International Conference
on Industrial Engineering and Systems Management
IESM 2009
May 13-15
MONTRÉAL - CANADA

An interdisciplinary method for a generic vehicle routing problem decision support system

Abstract

In this paper, we propose an interdisciplinary method for the logistics of transportation. It focuses on the design of a generic architecture for the vehicle routing problem (VRP). We highlight that human factors and dynamic aspects are generally ignored in the classical approaches to solve the vehicle routing problem. In our study, a link is done between methods of operations research (specific methods to solve vehicle routing problems and constraint programming techniques) and a work domain analysis technique coming from cognitive ergonomics. The proposed architecture allows to consider and to process the constraints identified by the work domain analysis during the problem resolution. It is also well adapted to the consideration of the Human as a main actor in the decision-making process.

Key words: Decision support system, work domain analysis, vehicle routing problem, constraint programming.

1 Introduction

Nowadays the optimization of the vehicle routing problem (VRP) has become one of the main issues for the companies involved in goods and services production. Indeed, aggressive competition forces them to guarantee a minimum level of quality of service for the customers. In transportation logistics for example, it implies an important effort to satisfy the customer demands at the right time.

This interest from the companies has been transferred to the researchers. For instance, the VRP has been widely studied by the Operations Research scientific community for about 15 years. Therefore, there exists a large number of methods to solve very efficiently the various existing variants of the problem [1,10,18].

However we consider that the traditional way to solve the VRP has two important limitations when considering the human factors and the dynamics of the contextual constraints. In order to overcome these limitations, we propose a generic architecture for a decision support system for the vehicle routing problems. An interdisciplinary approach with two components is proposed: (1) an ecological interface based on the abstraction hierarchy resulting from a work domain analysis [16,20]; (2) solving mechanisms based on Operational Research techniques, in particular Constraint Programming [7,17].

Both components are described in next sections. Then, an architecture for the decision support system is proposed. A scenario illustrates how the system works for the design and the modification of the routes. Finally, testing prospects on real problems are referred.

2 Vehicle routing problems

The *vehicle routing problem* (VRP) consists in determining the routes of a fleet of vehicles for the transportation of goods or passengers according to some customer demands (delivery, pick-up...) (Figure 1).