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Minimizing Shortest Path Queries without Pre-Computed Speed Information on Road Networks

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Abstract*— *The shortest path problems take place in various applications where the distances connecting merely a few precise pairs of source-destination (SD) nodes on road networks are required. Several competent methods have been planned to pick up the performance in the scattered road information, to execute shortest path explorations on road grids. Our technique is particularly fit for applications with static grid topology but variable curve distances and chosen SD pairs. To process queries, we first propose a Meta-Heuristic Query Technique (MQT) model to compute the distance accurate than earlier methods, which is more flexible and accepted models. The Main advantage of this technique is minimized the number of node exploration, save the time as well the energy for calculating the shortest path between the any two points. Hypothetical examination and general model experiments have been achieved to validate the efficiency of MQT in enlightening the system performance with just a little percentage.

Keywords*— *Meta-heuristic Query, SSSP, SDSP,

I. INTRODUCTION

This document is a template. An electronic copy can be downloaded from the Journal website. For questions on paper guidelines, please contact the journal publications committee as indicated on the journal website. Information about final paper submission is available from the conference website. When we traverse the graph, it takes total travelling cost and the distance covered from source to destination to be minimum is named as shortest path. In the undirected graph, the problem of finding a path between two vertices in a graph is called shortest path problem. While in the case of directed graphs the path should be chosen based on the successive nodes be connected. Some of the shortest path problems such as, single-source shortest path problem, single-destination shortest path problem, all-pairs shortest path problem, To find the minimum cost from a source node to all other destination node in the graph is called the Single Source Shortest Path Problem (SSSP). Single Destination Shortest Path (SDSP) is inverse of the SSSP. (i.e. multiple source to single destination). In the All-Pairs Shortest path problem, consider the pair of vertices as source and destination nodes from where to find the shortest distance from the each source and destination node. Sven Peyer et al [3], the most important algorithms for solving this problems are Dijkstra's algorithm Bellman–Ford algorithm, A*search algorithm, Floyd–Warshall algorithm, Johnson's algorithm, Viterbi algorithm.

The single source shortest path solved with the help of Dijkstra's algorithm and in the real time this algorithm is efficiently used in the road networks. Bellman-Ford algorithm has the positive cycle, and then it is called shortest path in the graph and based on the negative weights, even if no negative cycles are accessible. A* algorithm is the concept of heuristic search where the search process done with good velocity. Examples of this algorithm are Public Transport system, Vehicle Navigation System (to recognize the reasonable route set). Yuanyuan Pan et al [4], the main characteristics of VANET are as follows they are Mobility, communication environment, Post-crash Notification, Collision Warning, Unlimited Battery Power and Storage, Traffic Vigilance.Highly dynamic topology.The authors in [3] deliberate around the several attacks founded on their classification. Created on the kind of communication either V2I or V2V, Some of the applications of VANET are Safety oriented, Commercial oriented, Convenience oriented and Productive Applications.

II. RELATED WORK

An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it. David López et al [1], to find the shortest path for multimodal network. Multimodal network means transportation of goods under single contract. Their main theme is developing an Advanced Traveller Information System. So, they merge the use of real time information and frequencies for a multimodal transport network.

They used four main techniques they are (a) Pre compute of all possible paths, (b) Build Abstract graph and Relevant graph, (c) Topological paths are updated simultaneously, (d) final one is builds a transport network using database with hierarchical structure. In the existing approach, the transfer node and transfer arc is not mentioned earlier so the network size is lower. In order to find the optimum time from among all the paths the authors develop the Time-Dependent Intermodal Least Time Path (TDILTP) algorithm. It finds the shortest path with minimum time required.

And also reduced the size of the data structures by pre-processing all the possible modal transfers for any given time interval. This algorithm examines for the set of stops that are nearer to the origin, and then searches for the list of

possible paths and only those whose ends at a stop near to the destination are selected. Using this information, shortest paths are found with the k-shortest paths algorithm. If any obstacles are present in between the stop then this techniques is not possible. Using the Meta-heuristic algorithm, we can find the shortest path with less execution time. In order to traverse the nodes step by step, we can visit the nodes from source as well as from the destination at the same time. And it also reduces the search time too.

Wei YIN et al [2], In this paper Astar algorithm is used in the vehicle navigation systems. It has a better performance such as computing speed and veracity in the large scale road network. Iterative choice of next node is a key component of the algorithm because a new path which contains those nodes must be reasonable and different from the others in the paths set. They can divide the choice of algorithm into four layers of decision making Level A generate a restricted area. Level B Eliminate forbidden flows. Level C Find a different path, Level D Search the next link with high contribution to reach the target. The multipath astar based algorithm is prominent in the independence among chosen paths and the number of iterations.

The optimality of the chosen paths is lower than the k-dijkstra one. The drawback of this algorithm is that the iteration of next node may create some invalid, inefficient or overlapping paths. The output of one iteration is compared and another and then form the desired path. When add the heuristic search to present algorithm will reduce the number of iterative comparison.

III. PROBLEM STATEMENT

A. Shortest Path Search Problem

The entire document should be in Times New Roman or Times font. Type 3 fonts must not be used. Other font types may be used if needed for special purposes. The existing system contains the heuristic search to find the least cost path which mean that covers the less distance to travel from particular pair of nodes such as source and destination node. This type of process needs the maximum query processing and it need some time on the travelling path.

B. Query Processing on Shortest Path Problem

The query processing on shortest path problem has two main phases. The first phase of this module leads to analyses the path, source and destination. The second phase analyses and calculate the number of node exploration to be required to move from one step to another step on travelling path. The aim of this query processing to reduce the maximum amount of node explored which provide and the way to travel on shortest distance. This is expressed as, T=D. when we travel with less time than it is equal to the shortest distance Where T and D represents Time and Distance.

C. Norm in Shortest Path Problem

The aim of norm in shortest path heuristic problem to provide the travelling moves based on the minimum query processing and it offer the advantages such as least amount of node assessment ,it save the travelling time and it is used to cover the smaller distance with less energy.

IV. SYSTEM MODEL AND ASSUMPTION

Fig.1. Illustrates the system model defined in this paper. It consists of six main components: the input value(m*n), Source Node, Display the problem set, Midpoint, Number of node explored and Distance , Goal Node. Following Midpoint concept, we assume that Grid contains set of cells. Each cell is considered as node, initially the source node is fixed and then destination node is allocated. Second step is that they calculate the midpoint value using the equidistance concept.

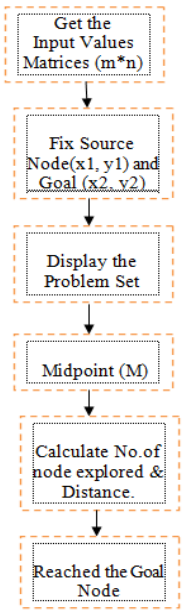


Fig.1.System Model

Then, it traversed from source node to midpoint node. From that node it can easily found the destination. This is known as Meta-heuristic Query Technique. Using this method we can minimize the time and also get the optimal path. Another advantage is Energy saving.

To smooth the presentation of our algorithm and performance analysis, we concisely define the A* search algorithm. A* search beginning with the source node, it traversed the lowest cost nodes and keep maintaining, this is known as open set or fringe. In this algorithm if node has lower cost means then that node contain higher priority value. So that nodes are updated accordingly, and these neighbours are added to the column. The same process is continues until a goal node has a smaller value when compared with the any other nodes in the list.

A. Inefficiency of A in the Incidence of Hurdle*

To consider an environment in which the heuristic search algorithm provides the not good result, this problem contains the two environments shown in Figure.2 (a). Analysing the shortest path (with query processing), (b). Analyse the shortest path with midpoint (with reduced query processing).

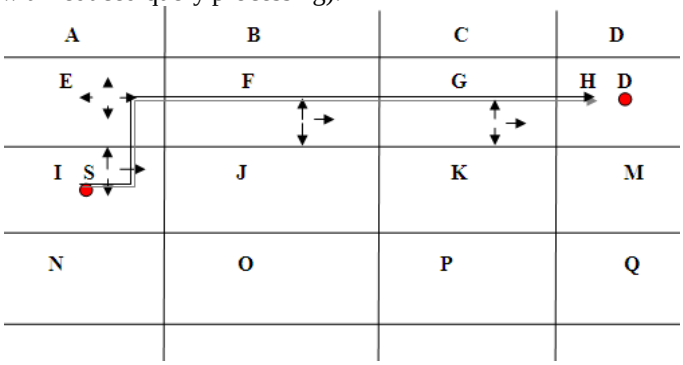


Fig.2 (a) Analyse the shortest path (with query processing)

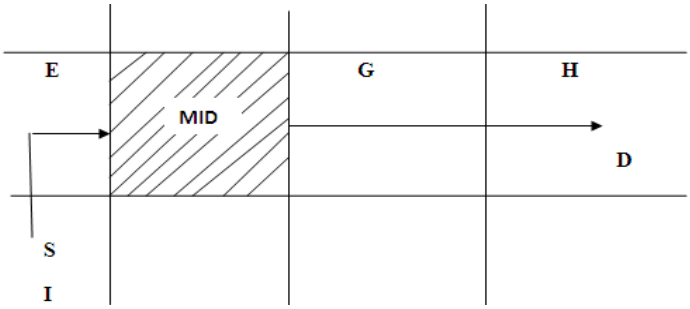


Fig.2 (b). Analyse shortest path with midpoint (reduced query processing)

The first figure shows the path fixing and the moves with node exploration and the second the figure shows the travelling path and this is done by calculating the average which leads to reduce the node consideration. This is the way to improve the traditional heuristic search algorithm.

B. Principle of A Midpoint*

Fix the source and destination on the road network and analyses the path in the network model. Choose the shortest path from the analysed path result. Then make a travel from source to destination based on the shortest path goal when make a moves leads to node exploration to attain the shortest path

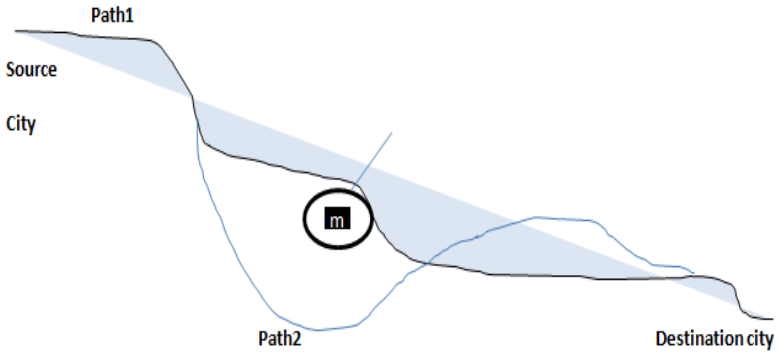


Fig.3.Concept of Algorithm for A* Midpoint with Query

The travel done by make moves from one cell to another as step by step process in the traditional A* search algorithm. With the help of midpoint concept reduce the query processing by calculating the mid for pair of source node to destination node and to reach the mid by dividing the total moves as partition.

Consider the above figure which have S, D and MID. Where S represent source, D represent destination and MID represent middle level. The shaded region in the figure shows the shortest path. In this network there many possible way to reach the goal each route nodes and link to connect with another nodes, but in this case we have to choose the optimal path. So based on the Borderline Heuristic search the user first find the norm for the set of the paths then they have to analyse the best path from that sets. The optimal path should follow the three main parameter such as Less Time, Minimum Distance, and Consumption less amount of energy.

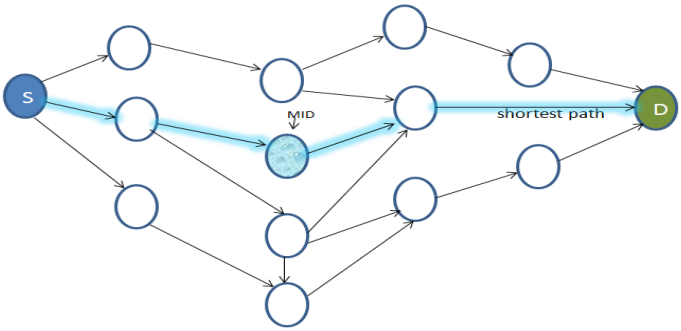
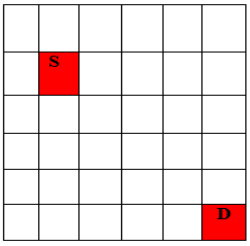


Fig.4. Network Model to Reach the Source and Destination Based on Borderline Heuristic Search

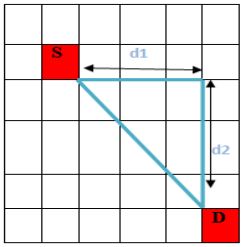
V. PROPOSED WORK

To improve the effectiveness in A* Search Algorithm and reduce the overheads for performing the shortest path search we proposed the Metaheuristic Query Technique.For the proof of searched algorithms, Standard Office Environment was used. The diagram was created by an A*search on the basis of Metaheuristic Query Technique (MQT). The A* Midpoint approach is applied on the shortest path travelling. These are the basic assumptions for the experiments. Different types of shortest path algorithms are analysed to get the efficient shortest path on the roadways environment. Execution time, Number of nodes explored and totaldistance can be calculated for traversed path and then evaluated.

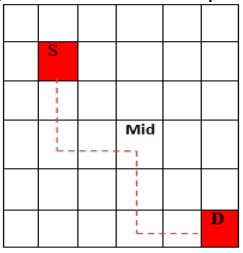
For the appropriate verification of algorithm mainly based on the execution time by calculating the performance with 100 times repetition of execution where performed. The mean, standard deviation, Residual and Regression from all repetitions result was calculated. In our problem the mean is used to find the range of the value or quantities of the input for the particular set of samples. Standard deviation is mainly calculated to find the amount of distribution occurred between the different set of source and destination. Regression analysis is an arithmetical method for assessing the relations between nodes. It comprises various procedures for exhibiting and evaluating numerous nodes, when the concentration is on the connection between a dependent node and one or more independent nodes. Residual process is performed at the end of a process. It measures the amount of quantity left over at the final state. In this manner, we examine the shortest path was reflected with the help of Metaheuristic Query technique.



(a)The Problem Set



(b) Distance between points



(c) Midpoint Value

Fig.5. An example of processing the shortest path using MQT

Here, the steps are used to find the optimal path. In the First step, define the problem set and get the origin(S) and destination (D) as shown in (Fig.5a). Then, it displayed in matrix form in that S and D have the value 1, other cells are represented by zero is shown below.

$$\text{Problem Set}=\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Using the Meta heuristic query technique, we could get information by discovering and knowing objects easily. The length of the distance d measured by using the Pythagorean Theorem, where, distance (D) = d1+d2. (Fig.5b) display that value of d1=4 and the value of d2=4. According to this theorem, we have to squaring on both sides.

We get, D^2=4^2+4^2=16+16=32; D=sqrt (32). D=5.65. Now plot that value and finally calculate the total length of the SD. Formerly, itcomputes the midpoint between the starting and end point. The main principle of midpoint is to calculate the middle point of the line. It is also called as "vertex centroid". It means a point wherever the lines meet and that may be considered as the centre point. Each line has two points, by using these two points we can draw and finding the midpoint of the line.

Fig.5(c) calculate the midpoint value,the midpoint is well-defined as the endpoint coordinates average. So, M1=(X1+X2)/2 and M2= (Y1+Y2)/2. Where X1=2, X2=6 and Y1=2, Y2=6. Now, the midpoint is plotted in (4, 4). Similarly, we can find the shortest path for different source and destination. The main advantage of this technique is to improve communication time significantly.

VI. CONCLUSIONS

This paper proposed a Meta-Heuristic Query Technique. Different from the existing A* Search Algorithm, this query consider two nodes, source and destination (goal), successively on the road network. The Meta-heuristic queries have been handled, and they are running according to their optional paths. To further boost the processing time, the bidirectional method is used to minimize the total path cost. The results on datasets show that the MQT query algorithms significantly reduced the vehicle travel times from both worldwide and distinct perceptions.

REFERENCES

[1] David López, Angelica Lozano, "Techniques in Multimodal Shortest Path in Public Transport Systems", EWGT 2014, 886 – 894.

[2] Wei Yin, Xiaoguang Yang, "A Totally Astar-based Multi-path Algorithm for the Recognition of Reasonable Route Sets in Vehicle Navigation Systems", 13th COTA International Conference of Transportation Professionals (CICTP 2013), 1069 – 1078.

[3] Sven Peyer, Dieter Rautenbach, Jens Vygen,"A generalization of Dijkstra's shortest path algorithm with applications to VLSI routing Journal of Discrete Algorithms, Volume 7, Issue 4, December 2009, 377-390.

[4] Yuanyuan Pan, Jianqing Li, "Cooperative pseudonym change scheme based on the number of neighbours in VANETs", Journal of Network and Computer Applications Volume 36, Issue 6, November 2013, 1599–1609.

