PROJECT REPORT

Subject: Route planning

By

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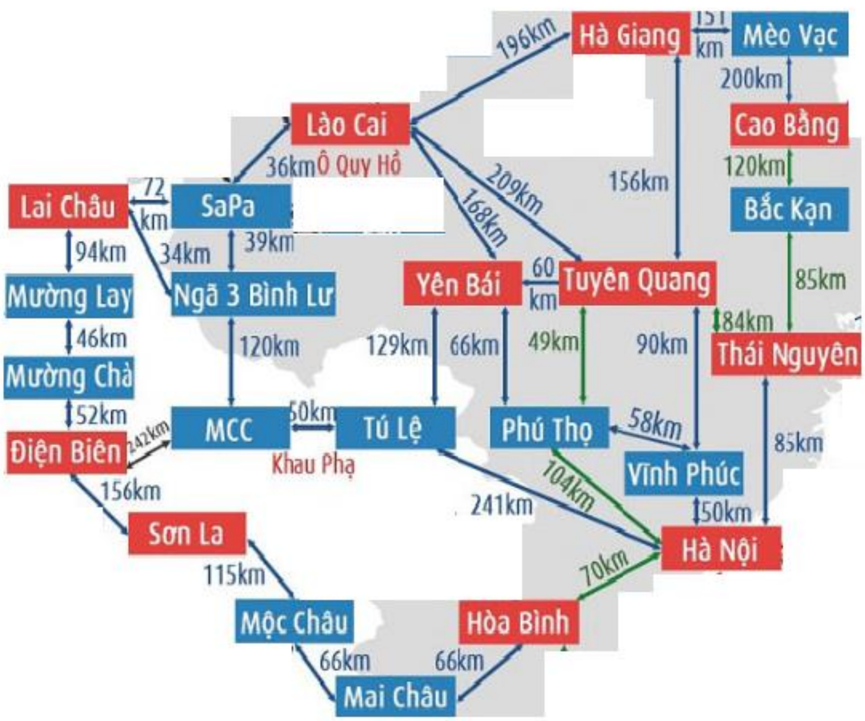
1. Presentation of the subject

Route planning is the method used to find the most effective route about cost, time, … when we move from a place to another.



2. Description of the problem

- Write a program to find the cheapest route between two Vietnamese cities and time taken is no more than time allowed. The intelligent vehicle can only travel between 2 adjacent cities, and the objective is to minimize the cost between two cities and satifies time allowed.

- Problem formulation:

+ Initial state: HaNoi

+ Actions model: Action (In: HaNoi) = [Go: HoaBinh, Go: HoaBinh, Go: TuLe, Go: PhuTho, Go: ThaiNguyen]

+ Goal test: LaiChau

+ Path cost: sum of cost, time taken

3. Selecting the algorithms to be used for solving the problem

We chose to apply uniform-cost search and A* search algorithms because:

+ Uniform-cost search and A* search algorithms are complete and give the optimal solution.

+ Breadth-search algorithm takes much time, exponencial complexity in the worst case.

+ Depth-search and greedy algorithms aren't complete and don't give the optimal solution.

4. Implementing the algorithms to be used for solving the problem

The main difficulties we had to face for implementation:

+ Making the data took much time, we used city graph in the Internet to make the data.

+ Initially we got stuck in local minima and plateau, such as PhuTho -> TuyenQuang -> PhuTho, then we used CheckInPriority function: when considering PhuTho, we put it in Closed(PriorityQueue) to eliminate it when considering subcities of TuyenQuang then.

5. Comparing the results of the algorithms used for solving the problem

a. Providing quantitative performance indicators

	Uniform-cost search	A* search
Percent of the algorithm successfully solved the problem	100%	100%
Average time complexity (s)		
Data 1	0.0019	0.00099
Data 2	0.00099	0.00098
Data 3	0.001	0.0099
Data 4	0.0013	0.001

b. Explaining these results

- Uniform-cost search:

  + Time Complexity: Let C* is Cost of the optimal solution, and ε is each step to get closer to the goal node. Then the number of steps is = C*/ε+1. Here we have taken +1, as we start from state 0 and end to C*/ε. Hence, the worst-case time complexity of Uniform-cost search isO(b1 + [C*/ε])/.

  +Space Complexity: The same logic is for space complexity so, the worst-case space complexity of Uniform-cost search is O(b1 + [C*/ε]).

- A* search:

+ Time complexity: The number of nodes expanded is still exponential in the length of the solution (path)

+ Space complexity: It keeps all generated nodes in memory. Hence space is the major problem here, not time

(C* is the cost of the optimal solution)

6. Conclusion and possible extensions

- Uniform-cost search algorithm:

+ The first solution found is also the one has the lowest cost.

+ If the problem has a solution, the algorithm will stop.

+ If all branches have equal cost, the algorithm becomes breadth-search algorithm.

- A* search algorithm:

+ The first solution found is also the one has the lowest cost.

7. List of tasks

- Programming tasks:

+ Implementing uniform-cost search algorithm: Nguyen Van Toan 70%, Le Thanh Thang 30%

+ Implementing A* search algorithm: Bui Anh Duc 70%, Ta Viet Cuong 30%

- Analytic tasks:

+ Writing the report: Ta Viet Cuong

+ Writing the presentation: Nguyen Van Toan 50%, Le Thanh Thang 50%

+ Creating the demo video: Bui Anh Duc

8. List of bibliographic references

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