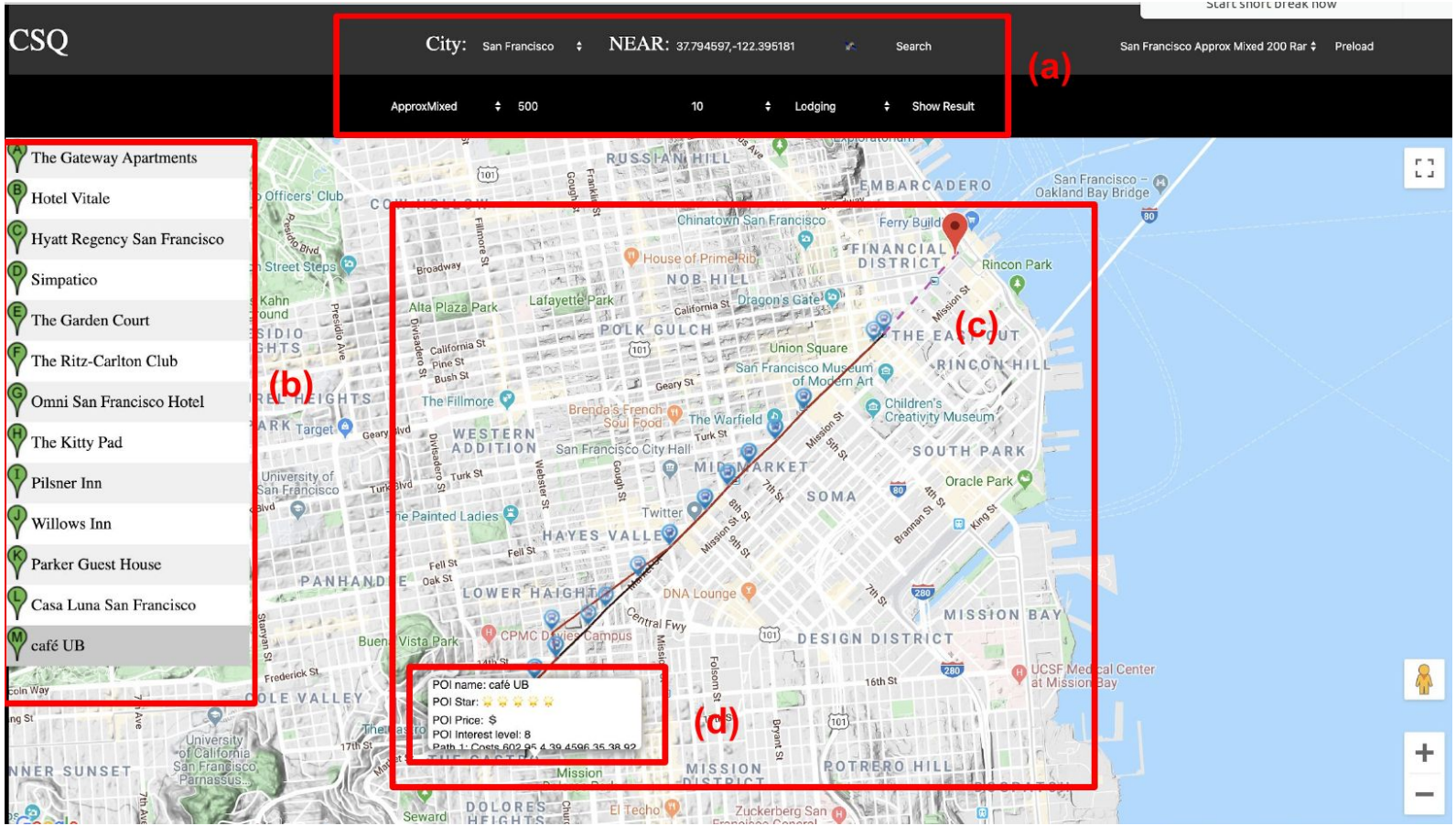
Demonstration



Accepted Parameters:

- ***Query point***
- ***POI Type***
- ***Distance threshold***
- ***Number of stops***

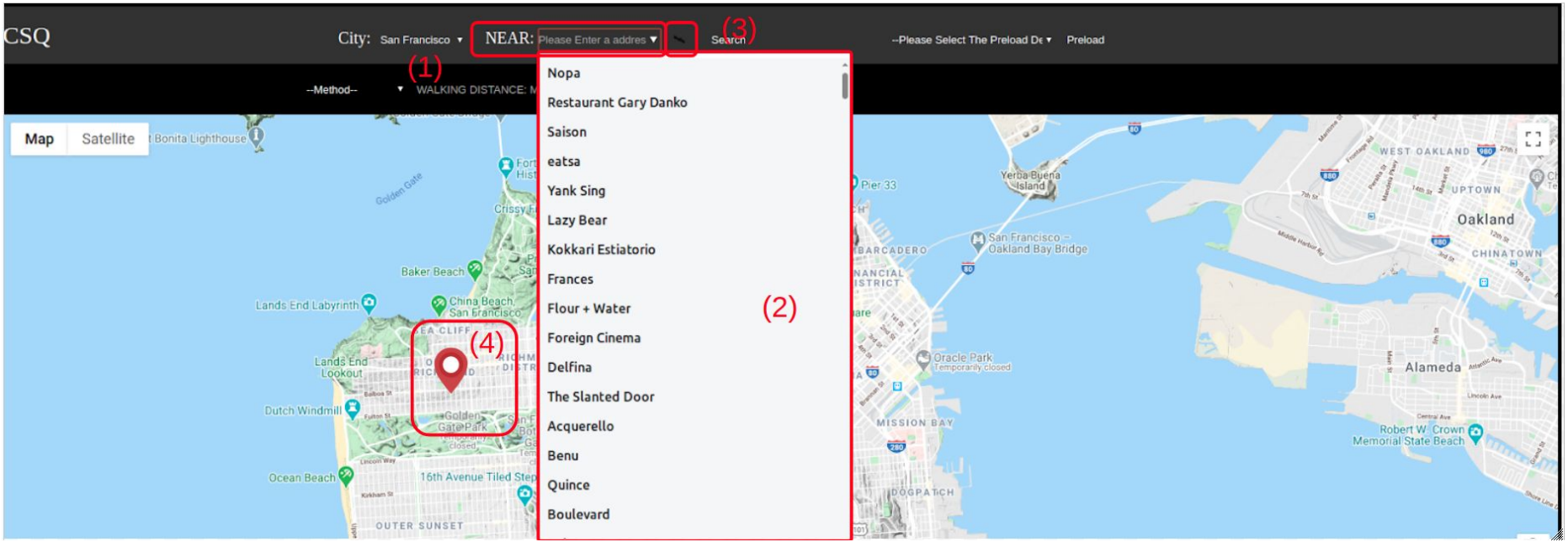
Demonstration



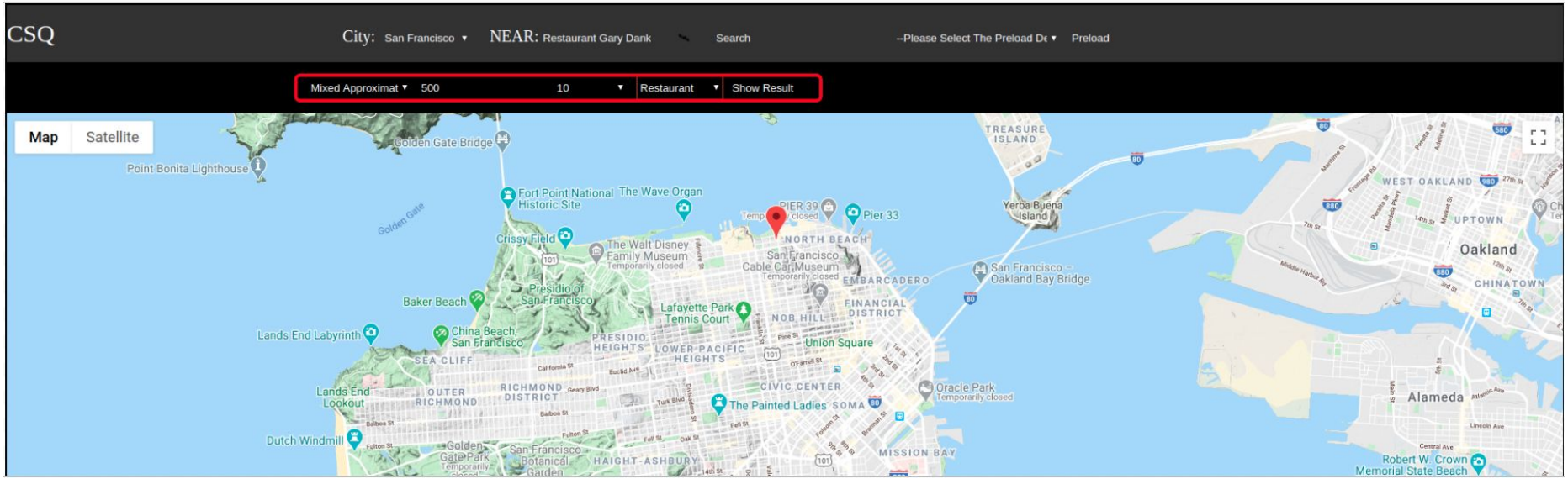
Real Dataset

Location	# of objects	# of nodes	# of edges
New York (NY)	14,155	5,127	11,152
Los Angeles (LA)	9,589	12,433	22,752
San Francisco (SF)	2,110	9,041	13,615
Overall	25,854	26,601	47,519

Basic usage - search panel

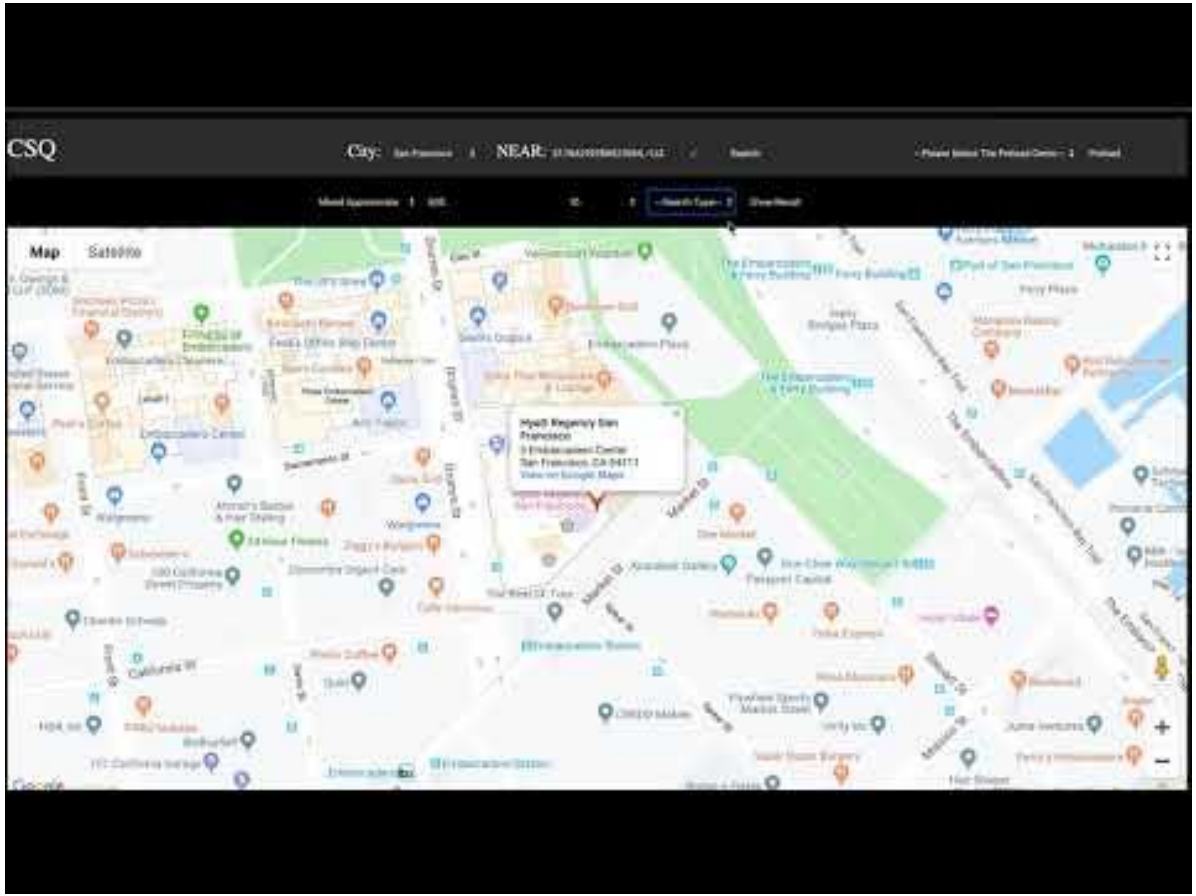


Basic usage - parameters selection

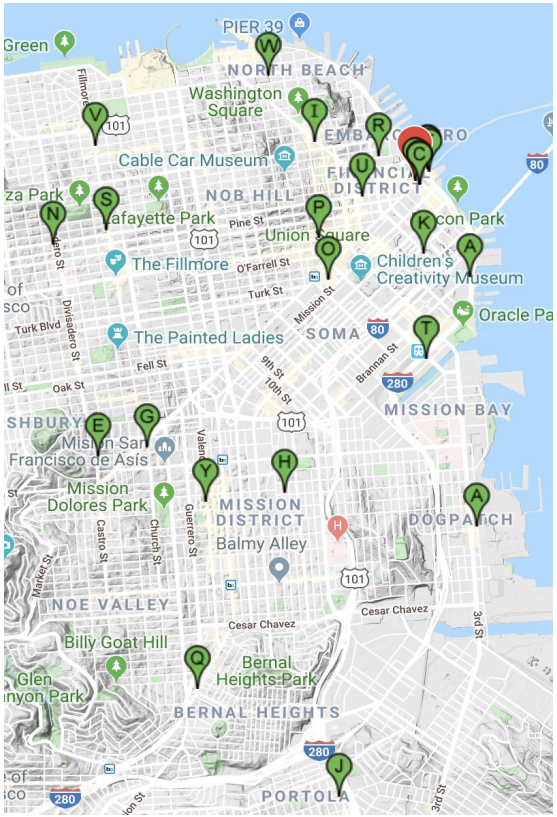


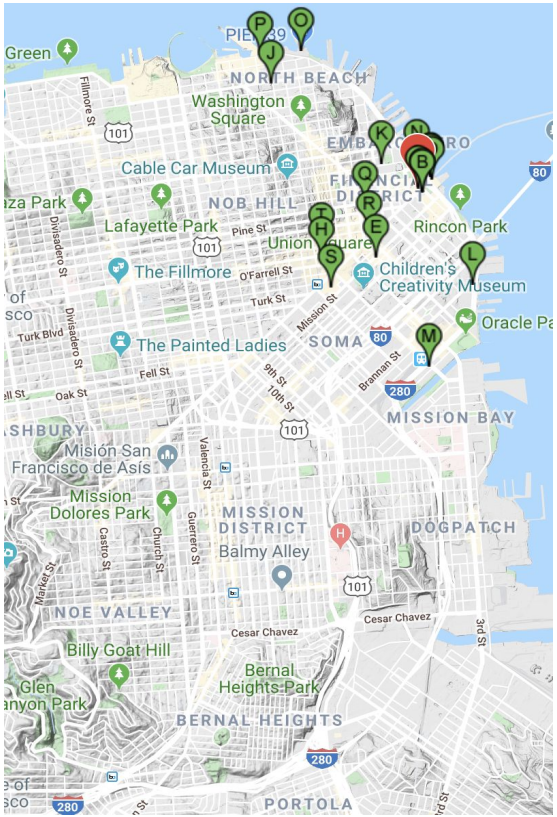
Demo demonstration

Short demonstration



Demo demonstration





Conclusions:

- The first system was built to support the Constrained Skyline Query on Multi-cost Transportation network.
- One exact search algorithm and two heuristic approaches were implemented.
- Two new features were added to make the system more practical and friendly.
- Interfaces help users understand CSQ algorithms and their answers.
- Demonstrated on three real datasets.

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References:

[1] Qixu Gong, Huiping Cao, and Parth Nagarkar. Skyline queries constrained by multi-cost transportation networks. In ICDE, pages 926–937. IEEE, 2019.

[2] Beckmann, Norbert, Hans-Peter Kriegel, Ralf Schneider and Bernhard Seeger. “The R*-tree: an efficient and robust access method for points and rectangles.” SIGMOD '90 (1990).

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Thank you !
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Questions?