Users are doing it for themselves: Pedestrian Navigation with User Generated Content

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Outline

Abstract

- OurWay is a mobile route planning system based on user feedback.
- The users can give feedback on route quality in the field - there and then.
- Collaboration between users in the form of shared experiences.
- We're reporting from the initial round of experiments, validating the concept.
- The results are encouraging.

About MAG / Østfold University College

- Halden is a town south-east in Norway.
- Our faculty of computer science traditionally has a practical and technology oriented focus.
- Over the last years, HCI and other forms of user-orientation has become increasingly important to us.
- The Mobile Applications Group (MAG) is a cross-dicipline group with a common focus on mobile applications.
- Our master program on mobile applications started in 2003.

Research motivation

- User generated content is prevalent on the net today.
  - Wikipedia.org
  - YouTube
  - MySpace
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  - . . . and loads of others.

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  - . . . and loads of others.
- Not to mention the plethora of blogs, podcasts and open source software.
- Further, route planning for pedestrians is quite different from route planning for car drivers.

MAG and geodata

- Experience from various aspects of geodata treatment.
  - Integration of heterogeneous geodata sources.
  - 3D-models (worlds, cities, sea floor)
  - Ontology building, metadata standards.

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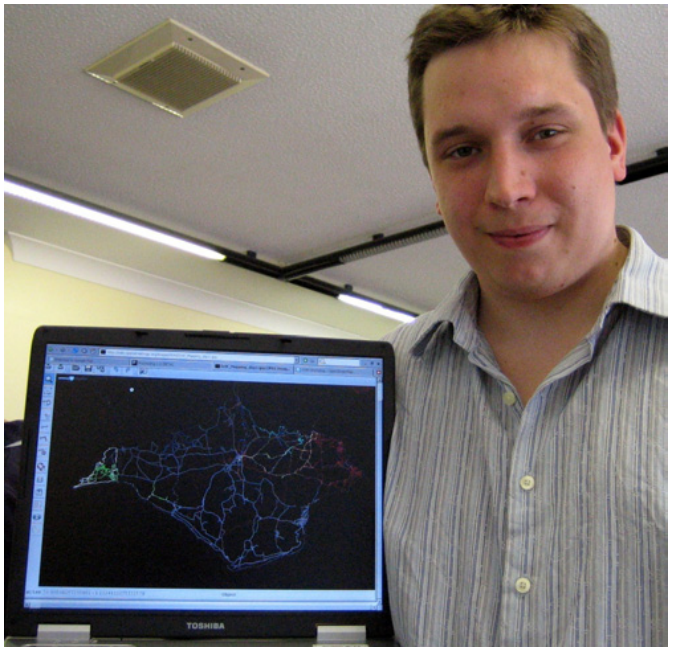
During work on Location Based Services, discovered OpenStreetMap, a wiki world map.

Map making: Field work

Proprietary

OpenStreetMap



Map making: Labor

Proprietary

- Paid employees.
- (More) Expensive equipment.
- Infrequent updates through a central process guided by marked demand.

OpenStreetMap

- Volunteers.
- Consumer equipment.
- Updates by anyone, at any time, wiki-style, user controlled.

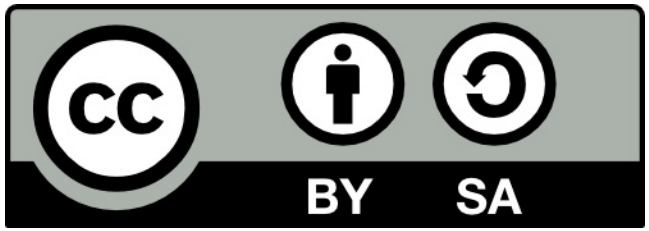
Map making: Results

Proprietary

OpenStreetMap

Having the data

- . . . and with OSM, the data is available under the Creative Commons Attribution-ShareAlike license.



Having the data

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  - Now, back to the issue of pedestrian route finding . . .
  - First, a brief review of two related projects.

A complex approach

MAGUS (Modeling Access with GIS in Urban Systems)

- Aims to assist new users and enable better navigation for existing users, and to be a means for planners.
- Based on a comprehensive level-of-service (LOS) model for wheelchair users, gathered using questionnaires, interviews, observations, and physical measurements.
- Three types of wheelchairs, ten levels of user fitness.
- 13 environment parameters in use, e.g. surface type, quality, and steps.
- Shortest path calculation based on *impedance*, computed by complex heuristics.
- Proprietary software, complex and expensive GIS system.

A simpler approach

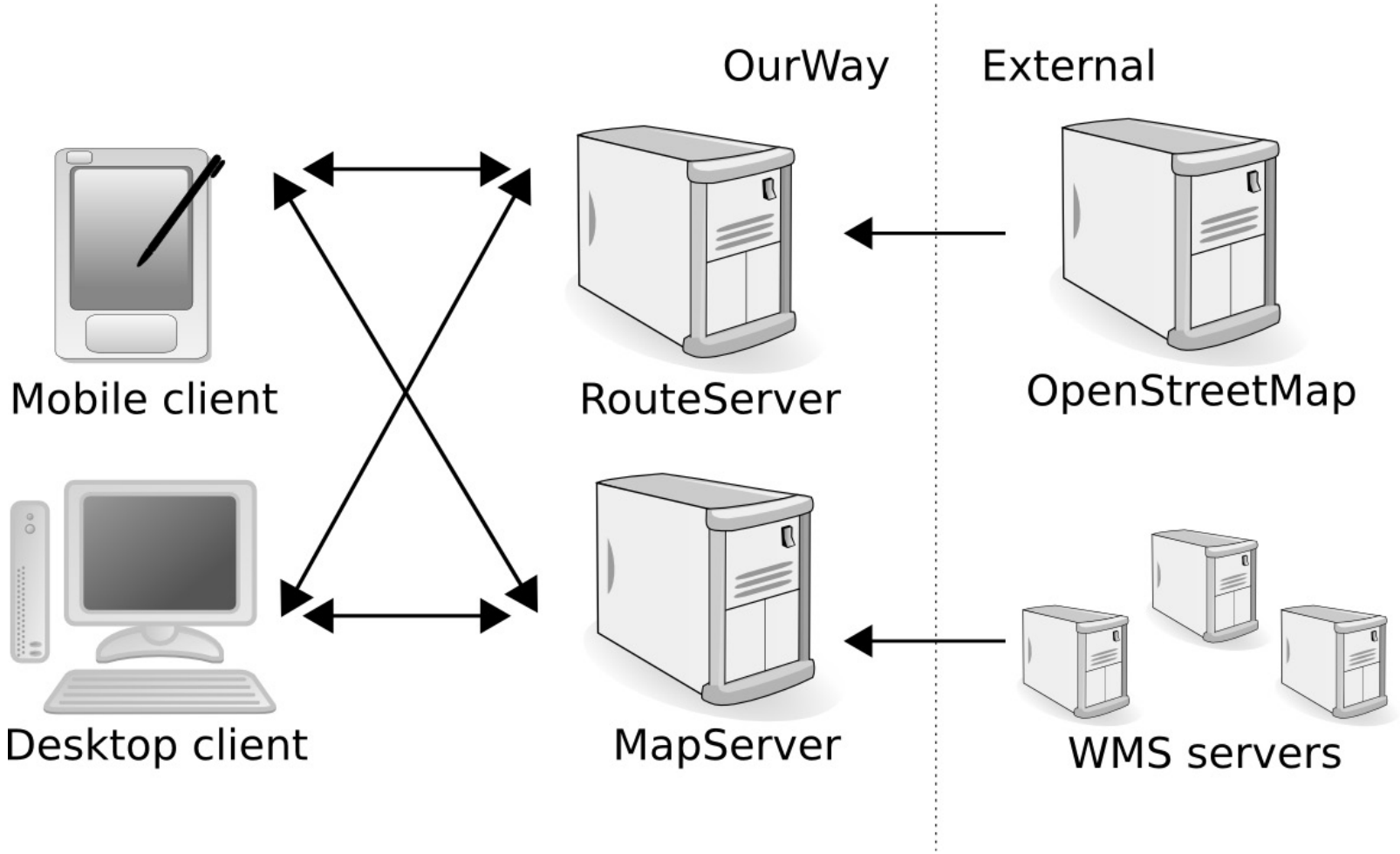
U-ACCESS (Universal Access)

- Used for planning purposes, campus routes, for pedestrians with varying levels of mobility.
- Based on a simpler data model than MAGUS.
- Three types of pedestrians: ambulatory, walking aid, and wheelchair.
- 11 environment parameters in use, e.g. curb buts, ramps, and sidewalks.
- Creates three separate networks based on accessibility variables and uses Dijkstra for route findings.
- Data acquisition and processing using expensive, proprietary software. Web-based client for the users.

The OurWay approach

- Route planning and user feedback on mobile and desktop clients for users in self-organized groups.
- A pragmatic approach, ignoring (most) metadata in the underlying geodata.
- Users subscribe to (or create) user groups.
- Only three types of *subjective* feedback: *good*, *bad*, and *inconvenient*.
- User feedback is used for weighting edges in the geographical network, influencing the cost function used by the A* algorithm.
- Open source applications, inexpensive, consumer level equipment. Mobile and desktop client.

OurWay architecture overview



Clients

- The main client is a mobile phone with a GPS attached.
- Mobile IP to server over UMTS / GPRS.
- A desktop client (port of the mobile application) for lab trials.
- The client presents a map image, and allows the user to query for a route between two given points.
- The suggested route is presented on the client map.
- The user can provide feedback whilst following a route: *good*, *bad* or *inconvenient*.

Project servers

- Route planner
  - Receives requests from the clients.
  - Calculates a route, and returns it to the client.
  - Receives and persists user feedback.

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- Map server
  - Proxy for (external) geodata servers.
  - Serves map tiles to the client, and provides caching.
  - Simplifies interaction with WMS servers and other services.

External services

- OpenStreetMap
  - Import of data from the OSM API and/or planet file.
  - Currently ignoring most of the metadata tags.
  - Raster images, Mapnik or Osmarender.

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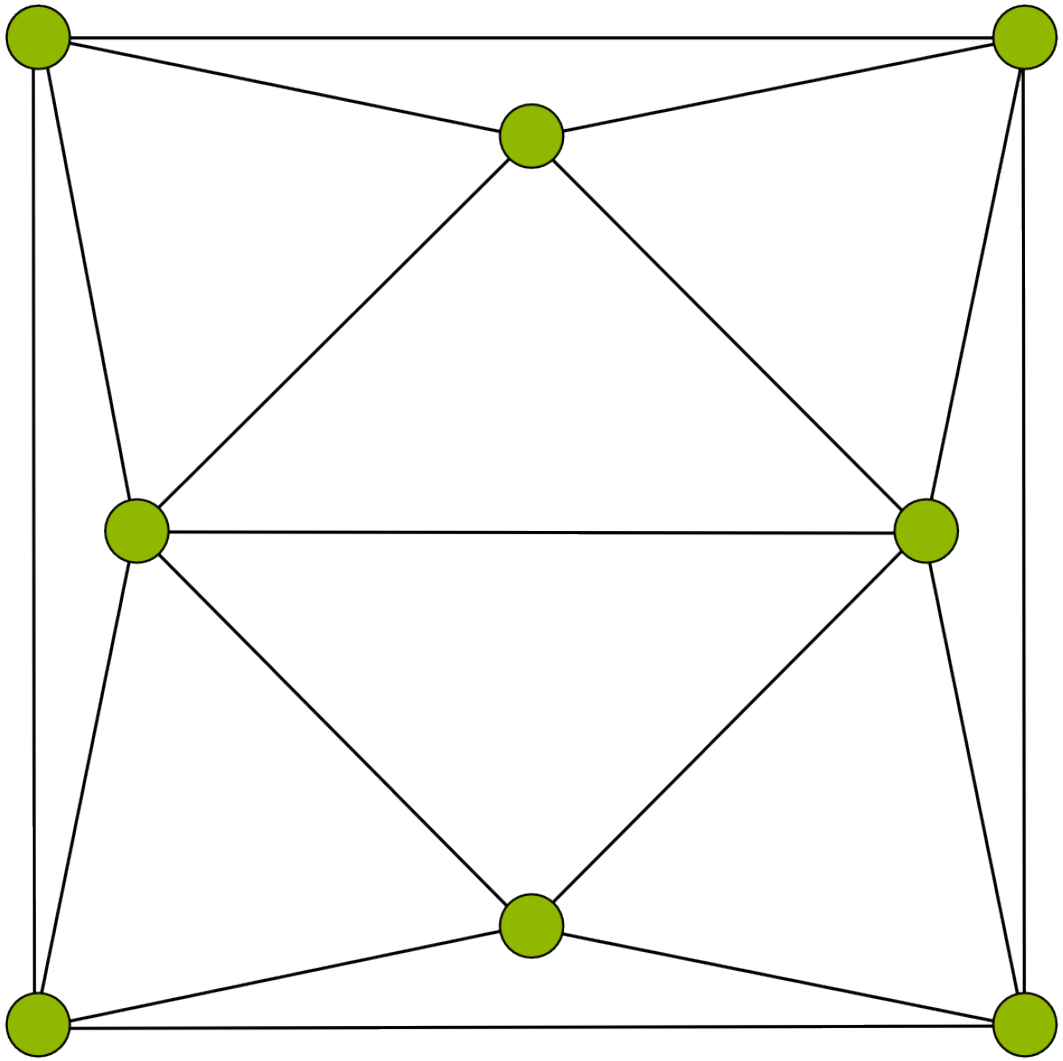
  - Raster images, Mapnik or Osmarender.
- WMS servers
  - Provides raster images.
  - Norkart (map tiles, street data).
  - Norge i bilder (aerial photography).

A* - animated example



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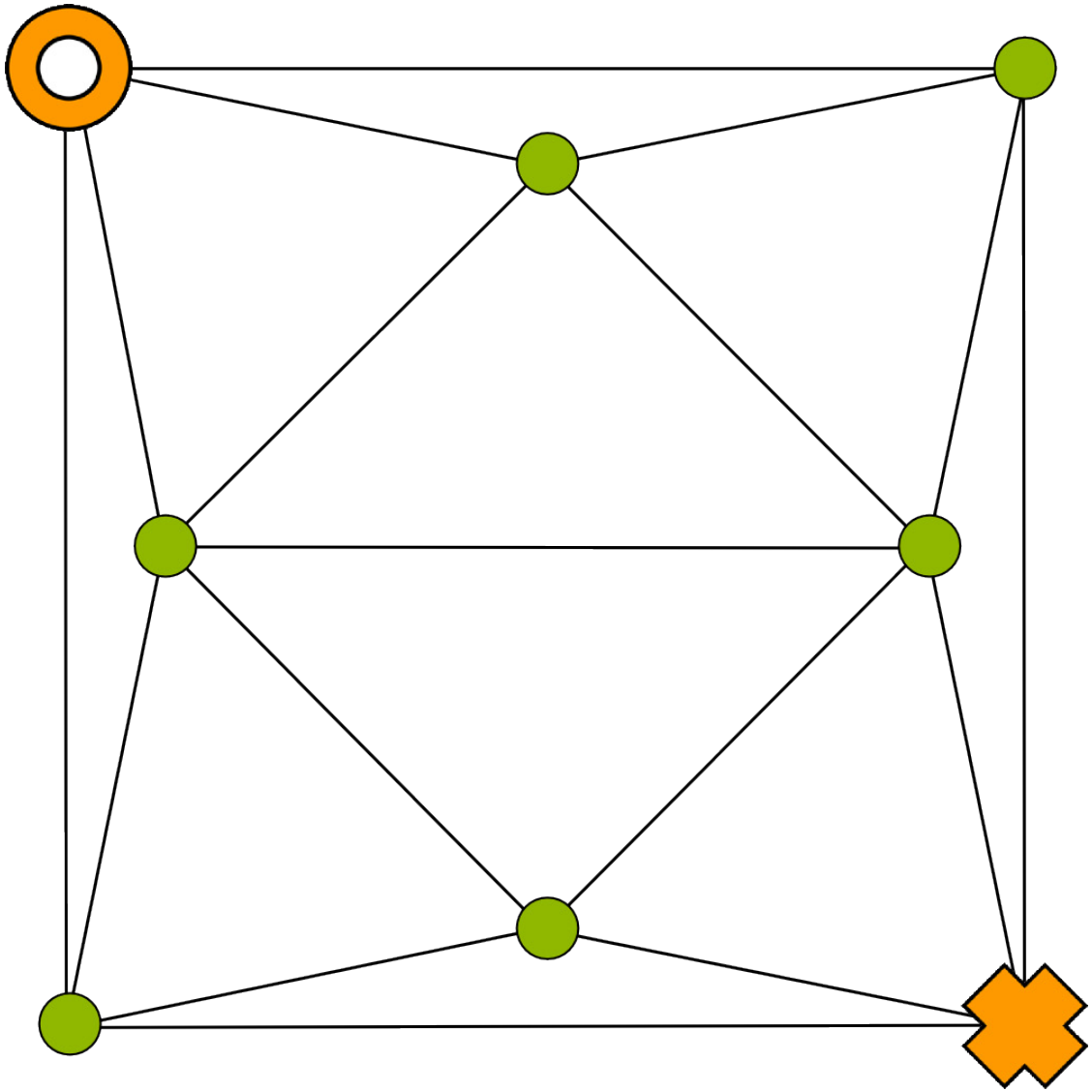

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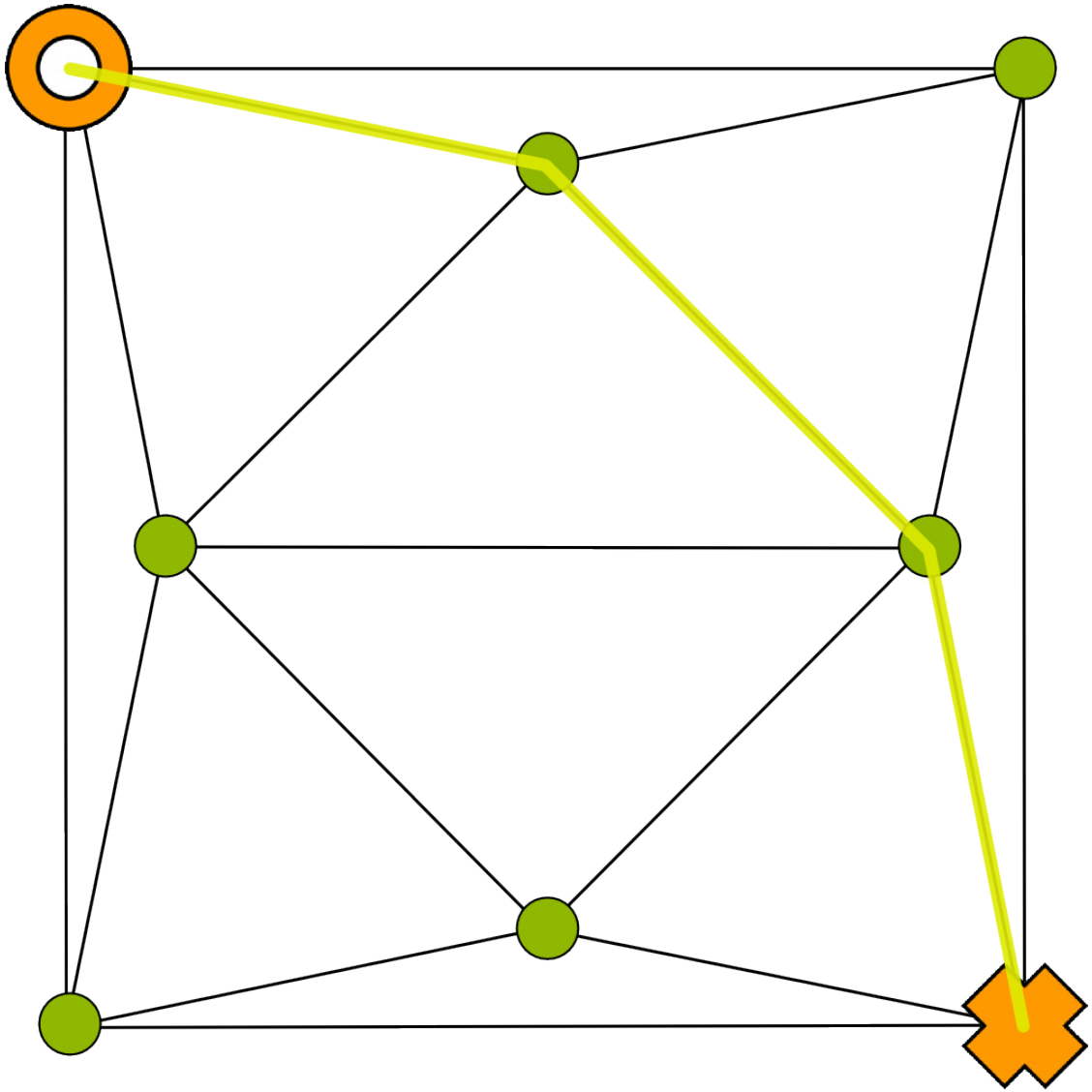

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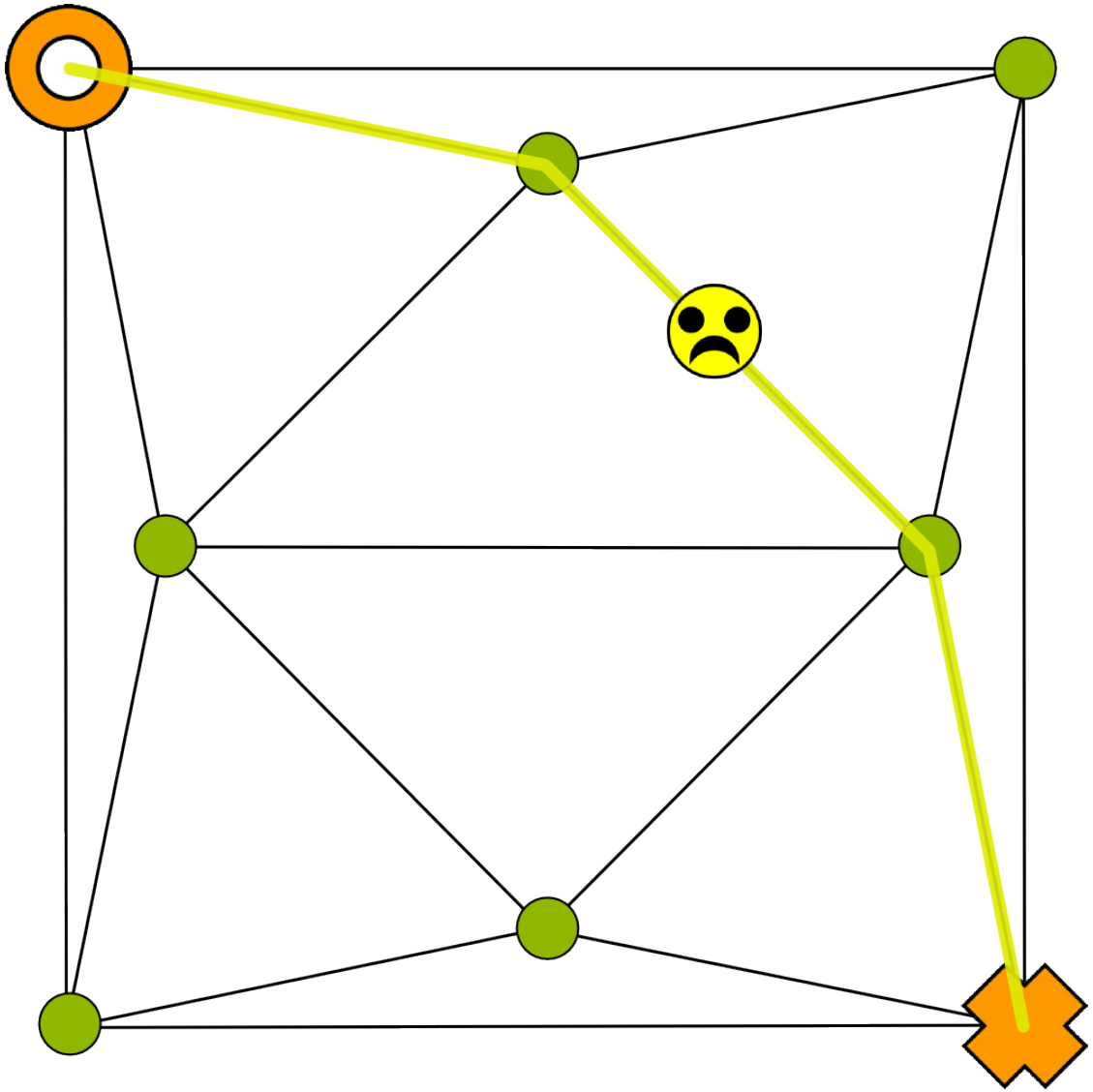

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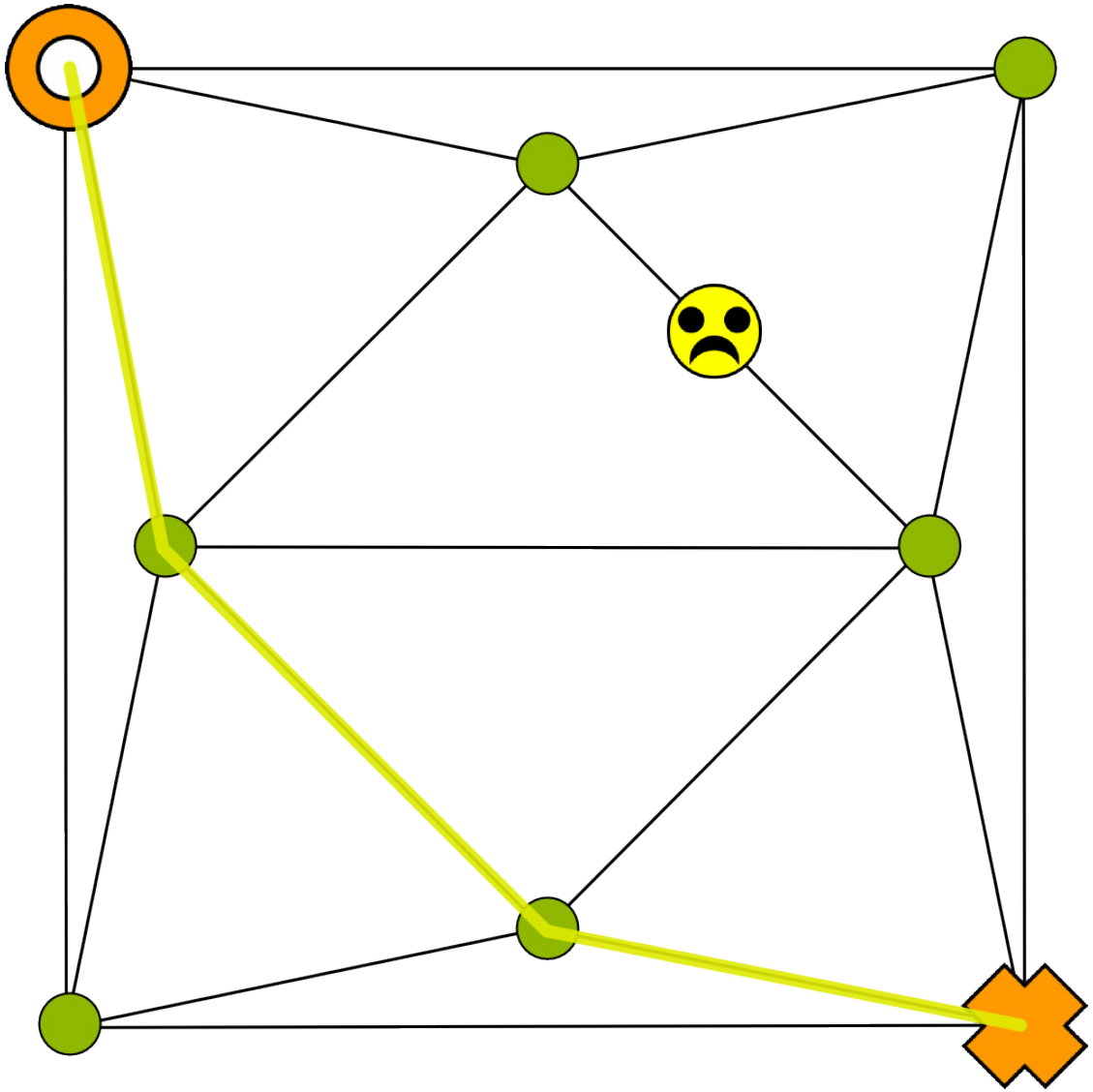

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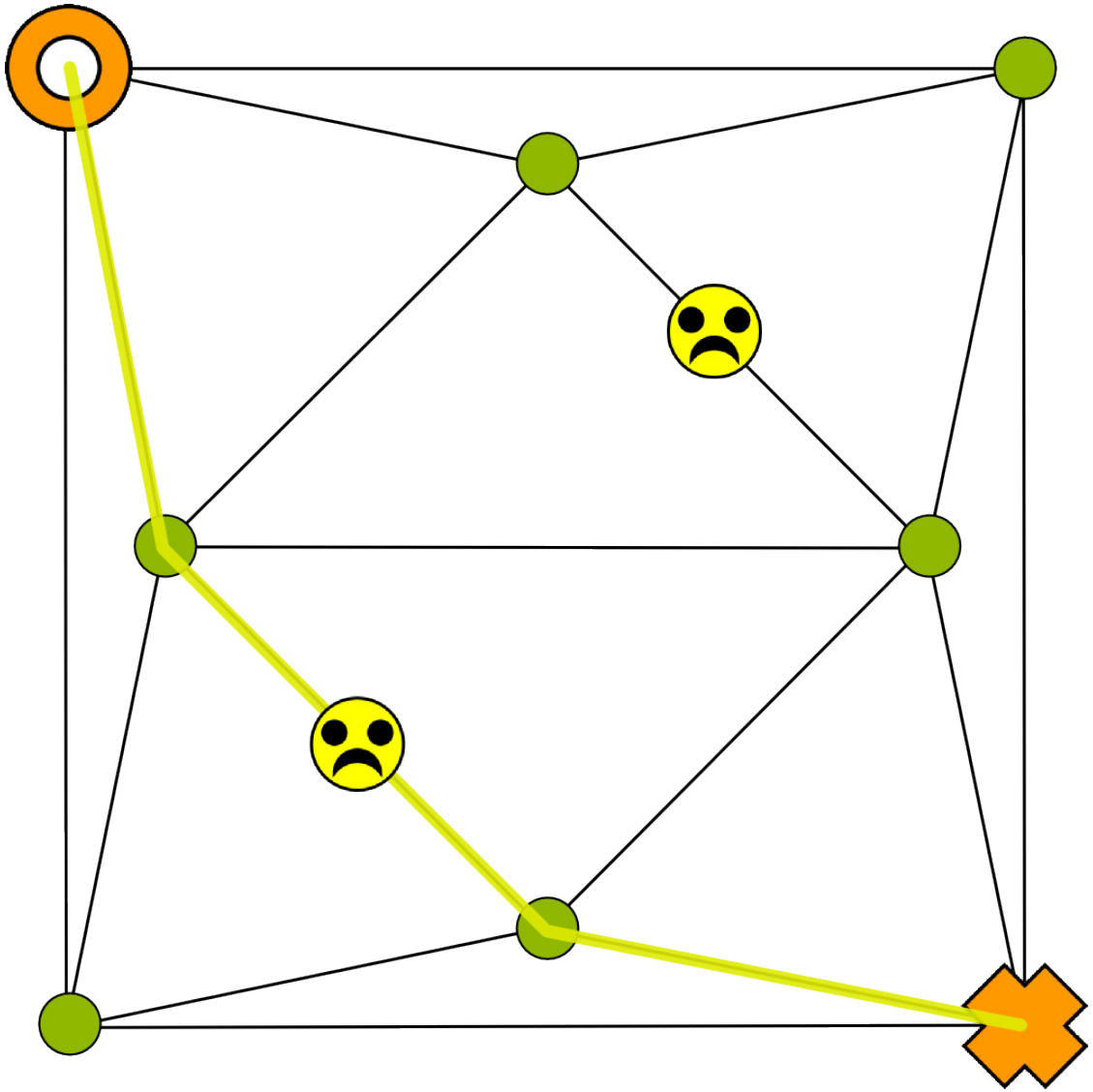

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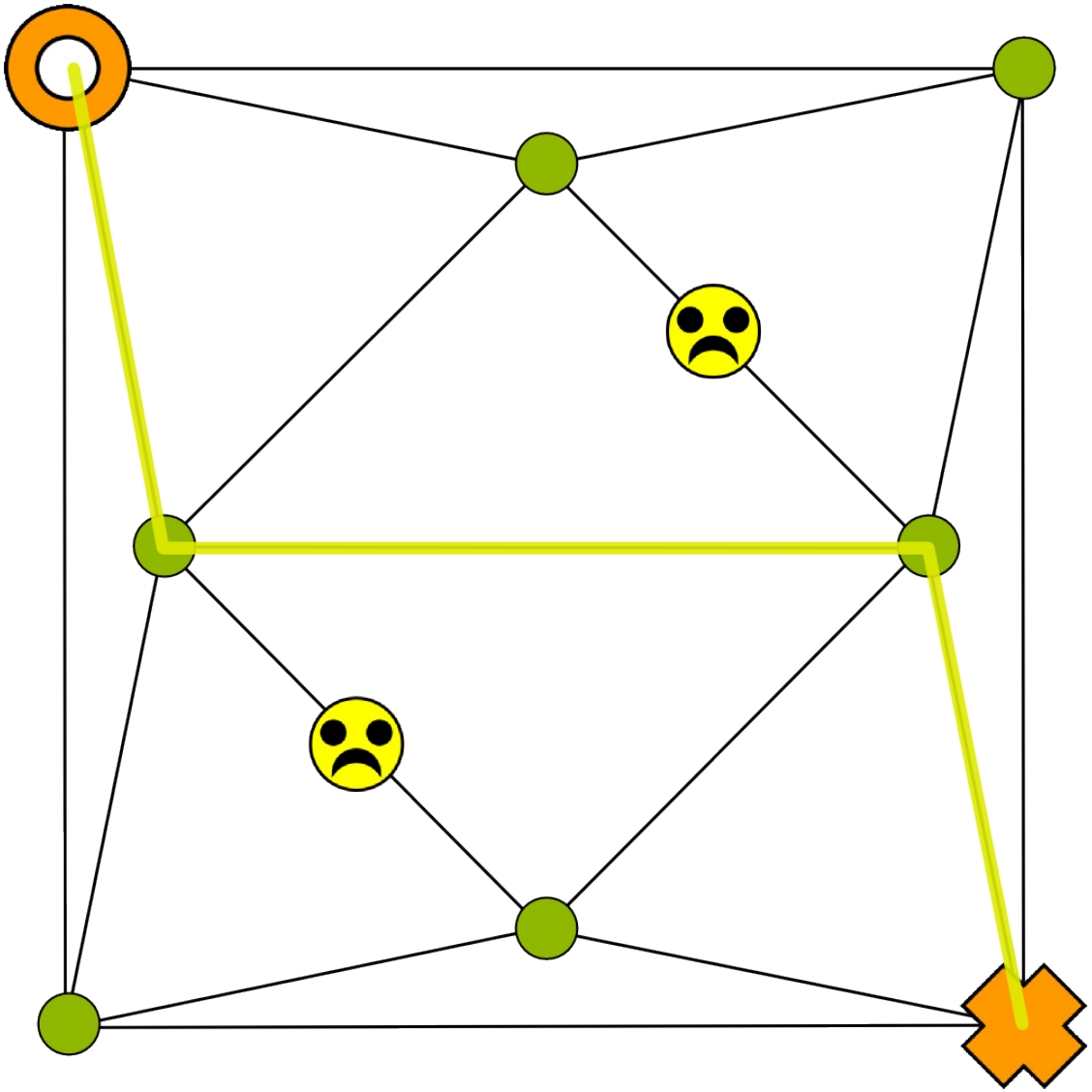

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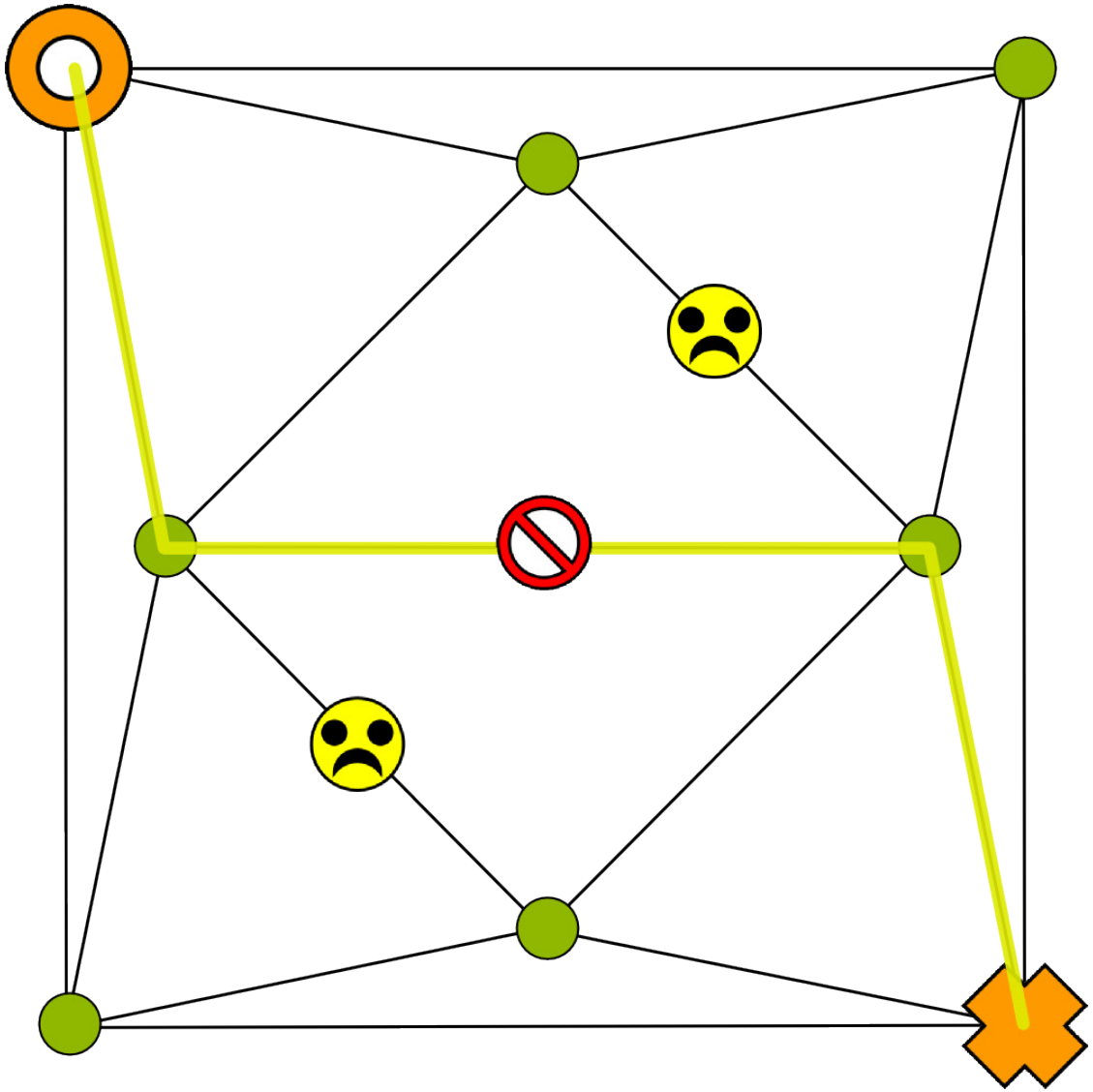

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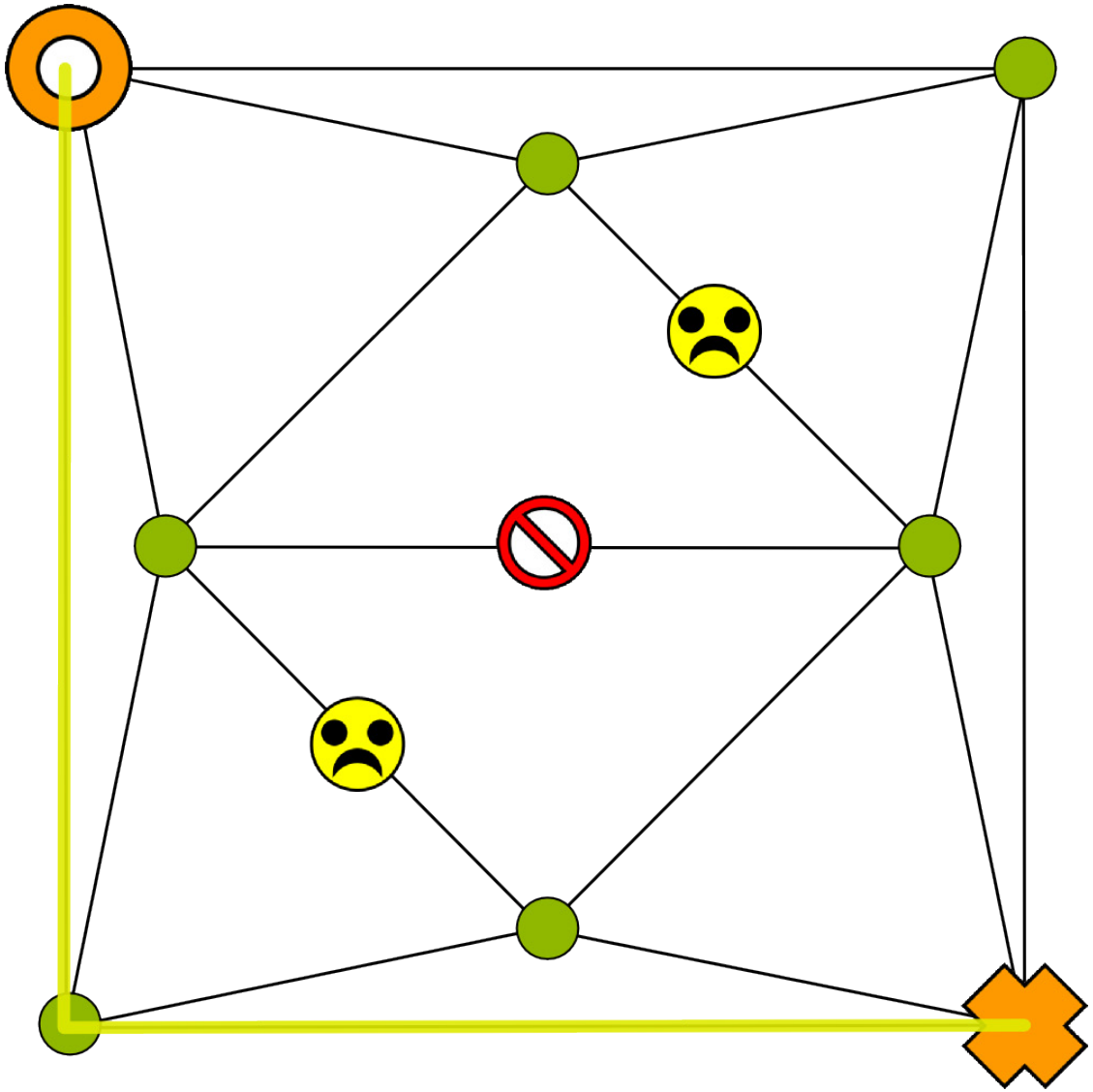

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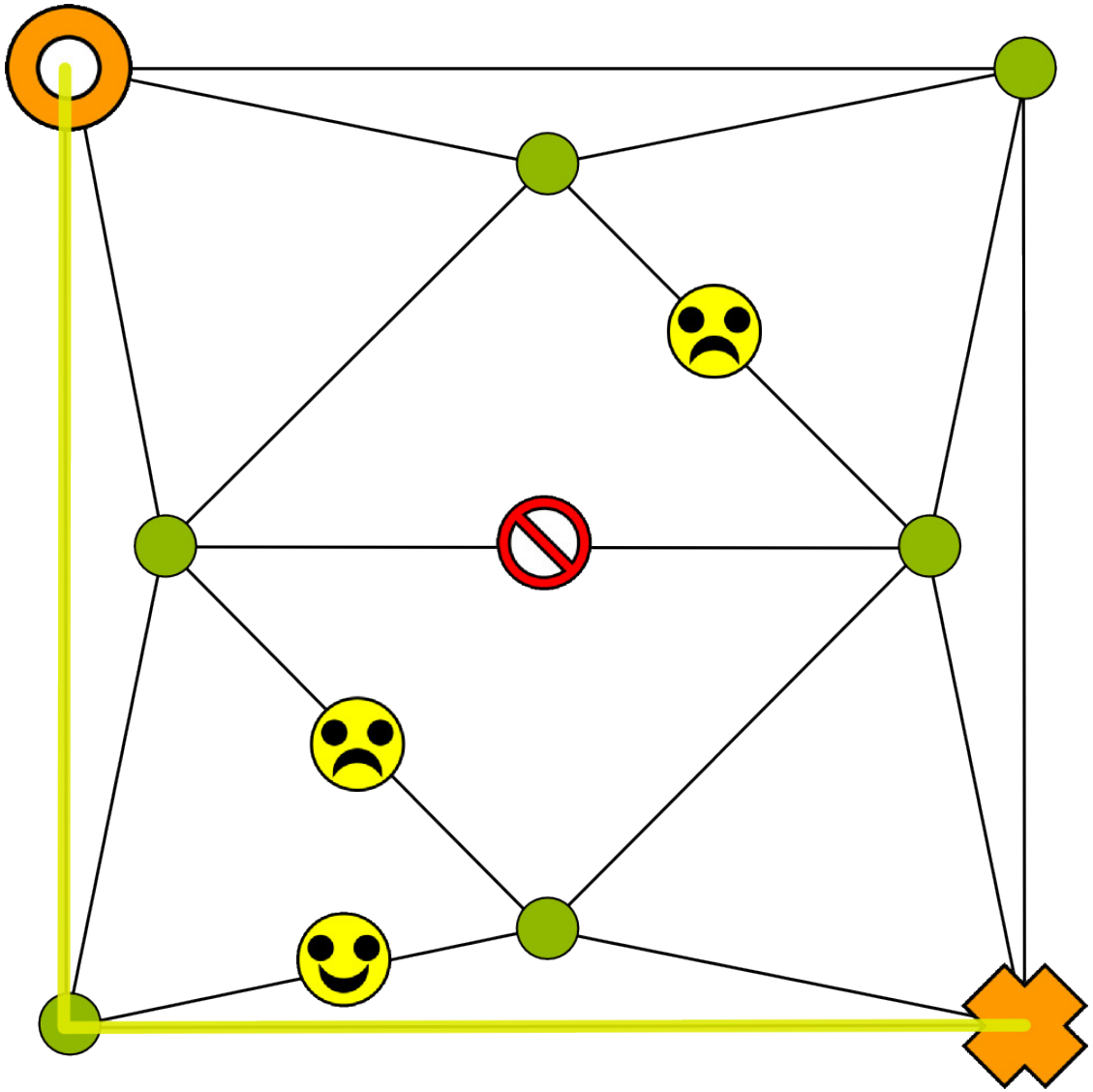

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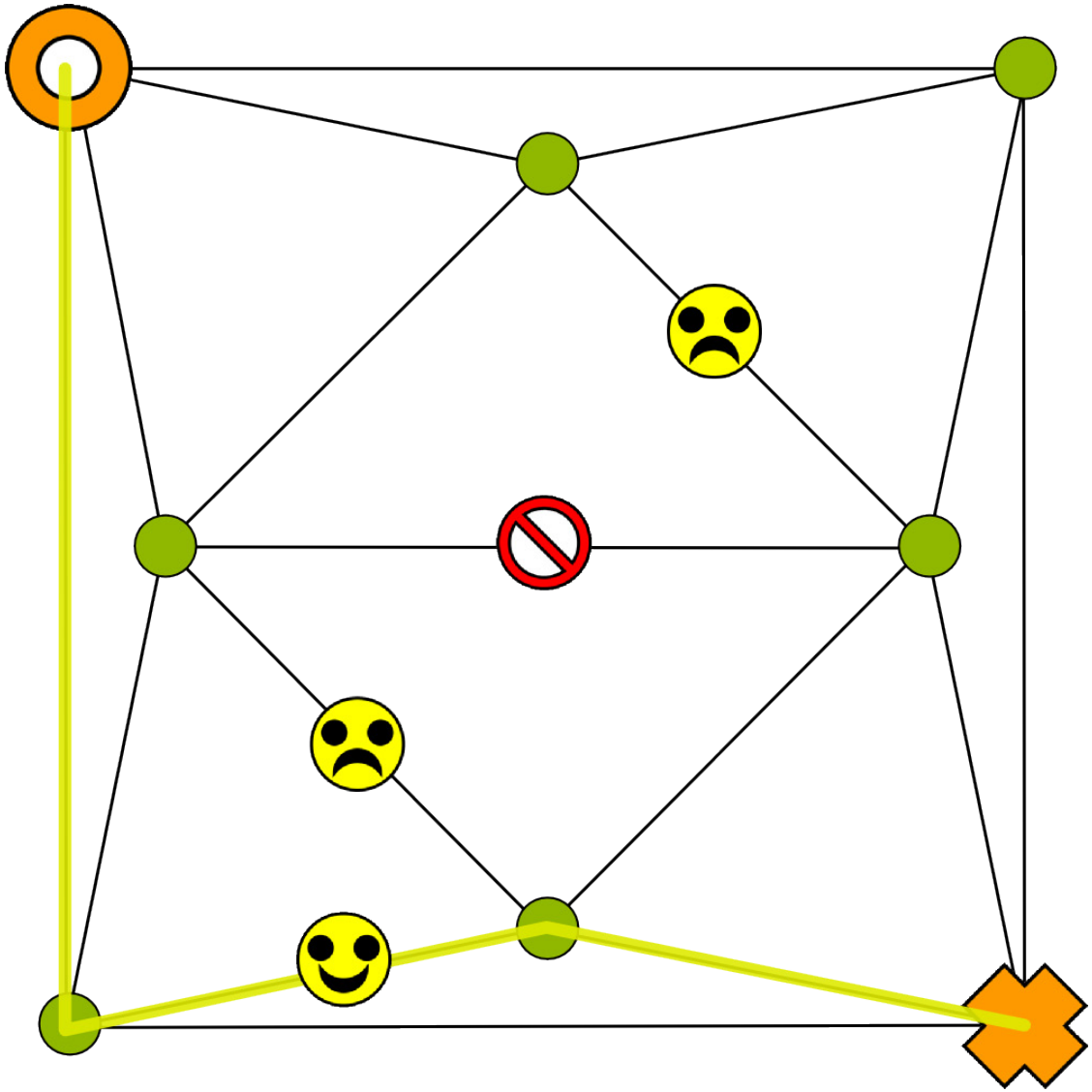

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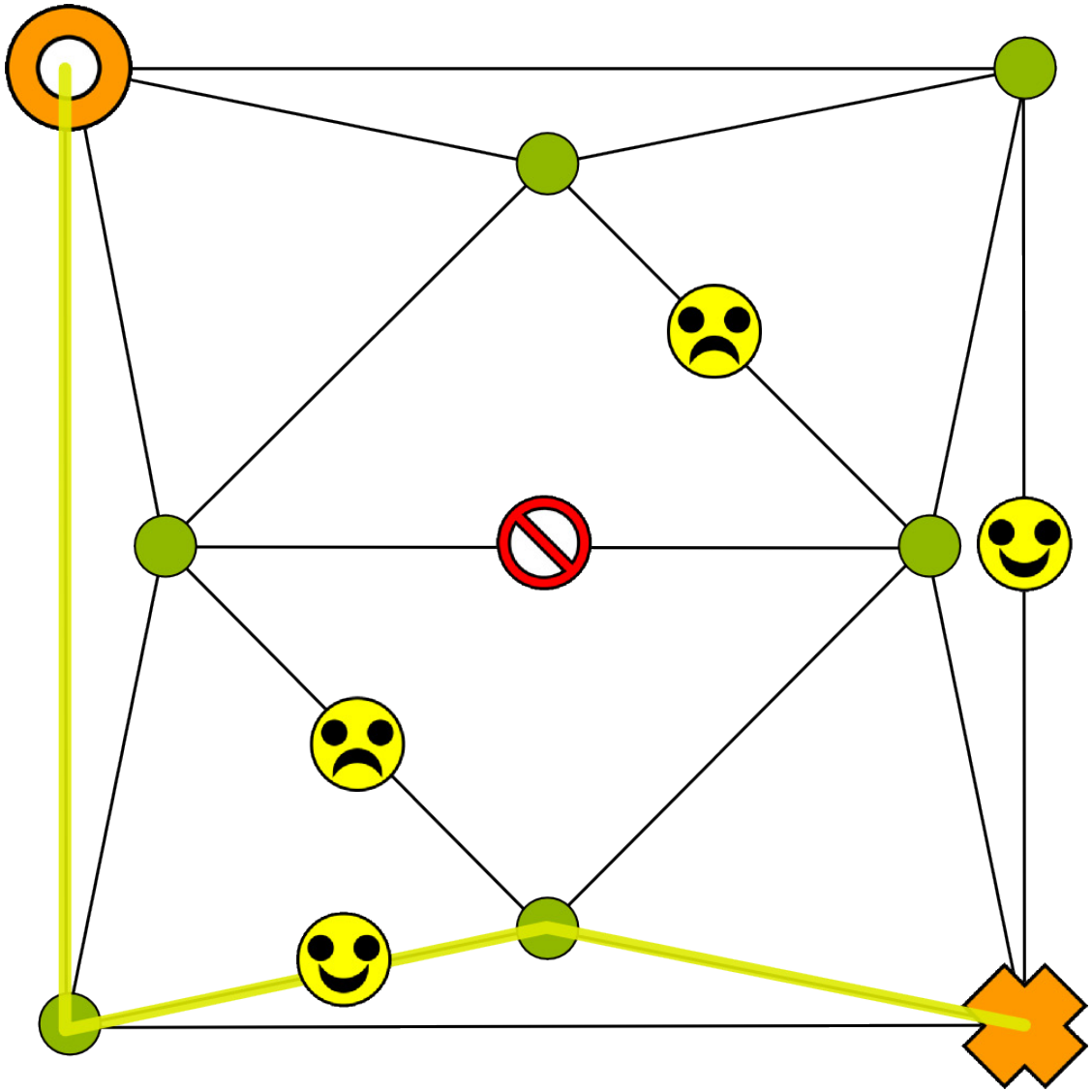

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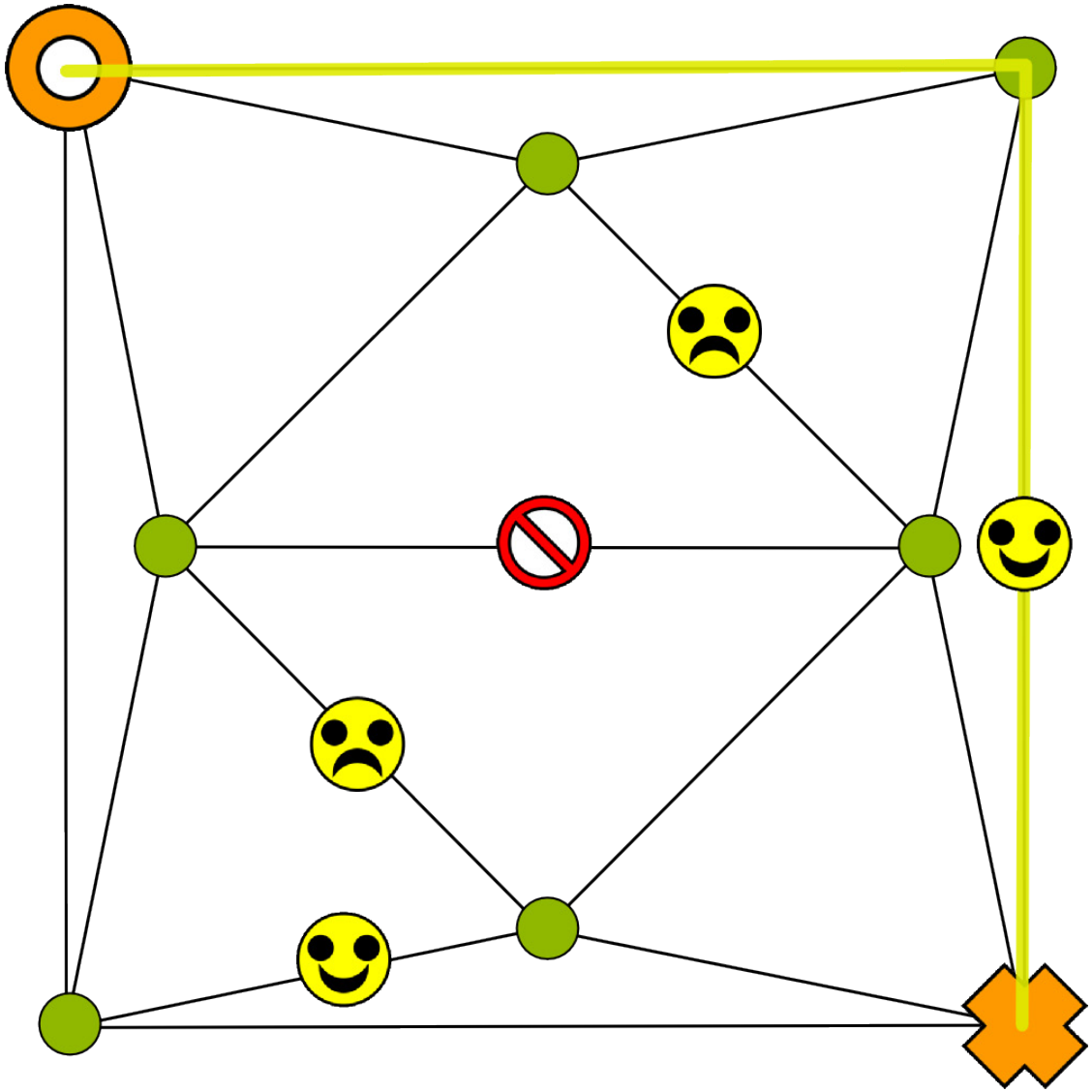


Concept validation

- Proof of concept, not full-blown user study.
- Baby strollers in Halden.
- A handful of start/destination sets.
- Iterated on each of the sets until the routes *converged*.
- Some iterations were done from the lab.

Animated iteration

User navigates to area of interest, either assisted by external GPS or manually by pan and zoom

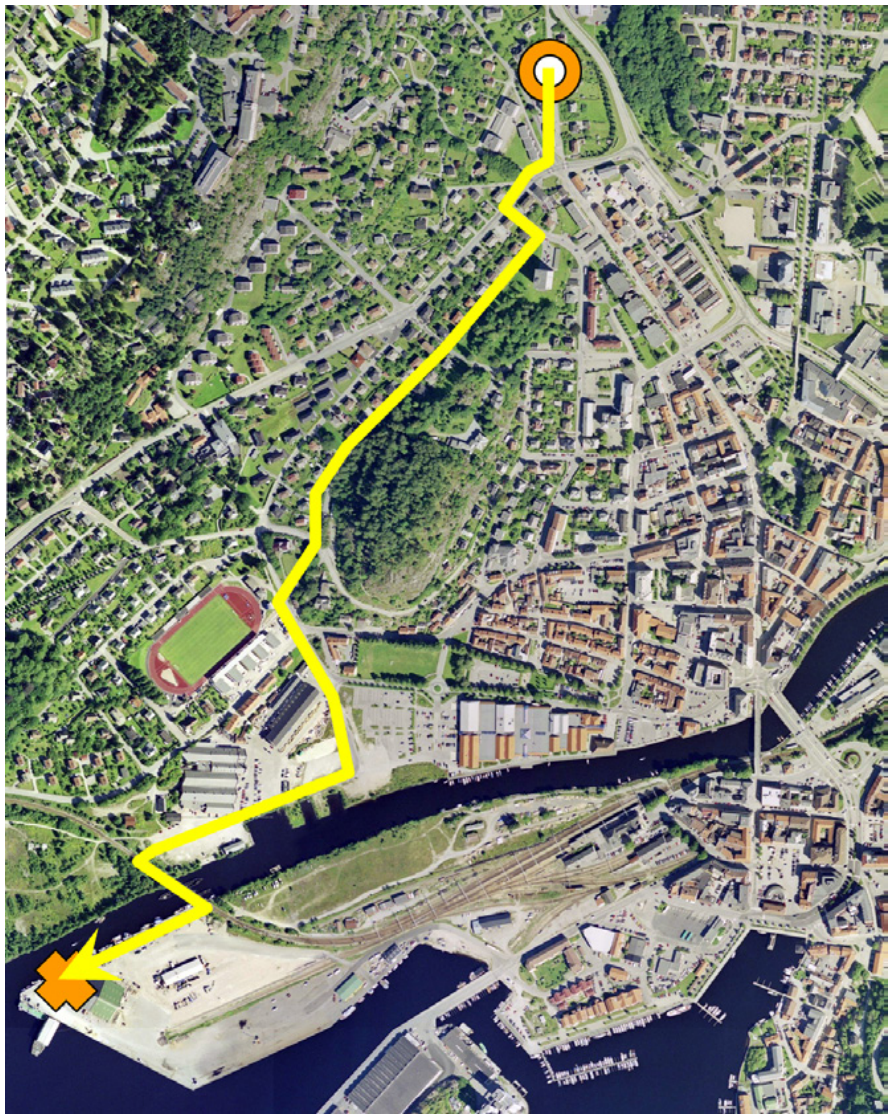
Animated iteration

Marks start.

Animated iteration

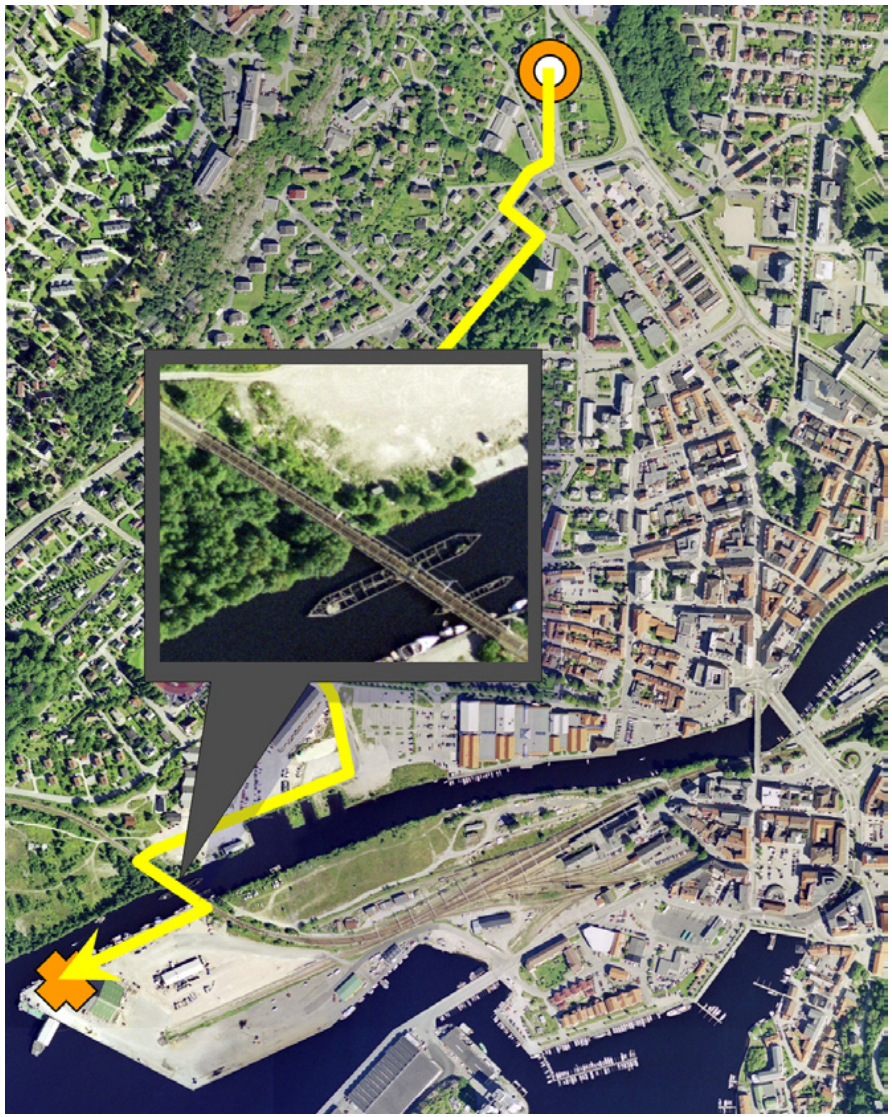
Marks destination.

Animated iteration



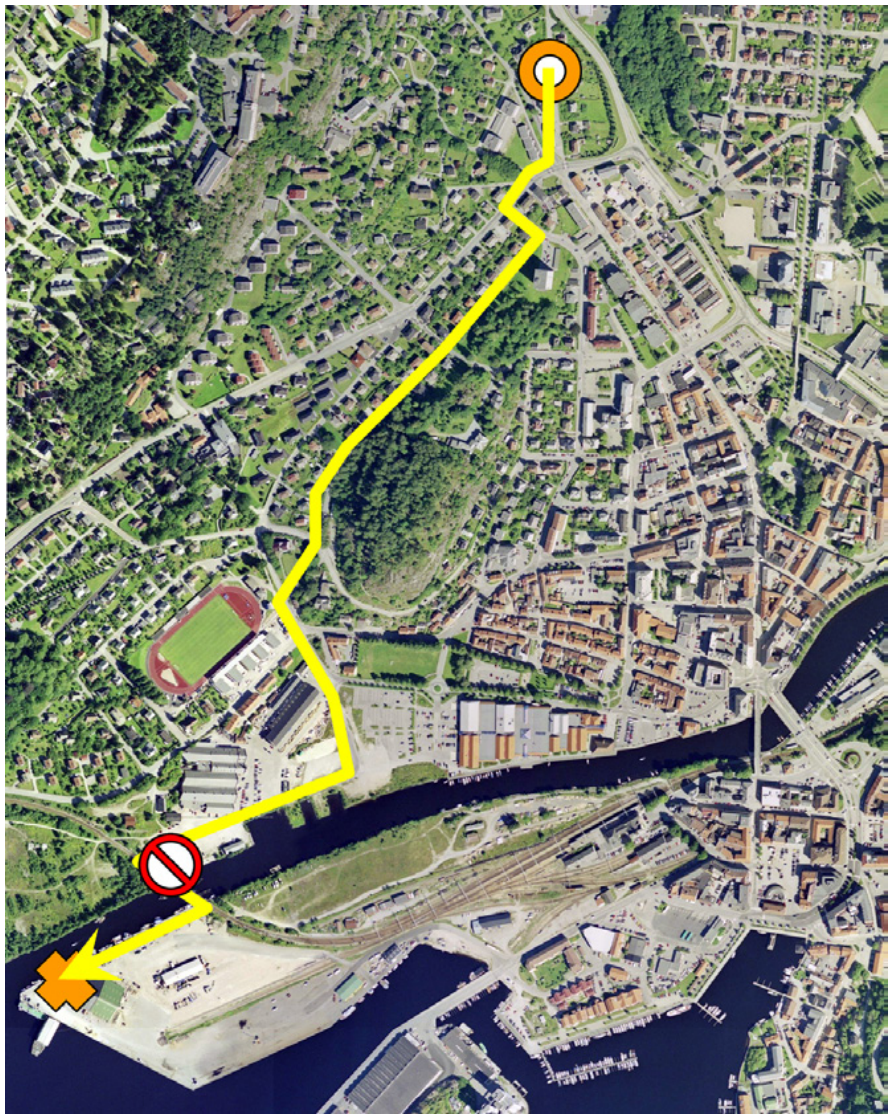
System finds and displays shortest route based on geographic distances of network edges.

Animated iteration



User encounters a steep stairway leading to a narrow pedestrian bridge.

Animated iteration

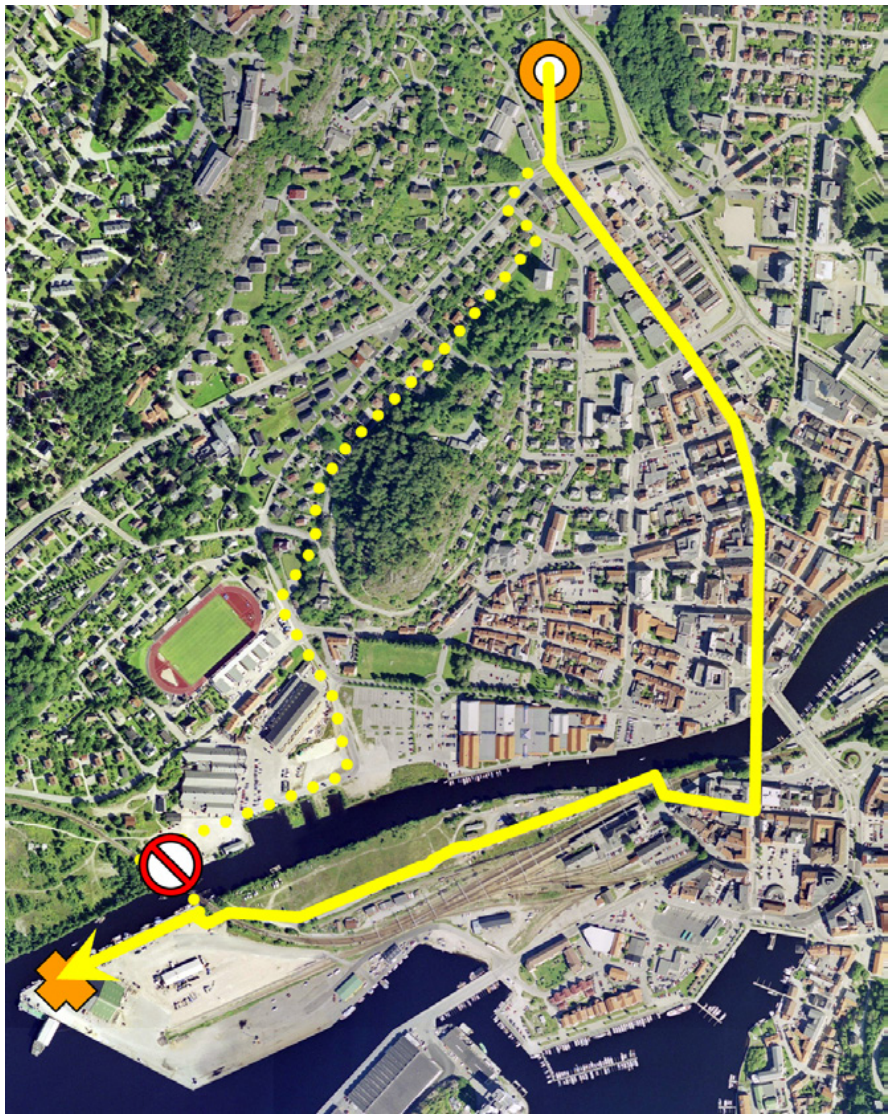


User marks location as inaccessible.

Animated iteration

System recalculates shortest route based on adjusted edge weight.

Animated iteration



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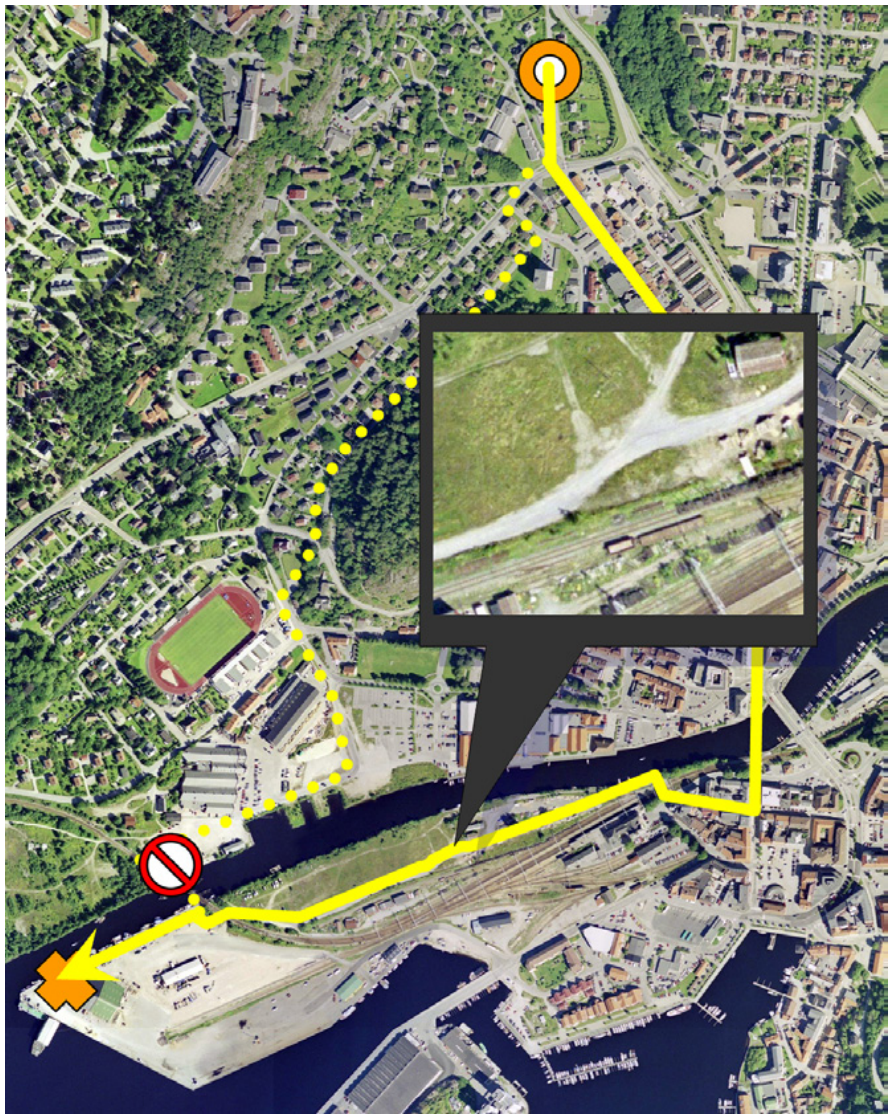
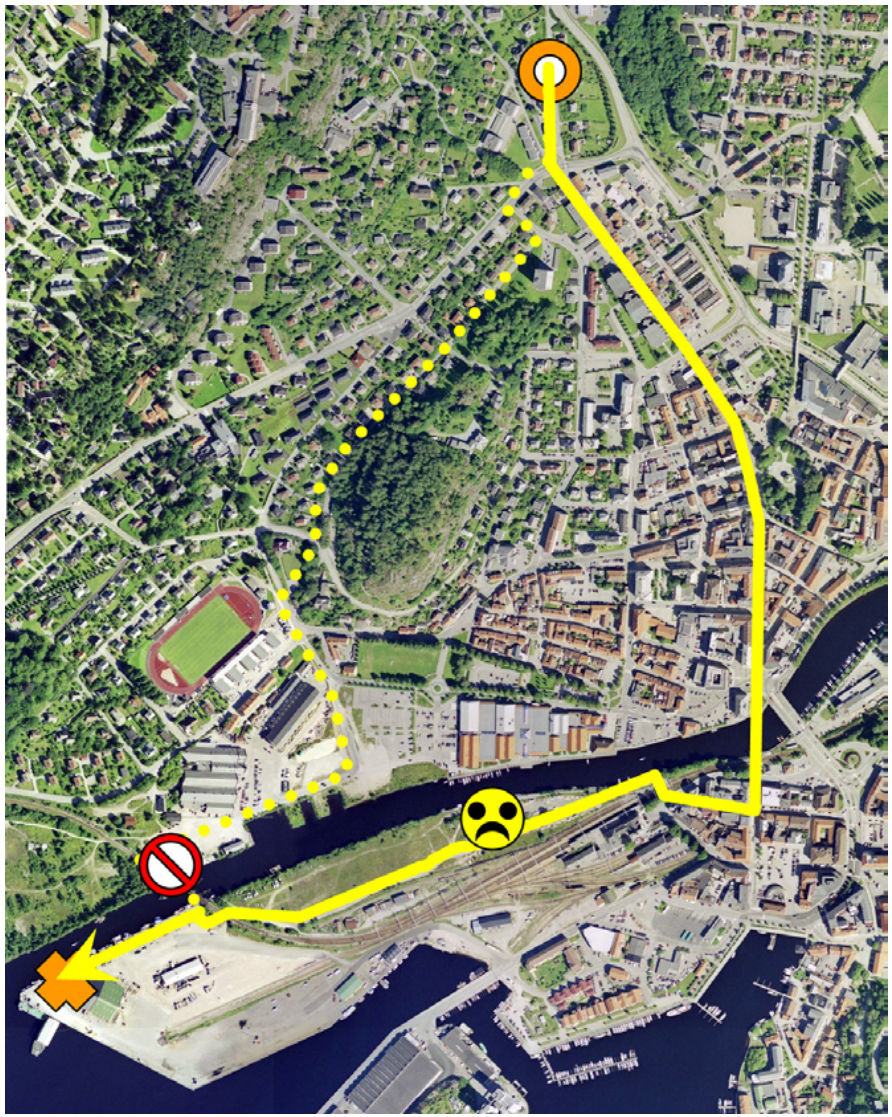


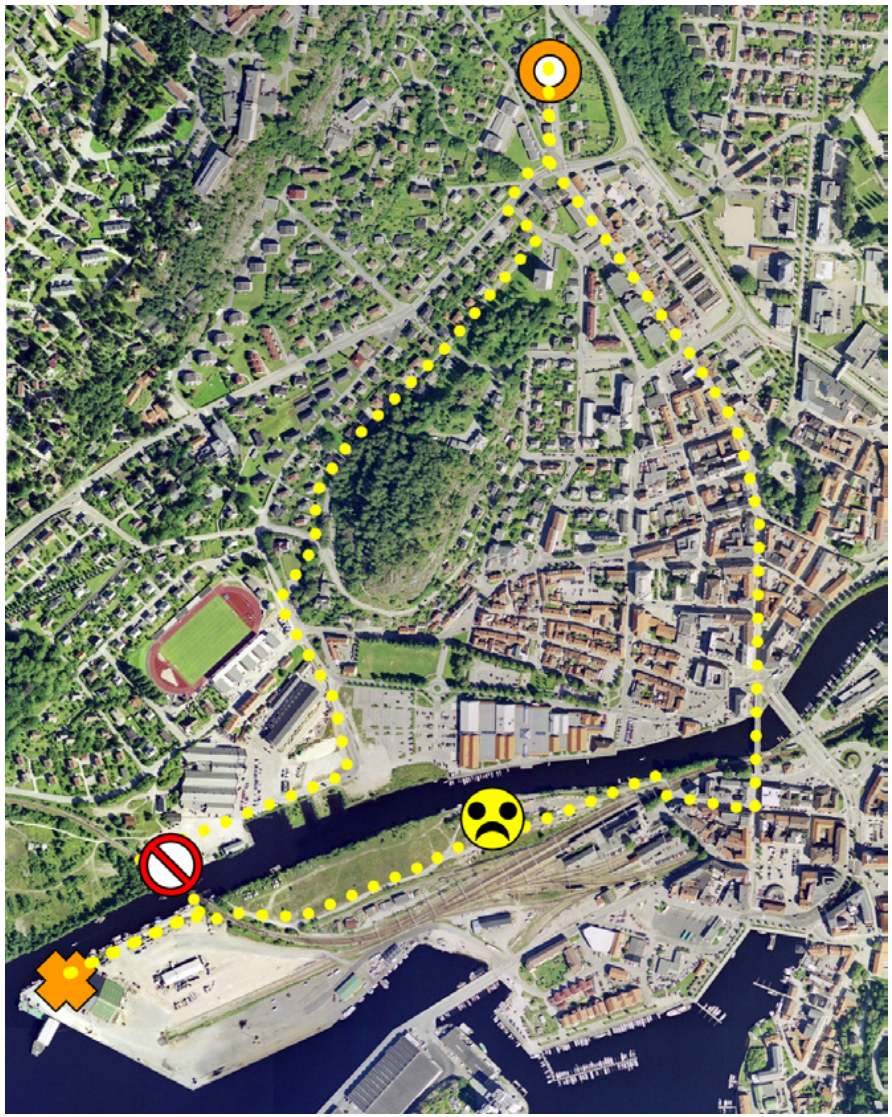
User entering a dirt road with bumps and various obstacles.

Animated iteration



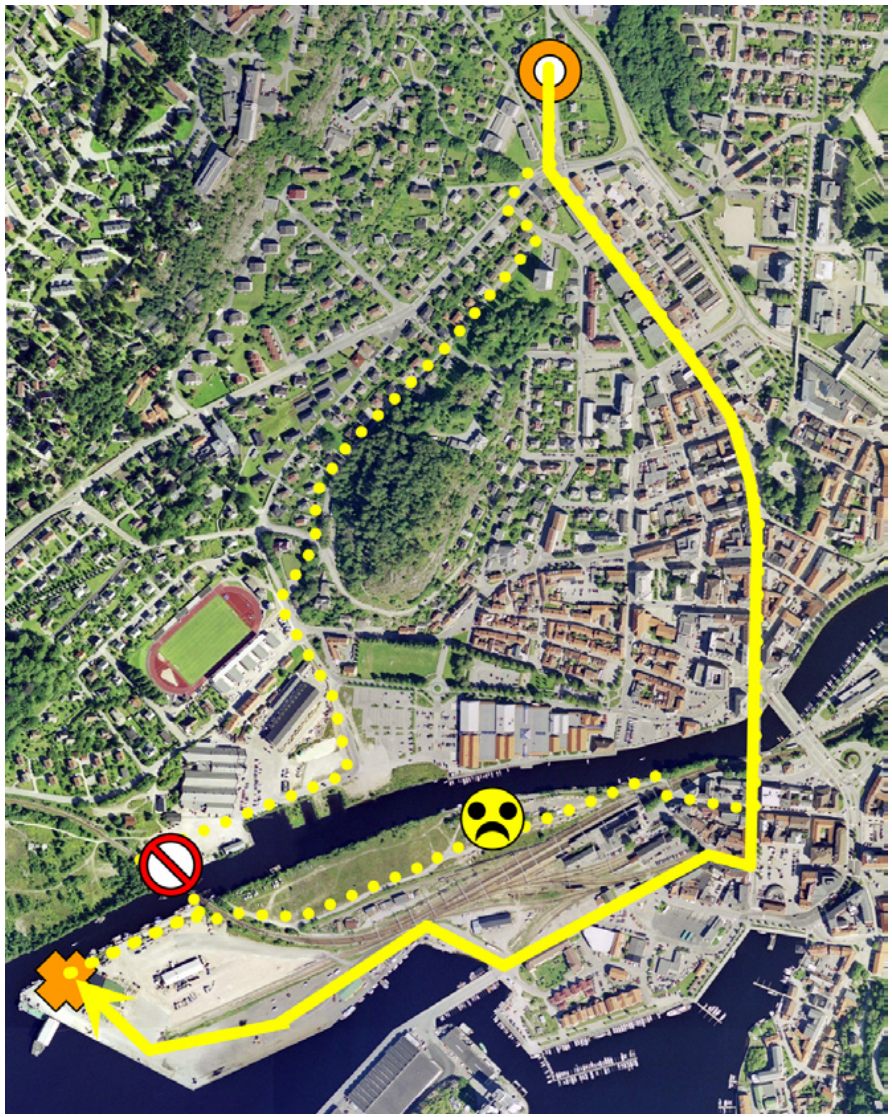
User marks location as uncomfortable.

Animated iteration



System suggests alternative and acceptable route.

Animated iteration



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Findings

- The routes converged surprisingly quickly.
- The rate is related to the homogeneity and lack of obstacles in an area.
- The *penalty factor* is low in an urban environment.
- User generated geodata serves as a promising platform for innovative Location Based Services.
- Users are more likely to give negative feedback than positive feedback.

The way forward

- More comprehensive testing, with a larger numer of users over a longer period of time.
- Sharing of annotation across user groups.
- Multiple user feedback.
- Creating an open service.
- Visualization of changes over time.
- Utilizing geographic metadata to prime the network.

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And . . .

maybe it's not only for pedestrians after all?

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