GUEST EDITORIAL

Jose E. Naranjo, Felipe Jiménez,
and Joshue Perez



Special Issue on Electro-Mobility

The socio-economic quest towards developing transportation with lower CO_2 emission is a global goal of the European Union, Japan and the USA, and a core element for the competitiveness of the whole transportation industry. Electro mobility (or e-Mobility) represents the concept of using electric powertrain technologies, in-vehicle information, communication technologies and connected infrastructures to enable the electric propulsion of vehicles and fleets. These technologies, clearly represented by electric and hybrid vehicles and their interaction with the environment, could be applied as solution to the present mobility challenges, but their implantation is presently limited by a large set of policy, economic and technological constraints. In fact in the new European Research Framework Programme, Horizont 2020, the Green Vehicles call includes research, technological developments, innovation and demonstration in support of improvements in energy efficiency of road transport vehicles and the use of new types of non-conventional energies into road transport such as electricity among others.

In this context, the objective of this Special Issue is to disseminate the best research results from cross-disciplinary researchers working on such Electro-Mobility technologies, as well as to increase the society awareness about the benefits of this new concept of mobility as solution and "evolution" of the future of road mobility. This Special Issue is also a follow-up of the Special Session on Electro-Mobility that was held at IEEE ITSC2013 in The Hague, The Netherlands, October 2013. The Special Session was successful and a Special Section of *IEEE Intelligent Transportation Systems Magazine* dealing with the same theme was planned. A call for paper was issued. The papers accepted after a rigorous review and revision cycle are included in this Special Section. The six papers that appear in this Special Section cover an important range of Electro-Mobility in Intelligent Transportation Systems, including relevant topics like driver modeling, market analysis or fleet recharging planning. These papers are summarized in the following.

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Papers in the Special Issue

"How Electric Vehicles Affect Driving Behavioral Patterns" by Magnus Helmbrecht, Cristina Olaverri-Monreal, Klaus Bengler, Roman Vilimek and Andreas Keinath. The gradual introduction of fully electrically powered vehicles into the market has extended the opportunities for sustainable mobility and a new technological era. In this paper, the changes in driver behavior patterns compared with patterns of traditional vehicles with combustion engines after having acquired the necessary adjustments needed for driving an electric vehicle are investigated.

"Optimization of Charging Stops for Fleet of Electric Vehicles: A Genetic Approach" by Francesco Alesiani and Nitin Maslekar. Electrification of transport is one of the approaches to improve transport efficiency and sustainability. The current cost of transport associated with electrical vehicles is mainly related to the cost of acquisition and maintenance of batteries. Finding an efficient way of managing the available energy allows reducing the size of the batteries and thus the cost associated with transport. This paper addresses the problem of finding the routes for a fleet of electric vehicles which will not only consider the battery limit of the vehicle, but also the concurrent use of charging stations along the route. The proposed solution computes routes for the fleet of vehicles that minimizes the associated cost which is a combination of travel time, charging time and the energy

consumption along the route and is based on an evolutionary genetic algorithm with learning strategy.

"Green Move: A Platform for Highly Configurable, Heterogeneous Electric Vehicle Sharing" by Andrea Bianchessi, Gianpaolo Cugola, Simone Formentin, Angelo Morzenti, Carlo Ongini, Emanuele Panigati, Sergio Savaresi, Fabio Schreiber, Letizia Tanca, Edoardo Vannutelli Depoli. Vehicle sharing in urban areas has the potential to be the answer to some of the main issues that hinder the spreading of electric vehicles, in particular for what concerns the high upfront costs of the vehicles, combined with their still limited range, which can induce phenomena such as range anxiety. For its potential to be realized, vehicle sharing must be tailored to the multiform needs of its users by offering a wide range of support services that can be selected based on the user preferences. In this paper is presented a platform for vehicle sharing developed in the Green Move project, which allows services to be dynamically loaded and unloaded on vehicles, and describe a pair of prototype applications to illustrate its benefits.

"Efficient Allocation of Electric Vehicles Charging Stations: Optimization Model and Application to a Dense Urban Network" by Fouad Baouche, Romain Billot, Rochdi Trigui and Nour-Eddin El Faouzi. The deployment of Electric Vehicles (EVs) needs an optimized and cost-effective implementation of charging stations. As a decision support tool for network design, we define a methodology to allocate charging stations in a real network. This study uses trip OD matrix information from household travel survey coupled with a dynamic vehicle model to evaluate EVs consumption based on realistic trips (urban drive cycles). The results indicate that this methodology can help the future implementation of charging stations at an urban scale.

"Modeling the Driving Behavior of Electric Vehicles Using Smartphones and Neural Networks" by Alberto Diaz, Francisco Serradilla, José Eugenio Naranjo, José Anaya and Felipe Jiménez. The modeling of eco-driving behaviors is a key issue in the research of Intelligent Transportation Systems. Most efforts have been made regarding internal combustion vehicles, and few works have reported in the field of electric vehicles. On the other hand, these behavior analyses are usually conducted through naturalistic driving researches that involve the use of instrumented vehicles, available in a small number, which reduces the impact of the results. This paper presents a system for estimating the remaining charge of an electric vehicle by considering the driving behavior measured using a smartphone and supported by Neural Networks.

"Managing the Charging of Electrical Vehicles: Impacts on the Electrical Grid and on the Environment" by Ricardo Faria, Pedro Moura, Joaquim Delgado and Aníbal Almeida. Electric vehicles are seen as an option to reduce greenhouse emissions, directly related with the electricity generation mix and with the time of charging due to the variations of the generation sources during the day. At the same time, with their widespread adoption the increase in the demand for electricity to charge these vehicles could pose significant challenges to the electrical grid in terms of additional load due to unmanaged charge strategies. In order to mitigate these problems, the charging of the electrical vehicles must be managed. This paper presents the development of a system architecture to dynamically control the charging of electric vehicles to maintain the proper operation of the local distribution grid and minimize the environmental impact.

"Energy Optimal Real-Time Navigation System" by Arben Cela, Tomas Jurik, Redha Hamouche, René Natowicz, Abdelatif Reama, Silviu-Iulian Niculescu and Jerome Julien. The rapid development of Mobile Internet and Smart Devices and advent of a new generation of Intelligent Transportation Systems (ITS) increase information about present driving conditions and make its prediction possible. Real time traffic information systems (TIS) like SYTADIN help in route to destination planning and traffic state prediction. Energy optimal routing for electric vehicles creates novel algorithmic challenges where the computation complexity and the quality of information on traffic state are the main issues. In this paper is presented an Energy Optimal Real Time Navigation System (EORTNS), implemented on Samsung Galaxy Tab, capable of calculating the route to destination based on information flow obtained from SYTADIN. As an application example we propose a real time energy management for a Hybrid Electrical Vehicle (HEV) composed of batteries and Super-Capacitors (SC).

"A Review of Network Mobility Protocols for Fully Electrical Vehicles Services" by Sofiane Imadali, Arnaud Kaiser, Fikret Sivrikaya, Nadim El sayed, Michael Boc, Witold Klaudel, Véronique Vèque, Alexandru Petrescu. This article reviews IETF network mobility techniques and ISO data protocols involved in electrical charging which represent key enablers for an IP-based platform composed of backend servers, networks of fixed charging stations and of mobile Fully Electrical Vehicles (FEVs). This platform further allows services for ensuring driver's confidence in reaching arbitrary destinations, despite well-known limitations such as battery technologies, and mitigating the risks involved by the use of inherently insecure basic IP datagram exchanges.

Jose E. Naranjo
University Institute for Automobile Research (INSIA), Spain

Felipe Jiménez
University Institute for Automobile Research (INSIA), Spain

Joshue Perez
Institut National de Recherche en Informatique et en Automatique (INRIA), France

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