Assignment

Battery Management System

Q. 1. What is BMS ? Types of BMS and differtiate the types of BMS.

Ans:-

1) A BMS (battery mangement system) manages a battery pack by protecting the battery from operating outside its safe operating zone by monitoring its state, controlling its environment, and balancing the Lithium-ion cells inside the battery pack.
2) It can additionally calculate data and report data via various communication protocols.
3) BMS is called the heart of the battery system.

Types of BMS

There are 2 types of BMS mainly depending on architecture
① Hardware BMS ② Software / Smart BMS

Hardware BMS: A hardware BMS performs basic protection functions to keep the battery pack functioning as healthy as possible. The basic functions includes:

- Overvoltage cut-off
- Undervoltage cut-off
- Continous current
- over current detection
- Over temperature cut-off.

Software / Smart BMS: It has all the features of the hardware BMS but additionally can collect data, can have memory to store data and can transmit data via CAN, Bluetooth, IoT, etc.

Q.2. What are the technical parameters to keep in mind while procuring a BMS for assembling a battery pack?

Ans:- Every BMS is going to be used in a different application that has a different pattern of battery architecture and different operating parameter. In order to achieve optimum battery performance and safety, it is necessary to understand what needs to be controlled and why it needs controlling. This requires an in-depth understanding of the fundamental cell chemistries, performance characteristics and operating temperature. Hence, a BMS is customized according to the application after know the predefined operating conditions.

1) Over voltage cut-off: Overvoltage cut-off is the maximum voltage of a cell to which a cell should be charged. The over voltage cut-off for a LFP cell is 3.6 and for a NMC cell is 4.2V. Cells in a battery pack must use a BMS that cuts off the cells once they are charged to this voltage. If the cells are charged beyond this voltage, it can lead to thermal runaway. In case of NMC cells, thermal runaway means fire.

2) Undervoltage cut-off: Undervoltage cut-off is the voltage at which a cell needs to stop discharging any further. Undervoltage cut-off for a LFP cell is 2.5V and for a NMC cell is 2.75V. But I highly discourage touching can lead to battery swelling. Ever wondered why did someone's cell swell, because of deep discharged.

3) Continous current: It is the parameter setting in a BMS that makes sure the BMS is functioning smoothly in all aspects when operated at a particular charge and discharge current.

4) Over current detection (OCD): It is the maximum current the BMS can allow for a very short period of time. The battery will cut-off after one second of achiving OCD.

5) Over temperature cut-off: Operating temperature of Lithium-ion cells affects its cycle life. A BMS enforces the maximum temperature the battery can achieve during charging and during discharging.

Q.3. What is the purpose of BMS with communication? What are the various protocols of communication used in a BMS?

Ans:-

1) Communication is used for communication between devices. For example, a CAN 2.0 BMS sends communication from the battery to the vehicle control unit (VCU).

2) It can continuously transmit data of the battery's thermal profile and moniter its temperature continously.

3) It uses the colleted data points (temperature, voltage, current) to estimate the state of charge (SoC), state of health (SoH), etc of the battery pack.

4) The data can either be stored (on-board storage), can be transmitted by CAN to the VCU or sent to the cloud.

Types of BMS Communication in EV

- CAN (Controlled Area Network): It is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computer. It is can also be implemented for communication between the battery charger and the Battery manggement system (BMS).

- Bluetooth: It is something that sends the data to the end users on their cell phone app. We saw the data as a screenshots of a cell phone in the smart BMS topic.

- IoT Cloud Connectivity: It requires wireless internet and can transmit data to the cloud and it can be viewed remotely by anybody with an access.