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Efficient Shortest Path Using Centroid Heuristic Search Algorithm

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Abstract— The shortest path mean that covering the very minimum distance to travel from the one point as source to another point as destination. The one of the heuristic algorithm is the a* algorithm designed to provide the shortest path. The proposed methods have a centroid heuristic search algorithm to provide the efficient shortest path vehicle environment with minimum distance. The proposed algorithm consists of three phases: node selection to fix the source and destination and choose the shortest path by finding the centroid by comparing the with path to cover less distance. Another important feature of TSP to provide the multiple set of comparison for a traveler to travel in required region to achieve the shortest path. When comparing the proposed algorithm with the existing algorithm, the new proposed centroid technique provide the better result leads to minimum distance.

Keywords— Heuristic search algorithm, heuristic function, TSP, shortest path and GIS.

I. INTRODUCTION

A* is an informed search algorithm, or a best-first search, meaning that it solves problems by searching among all possible paths to the solution (goal) for the one that incurs the smallest cost (least distance travelled, shortest time, etc.), and among these paths it first considers the ones that appear to lead most quickly to the solution. [5]It is formulated in terms of weighted graphs: starting from a specific node of a graph, it constructs a tree of paths starting from that node, expanding paths one step at a time, until one of its paths ends at the predetermined goal node. The path calculation done based using the following program which referred in [7].

```
function reconstruct_path(Came_From,current)
    total_path := [current]
    while current in Came_From.Keys:
        current := Came_From[current]
        total_path.append(current)
    return total_path
```

In this paper, we present midpoint version of heuristic search algorithm a recently proposed algorithm on A*. The main objective to collect the advantages from the midpoint search algorithm and the TSP in the implementation of heuristic search algorithm. To perform a series of experiments which applied in the TSP problem scenario and show that proposed algorithm is more efficient than the midpoint search and the heuristic search algorithm.

II. RELATED WORK

A* search algorithm is used to analyze and find the shortest path in the junction from one point to another point. The new weight based shortest path and vehicle trajectory aided map matching algorithm are used to improve the map matching process by connecting the low frequency data in the road map. [3]The weight based shortest path algorithm used for distance calculation leads to shortest path and provided the information from the shortest path. The recent map matching (MM) applied using a technique called as the fuzzy logic method and Bayesian interference which leads to improved data quality and has better performance than the other map matching algorithms. Consider the shortest path between two points are A and B, the distance along this path is 50 and the shortest distance between A and B is 35. When error occurs in map matching process, here the vehicle trajectory used to identify the correct link among all other link from the source to destination. This type of shortest path search reduces the processing time in between the two consecutive GPS fixes[1].

The aim of a* algorithm to reduce the run time by reducing the search space. [6]The work deals with the modified dijkstra's shortest path search algorithm and the cost of distance using this formula is equal to the cost calculated from the dijkstra algorithm in reduced graph. This type of comparison may leads to obtain optimal path have least cost travelling path. Aims to provide the less cost with minimum distance and efficient shortest path in larger graph and it also applicable in GIS[2].

The most widely used shortest path algorithm is a* algorithm and it is efficient than the dijktra algorithm which easy to implement but have low search efficiency because of complex computation. [4]The shortest path algorithm have the number of nodes are denoted as 'n' and the cost of shortest path denoted as d(n) from the source node to the end node. ω is a weighted value denoting the impact factor . θn is the angle between the vector that consists of nodes from staring point to current node[7].

$$\begin{cases} D(n) = d(n) + r(n) \\ r(n) = \omega * \cos\theta_n \end{cases}, -\frac{\pi}{2} \leq \theta_n \leq \frac{\pi}{2}$$

III. SYSTEM DESCRIPTION AND IMPLEMENTATION

The proposed algorithm is the centroid heuristic search algorithm to provide the optimal shortest path deals with the path cost and the heuristics estimation functions. This proposed algorithm aims to provide the parameters such as quality of services, minimum distance and least travelling cost. In this environment which have number of nodes with starting and ending node as current node. When travel from one node to another node to find the shortest path by using the centroid heuristics search algorithm to provide the efficient distance. The implementation have three phases are,

a. Heuristic search shortest path problem
b. Centroid Heuristic search shortest path problem
c. Midpoint in TSP for choosing the shortest path problem

The first module presents the analysis of all possible directions from one particular node and it explore the node leads to make a number of comparisons done between the multiple neighboring path from the source node. The move based on the calculation of heuristic function for each and every moves. The second module explore the centroid heuristic search shortest path algorithm is the newly proposed algorithm and it works by calculating the centroid from the source node to the destination node. Here the destination may change regularly after reach the first destination. The third module shows that implementation in TSP for choosing the shortest path and provide the result analysis. The results are analyzed and proved based on the annova test. This anova test is used to determine and analyze the performance to provide the statistical test report.

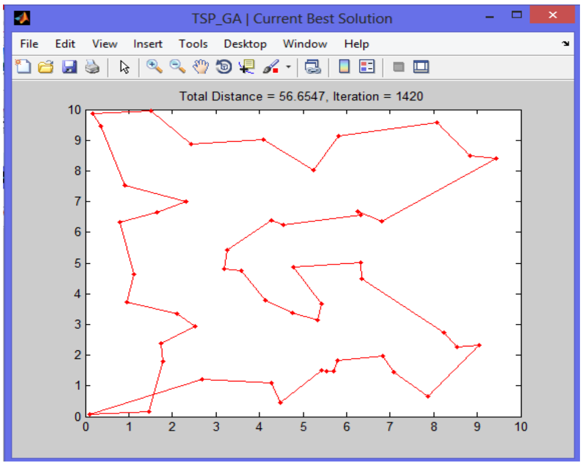

Fig.1 Node exploration model

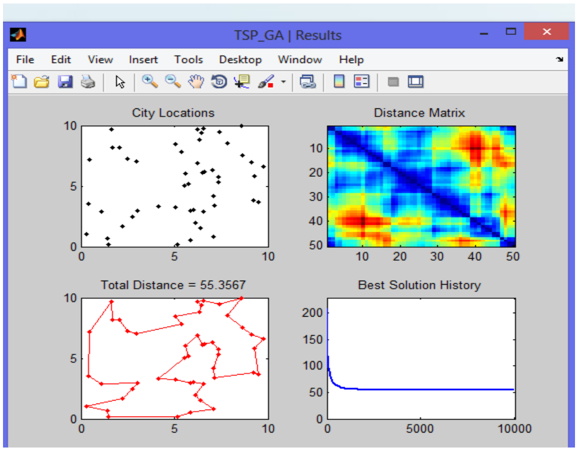

Fig.2 System implementation with performance result

IV. CONCLUSIONS

This proposed approach has been shown to be an efficient approach to path selection process to support the shortest path searches at vehicle environment. Although various efficient method proposed to travel on the shortest path and provide the some other advantages such as time saving, energy consumption and minimum distance. In this paper based on the shortest path concept, we present a new method called Centroid Heuristic search algorithm to have the efficient shortest path for travelers to reach their destination with minimum distance with less time and it requires the minimum number of node exploration for travelling path process. From this technique, centroid with TSP generates the set of required nodes to travel between the starting to destination with less cost for getting the shortest path.

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