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RESEARCH ARTICLE

ENCHANCING LIFE SPAN OF BATTERY PACK USING A NOVEL BATTERY BALANCING TECHNIQUE

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ABSTRACT

Large battery packs composed of Lithium-Ion cells are continuously gaining in importance due to their applications in Electric Vehicles (EVs) and smart energy grids. To ensure maximum lifetime, safety and performance of the battery pack, complex embedded system architectures consisting of sensors, power electronics and microcontrollers are integrated into the pack as Battery Management System (BMS).Active cell balancing is a recently developed method that reduces losses by reducing the hardware components and providing more software control. This also makes the system simpler and easier to design. This method uses a matrix switching circuit which provides the capability to add or remove a cell from a pack during charging and discharging.

INTRODUCTION

Passive cell balancing method is not very efficient because electrical energy is dissipated as heat in the resistors and the circuit also accounts of switching losses. Flying capacitor based active cell balancing method has drawback is that charge can be transferred only between adjacent cells. Also it takes more time since the capacitor has to be charged and then discharged to transfer the charges. Buck boostmethod also suffers from a major disadvantage that charge could be transferred only from higher cell to lower cell. Also the loss in switching and diode voltage drop should be considered.

Procedure

Existing System: Large battery packs composed of Lithium-Ion cells are continuously gaining in importance due to their applications in Electric Vehicles (EVs) and smart energy grids. To ensure maximum lifetime, safety and performance of the battery pack, complex embedded system architectures consisting of sensors, power electronics and microcontrollers are integrated into the pack as Battery Management System (BMS).Active cell balancing is a recently developed method that reduces losses by reducing the hardware components and providing more software control. This also makes the system simpler and easier to design. This method uses a matrix switching circuit which provides the capability to add or remove a cell from a pack during charging and discharging.

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Final Submission. In our proposed system we are overcome the existing method. The system consists of microcontroller, voltage level monitoring sensor, battery pack, and driver circuit. Voltage sensing device can be placed in separate battery to monitoring the charging level of the battery pack. During charging process the battery which is of high voltage will be removed from the pack using the driver circuit arrangements automatically with the help of microcontroller. The faulty high voltage battery is removed from the pack by using the driver circuit.. Thus the rest of the batteries are automatically charging continuously so as to balance them during charging. But the charging voltage has to be adjusted accordingly. The same technique can be followed during discharging also.

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Proposed system

Voltage Sensor: A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine both the AC voltage or DC voltage level. The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal.

Microcontroller: A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip.

Liquid crystal display: LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

Power Supply: A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters.

DRIVER CIRCUIT: In electronics, a driver is a circuit or component used to control another circuit or component,
such as a high-power transistor, liquid crystal display (LCD), and numerous others.

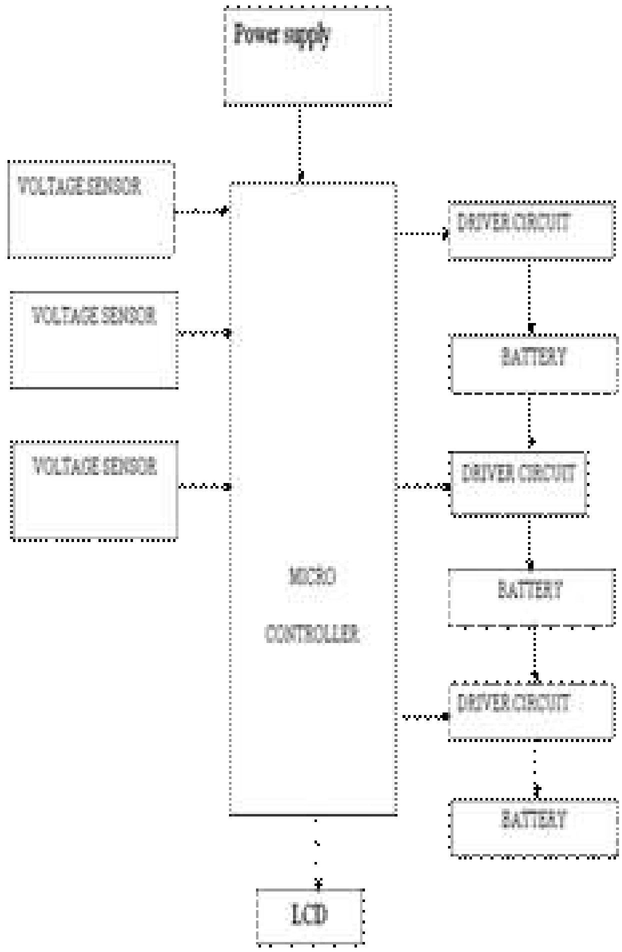
BATTERY: A battery is a device consisting of one or more electrochemical cells with external connections[1] for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode.

1. C. M. Martinez, X. Hu, D. Cao, E. Velenis, B. Gao, and M. Wellers,`` Energy management in plug-in hybrid electric vehicles: Recent progress and a connected vehicles perspective," IEEE Trans.
Veh. Technol., vol. 66, no. 6, pp. 4534_4549, Jun. 2017.
2. X. Zhang and G. Wang, ``Optimal dispatch of electric vehicle batteries
between battery swapping stations and charging stations," in Proc. IEEE
Power Energy Soc. Gen. Meeting, Boston, MA, USA, Jul. 2016, pp.1_5.

Units: Flying capacitor based active cell balancing method has drawback is that charge can be transferred only between adjacent cells. Also it takes more time since the capacitor has to be charged and then discharged to transfer the charges. Buck boostmethod also suffers from a major disadvantage that charge could be transferred only from higher cell to lower cell. Also the loss in switching and diode voltage drop should be considered.

Figures and Tables: Voltage sensing device can be placed in separate battery to monitoring the charging level of the battery pack. During charging process the battery which is of high voltage will be removed from the pack using the driver circuit arrangements automatically with the help of microcontroller. The faulty high voltage battery is removed from the pack by using the driver circuit.. Thus the rest of the batteries are automatically charging continuously so as to balance them during charging

Color Figures: Flying capacitor based active cell balancing method has drawback is that charge can be transferred only between adjacent cells. Also it takes more time since the capacitor has to be charged and then discharged to transfer the charges. Buck boostmethod also suffers from a major disadvantage that charge could be transferred only from higher cell to lower cell. Also the loss in switching and diode voltage drop should be considered.



The life of rechargeable NiCad and Nickel Metal Hydride batteries such as those used in power tools can be extended by the use of an intelligent charging system which facilitates communications between the battery and the charger. The battery provides information about its specification, its current condition and its usage history which is used by the charger to determine the optimum charging profile or, by the application in which it is used, to control its usage. The prime objective of the charger/battery combination is to permit the incorporation of a wider range of Protection Circuits which prevent overcharging of, or damage to, the battery and thus extend its life. Charge control can be in either the battery or the charger. The objective of the application/battery combination is to prevent overloads and to conserve the battery. Similar to the charger combination, discharge control can be in either the application or in the battery.

Battery Monitoring, keeping a check on the key operational parameters during charging and discharging such as voltages and currents and the battery internal and ambient temperature. The monitoring circuits would normally provide inputs to protection devices which would generate alarms or disconnect the battery from the load or charger should any of the parameters become out of limits. For the power or plant engineer responsible for standby power who's battery is the last line of defence against a power blackout or a telecommunications network outage BMS means Battery Management Systems. Such systems encompass not only the monitoring and protection of the battery but also methods for keeping it ready to deliver full power when called upon and methods for prolonging its life. This includes everything from controlling the charging regime to planned maintenance. For the automotive engineer the Battery Management System is a component of a much more complex fast acting Energy Management System and must interface with other on board systems such as engine management, climate controls, communications and safety systems.

Decision Logic Module: The Decision Logic module compares the status of the measured or calculated battery parameters from the Battery Model with the desired or reference result from the Demand Module. Logic circuits then provide error messages to initiate cell protection actions or to be used in the various BMS feedback loops which drive the system to its desired operating point or isolate the battery in the case of unsafe conditions. These error messages provide the input signals for the Battery Control Uni.

Conclusion

The remaining range, based on recent driving or usage patterns, is calculated from the current SOC and the energy consumed and the miles covered since the previous charge (or alternatively from a previous long term average). The distance travelled is derived from data provided by other sensors on the CAN bus (see below). The accuracy of the range calculation is more important for EVs whose only source of power is the battery. HEVs and bicycles have an alternative "Get you home" source of power should the battery become completely discharged. The problem of losing all power when a single cell fails can be mitigated at the cost of adding four more expensive contactors which effectively split the battery into two separate units. If a cell should fail, the contactors can isolate and bypass the half of the battery containing the failed cell allowing the vehicle to limp home at half power using the other (good) half of the battery.

Acknowledgment

The master controls the main battery isolation contactor(s) initiating battery protection in response to data from the main current sensor or voltage and temperature data from the slaves. The master also provides the system communications. C. Jin, J. Tang, and P. Ghosh, "Optimal electric vehicle charging: Acustomer's perspective," IEEE Trans. Veh. Technol., vol. 62, no.7, pp.2919–2927, Sep. 2013.

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