Optimization of Convenience Stores' Distribution System with Web Scraping and Google API Service

Thai Quang LE, Davar PISHVA♦

Ritsumeikan Asia Pacific University (APU), Beppu, Japan

quanle11@apu.ac.jp, dpishva@apu.ac.jp

Abstract— **Vehicle Routing Problem (VRP) has never become an obsolete research theme in the field of operations research and supply chain management. Considering that significant number of researchers have already tried addressing VRPs with mathematical modeling and algorithmic approaches, this paper focuses on a practical implementation and employs programming techniques to cope with a particular business problem in convenience stores' distribution system. It optimizes goods distribution process of convenience stores business, which involves lorries delivering products from a warehouse to a network of several convenience stores in a single trip, collecting their garbage, passing by a gas station for re-fueling when needed, and returning back to the warehouse. A mathematical 'network flow model' is initially developed to examine the problem. Geographical data of convenience stores, their associated warehouses, garbage dumpsites and gas stations are subsequently retrieved through programming with the 'web scraping' technique. A prototype of web-based delivery navigation system that utilizes Google API service is then developed to solve the optimal convenience stores' networking problem. Furthermore, a more general perspective of the problem is illustrated with cluster-first-route-second heuristic algorithm and a mobile version of the prototype, which can serve as a real time navigation system for delivery truck drivers, is developed. Validity of obtained results is also examined by other known methods to justify optimality and fast performance of the approach.**

Keyword— **Supply Chain, Maximal Covering, Assignment, Modeling, Optimization, Web Scraping, Google API Service**

Thai Quang LE was born in Khanh Hoa Province, Vietnam in 1993. He is presently pursuing his studies at Ritsumeikan Asia Pacific University (APU) in the field of Business Administration focusing on Strategic Management and candidate for graduation. He has received numerous scholarships including, APU Tuition Reduction Scholarship from 2011-2015, JASSO (Japan Student Services Organization) Scholarship from 2011-2012, and Oita Prefecture Scholarship in 2012-2013, 2014-2015. His research interests include applied programming in business, modeling for decision-making and machine learning, on which he has carried out a few presentations. The theme of his thesis is retail activity optimization and he has become an IEEE member since 2014.

Davar Pishva is a professor in ICT at the College of Asia Pacific Studies, Ritsumeikan Asia Pacific University (APU) Japan and presently serves as the Dean of both College and Graduate School of Asia Pacific Studies. In teaching, he has been focusing on information security, technology management, VBA for modelers, structured decision making and carries out his lectures in an applied manner. In research, his current interests include biometrics; e-learning, environmentally sound and ICT enhanced technologies. Dr. Pishva received his PhD degree in System Engineering from Mie University, Japan. He is Secretary General of IAAPS (International Association for Asia Pacific Studies), Senior Member of IEEE, and a member of IEICE (Institute of Electronics Information & Communication Engineers), IAAPS and University & College Management Association.

♦Corresponding Author: E-mail: dpishva@apu.ac.jp, Fax: +81-977-78-1001, Tel: +81-977-78-1000,

Address: Ritsumeikan Asia Pacific University 1-1 Jumonjibaru, Beppu, Oita 874-8577 Japan