IMPLEMENTATION OF TRAVELER'S AID SYSTEM FOR MAGWAY DIVISION

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Abstract

Traffic congestion is becoming a serious problem in more and more modern cities. So, this system is proposed to solve the traveler's facing problems in finding the shortest path from one place to another place. Encouraging the vehicle drivers is one of the most effective and economical ways to reduce the ever increasing congestion problem on the roads. This system is proposed as the traveler's aid system for Magway division. The proposed system is able to find the optimal route from the starting location to the intended location in short time by using Dijkstra algorithm.

Keyword: Optimal Route, Graph, Dijkstra.

1.INTRODUCTION

Graph theory plays an important role in computer science because it provides an easy and systematic way to model many problems. Many problems can be expressed in terms of graphs and can be solved using standard graph algorithms. This theory has been used in a wide variety of application. Some of these applications are analysis of electrical circuits, finding shortest routes, project planning, identification of chemical compounds, statistical mechanics, genetics, social sciences and so on. Methods in graph theory consist of breadth-first search, depth-first search, shortest path and minimum spanning tree methods. Among them, this system uses the shortest path method. In this system, shortest path method is used for solving transportation problems. Among many shortest path algorithms, this system uses the Dijkstra's shortest path algorithm to help the vehicle driver and to solve the single source shortest path problem.

The implementation of the shortest path algorithm is presented by the undirected graphs. Computing a shortest path from one node to another in an undirected graph is a very common task. This system is able to suggest unfamiliar public users to choose a route based on their preferences. Users can choose shorter route with more frequent station change. This system can calculate the solution path from the starting station to the intended station.

This system is implemented by using locations within Magway divisions as the vertices of an undirected graph. In this system, the associated distances between each location are represented as weight of the edges of the graph. Based on the solution paths, the system suggests the shortest distance of paths from the user's convenience.

2. RELATED WORK

In 2018, R. Wongso [1] presented shortest path finding application for Jakarta public transportation by using Dijkstra algorithm. The level of public transport users is still quite low because the use of public transport is considered ineffective as it usually cost longer time to reach a destination. Based on the factors, they presented the "TransTrip" that provides clear information about shortest path by using Dijkstra algorithm. The type of public transportation can be used to reach a destination, from a source location, with TransJakarta as the main transport and other public transport such as Angkot and Metromini to complete the routes.

In 2018, Sunita and G. Deepak [2] was dynamizing the Dijkstra algorithm which helps to efficiently solve the dynamic single source shortest path problem. Dynamization is achieved by using the retroactive priority queue data structure. Retroactive data structure identify the set of affected vertices step by step and thus help to accommodate the changes in least number of computations.

In 2019, A. Almash and F. Omar [3] searched shortest path for road network by using Dijkstra's algorithm. They involved in illustrating the best way to travel between two points and in doing so, the shortest path algorithm was created. Dijkstra's algorithm 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. This algorithm is often used in routing and other network related protocols.

3. GRAPH

A graph is a mathematical absolute object, which contains sets of vertices and edges. Edges connect pairs of vertices along the edge of a graph it is possible to walk by moving from one vertex to other vertices. Depending on whether or not can walk along the edges by both sides or by only one side determiners if the graph is directed graph or an undirected graph. Length of edge are called weight and is used for calculating the shortest path from one point to another. It is possible to apply the graph theory to different condition models. Graph can be used to represent maps where vertices represent cities and edges represent route that connect cities [4].

3.1. Shortest Path

The shortest path problem is a problem of finding the shortest path or route from a starting point to a final destination. Graphs are used to represent the shortest path problem. Shortest path algorithms consist of

- Dijkstra's algorithm,
- Bellman-Ford algorithm,
- Floyd-Roy-Warshall algorithm and
- Johnson's algorithm.

In the shortest path graph method, this method finds a path between two vertices (or nodes) such that the sum of the weight of its constituent edges is minimized. Shortest path is the path that is the least length between two vertices [5].

3.2. Shortest Path Problems

Shortest path problems consist of vehicle routing problem, travelling salesman problem and route optimization. These are as follows [4]:

- Vehicle routing problem about selecting the most optimum solution can decrease cost in delivering goods by creating a calculated and measured route.
- In travelling salesman problem, the business rep need to confine the hard and fast length of the journey and extra as much voyaging time and resources are possible. Every way is resolved and most sensible way is picked covering each objective in the manner while holding voyaging spending plan under the limits.
- Route optimization technique increase the efficiency of the transporting good between source and destination. It reduces the delay of receiving and sending of goods. It is also a great method for saving money by reducing the cost on fuel and salary used in the transportation of goods.

4. DIJKSTRA'S SHORTEST PATH ALGORITHM

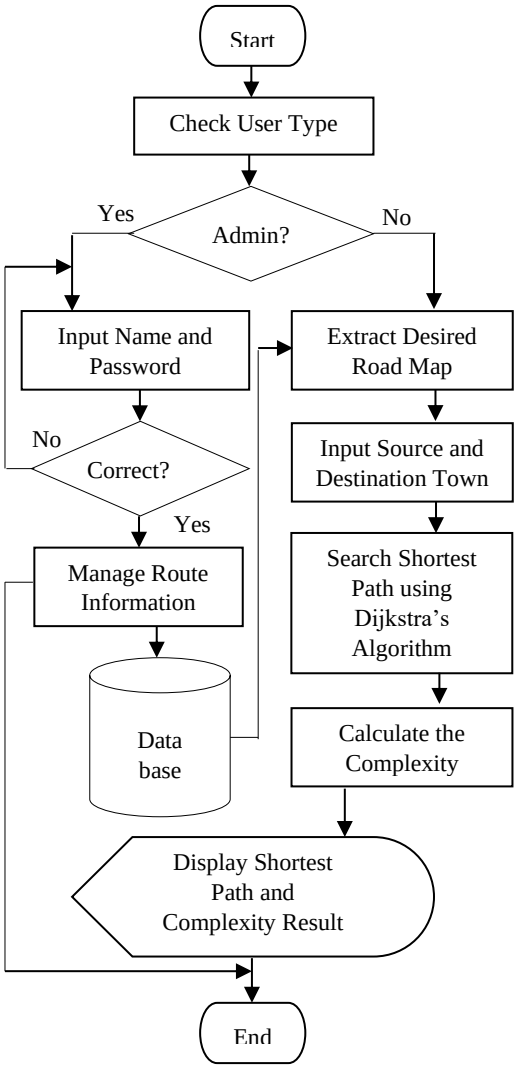
Dijkstra's algorithm is called the single-source shortest path. It is also known as the single source shortest path problem. This algorithm computes length of the shortest path from the source to each of the remaining vertices in the graph. Dijkstra algorithm is shown in Figure 1.

```
Begin
    Dijkstra (G, w, s){
    for ( each u Є V)
    {
        d[u] = ∞;
        pred[u] = nil;
        }
        d[s] = 0;
        Q = (queue with all vertices)
        While (Non-Empty (Q) ) {
           u = Extract-Min (Q)
           for ( each v Є Adj[u]) {
                 if (d[u] + w(u,v) < d[v]) {
                 d[v] = d[u] + w(u, v);
                 Decrease-Key(Q, v, d[v]);
                 pred[v] = u;
                 }
           }
        }
    }
End
```

Dijkstra's Algorithm

Djikstra's algorithm solves the problem of finding the shortest path from a source to a destination. It turns out that one can find the shortest paths from a given source to all vertices in a graph in the same time. In fact, this algorithm can be used to deliver the set of edges connecting all vertices such that the sum of the edge lengths from the source to each node is minimized [6].

5. PROPOSED SYSTEM DESIGN



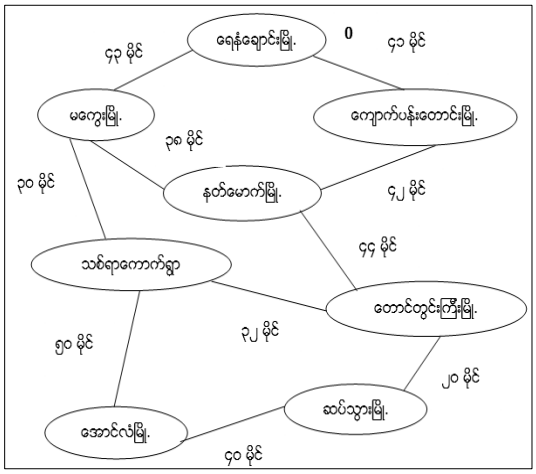
System Flow Diagram

System flow diagram is shown in Figure 2. For vehicle driver, the proposed traveler's aid system finds the optimal path within Magway division. In this system, there are two types of user role. These user roles are administrator and user. Administrator manages route information.

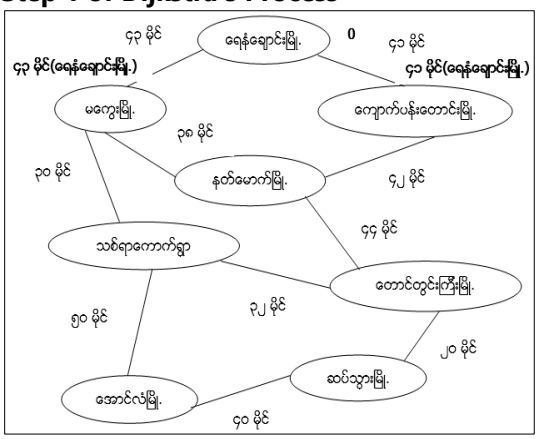
At first of the system, the user can extract the desired road map from the database. Then, the user must choose the source town and the destination town to search the shortest path that is the optimal path. For shortest path searching, this system uses the Dijkstra algorithm. After searching the shortest path, this system produces the shortest path as the optimal route for the vehicle driver. Then, this system calculates the complexity of Dijkstra's algorithm about shortest path searching process. Finally, this system displays both the shortest path and complexity to the user.

5.1. Dijkstra's Step by Step Process

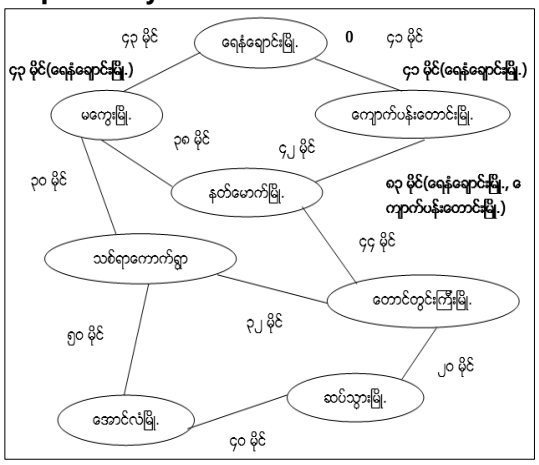
As a sample, this system searches the shortest path from the source town "ေရနံေခ်ာင္းၿမိဳ့" to the destination town "ေအာင္လံၿမိဳ့" within Magway division. In this sample, there are eight processing steps. Each step is shown in Figure 3, 4, 5, 6, 7, 8, 9 and 10.



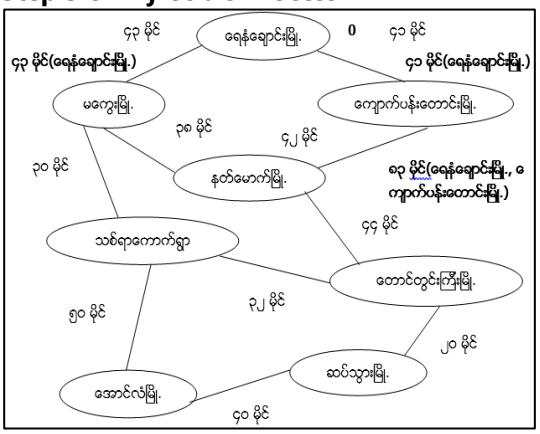
Step 1 of Dijkstra's Process



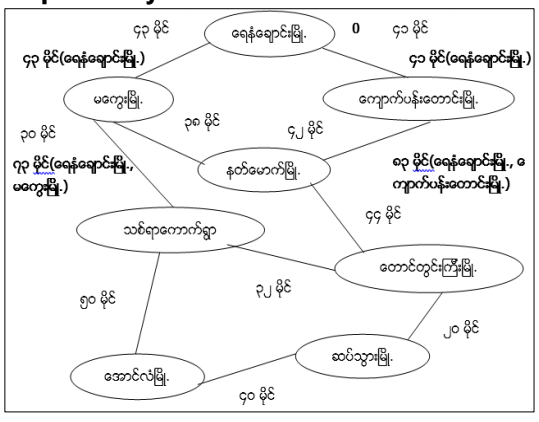
Step 2 of Dijkstra's Process



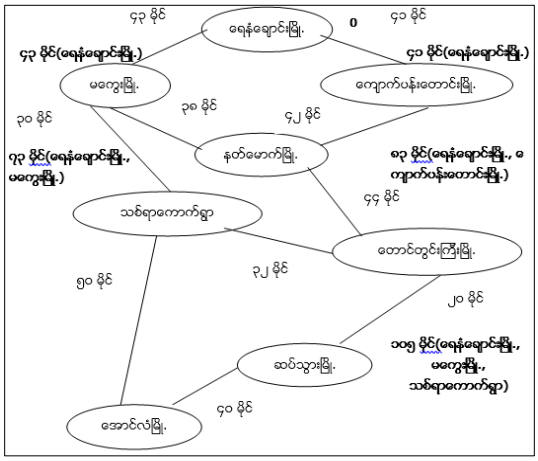
Step 3 of Dijkstra's Process



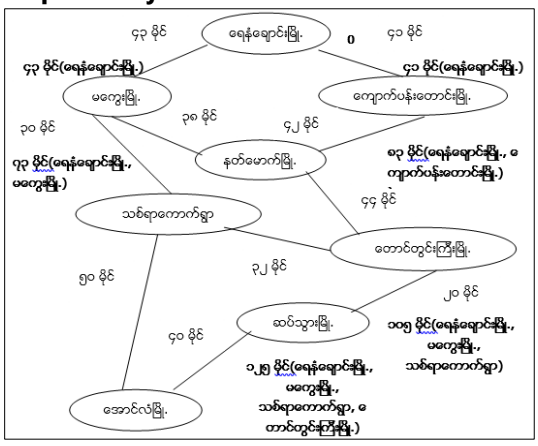
Step 4 of Dijkstra's Process



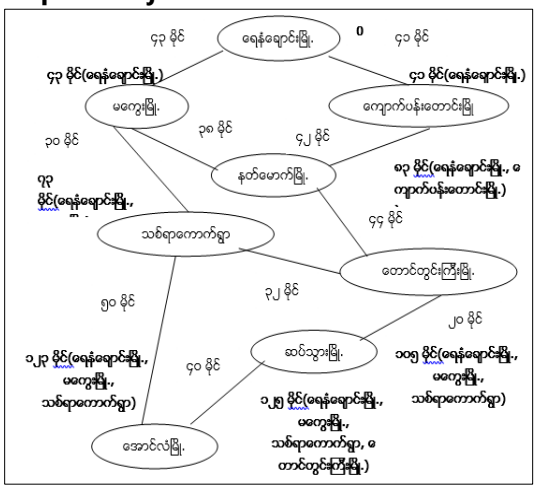
Step 5 of Dijkstra's Process



Step 6 of Dijkstra's Process



Step 7 of Dijkstra's Process



Step 8 of Dijkstra's Process

After calculating each processing steps, this system produces the shortest path among two searching paths. The shortest path is ေရနံေခ်ာင္းၿမိဳ့, ေမကြးၿမိဳ့, သစ္ရာေကာကြ္ရာ, ေအာင္လံၿမိဳ့.

6. EXPERIMENTAL RESULT

In this system, the complexity of Dijkstra's algorithm is measured. The complexity of Dijkstra's algorithm is O (|E| + |V| log |V|). E is number of edges and V is number of vertices. Complexity results of the proposed system are shown in Table 1.

Complexity Results of the System

Path Name	Town Name	Complexity
Path 1	ေရနံေခ်ာင္းၿမိဳ့, မေကြးၿမိဳ့, သစ္ရာေကာက္ရွာ, ေအာင္လံၿမိဳ့	5.4082
Path 2	ေရနံေခ်ာင္းၿမိဳ့, မေကြးၿမိဳ့, သစ္ရာေကာက္ရွာ, ေတာင္ကြင္းၾကီးၿမိဳ့, ေအာင္လံၿမိဳ့	7.4948

7. CONCLUSION

This system intends to deal with the difficulties faced when the user wants to visit the desired cities in the given road map. In this system, shortest path algorithm is used to extract the optimal route within Magway division. Moreover, this system analyzed the performance of this algorithm by producing the optimal route. For the unfamiliar public users, the system can help choosing the path from many existing routes as they wish.

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