Shortest-Path Finding System using Dijkstra's Algorithm

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Abstract

Traveling is the part of every person's day-to-day life. Dijkstra's algorithm can be used to find the shortest route between one city and all other cities. This paper proposes, when the user gives any road map as input, stores in database. If the user wants to search the shortest path of any two cities in given road map, the system calculates the shortest path using Dijkstra's algorithm. This shortest path display the total distances of the path passed of over all cities. This system can find shortest path of the world over, if the relation of the cities and distances between them is given by user. Therefore, it is widely used for various maps. As a result, using of shortest path finding system, it can save the time and cost. Unfamiliar public user with a region can be supported beneficially due to the above strength of this system. This system is useful in terms of computation when applied to the route finding task. The implementation of the shortest path finding system is used as undirected graph. This paper investigates the above algorithm and implements this algorithm by using Java Programming Language and MYSQL Database.

1. Introduction

Roadway is an identifiable route, way or path, between two or more places. Traffic condition among a city changes from time and a huge amounts of requests occur at any moment. Users can choose a shorter route with more frequent station change. Many solution routes, the information from this computation can be able to advice unfamiliar user on how to travel. This is a graph search algorithm that solves the single-source shortest path problem for a graph with nonnegative edge path costs, producing a shortest path tree. [3]

There are a number of ways to classify routing algorithms. One of the main reasons for the popularity of Dijkstra's Algorithm is that it is one of the most important and useful algorithms available for optimal solutions to a large class of shortest path problem. Therefore, physical distance of two points is not enough to describe the path. Instead, a logical distance is used to represent the real distance as well as shortest path. These calculation time of Dijkstra's shortest path algorithm increase rapidly as graphs. So a high-end CPU and memory are required to use it. Route calculation is the shortest of path use Dijkstra's algorithm it used for Internet routing because of its simplicity and suitability for program counter-based processor.[4]

In addition, Dijkstra's algorithm is especially use to find shortest path of given road map by user in this system. Computing a shortest path from node to another in an undirected graph is a very common task. Early shortest path work has been done by Dijkstra, Bellman and Ford, Floyd and Warshall. Furthermore, Dijkstra's algorithm is widely used in shortest path finding system. Algorithms for determining the through a shortest paths graph typically exploit the fact that a given shortest paths must contain other shortest paths within it. Dijkstra's algorithm proceeds by finding the length of the shortest path form source vertex, the length of the shortest path from source to a second vertex, and so on, until the length of the shortest path from source to destination is found.[7]

Dijkstra's algorithm is early used in Yangon division and any other division. In addition, there is calculated by only division. This paper of shortest path finding system, user can input any road map, any division and everywhere as implement. In section 2 of this paper, background theory is discussed. This contains shortest path, Route-Extraction, Graph and Undirected Graph. Section 3 describe of "Dijkstra's algorithm". The experimental results are reported in section 4 and conclusion in section 5.

2. Background Theory

2.1Shortest Path

Shortest path algorithms are used to find from the source city to destination city. Shortest path problem is the finding a path between two vertices (or nodes) such that the sum of the weights of its constituent edges is minimized. An example is finding the quickest way to get from one location to another on a road map, the vertices represent

locations and of road and are weighted by the time needed to travel that segment.[6]Shortest path algorithm is the most commonly used to solve the single source shortest path problem today. For a graph G(V,E), where V is the set of vertices and E is the set of edges, the running time and finding a path between two vertices varies. [1]This algorithm is applied point-to-point shortest path calculation on Road network geographical information system (GIS), telecommunication networks and, Reconfigurable Hardware, Public Transport Information System and so on.[4] So this paper use shortest path finding systems by using shortest of the path from one place to another, it will give less time and money in land trading.

2.2 Route-Extraction

The domination of traveling and trading of cargoes which emerged globally has caused range of setback such as traffic congestion and fuel expensive. For that reason, people are encouraged to used shortest path finding system for route extract. This system is able to suggest unfamiliar public users to choose a route based on their preferences. The system uses a shortest path route algorithm into an extracted public raster map to calculate the solution path from the starting city to the destination city.[2] The fare of the suggested route will also be displayed for the users' convenience. There are many systems to extract data from database. In some of them, many forms of user interfaces are used shortest path is path that is least length between two vertices. It is the set of lines has the shortest coverall distance. As well as in our system, the shortest path is found then the strength of our system is that can easily edit the road map. There are several different algorithms that find the shortest path between two vertices in a weighted graph. Any shortest path algorithm must examine each in the graph at least once, since any of the edges could be a shortest path. The version we describe solves this problem in undirected weighted graph where all the weights are positive.[3]

2.3 Graph

Graphs are used to solve problems in many fields. Graphs may be used to represent the highway, structure of a state or country with vertices representing cities and edges representing section of highway. Graphs are discrete structures consisting of vertices and edges that connect these vertices. Graphs that have a number assigned to each edge are call weighted graphs. An edge weight is also referred to an edge length. Graph represents a set of objects where some pairs of the objects are connected by links. The interconnected objects are represented by mathematical a called vertices, and the links that connect some pairs of vertices are called edges. A graph may be constructed by choosing the vertices to be the positive integers, and defining that there is an edge between two vertices if and only if those two integers have at least one decimal digit in common. The graph instatements in important role as the maps are used as graphs. Then the Dijkstra's Algorithm is also a graph search algorithm.

2.4 Undirected graph

Undirected graph is no distinction between the two vertices associated with each edge, or its edges may be directed from one vertex to another. This graph consisting of vertices that represent telephone line, network line, road map, where each edge connect two distinct vertices and no two edges connect same pairs of vertices.[5] Many problems can be modeled using graphs with weights assigned to their edges. As use the algorithm implies new bound on both the all-pairs and single-source shortest path problems.[8] And also it can loop the whole graph satisfy for route finding task. Therefore, undirected graph is especially used for shortest path algorithm.

3. Dijkstra's Algorithm

begin
$S \leftarrow \{v_0\}$
$D[v_0] \leftarrow 0$;
for each v in $V \leftarrow \{v_0\}$ do $D[v] \leftarrow l(v_0,v)$
while $S \neq V$ do
begin
Choose a vertex w in V-S such that D[w] is a minimum;
Add w to S;
for each v in V – S do
$D[v] \leftarrow MIN(D[w]+l(w,v))$
end
end

- S = the set such that the shortest path from the source of each vertex v in S lies wholly in S
- v_0 = a source vertex
- v = each vertex in V, the minimum over all paths from v_0 to v
- D[v] = the length of the shortest path from v_0 to v that lies wholly within S except for v itself

Table 1: Example of Kyaikhto(v18) to Mawlamyine(v1)

Loop (Step)	S set of cities(vertices)	W Minimum choose city (vertex)	D[w] Distance of initial to marked city	v17 Wall	v5 Thaton	v4 Yinnyein	v3 Payathansu	v2 Mottama	v1 Mawlamyine
Initial	{v18} (Kyaikhto)	-	-	22	∞	∞	∞	∞	∞
1	{v18,v17}	v17	22	22	58	∞	∞	∞	∞
2	{v18,v17,v5}	v5	58	22	58	67	∞	∞	∞
3	{v18,v17,v5,v4}	v4	67	22	58	67	86	∞	∞
4	{v18,v17,v5,v4,v3}	v3	86	22	58	67	86	99	∞
5	{v18,v17,v5,v4,v3,v2}	v2	99	22	58	67	86	99	104

The above table is the example of finding shortest path from Kyaikhto(v18) to Mawlamyine (v1), these cities are exist in Mon State. Calculation of the table is explained by mathematically.

Assign to every node a distance value. Set it to zero for our initial node and to infinity for all other nodes. Mark all nodes as unvisited. Set initial node, Kyaikhto(v18), as current. For current node, consider all its unvisited neighbors and calculate their distance. In loop 1 of above table Wall (v17) is marked and which distance becomes 22miles.If this distance is less than the previously recorded distance, overwrite the distance. The vertex of minimum distances is choosing until to the destination vertex, Mawlamyine (v1). Then the distance of the shortest path is display to the user. And the city which lies among the source city and destination city of shortest route also display.

4. System Design

This system design of the shortest path finding system is following shown in Figure1.User has to gives any road map as input by the system. In addition, user has to input source city and destination city that is necessary for their distance. After input the road map, the shortest path system is processed and stored it in database. It next information of new nodes can edit, insert, delete, and update their distance by this system. The information given by user has to be calculated with Dijkstra's algorithm that is generated by the system. Performance of the system can be search by any road map and any other division. Moreover, new road map can also as input again and again. There can plot one or more new city between existing points. Another way, user can create the desire map. Additionally, remove out the road map entry from database. So, user has to use above the pleasure for their travelling and trading. This is useful for reduce cost and time system consumption by using this arrangement.

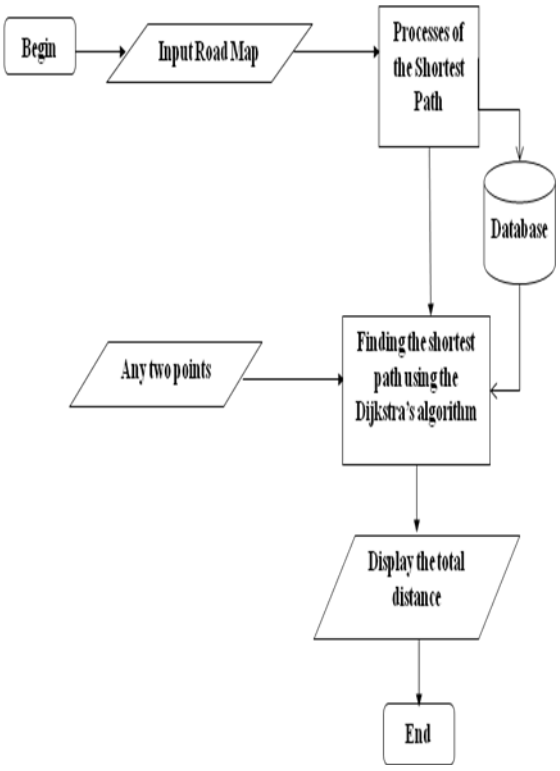

Figure1: System flow of Shortest Path Finding System

Algorithm maintains a solution set which contains all the vertices examined so far whose minimal distance to the source has been determined. As a result, this will display the total distance and the solution of shortest path passed.

4.1 Implementation of the Shortest Path Finding System

Road map input process by user is shown in Figure 2: In view of that, the map of Mon-State as

input by sample. User chooses any two cities of source city, Kyaikhto and destination city, Mawlamyine. User clicks the file menu from the main frame .When the user any road map as input to this process, if there is no road map, user input any new road map.

User must be double clicks in current map area to input the city or point. It also, links their distance. For that reason, numbers of cities are adding in database because of no limitation. As well as, the distance between of any two nodes can be change easily and it can remove the cities above way it can edit.

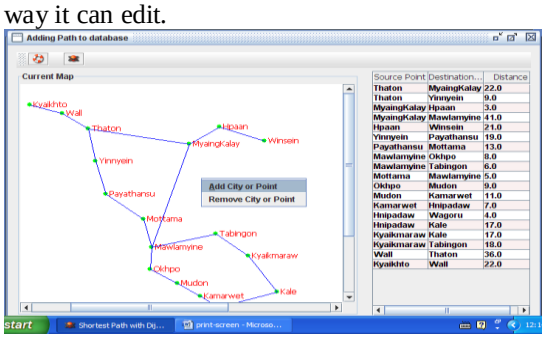

Figure 2: Road map input process by user

Select source city and target city from the map is shown in Figure 3: To find the shortest path of desire cities by choosing "Search Shortest Path" under the "Algorithm Menu".

User can input any two points or source city (Kyaikhto) and destination (Mawlamyine). The information given by user has to be calculated with Dijkstra's algorithm that is generated by the system. During shortest path finding system, this will take a few seconds to wait for user there is a modification of the system.

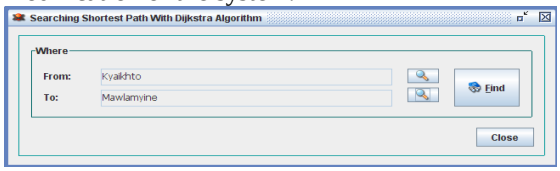

Figure 3: Select source and target from the map

Output result of solution path is displayed in Table 2: In additionally, total distance of Kyaikhto (source city) to mawlamyine (target city) is 104 miles.

The cities which shortest path passed is also displayed with their distances i.e. Kyaikhto to Wall is 22 miles, Wall to Thaton is 36 miles, Thaton to Yinnyein is 9 miles, Yinnyein to Payathansu is 19 miles, Pathansu to Mottama is 13 miles and Mottama to Mawlamyine is 5 miles.

Dijkstra's algorithm can be found shortest path even so many points. This method is helpful for visitor and Tourism. Furthermores, benefitted for bus driver because of decreasing the fuel. Dijkstra's algorithm is the best algorithm for shortest path finding system.

Table 2: Output result of the system

Result	Kyaikhto>>Wall>>Thaton>>Yinnyein> >Payathansu>>Mottama>>Mawlamyine	
Detail Result		
From	To	Distance
Kyaikhto	Wall	22.0
Wall	Thaton	36.0
Thaton	Yinnyein	9.0
Yinnyein	Payathansu	19.0
Payathansu	Mottama	13.0
Mottama	Mawlamyine	5.0
	Total Distance	104.0

5. Conclusion

This system supports flexibility for public users in the shortest path finding system. The user can easily use for choosing of road from his road-map. When the user gives the relation of the cities and distances between them, the shortest path of universally can be found by this system. And then, because of the calculation of cost and time consumption, it can remove the difficulties in travelling. Not only public users but also travelling agencies more easily for improve their business. In addition, supports for car agencies while any road map as input. So, car agencies are very economical by using this system. And then, paid amount are also increasing one-year-to-one-year. This system is more easily to user input and flexible to use. System will support the shortest path of traveling process before the travelers go to any where. It is use the mathematical and algorithm analysis field in the computerized system.

References

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