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
**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 an 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 naive 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.

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.

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.