ABSTRACT

Charging an electric motorcycle battery takes a long time. One solution to overcome this is to build Battery Swap station. However, battery swapping can be detrimental to the user if the swapped battery is indicated to be unhealthy which results in the motorcycle not being able to travel the distance promised by the manufacturer. This happens due to a decrease in the battery's state of health. State of Health (SoH) is a percentage of the battery's health level. An unhealthy battery has a SoH value below the End of Life (EoL) value. Therefore, battery health prediction is necessary.

In this study, a system is designed to predict battery health at Battery Swap Station. Semi-empirical equations are used to examine the relationship of each battery health parameter namely SoH, battery life cycle, and discharge rate. Furthermore, these parameters will become variables for the battery health prediction process using the Decision Tree Regression, and Random Forest methods. The prediction results are used as a reference for battery repair by the manufacturer if unhealthy batteries are indicated. Battery Swap Station will display SoC, battery life cycle, temperature, current, voltage, and SoH parameters as a percentage of battery health status.

The designed system displays the predicted SoH value of the battery. The prediction results are based on components that have an influence on battery capacity degradation through semi-empirical equations. This system has an RMSE value for Decision Tree Regression on NASA batteries of 0,001996, and Random Forest Regression of 0,0031. The gesits battery measurements were performed on multiple batteries. The current value is assumed to be constant based on five different speeds. The RMSE value obtained by the Decision Tree Regressor method is the same for each speed, namely 0,001766. As for the prediction of SoH on Gesits batteries using Random Forest Regressor, the best RMSE was obtained at a speed of 36 km / h, which was 0,00274.

Keywords: Battery Swap Station, Electric Motorcycle, Battery, Decision Tree Regression, Random Forest Regression