Master Thesis at Husqvarna AB:

End of Life (EOL) prediction model of Lithium-Ion Batteries

Background

Lithium ion batteries behavior is a hot topic in the research field. Multiple of those studies are conducted based on isolated lithium ion cell. However, the battery pack is equipped of a string of cells connected in series and/or in parallel supervised by a Battery Management System (BMS). The BMS ensures an optimal performance, long lifetime and safe operation of the battery by controlling the algorithms attempting to estimate the battery status. As batteries become increasingly prevalent in many of Husqvarna's products, we are eager to deep dive into this technology by continuously updating and upgrading the software design to increase the fidelity of battery state estimation in real-time.

Description

The prediction of the battery pack end of life (EOL) is crucial to control the battery health and to alert the user whether an action is required. The battery states estimated by the BMS such as the state of charge (SOC), the state of health (SOH) can in combination with some additional indicators be used to predict the EOL for a battery . A generic model with tuned weight factors of the different indicators, will be used to supervise of battery during its real-life use and the correct actions will be taken from the battery.

The target of this thesis is to design and implement an EOL function possible to use in a Robotic mower applications as a start. Later also for any other HVA battery application. The main tasks are the following:

1. **Design and formulate** a model of the battery EOL by using the BMS data from the battery and system data from the appliance as input to the algorithm. The output of the model will have three level: alert, warning and shut off.
2. **Develop and implement** a model that is possible to simulate and tune its parameters online to predict the battery end of life. The model developed needs to be able to flash into the BMS application software. The use of an artificial intelligence modeling or empirical modeling could be used.
3. **Test and verify** the performance of the proposed model using some real usage case data.

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Thesis Level: Master

Language: English/Swedish

Starting date: 2023-01-20

Number of students: 1

Required Documents

- CV
- Cover letter
- Transcripts of grades

Qualifications

- Embedded SW programming (C, C++, Python)
- Simulation tools (Matlab or similar)
- Electrical design understanding
- Office tools

Optional: Cell chemistry understanding

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