ABSTRACT

Currently, technological developments have developed very rapidly, one of which is in the

automotive sector. Many automotive manufacturers are actively developing their vehicles,

from oil-fueled vehicles to electric ones. Electric vehicles require batteries as a supplier of

electricity. However, often the process of charging batteries in electronic devices will exceed

their capacity, causing overcharging, and using too much power will cause the battery to

experience overdischarge.

Battery Management System (BMS) is a system designed to perform the function of

monitoring the performance of a battery to avoid the possibility of the battery operating outside

its specifications. The implementation of a digital twin-based Battery Management System is

carried out by combining the original battery data and the virtual model. The digital twin is

also a virtual model that can help humans collect data-based information and accurate

predictions to make decisions that affect battery performance optimization.

The digital battery model that is made can produce the required discharging data of 10,528

data and from the stability graph it is known if the battery system tends towards the balance

point so that it can be concluded that the battery model is stable. Then the hammerstain model

is able to make predictions accurately, this is evidenced by the graphs produced in each training

and validation process which are very close together and the results of the calculation of the

resulting evaluation of performance metrics are low. In addition, the estimation results show

that the hammerstein approach with the kernel method and the recursive least square method

is successful in overcoming the complexity and nonlinearity in estimating SoC in batteries.

From the two processes, digital twin data analysis was carried out where the results obtained

had good performance because the MSE error value on the SoC was 0.0083, the RMSE value

on the SoC was 0.0915 and the MAPE SoC value was 0.41% which indicates the model has an

error. low prediction. However, the test results for calculating the error value still use data that

is not equivalent between digital data and physical data. This system is only used as a trial of

the digital twin framework, so the results obtained require further steps to perfect the digital

twin framework.

Keywords: Battery, BMS, SoC, Digital Twin

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