A Study on the Optimal Evacuation Path through Dijkstra's Algorithm in the Case of Radiation Accidents

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1. Introduction

In an emergency, a large population may suddenly gather in a limited area and suffer massive casualties if effective evacuation is not achieved.[1]

In addition, if there are various evacuation routes, the evacuation must be completed as soon as possible by dispersing residents within a limited evacuation time to effectively reduce human casualties.[2]

This study calculated an effective introduction path based on the Dijkstra algorithm, the shortest distance analysis method that can reach the destination the fastest if various paths exist.[3]

An optimized evacuation path for multiple paths was performed by simulation using the Dijkstra algorithm.

2. Methods and Results

2.1 Model

In computer science, the Dijkstra algorithm or Dykstra algorithm is an algorithm that finds the shortest path between vertices in graphs that may appear in places such as road traffic networks. The algorithm was devised in 1956 by computer scientist Etzher Deikstra and published three years later.

This algorithm has many variations. Dijkstra's original algorithm is to find the shortest path between the two vertices, but a more common variant is to create a shortest path tree with an algorithm that fixes one vertex to the "source" vertex and finds the shortest path to all other vertices in the graph. [4]

2.2 Algorithm Method

Operational steps ① Set the departure node and the arrival node. ② Initialize the 'shortest distance table'. ③ Distinguish between unvisited nodes among neighboring nodes of the currently located node, and select the shortest node among unvisited nodes. Visit the node and process it. ④ The 'shortest distance table' is updated by calculating the cost (weight) of the edge passing through the node to another node. ⑤ Repeat steps 3-4.

The 'shortest distance table' is a one-dimensional array that records the shortest distance required to reach N nodes. Declare an array of size N (N + 1 to match node numbers starting from 1) and initialize it with a large value.

The 'Node Visited Check Array' is an array to record whether a node has been visited or not, and the size is the same as the 'Shortest Distance Table'. By default, it is initialized to False to indicate that it has not been visited. A bipolar amplifier was modeled in MATLAB as a circuit with two differentiators and an integrator.

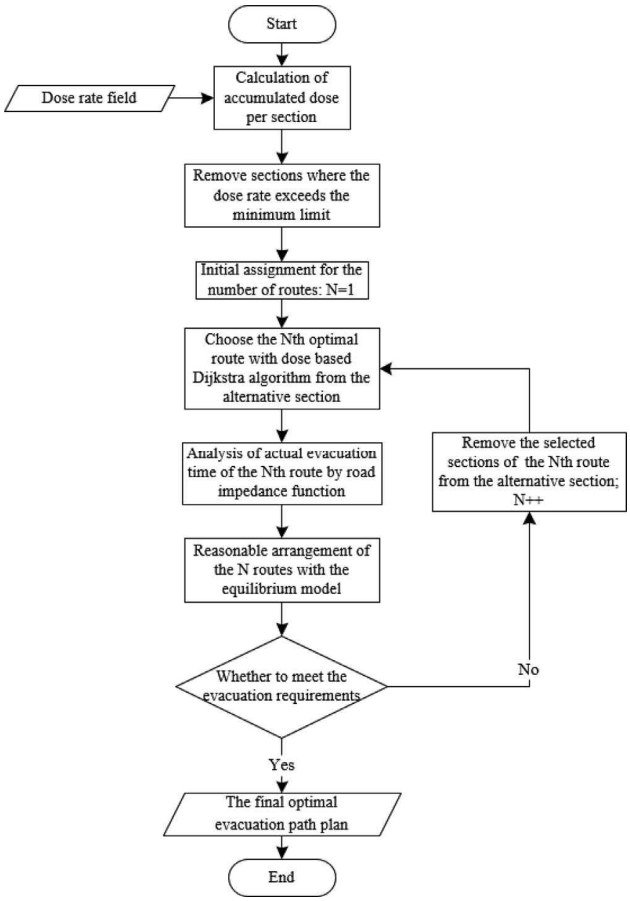

Fig. 1. Basic calculation flow chart.

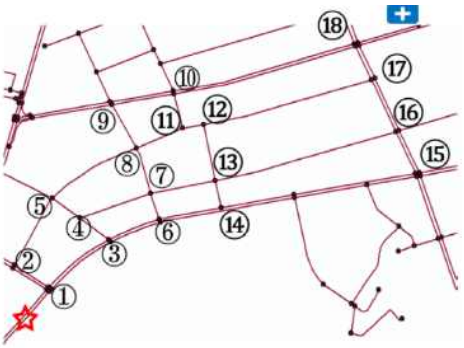

Fig. 2. The real road network diagram.

Dijkstra's algorithm is one of the algorithms to find the shortest path from one vertex (node) to another in a graph. In this process, not only the arrival vertex but also all other vertices are visited with the shortest path, and all the shortest paths to each vertex are found. Each time, the vertex of the shortest path is selected and the search is repeated.

Using the algorithm, the optimal evacuation route and evacuation time were calculated in the event of a radioactive material leakage accident**.**

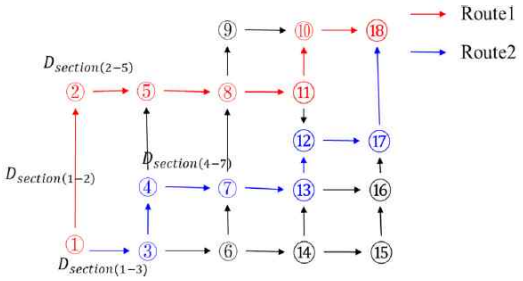

Fig.3. A weighted directed digraph corresponding to complex road network.

In the event of a radioactive material leakage accident, an optimal evacuation route was analyzed in order to detect the leak in the adjacent area early and evacuate safely for evacuees.

In order to propose an improved algorithm through optimization of the algorithm, an improved value can be obtained when the weight for selecting the optimal evacuation route in each scenario is considered.

3. Conclusions

If there are not many nodes, it can be seen that the optimized path is easily found with a few operations. However, when the number of nodes increases, the operation speed becomes very slow. In order to overcome this, a separate algorithm

This study is expected to reduce human casualties by proposing a safe and rapid evacuation route for evacuees in the event of a radiation disaster..

ACKNOWLEDGEMENT

This paper is research conducted with the support of the National Research Foundation of Korea (NRF) with funding from the government (Ministry of Science and ICT) (NRF-2020M2D2A2062571).

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