Path Advisor: A Multi-Functional Campus Map Tool for Shortest Path

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Introduction

- A web-based multi-functional campus map tool in The Hong Kong University of Science and Technology (HKUST) campus
- Viewing the calculated shortest path in
  o 2D view
  o Bird's eye view
  o Virtual reality view (VR view)
- Dijkstra's shortest path algorithm & breadth-first tree in 2D view
- Weighted shortest surface path algorithm in bird's eye view and VR view

Existing work

- Road network shortest path [3]
- Unweighted shortest surface path [1]
- Grown obstacle shortest surface path [2]
- Our work (Weighted shortest surface path)
  o Away from the obstacle
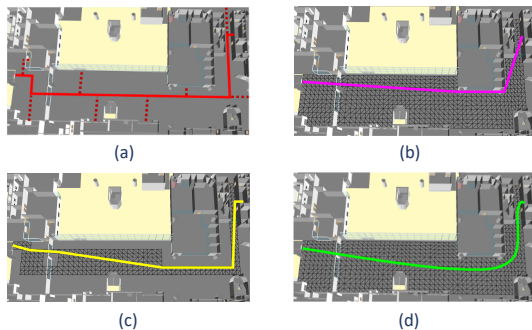 o No sudden direction changes

Figure 1: (a) Road network shortest path, (b) unweighted shortest surface path, (c) grown obstacle shortest surface path, and (d) weighted shortest surface path

Architecture

- Database
  o 2D floor plan image (stored in PNG file format)
  o 3D building model (stored in OBJ file format)
  o Spatial data (stored in OFF file format)
- Front-end
  o Web interfaces
- Back-end
  o Shortest path calculation algorithm

Contribution

- Insufficiency of existing algorithms:
  o They are not applicable for map applications with obstacles (such as the wall in a building)
  o They look unrealistic and strange when a road network approach is blindly adopted
- Our solution to solve these insufficiencies:
  o We set two requirements:
    ▪ The path should not be too close to the obstacle
    ▪ The path should not have sudden direction changes
  o Weighted shortest surface path algorithm:
    ▪ If a face is closer to the obstacle, the weight of this face on the floor plan is larger
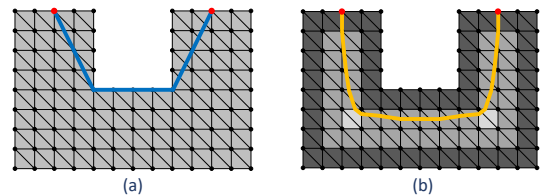   ▪ If a face is closer to the center, the weight of this face on the floor plan is smaller

Figure 2: (a) Unweighted shortest surface path, and (b) weighted shortest surface path
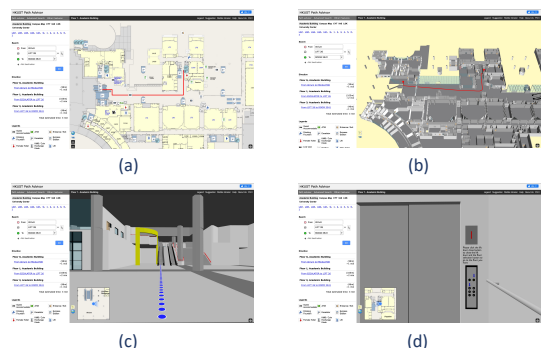
User interface

Figure 3: Demonstration of (a) the 2D view, (b) the bird's eye view, (c) the VR view at atrium (one place in HKUST) and (d) the VR view at lift 25/26 (one place in HKUST)

References

[1] J. Chen and Y. Han. Shortest paths on a polyhedron. In *SOCG*, page 360–369, New York, NY, USA, 1990.
[2] T. Lozano-Pérez and M. A. Wesley. An algorithm for planning collision-free paths among polyhedral obstacles. page 560–570, 1979.
[3] M. U. Ujang and A. Abdul Rahman. Implementing shortest path calculation for 3d navigation system. In *Advances toward 3D GIS*, pages 153–164, 2008.