frontiers | Frontiers in Energy Research

TYPE Editorial
PUBLISHED 24 August 2022
DOI 10.3389/fenrg.2022.972084

OPEN ACCESS

EDITED AND REVIEWED BY
ZhaoYang Dong,
College of Engineering,
Nanyang Technological University,
Singapore

*CORRESPONDENCE
Hussein T. Mouftah,
mouftah@uottawa.ca

SPECIALTY SECTION
This article was submitted to Smart Grids,
a section of the journal
Frontiers in Energy Research

RECEIVED 17 June 2022
ACCEPTED 06 July 2022
PUBLISHED 24 August 2022

CITATION
Mouftah HT, Radwan A, Rehmani MH, Al-Turjman F and Vaidya B (2022), Editorial: Prospects of energy and mobility-Connected and autonomous electric vehicles for sustainable smart cities.
Front. Energy Res. 10:972084.
doi: 10.3389/fenrg.2022.972084

Editorial: Prospects of energy and mobility-Connected and autonomous electric vehicles for sustainable smart cities

Hussein T. Mouftah[1]*, Ayman Radwan[2], Mubashir Husain Rehmani[3], Fadi Al-Turjman[4] and Binod Vaidya[1]

[1]University of Ottawa, Ottawa, ON, Canada, [2]Instituto de Telecomunicações, Universidade de Aveiro, Aveiro, Portugal, [3]Munster Technological University, Cork, County Cork, Ireland, [4]Artificial Intelligence Engineering Department, AI and Robotics Institute, Near East University, Nicosia, Turkey

KEYWORDS

sustainable smart city, sustainable transportation, sustainable energy, connected and autonomous electric vehicles, sustainable smart e-mobility, smart urban mobility

Editorial on the Research Topic
Prospects of Energy and Mobility-Connected and Autonomous Electric Vehicles for Sustainable Smart Cities

Rapid urbanisation and increased fossil-fuel consumption causing excessive greenhouse gas (GHG) emissions and climate change globally pose significant threats to the cities. Smart cities strive for increased efficiency, reduced GHG emissions and improved quality of life by leveraging information and communication technologies (ICT) to deliver scalable, affordable and reliable solutions. As energy and mobility are considered as indispensable components for such transformations, the convergence of energy and mobility is essential. Prospect of energy and mobility is growing rapidly as electric vehicles proliferate, and gradually autonomous vehicles penetrate to urban transportation in the future. New forms of mobility are emerging along with the required ICT infrastructure, to accommodate this growth. These advancements correspond with the evolution towards cleaner, decentralized and digitized energy systems and services, and electrification in the transportation systems. As the future of energy would be electrified, digitized and decentralized, and the future of mobility would be connected, autonomous, electric and shared, new ways of diffusion of sustainable energy and sustainable transportation would lead to sustainable smart cities. Since electro-mobility (e-mobility) and shared mobility are key constituents of a sustainable transportation, Connected and Autonomous Electric Vehicles (CAEVs) are expected to cause fundamental transformations to the urban transportation with potential benefits including improved fuel efficiency, improved safety, reduced emissions, and reduced traffic congestion. Similarly, decentralized energy resources along ICT technologies would be enabler for a low-carbon smarter electric grid. Furthermore, Artificial Intelligence (AI) and Machine Learning (ML) will play vital role in CAEV Applications.

Innovation challenges related to sustainable energy and sustainable transportation require multistakeholder approach to produce a large set of emergent technologies to

technical maturity. This Research Topic was created to be a platform for researchers, developers and practitioners to disseminate their latest research, development, results, and innovative ideas in the areas of sustainable energy and sustainable transportation for the current and future smart cities. Such a topic solicits novel solutions and techniques in term of concepts, state-of-the-art, implementations, testbeds, and industrial case studies.

Contributions were expected to focus on some of the following topics: Visions and strategies for convergence of mobility and energy; CAEV for sustainable transportation; Sustainable smart city and society; Big data and analytics for sustainable smart e-mobility solutions; and AI/ML for smart urban mobility.

In this context, this Research Topic has attracted lot of attention from both the academia and industry, and we received ten highly quality submissions. After a rigorous peer review process, six papers were finally accepted for publication. A brief overview of each paper is presented below.

In the article by Singh et al., authors proposed a heuristic EV charging scheduling scheme. The proposed EV charging scheduling scheme supports priority determination using the idle time ratio and TOU period, as well as priority-based time slot allocation. Through extensive simulations, authors showed that their proposed scheduling scheme outperformed in terms of the charging power and charging cost with the baseline scheduling scheme.

In the article by Dan et al., a tertiary control strategy for dynamic state operation has been proposed for energy management of EV. Basically, four energy management functions in tertiary control level have been proposed and extensive simulations were carried out to show the performance of the proposed schemes.

The authors, in Hu, propose a novel chaotic oscillation control model of the power system under electromechanical power interference. This research is driven by the challenge that the commonly occurred electromechanical oscillation in the power system requires dynamic and complex chaotic based analysis with disorder and irregularity, which is still in its early stage to be applied in industrial applications. Based on the analysis of the system chaotic attractor and the proposal of a fourth-order power system model considering dissipative-based power disturbance, the proposed control model quickly and smoothly suppresses the chaotic oscillation of the system, meanwhile effectively avoids the chattering problem with strong robustness. The results verify the performance of the proposal, providing quantitative reference to chaotic control strategies for the power system.

The work in Wang addresses another research challenge related to Coal and gas outburst in mines. In order to ensure the safe operation and production of the mine and avoid more risks in the process, it is necessary to analyze and study the phenomenon of coal and gas outburst and make high-precision predictions. At present, there is no thorough research on this phenomenon, and the causes of coal and gas outburst are very complicated. The authors propose the application of digital twin and deep learning in the risk prediction of coal and gas outburst strength. Digital twin is used to systematically design coal and gas outburst intensity prediction, and a neural network prediction model based on optimized quantum gate nodes is established. The practical application experiment and result analysis of the optimization algorithm in the coal and gas outburst prediction model are carried out. The achieved results show that the proposed algorithm significantly outperforms PSO algorithm in the optimization of the prediction system. The final prediction accuracy reaches almost 95%.

In the article by Zhao et al., the authors highlighted not only the development status of big data in urban planning and construction, but also the application of big data technology in smart city construction. Mainly, three stages of big data application in urban master planning were identified, namely, 1) understanding urban laws, 2) planning and programming, and 3) evaluation of planning implementation. They also analysed various aspects of smart city planning, including smart transportation, smart community, smart health care and smart education. Finally, a comparative analysis between new urban spatial data environment and traditional data environment was presented in terms of volume, category, source, spatial scale, time scale, accuracy, and value.

In article, Wang illustrated various methods of character recognition including Harr like feature and the influence of different optimization algorithms on the determination of support vector machine (SVM) parameters. The implementation of character recognition based on improved genetic algorithm SVM (IGASVM) was conceived. Conducting several experiments, Harr with IGASVM was compared with other algorithms such as Stringing method, Template matching method, Harr with SVM, and Harr with genetic algorithm SVM. Results showed that the character recognition was best achieved using Harr with IGASVM. Furthermore, the historical state data of transformer was analysed. The experimental results showed that the proposed machine vision intelligent condition monitoring method for substation power equipment has precise fault diagnosis accuracy and high operation efficiency.

Author contributions

HM, AR, MR, FA-T, and BV contributed for reviewing, editing and accepted manuscripts.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note