

Finding Shortest Path at HKUST

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Introduction

Since HKUST building is complex and therefore it is difficult for new students and visitors to find paths to their desired locations. A web-based guiding system is needed to address this problem.

In our project, we collected and inputted about 95% of the HKUST location data like rooms, offices, lifts, toilets and any other hotspots information and we developed a robust and user-friendly web-based guiding system that display a shortest path between two specified two locations. The system is also able to find hot spots like lift, toilet and drinking fountain that nearest to a specified location and then display the shortest path between them. We have also developed an administrative tool for editing the map data.



In 100% of the cases, our system responds to queries within one second.

Design of user interface

HKUST Path Advisor

Path Advisor Search Options

To

On the same floor

[Advanced Advisor](#)

Advanced Path Advisor

A room 3

B RCOM 3604 (Floor 3)
RCOM 3603 (Floor 3)
RCOM 3602 (Floor 3)
RCOM 3601 (Floor 3)
RCOM 3606 (Floor 3)

Path Indication

From A to B's path suggestion

Floor 3

From ROOM 3566 To LIFT 26 30 sec(s) (50.10m)

Floor G

Options Print Link

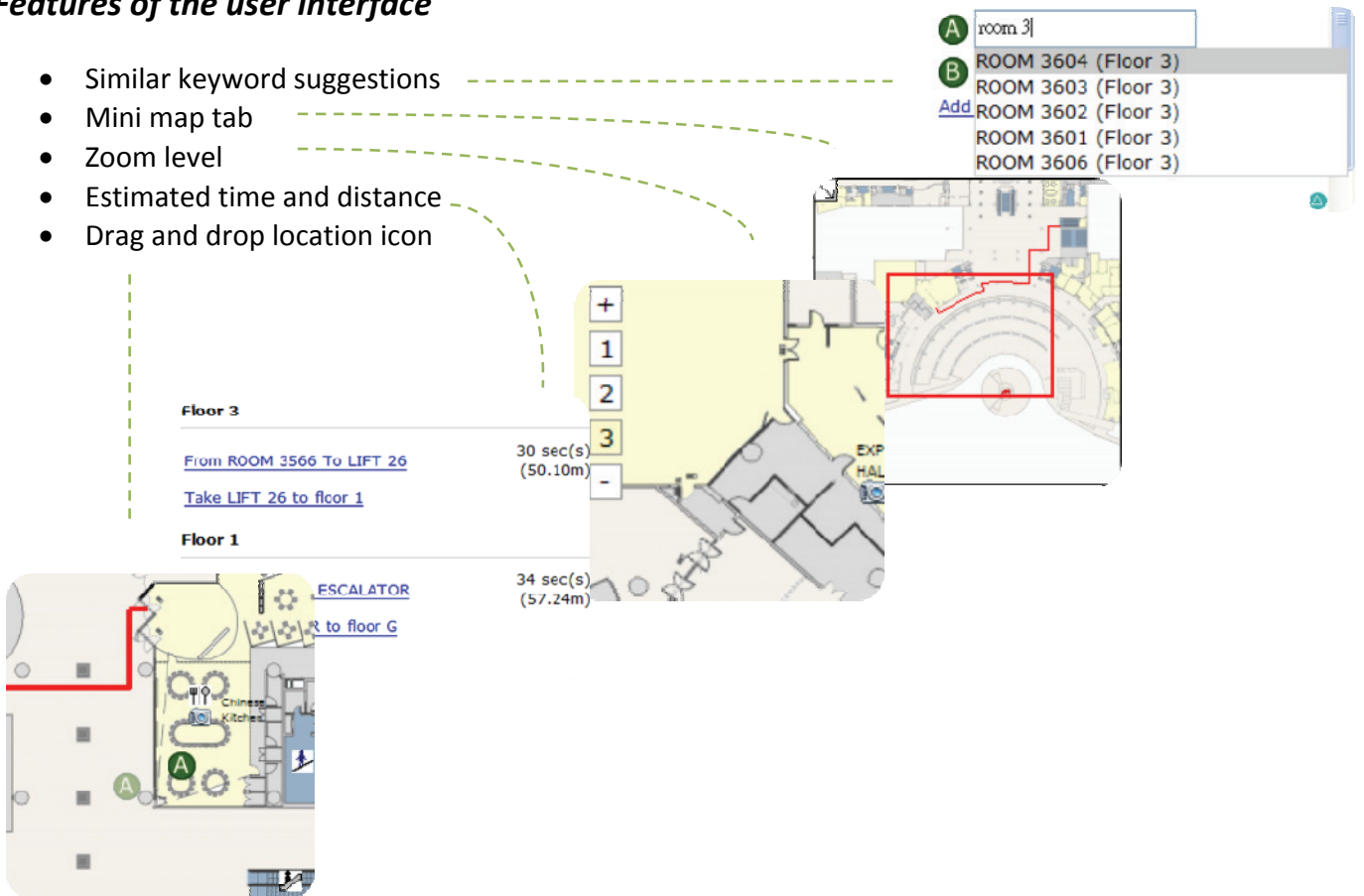
COMMERCIAL PRESS BOOKSTORE

EXPOSITION HALL

The screenshot displays the HKUST Path Advisor web interface. On the left, there is a search form with a 'To' field, a checkbox for 'On the same floor', and a 'GO' button. Below this is the 'Advanced Path Advisor' section, which shows a list of room suggestions for point B, including RCOM 3604 through RCOM 3606 on Floor 3. The 'Path Indication' section shows the path from point A to point B, with a travel time of 30 seconds and a distance of 50.10 meters. On the right, a map of Floor G is shown with a red path highlighted between two points, A and B. The map includes labels for 'COMMERCIAL PRESS BOOKSTORE' and 'EXPOSITION HALL'. An inset map in the bottom right corner shows the location of Floor G within the larger building layout.

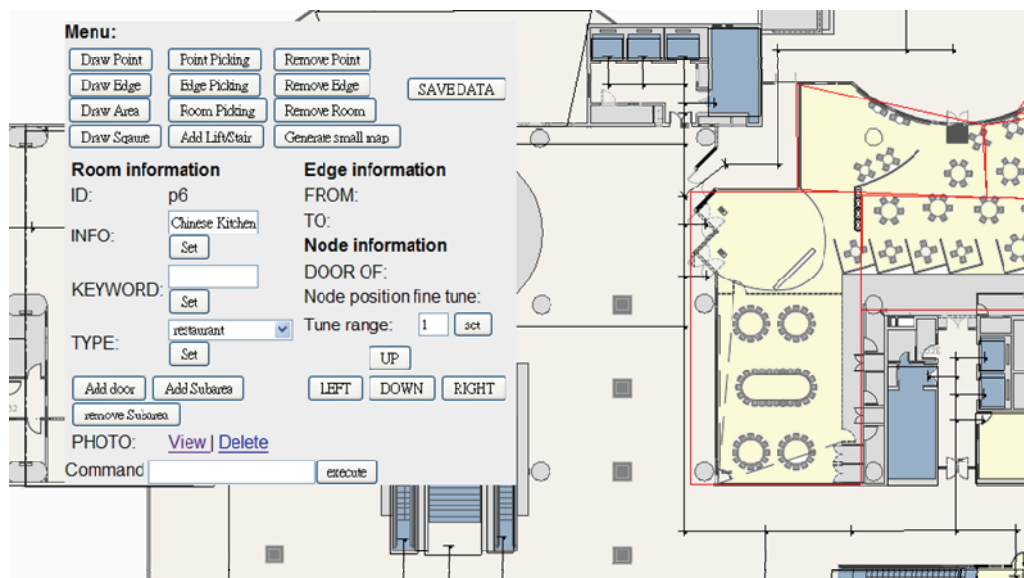
Features of the user interface

- Similar keyword suggestions
- Mini map tab
- Zoom level
- Estimated time and distance
- Drag and drop location icon



User interface for administrators

We designed a web-based administrative interface that allows administrators to create, modify and remove map data without having to think about of database structure or editing the plain text files. It also allows them to update or upload the map images using the interface.



Implementation

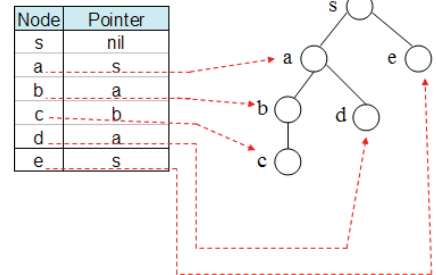
We developed our system using ANSI C++, JavaScript and PHP. The system can be installed on a Linux server or a Windows server, and users will access the system using browser.

We implemented the Dijkstra's shortest path algorithm to solve the shortest path problem. Then, we pre-compute the breadth-first tree by Dijkstra's shortest path algorithm for all nodes and store them separately in different plain text file.

For pre-computing, a naïve approach may take $O(n^3)$ space for storing all the pre-computed shortest paths. Motivated by the high storage complexity, we instead store the breadth-first tree for all nodes which only takes $O(n^2)$ space.

In client side, we used AJAX techniques in handling browser-server communication.

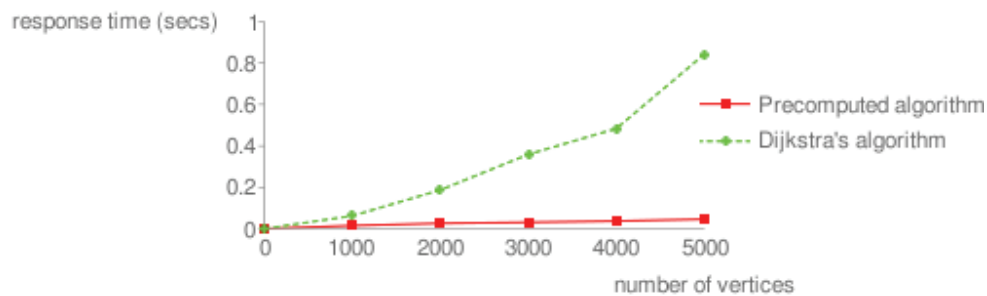
Breadth First Tree



Evaluation

In 100% of the cases, our system responds to queries within one second. With precomputed data, we further reduce the response time to 0.1 sec.

Response time against number of vertices in the graph



Our system supports the following browsers



Result

In this project, we built a web-based system that solves the shortest path problem. The user interface is easy to use, besides, we also developed an administrative tool for administrators to edit the map data in an easy way. For all time, our system responds to queries within one second.