A Survey on Shortest path routing algorithm for roadmap applications

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ABSTRACT

Many interesting route planning problems can be solved by computing shortest paths in a suitably modelled and weighted graph by representing a transportation network. Such networks are naturally road networks or time table networks of public transportation. For large networks, the classical algorithm used to compute shortest paths is too slow. And therefore, faster algorithms have been developed in recent years. These new algorithms have in common that they use precipitation and store auxiliary data to speedup subsequent shortest-path queries. A comparison was done by implementing three shortest path finding algorithms such as Particle swarm optimization, Dijkstra's Algorithm and Rapidly Exploring Roadmap Algorithm. Finally, the best shortest Path routing algorithm is to be found based on the results of the execution time.

I. INTRODUCTION

The network is defined as a connection of two or more computers together with the ability to communicate with each other. Computers on a network are called as nodes and network computer devices that originate route and terminate the data are called Network nodes. Computers and devices that allocate resources for a network are called servers. Computing shortest paths and distances in graphs is a fundamental and ubiquitous problem in discrete optimization and network analysis. Routing is the process of selecting a path in network traffic and it will be between or across multiple networks. The routing algorithm is a part of the network layer software conscientious for deciding which output line an incoming packet should be transmitted on. Routing Algorithm can be categorized as Adoptive and Non-adoptive routing Algorithm.

An Algorithm in which the network path can change their routing ways according to their traffic in network topology is called Adaptive algorithm. It is having a dynamic routing table in which it sends data over a network .Some categories of adaptive routing algorithm are Distance vector routing algorithm, Link state routing algorithm, and Distributed routing algorithm. This procedure is sometimes called Dynamic Routing.

An Algorithm in which it follows a static routing table for the data to allow transmission above the network is called Non-adoptive algorithm.This algorithm does not adjust with the current traffic and network topology. Some categories of Non-Adoptive routing algorithm are shortest path routing, flooding algorithm, and Random walk.This procedure is sometimes called **Static Routing**. The basic concept of a routing algorithm is to model the specific problem in a suitable graph and to compute the shortest path to solve it.

II. LITERATURE STUDY

The network is defined as a group of two or more computer systems which are linked with each other. It allows computers to exchange data from each other along the data connections. Computer networks differ in the transmission medium used to carry their signals, communication protocols to organize network traffic, the network's size, topology and organizational intent. The best-known computer network is the Internet.

The Process selecting the path in the network for transferring the data from source to destination through the router is called routing and the device used is called router.

Routing is a process of selecting a path in a network along which the packets are sending over the network traffic [5]. There are many routing algorithms which are used to determine the path, load, and distance from the network traffic.

Routing algorithms are classified as adaptive routing algorithms and nonadoptive routing algorithms. An adaptive routing algorithm is an algorithm in which the network path can change their routing ways in accordance to the changes taken place in the network topology and in the traffic. [44]It is having a dynamic routing table in which it sends data over the network. Distance vector routing algorithm, link state routing algorithm, distributed routing algorithms are coming under the category of adaptive routing algorithms [2]. The nonadoptive routing algorithms are the algorithms in which it follows a static routing table for the data to allow transmission over the network. This algorithm does not adjust with the current traffic and the network topology. Shortest path routing, flooding algorithms are coming under the category of nonadoptive routing algorithms.

The problem of extracting an optimal path from among all paths contained in the roadmap [37]. There are two main issues that are of concern. First, road maps contain many possible routes connecting two different nodes. Depending on the graph search algorithm and the criteria applied, different paths connecting the same start and goal nodes can be found. Second, a path extracted from a roadmap is composed of many short line segments and its quality is likely lower than a smoothed path obtained by exhaustive numerical optimization.

To generate road maps for simulations, the Research work used a class of roadmap–based planning methods which are called probabilistic roadmap methods (PRMs) that have proven to be very successful in efficiently solving high–dimensional problems in complex environments [43].

An automatic road map generation process that autonomously defines a set of near-optimal paths in order to cover and connect all the free space. An algorithm is proposed to build a roadmap in such a way that the coverage, the redundancy and the connectivity are maximized. A roadmap has to cover all the free space in order to reach all the positions of interest that is the operation points. The coverage is guaranteed by means of the medial axis transform (MAT) of the free space.

A path has a high clearance if it follows the medial axis of the free configuration space. The Research work uses our retraction algorithm from to retract the paths to the medial axis. Rather than retracting paths, our goal now is to retract the entire roadmap to the medial axis. To ensure that the complete roadmap will be retracted to the medial axis, the Research work requires that its nodes initially lie on the medial axis [48]

A basic motion planning problem is to produce a continuous motion that connects a start configuration S and a goal configuration G while avoiding collision with known obstacles. Motion planning is also known as navigation problem or the piano mover's problem. The term is used in robotics for the process of breaking down the desired movement task into discrete motions that satisfy movement constraints and possibly optimize some aspect of the movement[18].Motion planning algorithms might address robots with a larger number of joints, more complex tasks, different constraints, and uncertainty.

The shortest path problem is to find a path with minimum travel cost from one or more origins to one or more destinations through a network. Shortest path analysis is important because of its wide range of applications in transportation [21]. The shortest path helps calculate the most optimal route, and optimal routing is the process of defining the best route to get from one location to another.

The objective of the Dijkstra's algorithm is to determine the shortest-cost path based on the link weights [10]. At the end of executing the algorithm, each router has a routing table with complete path information from itself to every other node. If alternate path routing is used then each router also stores the information about alternate paths.

The rapidly exploring roadmap (RRM), a new method for single-query optimal motion planning that allows the user to explicitly consider the trade-off between exploration and refinement. RRM primarily explores the configuration space like a rapidly exploring random tree (RRT). Once a path is found, RRM uses a user-specified parameter to weigh whether to explore further or to refine the explored space by adding edges to the current roadmap to find higher quality paths in the explored space.

- Focus on Optimal Single Query Motion Planning
- Computes a Globally Optimal Plan
- Requires both Exploration and Refinement

The Particle Swarm Optimization method is employed as the global motion planner; that is, it is used for planning the large-scale, 'gross' motions of the robot. In this algorithm, a candidate solution is presented as a particle [31]. The algorithm utilizes a collection of flying particles (changing solutions) in a search space (current and possible solutions) and moves towards a promising area to get to a global optimum. Categorizes the elements of the PSO algorithm into four main aspects variables, particles, swarm, and process.

III. CONCLUSION

Main goal is to find the best algorithm for finding the optimized path with minimum length and greatest clearance from obstacle by comparing the algorithms Rapidly-Exploring Roadmap, Particle Swarm Optimization and Dijkstra's algorithm.

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