Electric Cars: Logistics For the Environment

Juan David Echeverri Villada
Universidad Eafit
Colombia
jdecheverv@eafit.edu.co

Juan Sebastian Guerra Hernandez
University Eafit
Colombia
jsguerrah@eafit.edu.co

Mauricio Toro
Universidad Eafit
Colombia
mtorobe@eafit.edu.co

ABSTRACT

Finding a way to combat climate change is one of the most important priorities in the last few years, that is why reducing the use of fossil fuels is a must for all the people. On other hand, the delivering companies have been growing exponentially and its services are more and more demanded with the time, occasioning high emissions of CO2 due to transportations matter. The electronic vehicles are clearly one of the best alternatives to solve this problem, but due to its characteristics, implementing them represents a complex logistic challenge. Looking to the precedents, The traveler salesman and its variant are problems that have a similar approach and the given solutions to them are a fundamental way to tackle the issue

1. INTRODUCTION

Due to the fact of the logistics needed to coordinate all the solicitudes and complete them with efficiency, delivering packages has always been a complex topic. Every time that a new technology can be implemented in this ambit, the logistics need to be recalculated, improving the efficiency but giving a hard time to the coordinators. That is the case of one of the most recent technologies developed, the electric cars, whose implementation could significantly improve the use of fossil fuels thus benefiting the environment. Nevertheless, implementing this technology has a certain price.

2. PROBLEM

To explain the problem, it is necessary to know what does implementing electric cars implies since they have certain limitations that must be taken into account by the time of calculating the logistics needed. Some of them are its limited conduction range and its long charging time, that represent a certain problem for the drivers, because they have a work schedule that cannot be exceeded. From here comes the necessity to adapt the planning and optimize the logistic process. developing a tool that evaluates the routes of each vehicle in a fleet and finds the most proper ones will allow the drivers to administrate efficiently the energy and the time, making easier the implementation of electric cars in this ambit and thus reducing the contamination of the environment.

3. RELATED WORK

3.1 The Traveler Salesman Problem

Proposed by William Hamilton and Thomas Kirkman, consists in searching for the best path that can be carried out in a set of n nodes, passing only once through each node until returning to the first one. Various solutions to this optimization problem have been proposed throughout the years. One of them is the Christofides' algorithm, which consists in choosing and replacing edges to keep less distance. It is a heuristic algorithm since its operation looks for an approximate route with the weights that are raised in the data [1].

3.2 Vehicle Routing Problem (VRP)

The VRP is the distribution of the Traveler Salesman Problem to different vehicles. It "decides which vehicle handles which request in which sequence so that all vehicle routes can be feasibly executed" [2]. In this case, a viable solution is the Clark and Wright savings algorithm, which consists in combining two possible routes, taking the savings that are produced from each one. Thus, in an approximate way, it is possible to attribute the best path for each vehicle.

3.3 Electric Vehicle Routing Problem (E-VRP)

“As corporations are becoming more conscious about the environment and the associated externality costs, electric commercial vehicles are gaining tractions in firms that deliver products" [3]. Under this premise, a variant of the vehicle routing problem was created, the E-VRP, which focuses on finding an optimal routing strategy with minimal travel time cost. energy cost and electric vehicles dispatched. Doing an heuristic approach could be the best way to tackle the EVRP.

3.4 Sequential Ordering Problem (SOP)

It is a variant of the TSP where there are precedence conditions. That means that there are certain nodes that have to be visited before another ones, therefore, the most optimal route may not be correct. Carina Vega (2014) used the algorithm SOP 3 Exchange as a way to solve this problem [4]. This algorithm has 2 components. The first one is in charge of checking the infraction of a precedence while the other ones change axis. When changing axis while

preserving roads you get in an heuristic way a path that has all the requisites .

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