INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATIONS AND ROBOTICS
ISSN 2320-7345

OPTIMAL ROUTE QUERIES WITH MOSQUITO SWARM ALGORITHM IN THE ROAD NETWORKS

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Abstract

Optimal routes between two points can be calculated using several methods. The existing method using mainly two algorithms namely Backward search algorithm and forward search algorithm. These two algorithms consider the number of intermediate points and partial order constraints. Along with the staring and destination location some other locations we have to visit in between are known as intermediate points. The partial order constraints means there is no sequential order for visiting the route but the constraint like one location should be visited before other. Thus the locations can be included before the first point, in between both and after the second point. Many varieties of routes are possible to find the optimal route. The Forward Search algorithm performs well. The proposed method uses Mosquito Swarm Algorithm (MSA) for finding the optimal route by considering some other constraints and qualities. The host seeking behaviour of the mosquitoes are used in this approach and this will produce the theoretical optimum solution. Traffic and time constraints are considered in the proposed system. These two constraints will improve the performance of proposed method.

Keywords: Query processing, Optimal route queries, Spatial search, Categorical information, Constraints

1. Introduction

Route finding have greater importance nowadays. The route queries find out the routes from the spatial data with categorical information stored in the database. The optimal route queries produce the optimal route in the road network from the given set of information. The users have to provide query starting point and set of constraints [1], [2] along with the database. The database which contain the categorical information about the road map or the place where the optimal route has to find. Several methods are used for the processing of route queries in the road network. The some of the methods consider the travelling constraints which are either total order or partial order and some other without any specification. The user given constraints may be either partial order or total order. Optimal route query processing produces all the possible routes and then optimizes these possible routes. For that, route queries operate on the spatial data with categorical information [3], [4] and find the best solution. The final result will be the optimal route from the given queries.

The existing solution will find the optimal route from the starting point, destination point, and a number of intermediate points. For that two algorithms are user Backward Search algorithm (BS) and Forward Search algorithm (FS)[1]. These two algorithms consider the partial order constraints. For example the constraint is hotel must be visited before mall. This doesn't mean that the mall should visit just after the hotel.

That is a number of other locations can be visited in between the hotel and mall. Even then hotel must be visited before mall. The Backward Search algorithm finds the optimal route from destination to the starting point. The Forward Search algorithm finds the path from starting to destination and then backtracks to starting point by using Backward Search concept for find the best route.

The proposed system uses the Mosquito Swarm algorithm [5]. This is a biologically inspired algorithm from the host behaviour of the mosquitoes. Mosquitoes have sensors designed to track their prey. Mainly two types of sensors; they are chemical sensors and heat sensors [6]. Similarly here the concept is implemented as the positions and the quality of the travelling routes are recorded. These recorded values are used to find out the best path later. All the possible routes are calculated with their distance and the temperature also recorded. Then the further optimal route finding is based on the recorded values.

The paper is organized as follows. Section 2 presents the details of the proposed method. Section 3 gives the results. Finally, in section 4 conclude the paper.

2. Proposed Method

This paper investigates the problem of optimal route query processing. Existing solutions consists of redundant and complex computations. Hence, an alternate solution is proposed, Mosquito Swarm Algorithm (MSA). The solution is the comparison of the proposed method with backward and forward search and shows the best performance. The proposed method reduces the complexity of the existing techniques.

2.1 Mosquito Swarm Algorithm

Mosquito Swarm Algorithm (MSA)[5] can be used as an alternative for finding the optimal route queries. The positions and the quality of the travelling routes are recorded by using the MSA. These recorded values and qualities are used to find out the best path later. All the possible routes are calculated with their distance and the qualities such as time and traffic which is recorded by the system. These recorded values are used to find better optimal routes. That is considering the quality of the routes.

The following is the Mosquito Swarm Algorithm (MSA)[5]

Input: number of mosquitoes (n)

1. Initialize a Mosquito Population with Chemical Sensors (CS) and Heat Sensors (HS).
2. Generating the initial locations (x) of the mosquitoes (n)
3. Initialize the temperature (t) and Maximum Temperature (T).
4. Repeat (total of mosquitoes)
5. Repeat (maximum temperature)
6. Generate new solutions by adjusting the Heats (HS) and updating the locations (x)
7. Verify and assign the feasibility of the solution by the Chemical Sensor (CS)
8. Select the best solution (S).
9. While t<T
10. While (n total of mosquitoes)
11. Report the best solution

Mosquito Swarm Algorithm is an optimization algorithm for dealing with problems in which a best solution can be represented as a point or surface in a plane. The users (mosquitoes) then move through the space and are evaluated according to the distance recorded at each position by the sensors. Finally all the optimal sub routes forms the best route. The traffic at every point and the time bound to reach at each position will be sensed by each users (mosquitoes) and these two qualities will be considered for selecting the best route.

2.2 Backward Search and Forward Search algorithms

The existing techniques for finding the optimal routes are Backward Search Algorithm (BS) and the Forward Search Algorithm (FS). It calculates the optimal route from destination to the starting point. Two types of

backward search algorithms are implemented which are Simple Backward Search (SBS) algorithm and Batch Backward Search (BBS) algorithm[1]. In the SBS algorithm each location to be visited is processed individually. That is point by point processing is done to calculate the optimal routes. In the Backward Search approach the algorithm traces the location of each point and computes a route by repeatedly connecting the last location to the nearest point. Similarly the routes are calculated for all the points and its locations are extracted in reverse manner. That is the distance between the points from destination to source points is calculated. In this, after finding all the estimated paths the minimum distance is extracted between the points. Based on the minimum distance points the shortest route is found between the routes and the points are joined using backward join algorithm. The SBS fully depends on the quality of the greedy bound. Hence Batch Backward Search (BBS) algorithm which processes the locations to be visited as clusters according to some criteria. The demerits of SBS can be eliminated by using BBS.

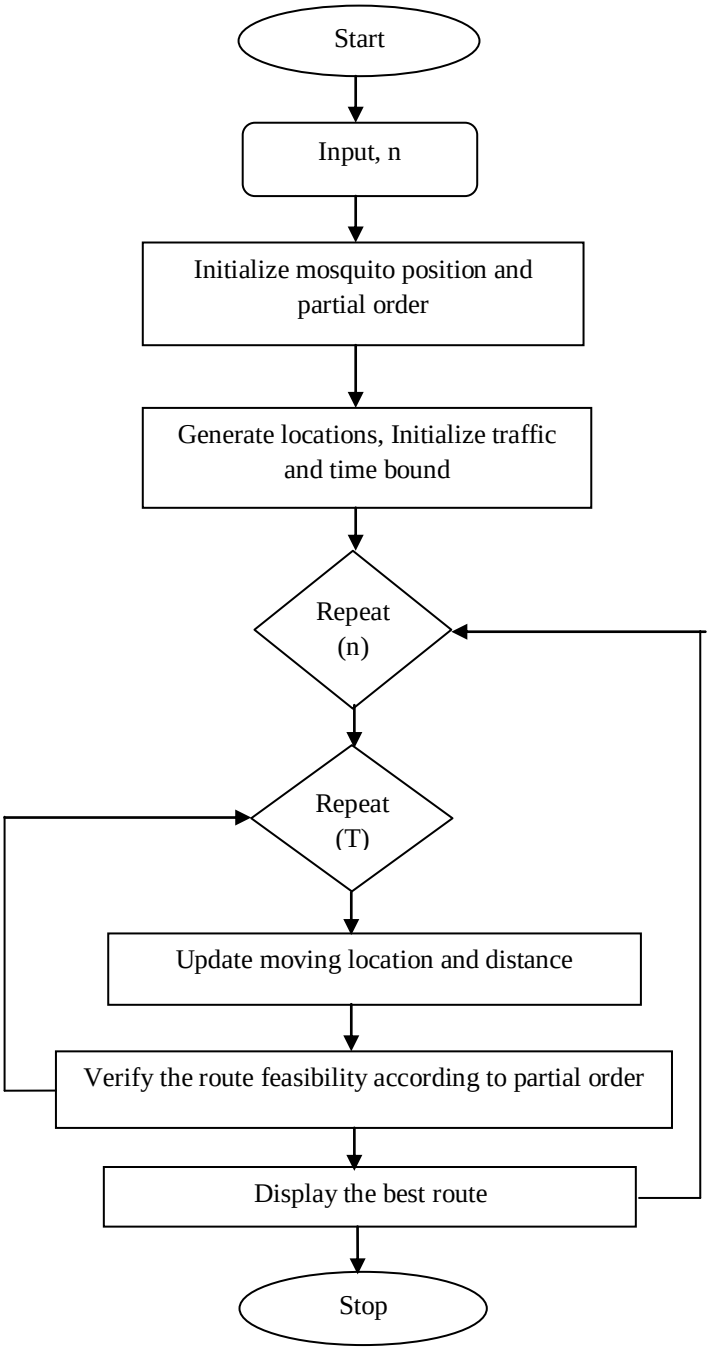

Figure 1: Flow chart of proposed system

The other approach is Forward Search algorithm (FS). It calculates the optimal route from starting point to the destination point. First of all it calculates the optimal route directly and then backtracks to the starting point by using Backward Search Algorithm. Hence it is more effective than the backward approaches. Two types of Forward Search algorithms are Simple Forward Search (SFS) algorithm and Batch Forward Search (BFS) algorithm. In this forward approach the algorithm traces the location of each point and computes a route by repeatedly connecting the current location to the nearest point. Similarly the routes are calculated for all the points and its locations are extracted. Based on the location latitude and longitude position the distance is calculated. After that finding all the estimated paths the minimum distance is extracted between the points. Based on the minimum distance points the shortest route is found between the routes and the points are joined using forward join algorithm. Finally this will obtain an optimal route from the forward search algorithm. The SFS fully depends on the quality of the greedy bound. Hence Batch Forward Search (BFS) algorithm which processes the locations to be visited as clusters according to some criteria. The demerits of SFS can be eliminated by using BFS. More number of locations can be considered using these clustering techniques.

3. Results

The algorithm traces the location of each point and computes all possible routes by repeatedly connecting the current location to the nearest point. Similarly the routes are calculated for all the points. Then the algorithm records the distance, time and traffic. From these the best route is calculated. By using these techniques the optimality can be guaranteed.

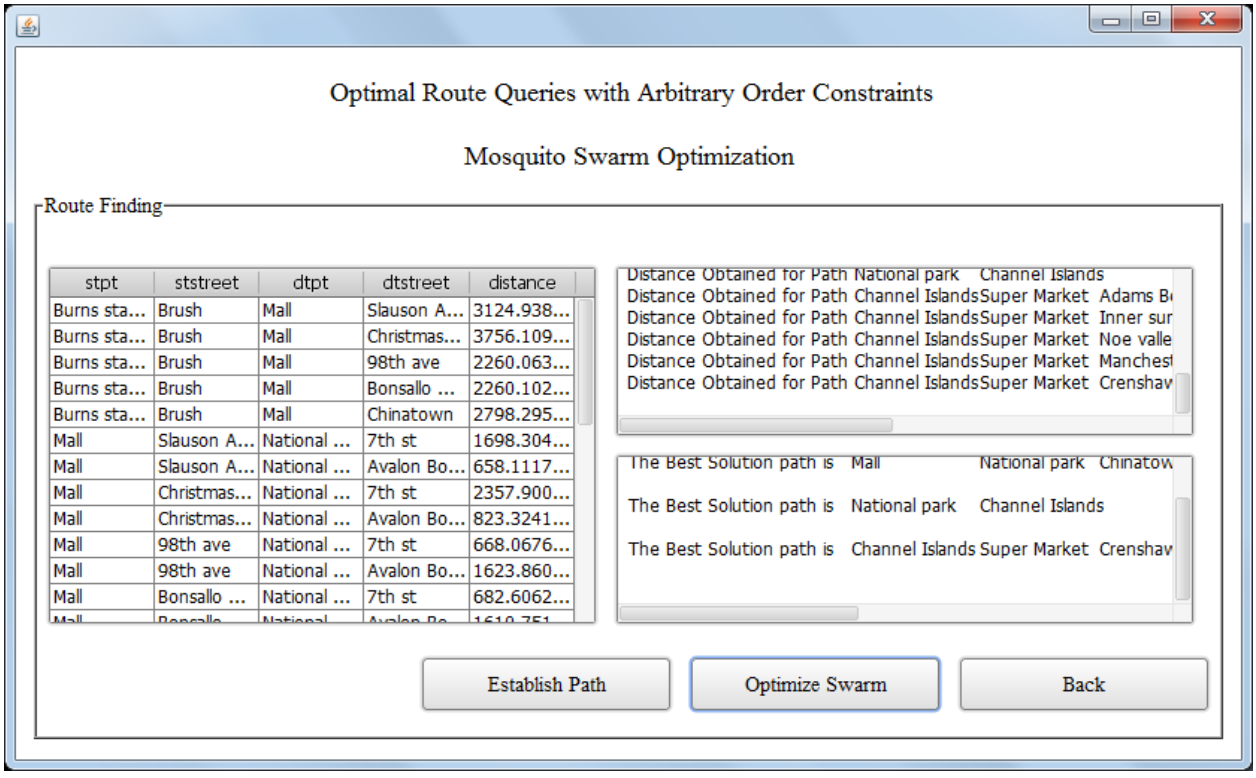

Figure 2: Resulting routes and optimal route

In this work real dataset is used for implementation. The dataset consists of the information about the categories to be visited, street, latitude and longitude. Here mainly three algorithms are used they are Backward Search algorithm (BS), Forward Search algorithm (FS)[1] and Mosquito Swarm Algorithm (MSA)[5]. The performance of these three algorithms is computed based on total running time. The running time will be increased with respect to

the number of categories visited. The forward search algorithm also makes use of some features of backward search algorithm, this leads to decrease in running time when compared with backward search algorithm. The running time of these three algorithms varies according to the number of locations to be visited. MSA considers the quality of the routes and finds the best route.

4. Conclusion

Existing solutions of optimal route query processing are consisting of redundant and complex computations. Earlier works on optimal route computations mainly focused on Backward Search (BS) and Forward Search (FS). The new approach for route query uses the different approach but in a same way. The first, namely BS, resembles the R-LORD; this will find the route from destination to the starting point. The second algorithm, FS resembles the greedy approach. And which uses some concept of BS. The solution BFS that combines merits from both backward and forward search achieves the best performance. The Mosquito Swarm Algorithm (MSA) is also an effective alternative to the optimal route finding. The algorithm sensors the traffic, time bound constraints and finds the route according to the sensed values along with the shortest distance and partial order constraints. The route obtained will be the best route with all the best qualities of the route query.

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A Brief Author Biography

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