ABSTRAK

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Judul Tugas Akhir	:	Rancang Bangun Alat Estimasi *State Of Charge* Baterai *Lithium-ion* Dengan Fungsi *Cut Off Charge* Dan *Discharge* Pada Mobil Listrik

Penelitian ini bertujuan untuk merancang sistem estimasi *State of Charge* (*SOC*) pada baterai *Lithium-ion* menggunakan metode *Coulomb Counting* dengan fungsi *cut-off* untuk mencegah *overcharge* dan *overdischarge* pada mobil listrik. Sistem menggunakan sensor arus (ACS712 dan ACS758) serta sensor tegangan, dengan pemrosesan data dilakukan oleh mikrokontroler *Arduino Uno*. Nilai *SOC* digunakan untuk mengendalikan dua buah *relay* yang secara otomatis memutus arus pengisian saat *SOC* mencapai 90% dan arus pengosongan saat *SOC* turun ke 10%. Pengujian awal dilakukan untuk menentukan kapasitas aktual baterai melalui proses pengisian penuh (10,29 A selama 6 jam 58 menit) dan pengosongan penuh (13,20 A selama 5 jam 30 menit) dan diperoleh kapasitas aktual sebesar 72 Ah. Pengujian sistem dilakukan dalam lima siklus, dengan pengisian dari *SOC* 10%-90% menggunakan arus 5,69-9,96 A selama 5 jam 52 menit hingga 10 jam. Pengosongan dari *SOC* 90%-10% menggunakan arus 13,14-13,58 A selama ±4 jam 18 menit. Hasil pengujian menunjukan bahwa sistem berhasil melakukan *cut off* pengisian pada *SOC* 90% dan *cut-off* pengosongan pada *SOC* 10%. Sistem ini efektif dan konsisten, serta berpotensi diterapkan pada kendaraan listrik berbasis energi terbarukan.

Kata Kunci: State of *Charge*, *Coulomb Counting*, *Lithium-Ion*, Mobil Listrik, *Cut-off Charge*, *Cut-off Discharge*

ABSTRACT

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Title : *Design and Development of a Lithium-Ion Battery State of Charge Estimation System with Charge and Discharge Cut-off Function for Electric Vehicles*

This study aims to design a State of Charge (SOC) estimation system for lithium-ion batteries using the Coulomb Counting method with a cut-off function to prevent overcharging and overdischarging in electric vehicles. The system employs current sensors (ACS712 and ACS758) and a voltage sensor, with data processing handled by an Arduino Uno microcontroller. The SOC value is used to control two relays that automatically disconnect the charging current when SOC reaches 90% and the discharging current when SOC drops to 10%. Initial testing was conducted to determine the actual capacity of the battery through a full charging process (10.29 A for 6 hours and 58 minutes) and a full discharging process (13.20 A for 5 hours and 30 minutes), resulting in an actual capacity of 72 Ah. The system was tested over five cycles, with charging from 10% to 90% SOC using a current of 5.69–9.96 A for 5 hours and 52 minutes to 10 hours. Discharging from 90% to 10% SOC was carried out using a current of 13.14–13.58 A for approximately 4 hours and 18 minutes. The test results show that the system successfully performed charge cut-off at 90% SOC and discharge cut-off at 10% SOC. The system proved to be effective and consistent, and it has strong potential for application in renewable energy-based electric vehicles.

Keywords: State of Charge, Coulomb Counting, Lithium-Ion, Electric Vehicle, Cut-off Charge, Cut-off Discharge