Chapter 4
Cybersecurity of Electric Vehicle Smart Charging Management Systems

Kamalendu Pal
https://orcid.org/0000-0001-7158-6481
University of London, UK

ABSTRACT

This chapter delves into the cyber security challenges faced by smart cities, with a specific focus on the intelligent, integrated, and interconnected electric vehicle (EV) charging infrastructure. The analysis, conducted with meticulous attention to detail, leaves no stone unturned in demonstrating that not all innovative elements and smart city solutions have sufficient cybersecurity protection. It is crucial to recognize that certain novel technologies, such as vehicle-to-grid (V2G), smart charging, and intelligent energy management, pose significantly higher risks than others. The central objective is to create a strong foundation for securing EV charging infrastructure by thoroughly analyzing the problem context and the data that needs protection, including attack surfaces, cybersecurity threats, and vulnerabilities in the EV ecosystem. Additionally, it involves evaluating standardization for the EV connection to the charging infrastructure and presenting a comprehensive set of recommendations and best practices for securing EV charging infrastructure.

INTRODUCTION

The transportation and automotive industries are undeniably undergoing a rapid and significant transformation, largely due to the widespread adoption of electrification across various road transport segments. In this transformation, policymakers

DOI: 10.4018/979-8-3693-4314-2.ch004

play a pivotal role in driving the automotive market towards zero-emissions options and preparing the power system for electric vehicles. Their decisions and actions are not only shaping new economic opportunities but are also crucial for reducing emissions from road transport.

In addition to electrification, shared mobility, vehicle connectivity, and autonomous vehicles will reshape automotive and freight markets globally. However, electric vehicles have their challenges. One of the central issues is energy consumption, which needs to be addressed urgently to accommodate the industry effectively. This includes the immediate need to design and develop better-quality batteries, charging infrastructure, and strategies to manage energy demand.

Moreover, the new generation of electric vehicles is on the brink of a revolution, and the potential of intelligent techniques in managing them in various circumstances is immense. These techniques, such as sensor networks and artificial intelligence, hold the promise of an efficient and sustainable future, opening up new possibilities for vehicle management and control. They could pave the way for safer, more reliable, and more convenient transportation systems, instilling a sense of optimism about the industry's potential, particularly in industrial supply chain freight transports.

The role of industrial supply chain management is to facilitate smooth operations and generate revenue by manufacturing products, adding value for providing various services, and selling products to consumers (Pal, 2018) (Pal & Yasar, 2020) (Pal, 2021). Common to all industrial sectors, supply chain operations must manage raw materials flowing from selective suppliers through value-adding processes and distribution channels to serve ultimate consumers. In order to provide an efficient level of service without producing an undue expenditure burden, all the business processes along the supply chain operations need to be in balance, and often, innovative technologies play essential roles. For example, electric vehicles (EVs) are the means of transporting products, services, and personnel that use electric power rather than the traditional transport systems that depend on fossil fuels. Moreover, fossil-fueled transportation is one of the significant causes of negative environmental impact due to greenhouse gas emissions out of its regular operation. The ongoing climate crisis demands green sources of alternatives to replace technologies with high environmental impact. In this way, EVs have been introduced as a sustainable green source of automobiles, where electric batteries are employed as a power source, and this modern transportation technology provides opportunities to achieve global sustainability objectives in supply chain operation (Pal, 2023).

During recent years, the number of people opting for the EV alternative increased to the point where the specific market share of new EV sales reached more than fifty percent in some countries (e.g., Iceland (55.6%) and Norway (82.7%) (Zachary, 2021). Moreover, with the expanding prevalence of electric vehicle use and the charging infrastructure in the passenger vehicle sector, EVs for medium and heavy-duty