

The Icebergs Challenge

The task

Navigate a ship from point A to point B in the Northern Ocean with icebergs. The path should be as short as possible and not cross any of the icebergs (touching an iceberg's edge or corner is OK).

You can assume all coordinates are positive decimals (if you wish) and all polygons are convex.

Iceberg Web App

1. Route Plan for creating start, end points and polygons
2. Short Path Calculation
3. Visual display of Shapes and shortest path
4. 2 Route Plan Objects,
 1. Demo with predefined start, end points and polygons.
 2. Route Plan for creating points and polygons

Technology

ES6 updated code and OO syntax, Angular, Bootstrap, HTML5 Canvas (Java script only)

Install

Copy folder as is to your host server (Copy and Play)

Structure

5. Route Plan Class
 1. Create, Add and Manage a collection of Circles and Shapes
 2. Draw Shapes
 3. Calculates Shortest Path
 4. Implementation of graph routes and edges in (JavaScript implementation).
Graph with all possible routes and their lengths. Created graph is analyzed using the shortest route algorithm (Dijkstra's algorithm) to calculate the shortest path.
6. Point Class: Base class with x,y attributes
7. Shape Class: Base class
 1. Create, Add and Manage a collection of segments
 2. Draw Shape
8. Circle Class, extends Shape
9. GraphSearchAlgo Module with shapeCtrl for Setting and Adding Shapes to Route Plan, execute short path method and display data

Graph Edges Algorithm

Navigate a ship from point A to point B in the Northern Ocean with icebergs. The path should be as short as possible and not cross any of the icebergs (touching the iceberg is OK).

Assumptions:

All polygons are convex.

The polygons are not overlapping with each other (touching is OK).

Algorithm

Observation: the shortest route must only go through the start and end points and vertices on the various icebergs. If an iceberg is blocking a possible travel between two points, it is always shorter to go around it to its edge rather than further.

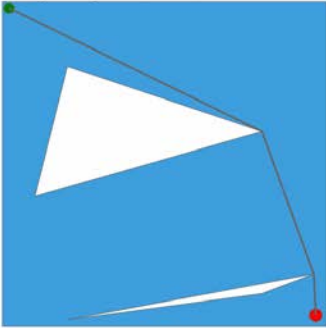
Therefore, we first build an undirected graph where each point (start, end and vertices of all the icebergs) is a node. Then, we go through each pair of nodes and figure out if a route between them is possible (not blocked by an iceberg). If the route is clear, we add an edge to the graph between the two nodes and mark its weight as the geometric distance between them.

Finally, we have a graph with all possible routes and their lengths. What is left is to use a shortest route algorithm (such as Dijkstra's algorithm) to calculate the shortest path.

Screen Cast Video: <https://youtu.be/KXuh3wxa5tc>

Live Demo: <http://veeca.me/iceberg/index.html>

Iceberg Challenge board (500X500)



Select a Route Plan: Route Plan

10

10

Start X,Y

483

483

End X,Y

100

490

Add point

Points: Shortest Path

Shortest distance between Start point (Green) and End point (Red)

["points": [[{"x":10,"y":10},"type":"circle","radius":8]

["points": [[{"x":483,"y":483}]],"type":"circle","radius":10] is 730.9856256089556

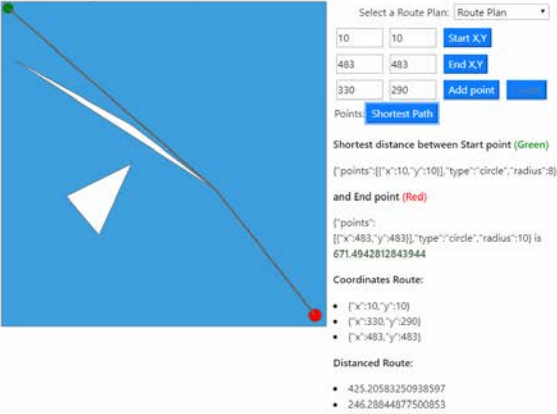
Coordinates Route:

- ["x":10,"y":10]
- ["x":400,"y":200]
- ["x":480,"y":420]
- ["x":483,"y":483]

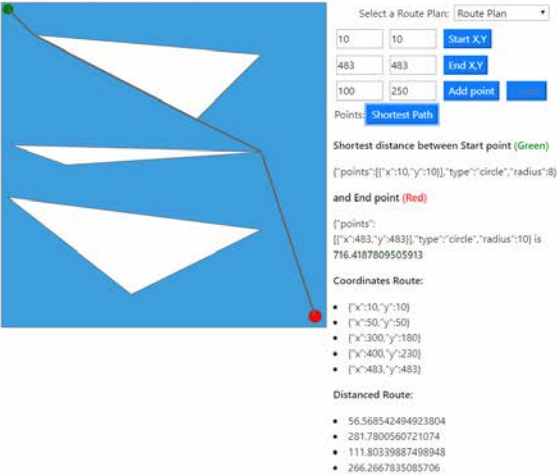
Distanced Route:

- 433.82023926967724
- 234.0939982143925
- 63.071388124885914

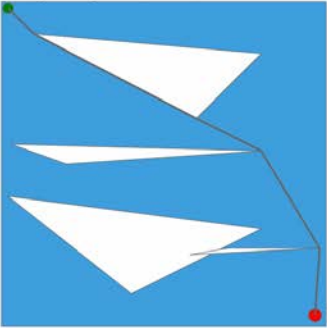
Iceberg Challenge board (500X500)



Iceberg Challenge board (500X500)



Iceberg Challenge board (500X500)



Select a Route Plan: Route Plan

10

10

Start X,Y

483

483

End X,Y

290

390

Add point

Points: Shortest Path

Shortest distance between Start point (Green)
[{"points":[{"x":10,"y":10},"type":"circle","radius":8]}
and End point (Red)
[{"points":[{"x":483,"y":483},"type":"circle","radius":10]} is
724.541774071632

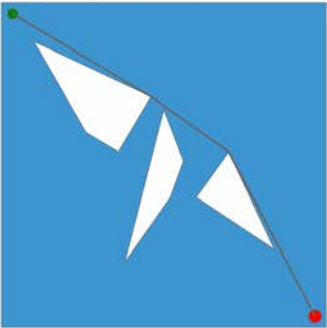
Coordinates Route:

- ["x":10,"y":10]
- ["x":50,"y":50]
- ["x":300,"y":180]
- ["x":400,"y":230]
- ["x":490,"y":380]
- ["x":483,"y":483]

Distanced Route:

- 56.568542494923804
- 281.7800560721074
- 111.80339887496948
- 174.92855684535903
- 103.2375900323593

Iceberg Challenge board (500X500)



Select a Route Plan: Demo Route Plan

Shortest distance between Start point (Green)
[{"points":[{"x":17,"y":17},"type":"circle","radius":8]}
and End point (Red)
[{"points":[{"x":483,"y":483},"type":"circle","radius":10]} is
681.3845407288466

Coordinates Route:

- ["x":17,"y":17]
- ["x":230,"y":145]
- ["x":350,"y":230]
- ["x":483,"y":483]

Distanced Route:

- 248.50150904974402
- 147.05441169852742
- 285.82861998057507