ABSTRAK

Deven Ivander Austin Tanggo. Model Prediksi SoH dan Estimasi Umur Pakai Baterai Lithium-Ion Berbasis Data Operasional Pada PLTS Berbasis IoT
Bimbingan oleh Heri Suyanto, S.T., M.T.

Baterai lithium-ion merupakan komponen penting pada sistem Pembangkit Listrik Tenaga Surya (PLTS) karena berfungsi sebagai media penyimpanan energi. Seiring penggunaannya, baterai mengalami degradasi kapasitas yang dapat memengaruhi kinerjanya. Penelitian ini bertujuan merancang sistem monitoring baterai berbasis Internet of Things (IoT), melakukan estimasi State of Health (SoH), serta mengestimasi umur pakai baterai. Sistem menggunakan ESP32, sensor tegangan, arus, dan suhu yang terintegrasi dengan Firebase Realtime Database untuk monitoring secara real-time. Estimasi SoH dilakukan menggunakan metode Coulomb Counting berdasarkan perbandingan kapasitas aktual dan kapasitas nominal baterai. Hasil pengujian menunjukkan sistem mampu melakukan monitoring dan mengirimkan data secara real-time. Nilai SoH menurun dari 100% menjadi 97,30% dengan kapasitas aktual sebesar 9,93 Ah dari kapasitas nominal 10 Ah. Hasil estimasi menunjukkan hubungan positif antara SoH dan umur pakai, dengan estimasi umur pakai sebesar 12–72 bulan pada rentang SoH 50–100%. Dengan demikian, sistem dapat digunakan untuk memantau kondisi, mengestimasi kesehatan, dan memperkirakan umur pakai baterai pada sistem PLTS.

Kata Kunci : Baterai Lithium-ion, State of Health, Coulomb Counting, Internet of Things, PLTS.

ABSTRACT

Deven Ivander Austin Tanggo. *SoH Prediction Model and Lithium-Ion Battery Life Estimation Based on Operational Data in IoT-Based Solar Power Plants*

Supervised by Heri Suyanto, S.T., M.T.

Lithium-ion batteries are important components in Solar Power Plant (PLTS) systems because they function as energy storage devices. During operation, battery capacity gradually degrades, which can affect its performance. This study aims to design an Internet of Things (IoT)-based battery monitoring system, estimate the State of Health (SoH), and estimate battery lifetime. The system uses an ESP32, voltage, current, and temperature sensors integrated with Firebase Realtime Database for real-time monitoring. SoH estimation is performed using the Coulomb Counting method based on the ratio between actual and nominal battery capacity. The test results show that the system is capable of monitoring battery parameters and transmitting data in real time. The SoH decreased from 100% to 97.30%, with an actual capacity of 9.93 Ah from a nominal capacity of 10 Ah. The estimation results show a positive relationship between SoH and battery lifetime, with an estimated lifetime of 12–72 months within the SoH range of 50–100%. Therefore, the developed system can be used to monitor battery conditions, estimate battery health, and predict battery lifetime in PLTS systems.

Keywords: Lithium-ion Battery, State of Health, Coulomb Counting, Internet of Things, Solar Power Plant.