Chapter 22
Generic Cabling of Intelligent Buildings Based on Ant Colony Algorithm

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ABSTRACT

Generic cabling is a key component for multiplex cable wiring. It is one of the basic foundations of intelligent buildings. Using operation flow in generic cabling, the index constraints affecting generic cabling have been evolved in this paper. A mathematical model is built based on the ant colony algorithm with multiple constraints, and improvements were made on the original basis to extend the ant colony algorithm from the regular simple ant colony and structure to a multi-ant colony and structure. The equilibrium settlement of multiplex wiring is realized according to the introduction of the multi-ant colony model. The ant cycle model is combined to extend the optimization target from the local wiring path to the entire wiring path, and to solve the drawbacks existing in the regular ant colony algorithm and other search algorithms that take the local wiring path as the optimization target. The introduced retrospective algorithm make the ants avoid the path marked “invalid” in the subsequent search process and improves the search performance and convergence speed of the ant colony algorithm.

INTRODUCTION

Intelligent buildings use computer technology and communication technology to monitor and control the equipment used in the buildings automatically, to manage information resources and to provide information services for users. Intelligent buildings are an important symbol of the information age; they are part of the international information superhighway and the intelligent urban network node. They play an important role because of their special function and efficiency.

DOI: 10.4018/978-1-4666-2651-5.ch022
Generic cabling is the physical basis of the high-speed information network in intelligent buildings and it is also the key component of intelligent building construction. Generic cabling is an information transmission media system that is made up of cable, optical fiber, various types of soft cable and related link hardware. Generic cabling can put the transmission medium and equipment into a certain order as an organic whole and support the transmission of voice, data, image and monitoring information (Xue, 2002). In the process of cabling, this paper will discuss how to meet the customers multiple constraints and reduce costs by using ant colony algorithm.

Dijkstra's algorithm solves the single-source shortest-path problem when all edges have non-negative weights. It is usually used in the generic cabling system of intelligent buildings because it meets the users’ simple and basic requirements. However, because intelligent buildings are becoming more intelligent, the traditional algorithm no longer meets the current complex needs.

The ant colony algorithm is a probabilistic technique for solving computational problems which can be reduced to finding good paths through graphs (Colorni, Dorigo, & Vaniezzo, 1991; Dorigo, 1992). The first algorithm was aiming to search for an optimal path in a graph; based on the behavior of ants seeking a path between their colony and a source of food. Investigation has revealed that the ant colony algorithm is a better algorithm with robustness; it provides a new way to solve complex combinatorial optimization problems (Ma & Xiang, 2001; Wang & See, 2009). It has been applied to many combinatorial optimization problems (Xing et al., 2009; Garcia et al., 2009), ranging from the multi-objective flexible job shop scheduling to the path planning for mobile robots and a lot of derived methods have been adapted to dynamic problems in real variables, stochastic problems, multi-targets and parallel implementations.

According to the users’ requirements, we used the ant colony algorithm to solve the generic cabling problem of intelligent buildings. The results prove that generic cabling with restriction based on the ant colony algorithm can meet the complex requirements and has better solution results, at the same time it can save much time for designers and workers and reduce the costs. Therefore, generic cabling with restriction based on the ant colony algorithm is very important, but also further enhances the level of intelligent buildings.

GENERIC CABLELING SYSTEM

1. According to the description of generic cabling, before a generic cabling project is started, it is necessary to clear the known conditions; in other words, these conditions are the input of the problem. And the following describes the analysis of the known conditions:
   a. Bridge: It is also known as cable track or cable ladder used to place cables. Before the generic cabling of a building, engineers can discover the situation of the bridges laid from the drawings of civil work; therefore, the spatial position of the bridge is one of the known conditions.
   b. Device: Before the generic cabling, the location of every subsystem has been preassigned, and the position of each device that belongs to the subsystem has been preassigned, too. Therefore, the spatial position of the device is another known condition.
   c. Connection Group: Before the generic cabling, customers need to specify a number of connection groups (Flax, 1991), since different subsystems should be installed into different installations; this guarantees that there will be no interference between different subsystems. We can deal with a connection group as a device or a subsystem.
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