Chapter 15
Intelligent Battery Management System (BMS) in the E-Mobility Infrastructure

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ABSTRACT

Today's electric vehicles (EVs) are designed to replace traditional gasoline vehicles' engines, tanks, and fuel pumps with electric motors, batteries, and chargers. In other words, in this case, battery packs were used to power the vehicle instead of fossil fuels. Electric vehicles are required due to global climate change and abnormally high oil prices at the international level. Addressing these issues requires developing or improving new energy sources to replace fossil fuels: green and sustainable energy. That's why it's important to ensure your batteries are as reliable as fossil fuels. Preserving battery life and improving the performance of electric vehicles are therefore heavily influenced by the design of battery management systems. It assists the charge remaining (SOC) and health (SOH) of the cells, the management and supervision of the charge/discharge characteristics, and cell balancing. In this chapter, the authors discuss the battery management for a battery pack made from 18650 Li-ion batteries.

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1. INTRODUCTION

As we strive towards a greener future, electric mobility has emerged as a crucial aspect of the transition towards sustainability. The EV revolution has fundamentally altered transportation by offering a more environmentally friendly and sustainable alternative to traditional petrol engines. The most crucial component of any EV is its battery storage, which houses the energy needed for the vehicle to function. Therefore, to get the most out of a battery must have an effective battery management system (BMS) in it to operate safely. It keeps tabs on the battery's efficiency and security. It is a cutting-edge technology that enhances the reliability and performance of the system by providing monitoring and control of its charge, temperature, and voltage levels.

The goal of this study is to summarize previous research on 18650 lithium-ion batteries and battery management systems (BMS) for electric vehicles. While some publications emphasize balancing the battery's level of Charge (SOC), others emphasize the significance of BMS in electric vehicles. The articles covered how the active battery's lifespan is increased by the BMS's cell balancing method. According to a review of the papers, the BMS offered customers a variety of operational settings that are essential for the development of the EV and had sufficient dependability to replace the current fleet of fossil fuel-powered vehicles.

1.1 Electric Vehicle (EV) System

Before we start with BMS it is important to know about the electric vehicle system. An electric vehicle (EV) system comprises a variety of components that work together to propel the vehicle using electric power. The most critical component of an EV system is the battery, which serves as the energy storage unit. The battery provides the required energy to propel the vehicle forward. Other essential components of the EV system include the electric motor, power electronics, charger, and battery management system (BMS). The electric motor transforms electrical energy into mechanical energy, propelling the wheels and facilitating motion, while power electronics are responsible for managing the power flow between the battery and the motor. The charger is responsible for charging the battery from an external power source Lastly, the BMS monitors and oversees the battery's state of charge, state of health, and overall performance, ensuring optimal functionality.

In an EV system, the integration of these components is crucial for guaranteeing optimal performance, safety, and dependability. The system's overall design is also critical in determining the vehicle's range, efficiency, and overall Functioning. EV manufacturers must carefully select the battery chemistry, motor type, power electronics, and other components to achieve the desired performance characteristics. Additionally, the system must be optimized for the intended application, whether it be a passenger vehicle, commercial vehicle, or even an off-road vehicle. Overall, the design and implementation of an EV system require a multidisciplinary approach that involves electrical, mechanical, software, and engineering.

1.2 Battery

In the realm of e-mobility, batteries play a fundamental role as the principal energy storage source for electric vehicles (EVs). They serve as electrical power storage units composed of one or more electrochemical cells, with external connections that power various electrical devices. In the process of supplying power, the battery's positive terminal acts as the cathode, while the negative terminal functions as the