RAPIDLY EXPLORING RANDOM TREES USED FOR MOBILE ROBOTS PATH PLANNING

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Path planning problem in mobile robotics can be solved in several ways. Often used are probabilistic roadmaps and potential field algorithm. However, adding nonholonomic constraints into path planning algorithm can be difficult for those methods. Therefore the rapidly exploring random trees (RRT) algorithm was examined and paper illustrates its usability in path planning task for both legged (walking) and wheeled mobile robots. The method proved to be capable of coping with limiting constraints and at the same time it is very fast, enabling its use in real time path recalculation when used with localization algorithm.

Key words: *path planning, mobile robots, rapidly exploring random trees, navigation*

1. Introduction

There is a number of algorithms for solving the path planning problem. Probably most popular ones are probabilistic roadmap algorithm [1] and randomized potential field algorithm [2]. The key idea of roadmap algorithm is to capture the connectivity of free regions with a roadmap of one-dimensional curves. Algorithm first builds a roadmap of nodes which are obstacle free and those nodes which can be connected in obstacle free space are connected. Then initial and goal nodes are connected to the roadmap and path is found within the roadmap directly giving obstacle free path. After the roadmap is built the path finding is usually very fast. Probabilistic version of roadmap algorithm generates random configurations and attempts to connect those with local planner. The connection problem is the main issue when dealing with nonholonomic system.

The key idea of randomized potential field algorithm is that object under consideration is represented as a point in N-dimensional space and is treated as a particle under the influence of artificial potential field U, which is constructed to reflect locally the structure of free space. Unfortunately the methods depends essentially on choice of 'good' heuristic potential function which might be difficult when coping with dynamical constraints.

To avoid above mentioned problems method of rapidly exploring random trees (RRT) can be successfully used. Following paragraphs describe the core of the method and show its use for path planning of legged walking robot and wheeled robot.

2. Rapidly exploring random trees

Method of rapidly exploring random trees was first introduced by LaValle in 1998 [3]. Basically it is randomized data structure, which is sequentially expanded by creating new

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