Assignment

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Q1) what is a BMS ? Types of BMS & differentiate the type of BMS

A) **BMS**

A Battery management system manages a battery pack by protecting the battery from operating outside it's safe operating zone by monitoring it's state, controlling it's environment & balancing the Lithium-ion cell inside the Battery pack. It can additionally calculate data & report data via various communication protocols ~~are all data about Communication protocol at a later stage~~. BMS keeps a check on the key operational parameters during charging & discharging such as voltage & current & the battery internal & ambient temperature. the monitoring circuits could normally provide input to protecting devices which could generate alarm or disconnect the battery from the load ~~for~~ or charger should any of the parameter become out of limits.

Basically BMS is is ~~dat~~ classified in to two

1) Hardware BMS
2) Software BMS / smart BMS

1) ~~Hard~~

the main BMS functions are

1) over voltage cut off
2) under voltage cut off
3) continous current
4) over current detection
5) over temperature cut off

*1) Hard ware BMS

The BMS will also control the recharging of the battery by redirecting the recovered energy back in to the battery pack Battery thermal management systems can be either passive or active & the cooling medium can either be air, liquid or some form of phase change. Air cooling is advantageous in its simplicity. such systems can be passive, relying only on the convention of the surrounding air or active, using fan for airflow ~~Commercially~~ The major disadvantage of air cooling is its inefficiency. Large amount of power must be used to operate the cooling mechanism, far more than active liquid cooling. also add weight to the BMS, reducing the effeiency of batteries. used for transportation.

the Hard ware BMS performs Basic protection functions to keep the battery pack functioning as healthy as possible. the basic function includes. as above.

2) Software / Smart BMS

It has all the feature of the hardware BMS but additionally can collect data, can have memory to store data and can transmit data via Can, Bluetooth, etc, A smart BMS offers benifits such as online monitoring for battery status regarding voltage, current, impedance, internal temperature, etc. monitoring allows for timely response in case of potential battery accidents. while ~~regarding~~ reducing human maintenance costs. real time alarm and online balancing enables the system to analyse uploaded data and auto-verify.

A smart BMS can be called a BMS. data center due to all hystorical data collection, storage & analysis. At the same time, you can get real time battery information via a certain system.

Q2) what are the technical parameter to keep in mind while procuring a BMS for assembling a battery pack.

A) 1) Battery cell monitor

A battery cell monitor primarly monitors the voltages for battery system. It is a high speed system that offer a low overall cost for high voltage measurements.

The ~~easiest~~ easiest way to determine the Battery pack's charge is to monitor individual cell voltage with refference to the set voltage level. when the voltage of the first cell reaches the ~~voltage~~ voltage limit the charging automatically trips. It indicates that the battery charging limit has been reached.

If the battery pack has a lesser charge than the average cell then the least charged cell will reach the limit first, and the rest of the cells will be left partially charged.

2) Cut off ~~FETs~~ FETs

FET driver is accountable for connection and isolation between load and charger of the battery pack. the behaviour prediction is done through voltage, current measurement, in real time detection circuitry. they can be connected to a battery pack's low or high side. we use a a low-side FET driver to reduce costs. in integrated solutions since a charge pump is not needed. High voltage devices are not required in such cases. The ground connection of the battery pack floats using low-side cut-off FETs. this can affect the IC performance, making it more sensitive to insinuated noise measurement

3) monitoring temperature

with the increase in product requirement, the batteries have been on a constant surge in delivering currents at fixed voltages. The continous operation process may cause a catastrophic event such as fire or explosion. We can identify whether battery is charging or discharging is desirable using temperature measurement. Temperature sensors monitor the energy storage system or cell grouping for compact protable applications. The circuits. temperature is monitored by the internal ADC voltage-powered thermistor. Employing the

Internal voltage reference helps reduce the temperature inaccurasis and improves the overall measurement system.

4) Cell voltage balance

It is crucial to determine the health of the battery pack. That is why cell voltage monitoring is done to ensure that the cells are in a proper running condition for attaining a long battery life. The operating voltage ranges from 2.5V to 4.2V in a Li-ion battery. The battery life is significantly affected while performing battery operations. beyond the voltage range. This reduce the life of a cell which may even make it unfit for use. Connecting the battery pack in parallel increase the overall drive current, where as series connection adds the overall voltage.

5) BMS algorithms

To make quick and effective decision in real time based on the information received. for this purpose, a micro controller for battery managment system is needed to collect, organize and ~~ass~~ assess the information from the sensing circuitry. the memory space and micro controller for battery managment system clock cycles. can be cleared using these standalone solution

6) Real time clock

Allowing the user to know the battery pack's behaviour before any alarming event, the real time clock acts as a block box system for time-stamping and memory storage. The BMS electronics, is kept away from synchronizing with a third

Partly ~~between~~ battery pack through battery authentication The peripheral power circuitry is used around the components of battery management system through voltage regulator.

Q3) what is the purpose of BMS with communication? what are the various protocols of communication used in a BMS

A) ~~The main~~ goal

* Communication is used for communication b/w devices. For example, a CAN 2.0 BMS sends communication from the battery to the vehicle control unit (VCU)
* it can continuously transmit data of the battery's thermal profile and monitor its temperature continously.
* It uses the collected data points (temperature, voltage, current) to estimate the state of charge (SOC), state of health (SOH) etc... of the battery pack.
* The data can either be stored (on board) can be transmitted by CAN to the VCU or send to the cloud.

The main goal of BMS is to keep the battery within the safty operation region in terms of voltage, current & temperature, during charge, discharge, and in certain cases at open circuit, when working with a BMS usually use a 'BMS IC Depending on the BMS IC being used to control your BMS

Communication Protocols

UART :- Universal Asynchronous Receiver/Transmitter, is the most widely used communication protocol used in battery management system. UART is a form of serial communication which means bits are sent one after another sequentially instead of multiple bits sent at once which is what occurs with parallel communications. It is ~~not~~ widely used for communication b/w a micro-controller and the BMS IC in a BMS

CAN :- Controller area Network, is the most widely used communication protocol in the automotive industry. CAN Communication are used frequently in ~~a~~automotives because it removes all signal noises, ~~such~~ it also removes a host of wire harnesses from a system. It is one of the most robust and reliable communication protocol. the micro controller Connects to the CAN chip. which then connects to the outside devices. The CAN chip has TXD and RXD pins, which allows it to Communicate with the micro controller. The TXD pin is for the transmission of data on the RXD pin is for the receiving of data ~~So these are the~~

SPI :- Serial peripheral Interface, is a master-slave type protocol that provides a simple and low cost Interface b/w a microcontroller and it's peripherals. The SPI protocol uses a dedicated clock signal that is created by the master device to synchronize the transmitter and receiver or master and slave. The micro controller can communicate with the BMS IC via SPI Communication, along with other Peripheral

devices that can communicate with the SPI communication SPI communication uses 4 lines for each device. there is an input data line and output data line, a clock line, and a chip-select line to identify which slave divice the master trying to communicate

I2C :- Integrated Circuits communication, is a protocal used for IC to IC communication. I2C is intended primarily for short distance communication b/w 2 ICs on the same printed board. The I2C is a standard bidirectional Interface that uses a controller known as the master to communicate with slave devices. The physical I2C interface consists of the serial clock and serial data lines. Both SDA & SCL line must be connected to VCC through a pull-up resistor Being that the SDA lines is bidirectional. It functions to transmit data or recieve data.