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Pulse charging based intelligent battery management system for electric vehicle

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ABSTRACT

Electric vehicles (EVs) are now an important part of the automotive industry for two main reasons: decreased reliance on oil and reduced air pollution, which helps us contribute to the development of an environmentally friendly environment. EV buyers examine overall vehicle mileage, recharge time, vehicle mileage after every charge, batteries charging/discharging security, lifespan, charged rate, capability, and temperature increase. A new improved pulse charging technique is proposed, in which the battery is charged using proportional integral derivative (PID) control action and a neural network. A PID controller is used to develop the charging unit in this design. The feed forward neural network was used to determine the values of the PID control parameters. The battery management system (BMS) ensures that this designed battery charging system takes less time to charge the battery efficiently. The system is built with MATLAB/Simulink.

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1. INTRODUCTION

Li-ion batteries used to have low levels of self rate and a high energy density. For electric vehicle (EV) sectors, lithium-ion batteries must improve power management, energy density, control, security, and charger [1]. Low ambient temperatures in EV markets impede Li+ ion diffusion at electrolytes and electrodes, slowing complication kinetics. It is hard to eliminate proficiently and uniformly which leads to degradation and concerns into safety-related problems due to the heat generated while doing fast charging of the battery [2]-[4]. The improvement of batteries technology with battery-management systems, that include surveillance, security, and monitoring of battery variables that serve as the battery platform's brain, has critical to the evolution of electric vehicles. Since incorrect actions such as over-current, over-voltage, or over-charging/discharging may cause serious safety concerns to the cells, significantly accelerate the ageing process or even wildfires if left unattended [5]-[7]. As a result, battery management system (BMS) plays a vital role in guaranteeing battery reliability and safety. It also has an automatic cut-off feature, which disconnects the battery from the electrical circuit and loads the side when charging and discharging levels exceed the set limits [8]-[10].

There are many challenges to manufacturers to introduce electrified solutions with their ranges, motor configuration, and converters acceptance by the customer of EVs and battery electric vehicles that are not