Comparison between Breadth First search and Nearest Neighbor Algorithm for Waveguide Path Planning

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***Abstract*- This paper proposes comparison between Breadth First Search (BFS) algorithm and Nearest Neighbor Algorithm(NNA) for waveguide path planning. Both algorithms achieve path between starting point and goal point by avoiding multiple static obstacles in given map. Paths generated by BFS are more optimal and simpler than NNA algorithm. Simulation results show that the path planning by Breadth First Search algorithm is comparatively optimal and gives better solution than the Nearest Neighbor Algorithm.**

Index terms - Breadth First Search(BFS), Nearest Neighbor Algorithm(NNA), Path Planning.

I. INTRODUCTION

This part contains introduction about waveguide routing and path planning. The problems which arise in path planning and what should be the solution of this problem. Waveguide is the metallic tube which works as a transmission line to carry electromagnetic or sound waves. Satellite contains number of panels such as North, South, West, East panel. Each panel contains no. of components such as waveguide, flange, bracket and other electronics components.

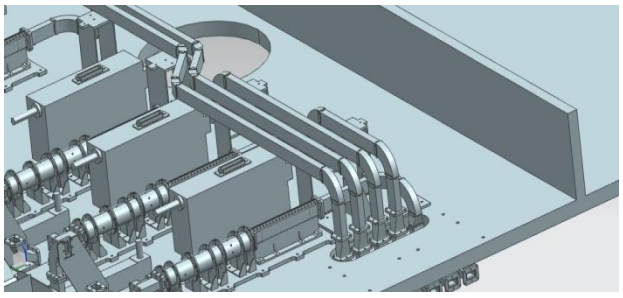

Figure 1- Waveguide routing on panel

For waveguide routing, it is done manually in CAD/CAM software by trial and error method. It takes greater time to accomplish this task. Generally it does not give optimal solution and utilize more space on circuit panel. To overcome this problem, we need to generate and plan the automatic path between source and destination points by approaching path planning algorithms. Here, we developed Breadth First Search (BFS) and Nearest Neighbor Algorithm (NNA) for automatic path generation. After implementation, we discussed and found some results which compared two algorithms.

II. ALGORITHM IMPLEMENTATION

In this part, it contains basic information about BFS algorithm and NNA algorithm.

1. BFS Algorithm

BFS was invented in the late 1950s by E. F. Moore, who used to find the shortest path out of a maze,[1] and discovered independently by C. Y. Lee as a wire routing algorithm (published 1961).[2]BFS begins at the starting position of the root node and looking for the goal by expanding all of the successors of the root node. [3] The successors of a node are all allowable directions that could go to next node. Allowable means that directions which does not cause any interruption with obstacle and go to the next node. From starting node, BFS looking for the next node which expands it's all possible successors and go to the best suitable one. Then, if it is not the goal node, mark it as a visited node and from current node expands all possible successor nodes. Go to the best suitable one and repeat this step until the goal node is achieved.

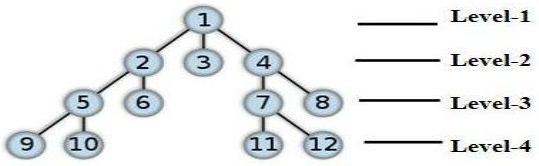

Figure 2- Order in which nodes are expanded (Tree Structure of BFS algorithm)

2. NNA Algorithm

The Nearest Neighbor Algorithm was one of the first algorithms used to determine a solution to the travelling salesman problem. [4] In it, the salesman starts at a random city and repeatedly visits the nearest city until all have been visited. It quickly yields a short tour, but usually not the optimal one. The nearest neighbor algorithm is easy to implement and executes quickly, but it sometimes miss shorter routes which are easily noticed with human insight. For path planning Nearest Neighbor Algorithm creates and plans a path and finds nearest node from possible neighbors of current node until it achieves destination node.

III. SIMULATION RESULTS AND DISCUSSION

a)

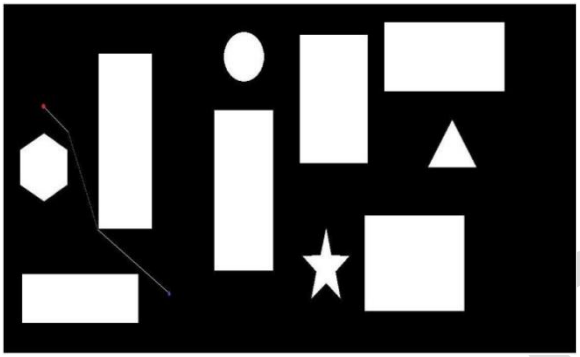

Figure 3:-Path planning by BFS algorithm

Path planning by BFS algorithm is shown in figure 3. In this map, White entities located here are the obstacles. Source node is represented by red spot and destination node is represented by blue spot. Every obstacle has its checkpoint that does not let enter the path into them. So BFS algorithm creates path within three levels that we can see in figure 3. First path passes through checkpoint of hexagonal obstacle then passes through checkpoint of rectangular obstacle. After that it will get its goal point in third level which is its destination node. This way BFS creates path between source node and destination node by avoiding obstacles.

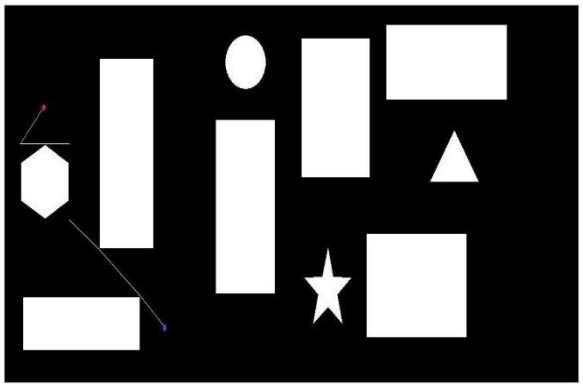

Figure 4:-Path planning by NNA algorithm

Whereas, path planned by NNA algorithm is shown in figure 4. NNA algorithm checks the nearest neighbor then passes through that node. Now it checks all nearest neighbor then passes through the node which is nearest among them. This way it generates path and get the destination node. So we can say that from the results, BFS algorithm plans optimal path between two nodes than the NNA algorithm.

b)

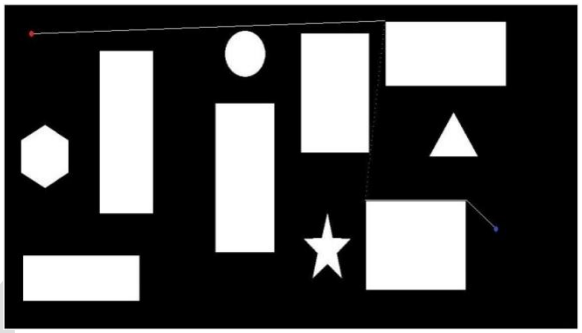

Figure 5:- Path planning by BFS algorithm

In this case, from figure 5, BFS algorithm generates path between source node and destination node by avoiding obstacle within four levels. Path is passed through the check point of rectangular obstacle then passes through two checkpoints of another rectangular obstacle and gets the destination node.

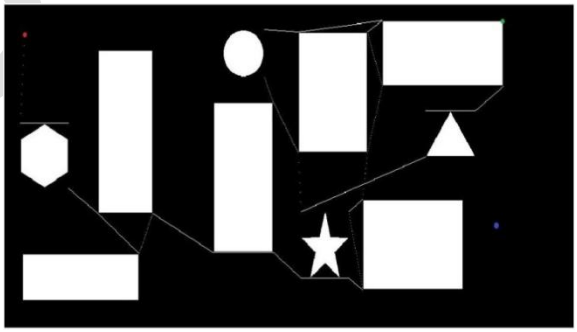

Figure 6:- Path planning by NNA algorithm

So for NNA algorithm from figure 6, NNA algorithm creates path by passing all nearest neighbor through checkpoints and finally it has got trapped at node which is indicated by green spot. At green spot, path has not left any nearest node to pass through it. So algorithm is failed to get destination node. Path generated by BFS is optimal and simple but path generated by NNA is complex and it is trapped at some point. So algorithm is failed in this case.

IV. CONCLUSION

This paper proposes the comparison between the BFS algorithm and NNA algorithm for path planning. Simulation results shows that the proposed two algorithms are capable

of finding path between source node and destination node by avoiding static obstacles. BFS algorithm is produced more optimal and simple path than NNA algorithm. So it is more efficient and favorable path planning algorithm. Following table shows the comparison between two algorithms.

TABLE I
COMPARISON BETWEEN BFS AND NNA ALGORITHM

Sr No.	BFS Algorithm	NNA Algorithm
1	It gives optimal path leaving some cases.	It creates path but not optimal for every cases.
2	Planed path is comparatively simple than NNA.	It creates complex path when source and destination points are far from each other.
3	It occupies more memory.	It occupies less memory.
4	It gives more effective solution.	It gives less effective solution.
5	No trapping is occurred.	There may be a chance of trapping between two points.

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