Chapter 1
Volunteered Geographic Service: Planning a Senior Shuttle Service Using GIS and OR

Monica Gentili
University of Louisville, USA & University of Salerno, Italy

Nigel Waters
University of Calgary, Canada

Muhammad Iqbal Tubbsum
Saskatchewan Ministry of Highways and Infrastructure, Canada

Dennis E. Nicholas
George Mason University, USA

ABSTRACT

A lack of transportation services for the increasing number of senior citizens in Calgary presents a challenge for planners and decision makers alike. Transportation services offered by Access Calgary, Calgary Transit, and volunteers are unable to meet the current needs of this growing segment of society. Difficulties accessing transportation services mean that many seniors find it challenging to meet such basic needs as grocery shopping, or to visit libraries, parks, fitness, and recreation centers, or to attend medical appointments. This research focused on providing a unique alternative transportation service that would be acceptable and accessible for seniors in Calgary by integrating GIS and OR methods as a planning tool for a senior shuttle service provided by the Calgary Motor Dealers Association (CMDA).

DOI: 10.4018/978-1-5225-7591-7.ch001
INTRODUCTION

ElderNET, an organization dedicated to the improvement of the lives of Calgary’s senior citizens, identified a need to supplement the existing seniors’ transportation services that were then being provided by Calgary Transit and Access Calgary (ElderNET, 2005). In response to this need, the Calgary Motor Dealers Association (CMDA, 2018) agreed to provide one hour of shuttle bus service between 10.00 a.m. and 2.30 p.m. from Monday to Friday. The question then arose as to whether this was a worthwhile enterprise and how these volunteer geographic services (VGS) might be organized and optimized. This research focused on addressing this question by providing a unique alternative transportation service that would be acceptable and accessible for seniors in Calgary by integrating GIS and OR methods as a planning tool for a senior shuttle service provided by the Calgary Motor Dealers Association (CMDA).

In order to show the potential of this novel concept of what is characterized as a Volunteered Geographic Service (VGS) (Waters et al., 2009; Savelyev et al., 2011; Thatcher, 2013), a preliminary study on how the shuttle bus service for seniors could be organized in the city of Calgary is reported in this chapter. The main aim of this study is to outline the capabilities of the service and its social utility by the optimization of the limited available resources, and therefore to encourage the development of this project, in the future, by the design and implementation of a web-based GIS application for the planning and management of the senior shuttle service. In particular, the authors propose a methodology to address the problem by defining a combinatorial problem, namely the Volunteered Bus Service (VBS) problem. VBS belongs to the more general class of Vehicle Routing Problems, but it tackles two main aspects, generally not addressed in the literature, which are instead two main features of a volunteered service: simplicity and equity. The authors formalized the problem by means of a mathematical formulation that is implemented by a simple iterative and constructive heuristic to find a solution in the northwest quadrant of the City of Calgary.

The preliminary results of the study show the effectiveness of this novel concept of a VGS and encourage its implementation and extension. Further, the authors argue that it is one possible extension and development of the concept of Volunteered Geographic Information.

The organization of the chapter is as follows. A preliminary data analysis (described in the next section) was carried out to understand whether the idea was workable and worth further development. The results from the data analysis revealed the idea to be feasible, hence the research proceeded with the development of a mathematical model and by the design and implementation of a basic, constructive, heuristic algorithm to solve the problem. The mathematical model and the algorithm are described in The Volunteered Bus Service Problem section. Some preliminary results on how to organize the service are obtained by applying the proposed model and running the proposed heuristic on the northwest part of the city of Calgary. These results are given in the Computational Results section. Further research and conclusions are discussed in the last section.

PRELIMINARY DATA ANALYSIS

Data Description, Sources and Assumptions

The performed research determined that the service would be most easily implemented if it were confined to the 117 Senior Lodges that existed during the execution of this project in Calgary. Senior Lodges are
17 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the product's webpage: www.igi-global.com/chapter/volunteered-geographic-service/221758?camid=4v1


Related Content

The Role of Strategy Implementation in the Relationship Between Strategic Planning Systems and Performance
www.igi-global.com/article/the-role-of-strategy-implementation-in-the-relationship-between-strategic-planning-systems-and-performance/245687?camid=4v1a

Volunteered Geographic Service: Planning a Senior Shuttle Service Using GIS and OR
Monica Gentili, Nigel Waters, Muhammad Iqbal Tubbsum and Dennis E. Nicholas (2019). *Analytics, Operations, and Strategic Decision Making in the Public Sector* (pp. 1-19).
www.igi-global.com/chapter/volunteered-geographic-service/221758?camid=4v1a

Similarity Measure Optimization for Target Detection: A Case Study for Detection of Keywords in Telephone Conversations
www.igi-global.com/chapter/similarity-measure-optimization-for-target-detection/209812?camid=4v1a

Scheduling Aircraft Ground Handling Operations Under Uncertainty Using Critical Path Analysis and Monte Carlo Simulation: Survey and Research Directions
www.igi-global.com/article/scheduling-aircraft-ground-handling-operations-under-uncertainty-using-critical-path-analysis-and-monte-carlo-simulation/245689?camid=4v1a