SHORTEST PATH: A DYNAMIC AND EXTENSIBLE INDICATOR FOR GEOGRAPHICAL SEARCH ON ROAD NETWORK

A PROJECT REPORT

*Submitted by*

**AISHWARYA R (111712104002)**

**HARI PRIYA P (111712104032)**

*In partial fulfilment for the award of the degree*

*of*

BACHELOR OF ENGINEERING

IN

**COMPUTER SCEINCE AND ENGINEERING**

RMK ENGINEERING COLLEGE, KAVARAIPETTAI

ANNA UNIVERSITY: CHENNAI 600 025

**APRIL 2016**

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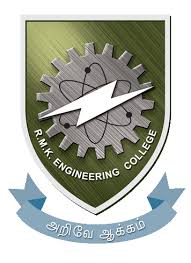
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**BONAFIDE CERTIFICATE**

Certified that this project report “SHORTEST PATH: A DYNAMIC AND EXTENSIBLE INDICATOR FOR GEOGRAPHICAL SEARCH ON ROAD NETWORK” is the bonafide work of “AISHWARYA R (111712104002), HARI PRIYA P (111712104032)” who carried out the project work under my supervision.

**SIGNATURE SIGNATURE**

**Mr.Dr.SHUNMUGANATHAN K L, Ms.JASMINE GILDA A,M.E.,**

**M.E.,M.S.,FIE,PH.D.**

**HEAD OF THE DEPARTMENT SUPERVISOR**

ASSISTANT PROFESSOR

Computer Science And Engineering Computer Science And Engineering

R.M.K. Engineering College R.M.K. Engineering College

R.S.M. Nagar, Kavaraipettai R.S.M. Nagar, Kavaraipettai

Chennai-601 206 Chennai-601 206

**CERTIFICATE OF EVALUATION**

**R.M.K. ENGINEERING COLLEGE**

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**VIII SEMESTER**

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| **NAME OF THE CANDIDATES** | **PROJECT TITLE** | **NAME OF THE SUPERVISOR** |
| AISHWARYA R  (111712104002) | SHORTEST PATH: A DYNAMIC AND EXTENSIBLE INDICATOR FOR GEOGRAPHICAL SEARCH ON ROAD NETWORK | Ms.A.JASMINE GILDA,M.E., |
| HARIPRIYA P  (111712104032) |

The report of the project work submitted by above students in partial fulfillment for the degree of **BACHELOR OF ENGINEERING** in **COMPUTER SCIENCE AND ENGINEERING** branch of Anna University were evaluated and confirmed.

The university viva-voce is held on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**INTERNAL EXAMINER EXTERNAL EXAMINER**

**ACKNOWLEDGEMENT**

We wish to express our sincere gratitude to the following persons with whose help and encouragement we have completed our project successfully.

First and foremost, we would like to express our deep gratitude to our

Honourable Founder and **Chairman Mr.R.S.Munirathinam** and **Vice Chairman Mr.R.M.Kishore** for their kind encouragement and blessings.

Our deepest gratitude and thanks to our Respected **Director Mr.R.Jothi Naidu** and **Principal Dr. Elwin Chandra Monie** who have always helped us whenever we approached them during the course of our project.

We wish to express our sincere thanks to our Respected **Head of the Department** of Computer Science and Engineering **Mr.Dr.SHUNMUGANATHAN K L** who has been a guiding force and constant source of inspiration to us.

Our sincere gratitude to our **Project** **Guide, Ms.JASMINE** **GILDA A,** **Assistant Professor** for having extended his immense support in doing this work, without which the project would not have been a success.

Our Special thanks to our **Project Coordinator, Dr.Sethukarasi T,** **Professor** for having spent their time with us and help us to finish the project successfully.

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**ABSTRACT**

This project deals with the optimization of vehicle routing. Since the total traveling time is not always effective due to road condition and some other obstacles, the objective regarded in this project comprises not only total traveling distance, but also the total traveling time. We propose Graph Search Algorithm (GSA) to solve the problem. Path query, k nearest neighbor (kNN) query, and keyword-based kNN query, are widely used in location-based systems (LBS) which are useful to estimate in real time. The basis for this framework is an assembly-based method to calculate the shortest-path distances between two vertices (Based on Road Condition and Distance). Based on the assembly-based method, efficient search algorithms (Fuzzy Logic and Graph Search Algorithm) are used to answer k nearest neighbor (kNN) queries and keyword-based kNN queries are developed. Based on the road conditions and traffic conditions we develop an optimum value, based on which we try to find not only the shortest path but also the optimum path which helps in real time scenarios especially in road networks. Along with distance, we take this optimum value to find the best route in road networks.

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**CHAPTER - 1**

**INTRODUCTION**

**1.1 OBJECTIVE OF THE PROJECT:**

The main Objective of this project is find the shortest distance based on Road condition and Distance of all the possible routes.

**1.2 MOTIVATION OF THE PROJECT:**

The multi-depot vehicle routing problem is one of the common optimization problems in the logistics area. In a real-world environment, drivers choose the shortest route to reach a destination since they assume that it should take the shortest time to travel the shortest route. However, if some events such as traffic congestions, accidents happen in the shortest route, the traveling time spent on this route can be greater than that on the longer route. Thus, this Project considers not only the cost due to the total traveling distance, but also the cost due to the total traveling time, as two objectives. We propose a stochastic search technique called FLGA to solve the problem. Based on the promising computational results obtained in this Project, the proposed model and technique will be effective for industries to be applied in solving real-world problems.

* 1. **OVERVIEW OF THE PROJECT:**

This Project deals with the optimization of vehicle routing problem in which multiple depots, multiple customers, and multiple products are considered. Since the total traveling time is not always restrictive as a time

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window constraint, the objective regarded in this Project comprises not only the cost due to the total traveling distance, but also the cost due to the total traveling time. We propose to use a stochastic search technique called fuzzy logic guided

genetic algorithms (FLGA) to solve the problem. The role of fuzzy logic is to dynamically adjust the crossover rate and mutation rate after ten consecutive generations. In order to demonstrate the effectiveness of FLGA, a number of

benchmark problems are used to examine its search performance. Also, several search methods, branch and bound, standard GA (i.e., without the guide of fuzzy logic), simulated annealing, and tabu search, are adopted to compare with FLGA in randomly generated data sets. Simulation results show that FLGA outperforms other search methods in all of three various scenarios.

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**CHAPTER – 2**

**LITERATURE SURVEY**

**2.1 A New Spatial Object Search Framework for Road Networks. :**

In this paper, we present a new system framework called ROAD for spatial object search on road networks. ROAD is extensible to diverse object types and efficient for processing various location-dependent spatial queries (LDSQs), as it maintains objects separately from a given network and adopts an effective search space pruning technique. Based on our analysis on the two essential operations for LDSQ processing, namely, network traversal and object lookup, ROAD organizes a large road network as a hierarchy of interconnected regional sub networks (called Rnets). Each Rnet is augmented with

1) shortcuts and

2) object abstracts

to accelerate network traversals and provide quick object lookups, respectively.

**2.2 A System for Distributed Spatial Group Keyword Search on Road Networks. :**

Query (e.g., shortest path) on road networks has been extensively studied. Although most of the existing query processing approaches is designed for centralized environments, there is a growing need to handle queries on road networks in distributed environments due to the increasing query workload and the challenge of querying large networks. In this demonstration, we showcase a distributed system called DISKs (DIstributed Spatial Keyword search) that is capable of efficiently supporting spatial group keyword search (SGKS) on road

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networks. Given a group of keywords X and a distance r, an SGKS returns

locations on a road network, such that for each returned location p, there exists a set of nodes (on the road network), which are located within a network distance r from p and collectively contains X.

**2.3 G-Tree: An Efficient Index for kNN Search on Road Networks. :**

In this paper we study the problem of kNN search on road networks. Given a query location and a set of candidate objects in a road network, the kNN search finds the k nearest objects to the query location. To address this problem, we propose a balanced search tree index, called G-tree. The G-tree of a road network is constructed by recursively partitioning the road network into sub-networks and each G-tree node corresponds to a sub-network. Inspired by classical kNN search on metric space, we introduce a best-first search algorithm on road networks, and propose an elaborately designed assembly-based method to efficiently compute the minimum distance from a G-tree node to the query location

**2.4 Processing of Continuous Location-Based Range Queries on Moving Objects in Road Networks. :**

With the proliferation of mobile devices, an increasing number of urban users subscribe to location-based services. This trend has led to significant research interest in techniques that address two fundamental requirements: road network-based distance computation and the capability to process moving objects as points of interests. However, there exist few techniques that support both requirements simultaneously. To address these challenges, we propose a

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novel approach to process continuous range queries. We build on our previous work of an infrastructure that supports location-based snapshot queries on

MOVing objects in road Networks (MOVNet).

**2.5 Top-K Spatial Keyword Queries on Road Networks. :**

With the popularization of GPS-enabled devices there is an increasing interest for location-based queries. In this context, one interesting problem is processing top-*k* spatial keyword queries. Given a set of objects with a textual description (e.g., menu of a restaurant), a query location (latitude and longitude), and a set of query keywords, a top-*k* spatial keyword query returns the *k* best objects ranked in terms of both distance to the query location and textual relevance to the query keywords. So far, the research on this problem has assumed Euclidean space.

**2.6 Processing of Continuous Location based Range Queries on Moving Objects in Road Networks. :**

With the proliferation of mobile devices, an increasing number of urban users subscribe to location-based services. This trend has led to significant research interest in techniques that address two fundamental requirements: road network-based distance computation and the capability to process moving objects as points of interests. However, there exist few techniques that support both requirements simultaneously. To address these challenges, we propose a novel approach to process continuous range queries. We build on our previous work of an infrastructure that supports location-based snapshot queries on MOVing objects in road Networks (MOVNet). We introduce several significant

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features to enable continuous queries. The dual index structure that we proposed for MOVNet has been appropriately modified. We further appoint a number of connecting vertices in each cell and pre compute the distances among them to expedite query processing. Most importantly, to alleviate the effects of frequent object updates, we introduce a Shortest-Distance-based Tree (SD-Tree). We illustrate that the network connectivity and distance information can be preserved and reused by the SD-Tree when the query point location is updated; hence, reducing the continuous query update cost. Our experimental results demonstrate that our method yields excellent performance with a very large number of moving objects.

**2.7 An Efficient Path Computation Model For Hierarchically Structured Topographical Road Maps. :**

Computing the shortest path in real road networks is of great interest to us. In fact, we are dealing with such routing problems almost every day. We want to get to a desired destination through the fastest way which may be the shortest travel time/distance, or we may balance among several influencing factors such as time, security, and toll charges. In network theory, this corresponds to the shortest path problem, and different influencing factors will only affect the form of arc weights based on user’s preference. The most classical shortest path algorithm is the Dijkstra algorithm (Dijkstra, 1959) with a complexity of O(|E|+|V|log|V|), where |V| is the number of vertices and |E| is the number of arcs. Though Dijkstra algorithm computes the optimal solution in a theoretical sense, it is often far too slow for real-time route guidance applications.

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**2.8 Voronoi-Based K Nearest Neighbor Search For Spatial Network Databases. :**

A frequent type of query in spatial networks (e.g., road networks) is to find the K nearest neighbors (KNN) of a given query object. With these networks, the distances between objects depend on their network connectivity and it is computationally expensive to compute the distances (e.g., shortest paths) between objects. In this paper, we propose a novel approach to efficiently and accurately evaluate KNN queries in spatial network databases using first order Voronoi diagram. This approach is based on partitioning a large network to small Voronoi regions, and then pre-computing distances both within and across the regions. By localizing the pre computation within the regions, we save on both storage and computation and by performing across-the-network computation for only the border points of the neighboring regions, we avoid global pre-computation between every node-pair. Our empirical experiments with several real-world data sets show that our proposed solution outperforms approaches that are based on on-line distance computation by up to one order of magnitude, and provides a factor of four improvements in the selectivity of the filter step as compared to the index-based approaches.

**2.9 Analysis of Multilevel Graph Partitioning. :**

Recently, a number of researchers have investigated a class of algorithms that are based on multilevel graph partitioning that have moderate computational complexity, and provide excellent graph partitions. However, there exists little theoretical analysis that could explain the ability of multilevel algorithms to produce good partitions. In this paper we present such an analysis.

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We show under certain reasonable assumptions that even if no refinement is used in the uncoarsening phase, a good bisection of the coarser graph is worse than a good bisection of the finer graph by at most a small factor. We also show that for planar graphs, the size of a good vertex-separator of the coarse graph projected to the finer graph (without performing refinement in the uncoarsening phase) is higher than the size of a good vertex-separator of the finer graph by at most a small factor.

* 1. **Hierarchical Encoded Path Views For Path Query Processing: An Optimal Model And Its Performance Evaluation.**

Efficient path query processing is a key requirement for advanced database applications including GIS (Geographic Information Systems) and ITS (Intelligent Transportation Systems). We study the problem in the context of automobile navigation systems where a large number of path requests can be submitted over the transportation network within a short period of time. To guarantee efficient response for path queries, we employ a path view materialization strategy for pre computing the best paths. We tackle the following three issues: memory-resident solutions quickly exceed current computer storage capacity for networks of thousands of nodes, disk based solutions have been found inefficient to meet the stringent performance requirements, and path views become too costly to update for large graphs. We propose the HEP V (Hierarchical Encoded Path View) approach that addresses these problems while guaranteeing the optimality of path retrieval. Our experimental results reveal that HEP V is more efficient than previously known path finding approaches.