Intelligent Automation and Soft Computing, Vol. 16, No. 1, pp. 75-76, 2010

RECENT ADVANCES AND FUTURE TRENDS IN VERTICAL TRANSPORTATION

A SPECIAL SECTION OF INTELLIGENT AUTOMATION AND SOFT COMPUTING GUEST EDITORIAL

BY

P. CORTÉS
Escuela Técnica Superior Ingenieros
Ingeniería Organización
Seville University
Camino de los Descubrimientos s/n
Sevilla 41092, Spain
Email: pca@esi.us.es

The progressive price increase in the urban centers and business areas of the larger cities makes necessary the intensive exploitation of land by means of the construction of high buildings. Today the installation of synchronized elevator groups in such professional use buildings is a usual practice.

The management of complex groups of elevators providing service to a huge amount of passengers travelling to a great variety of floors, and sometimes sharing different buildings, requires the consideration of complex algorithms to be installed in the controllers of the elevator group.

Furthermore the multiple criteria to be considered make the problem particularly difficult because problems are constantly evolving and the challenges to be faced are always growing. Traditionally, the main objective has been the minimization of the system waiting time in order to increase the users' quality. This system waiting time includes the waiting time for the lift in the hall plus the trip time inside the lift. Also, in order to attain an efficient system performance is necessary to bind the maximum waiting times or the queue sizes of persons waiting for the lift. Recently, other significant criteria are gaining interest. It is the case of the system energetic consumption. Here, a new challenge comes to the fore: the construction of lift groups designed to be more energy efficient. Undoubtedly, this is an aspect which is of growing importance in an increasingly environmentally aware society. A more rationale consumption will lead to the reduction of the costs of the electronic devices, as well as the reduction of the energetic invoice at the same time.

Also, a relevant area of interest is to take on board the research already undertaken and incorporate ambient intelligence in the vertical transport system. This ambient intelligence will lead to greater user-friendliness; more efficient services support, user-empowerment, and support for human interactions. The construction of a real ambient intelligence will need of ubiquitous computing, ubiquitous communication and intelligent user interfaces, such as embedded algorithms for traffic pattern recognition or devices for vision or pattern recognition for lift group control and monitoring among others.

This special issue tries to collect some of the most relevant research that is being undertaken in the field. So, the papers presented in this special issue offer recent developments in this regard with new results that are based on computational experiments using most of the times real building data, as well as computer simulations that provide technical insight into various vertical transportation problems. Topics covered include search tree heuristics, genetic algorithms, artificial neural networks, particle swarm optimization approaches, and a network management heuristic algorithm using the standard IEEE 802.15.4 as wireless control field bus for vertical transportation systems.

The paper by David Mulvaney, Jonathan White and Muna Hamdi focuses on an approach able to generate timely heuristic information that reduces the complexity of the elevator dispatching task to one of finding the best route through already computed data. The heuristic is tested in practical elevator installations showing optimality for the dispatching problem.

Berna Bolat, Pablo Cortés, Ersun Yalçin and Mustafa Alisverisçi also tackle the car dispatching problem in an elevator group using genetic algorithms. The main contribution of the paper is centered on the description of a novel fitness function to evaluate the individuals' fitness, allowing a quick computation. Tests are provided for various types of real-life high-rise buildings to assess the elevator service performance, outperforming traditional algorithms developed in the industry.

Mahir Dursun deals with the utilization of artificial neural networks for controlling elevator groups. Simulations are carried out comparing artificial neural network and traditional methods under 10 different variable speeds with constant acceleration. Valuable results attending to car trip times and passenger waiting times were obtained reaching reductions over 18% for uppeak traffic conditions.

Zhonghua Li has presented an elevator group supervisory control system that applies particle swarm optimization as a heuristic intelligent search method to optimize elevator traffic car scheduling in real time. Experimental results are used to validate the proposed PSO-based scheduling approach that handles peak elevator traffic in an efficient way.

David Daza, Marina Díaz, Carlos Rubia, María C. Delgado and Pablo Cortés address the problem of creating a wireless infrastructure to control a vertical transportation system. Their work uses the standard IEEE 802.15.4 as wireless control field bus allowing ubiquitous computing devices. The paper compares different network topologies together with the network management algorithms. The paper suggests the use of tree topologies as the most suitable for the vertical transportation system based on experimental results.

The collection of papers herein reveals the richness of the research that is being undertaken in vertical transportation systems. The results will contribute to continued progress toward understanding and solving the essential problems of controlling and car dispatching in vertical transportation systems. Some of the research that has been here presented is being carried out in practice. Experiences like these could lead to help bridge the gap between the academic research and the industrial activity.

I would like to sincerely thank the authors for their valuable contributions to this special issue, as well as the reviewers in the selection process. I am also grateful to the Editor-in-Chief, professor Mo Jamshidi, for supporting this project of bringing the research on vertical transportation to readers of AutoSoft.

Pablo Cortés
Escuela Técnica Superior Ingenieros, Ingeniería Organización, Seville University,
Camino de los Descubrimientos s/n, Sevilla 41092, Spain.
Email: pca@esi.us.es