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Editorial

Smart Energy and Intelligent Transportation Systems

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1. Introduction

With the Internet of things and various information and communication technologies, a city can manage its assets in a smarter way, constituting the urban development vision of a smart city. This facilitates a more efficient use of physical infrastructure and encourages citizen participation. Smart energy and smart mobility are among the key aspects of the smart city, in which the electric vehicle (EV) is believed to take a key role. EV adoption in the market can clearly provide supporting evidence. When comparing to 2019, the 2020 global EV stock showed a 43 % increase, hitting the 10 million mark.

EVs are powered by various energy sources or the electricity grid. With proper scheduling, a large fleet of EVs can be charged from charging stations and parking infrastructures. Although the battery capacity of a single EV is small, an aggregation of EVs can perform as a significant power source or load, constituting a vehicle-to-grid (V2G) system. V2G refers to a system allowing EVs to communicate with the power system for demand response services by either discharging their excessive energy to the grid or by being charged with the excessive electricity from the grid. Besides acquiring energy from the grid, in V2G, EVs can also support the grid by providing various demand response and auxiliary services. We can reduce our reliance on fossil fuels and utilize renewable energy more effectively. V2G enables EVs to store electricity generated from renewable energy sources so as to overcome the intermittency of renewable due to different weather and time of day conditions.

The EV market is growing very quickly, and there will likely be an abundance of EVs running on the road in the near future. EVs are also important building blocks to developing intelligent transportation systems. The self-control of autonomous vehicles (AVs) and the systematic remote control of AV fleets will bring smart energy and intelligent transportation systems into new dimensions. We can develop a public transportation system with AVs, in which a fleet of AVs is managed to accommodate transportation requests, offering point-to-point services with ride sharing. AVs can also participate in V2G to support various V2G services. Through properly coordinating AVs in appropriate parking facilities, it has been shown that AVs can facilitate better V2G services with higher efficiency. On the other hand, an energy delivery system can be built upon the transportation network and EVs utilized as energy carriers to transport energy over a large geographical region. With proper routing, energy can be transmitted from sources to destinations as in a packet-switched network. Such a system can complement the power network and enhance the overall power system performance.

This Special Issue contributes to the smart energy and intelligent transportation system agenda through enhanced scientific and multi-disciplinary knowledge intended to improve performance and deployment by bringing some focus to electric and autonomous vehicles in order to meet technical, socio-economic, and environmental goals, as well as for energy security. We are particularly interested in investigating how smart energy technologies contribute to intelligent transportation systems, and vice versa.

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2. Summary of the Contributions

Research works by scholars from divergent backgrounds are included in this Special Issue. Refs. [1,2] focus on the health of the vehicle and road–rail accidents. Ref. [3] investigates the control of charging in V2G while [4] develops an EV recommendation system. Ref. [5] studies the loading hub placement in an electric bicycle-oriented city logistic system.

Ref. [1] makes use of artificial neural networks in diagnosing the technical condition of driving systems operating under variable conditions, in which the effects of temperature and load variations on the values of diagnostic parameters were taken into consideration. A new approach is proposed to train the network using a learning set from the efficient system only. The responses to new data from the undamaged system are compared to the response to data recorded for three damage states: misalignment, unbalance, and simultaneous misalignment. As a normalized measure of the deviations, a diagnostic parameter for the faulted system is derived from the result for the undamaged condition.

Ref. [2] focuses on assessing the likelihood of the occurrence of various effects of road–rail accidents in different selected situations.The specificity of the road–rail accidents requires a separate characteristic to categorize types of incidents and to specify the affecting factors with an assessment of the strength of this impact. Classification trees are adopted to deal with the ordinal form of the dependent variables. The experiment results facilitate the characterization and assessment of the danger and constitute guidelines for taking preventive actions.

The massive adoption of EVs creates an unprecedented energy load for the power system, in which the stability and quality are compromised by multiple simultaneously connected vehicles, especially on a local distribution level. In [3], a choice-based pricing algorithm is proposed to indirectly control the charging and V2G activities of EVs in non-residential facilities. Two metaheuristic methods are applied to solve the proposed optimization problem with a comparative analysis for performance evaluation.

Due to the Act on Electromobility and Alternative Fuels, EVs are becoming popular in Poland, in which local government units and state administration are expanding their EV fleets. The expansion of the fleet should be well-planned and supported by economic analyses. Ref. [4] develops an EV recommendation system which meets the needs of the local and state administration to the greatest extent. A multi-criteria decision analysis method is designed with the Monte Carlo method, and it allows of promoting more sustainable vehicles with high technical, economic, environmental and social parameters.

Electric cargo bicycles are popular transport for last-mile goods deliveries in urban areas with restricted traffic. In a cargo bike delivery system, loading hubs serve as intermediate points between vans and bikes ensuring loading, storage, and e-vehicle charging operations. The loading hub placement a key problem for designing city logistic systems, which heavily rely on electric bicycles. In [5], the authors propose a mathematical model by considering consignees and loading hubs as vertices in the graph constituting a transport network. This allows determination of the location of a loading hub under stochastic demands for transport services in the closed urban area.

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