GENERAL-PURPOSE CELL BALANCING FOR BATTERY MANAGEMENT SYSTEM (BMS)

PROJECT BY:

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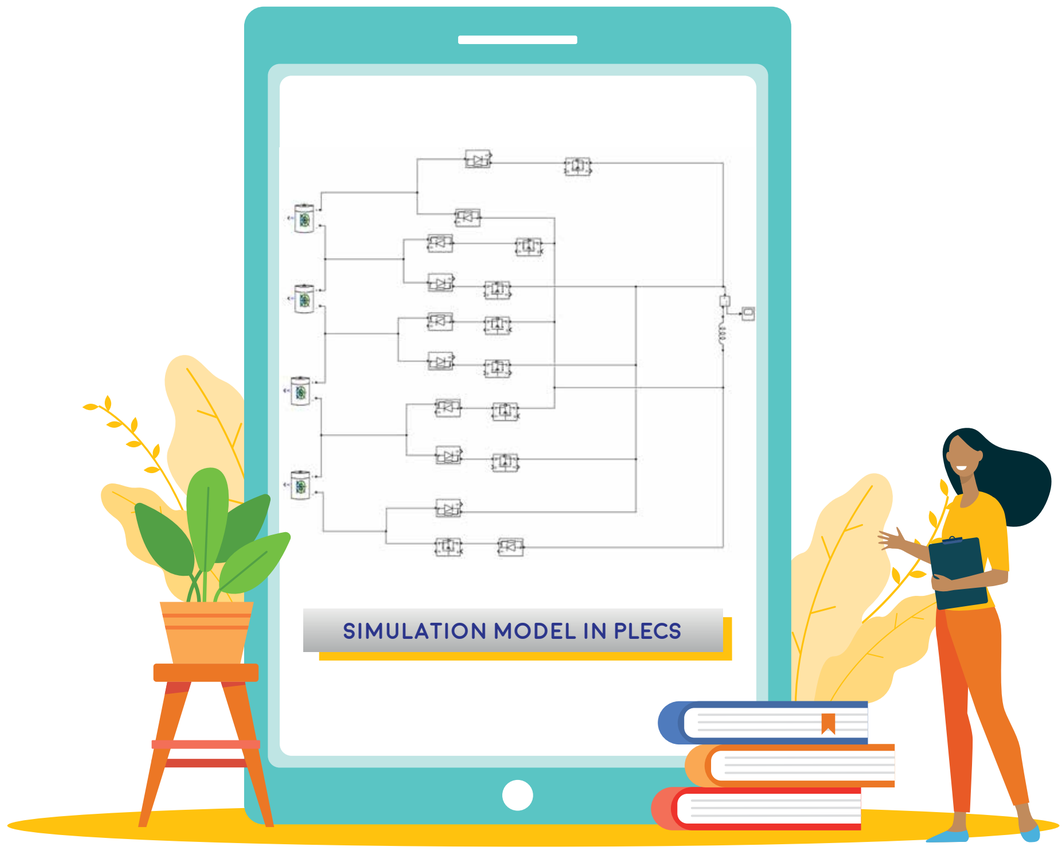
PROJECT OBJECTIVE

A BMS is a critical component of a modern electronic battery system as it extends the battery cells' usable lifespan, thereby reducing environmental waste generated at the battery's end of life. However, the majority of off-the-shelf BMS products use passive cell-balancing, which wastes energy by dissipating the energy in resistors. This project aims to design and build a more energy-efficient BMS that utilises active cell- balancing applicable to all types of batteries, including Li-ion, lead acid, etc.

PROJECT SUMMARY

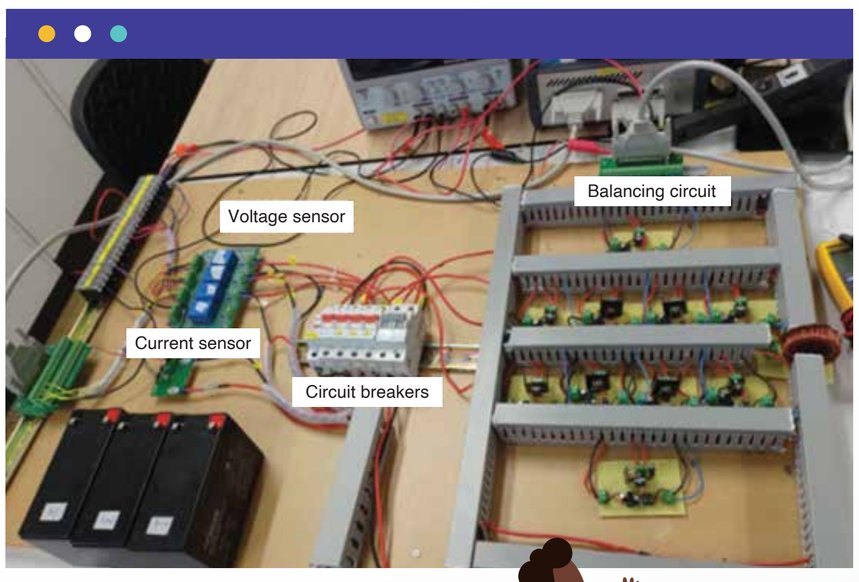
A simulation model with PLECS has been developed to verify the circuit and the control algorithm, which is used to determine the rating of critical components. Circuit hardware covers sensing (V/I sensors), switching (MOSFETs) and storage (Inductor), with protection devices being developed. An RT Box with hardware-in-the-loop (HIL) testing capability is used as the central controller to acquire the real-time operating status of all battery cells and send switching signals to MOSFETs to determine the charge/discharge of the selected cell to realise the State of Charge (SoC) balance among them. Various testing scenarios have been designed to verify the performance of the BMS.



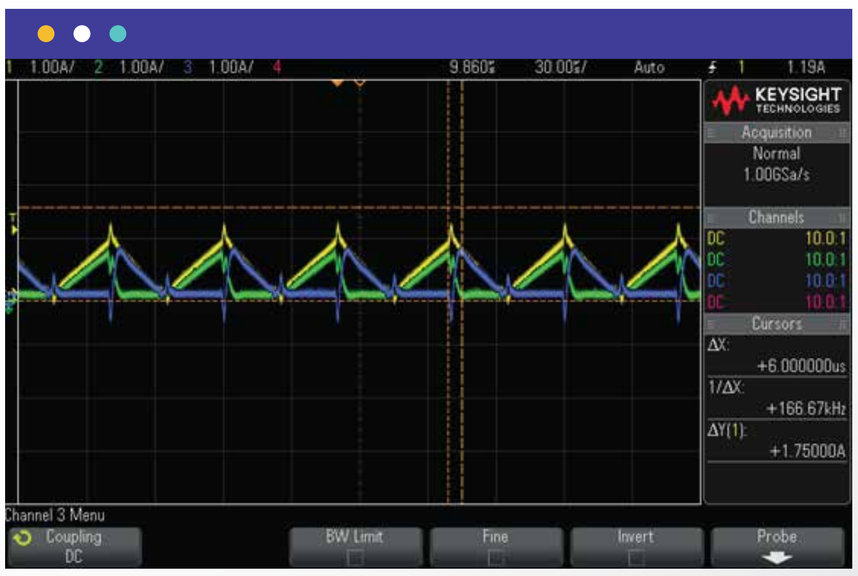
PROJECT OUTCOMES

- Simulation model with verification of both circuit and control algorithm.
- Developed BMS hardware platform with conversion efficiency of 97.5% for active balancing.
- Comprehensive testing for performance verification.

BMS CIRCUIT



INDUCTOR CURRENT IN CHARGE AND DISCHARGE STATUS



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