5S BATTERY MANAGEMENT SYSTEM FOR LITHIUM-ION BATTERY

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Abstract: Battery Management Systems (BMS) are used in many industrial and commercial systems to make the battery operation more efficient and for the estimation to keep the battery state, as long as possible, away from destructive state, to increase battery life time. For this purpose, many monitoring techniques are used to monitor the battery state of charge, temperature and current.

INTRODUCTION: A Battery management system (BMS) consists of software and hardware, designed to increase the discharge cycle of the battery to maximize the battery lifetime [1]. To explain the battery management systems (BMS), there are two variables that should be considered. The first variable is the battery State of Charge (SOC) which refers to the amount of charge presented in a battery in a charge or discharge cycle. The second variable is the Battery State of Health (SOH) which represents the performance of the battery compared to its past and expected future.

SOC DETERMINATION: A good SOC calculation provides many advantages for EV such as; longer battery life, better battery performance and failure warning of the battery pack. The residual battery capacity can be determined by measurement of the density of chemical components of the battery; however it is not a practical solution Accordingly, various methods have been proposed based on battery voltage and current measurement. Most of these methods ignore the temperature effect in calculation of the battery SOC. The SOC should be determined accurately, especially for electrical vehicles applications to predict the travel / remaining distance of the vehicle. There are three basic interrogation methods existing for determining the SOC of a battery.

The methods are as follows:

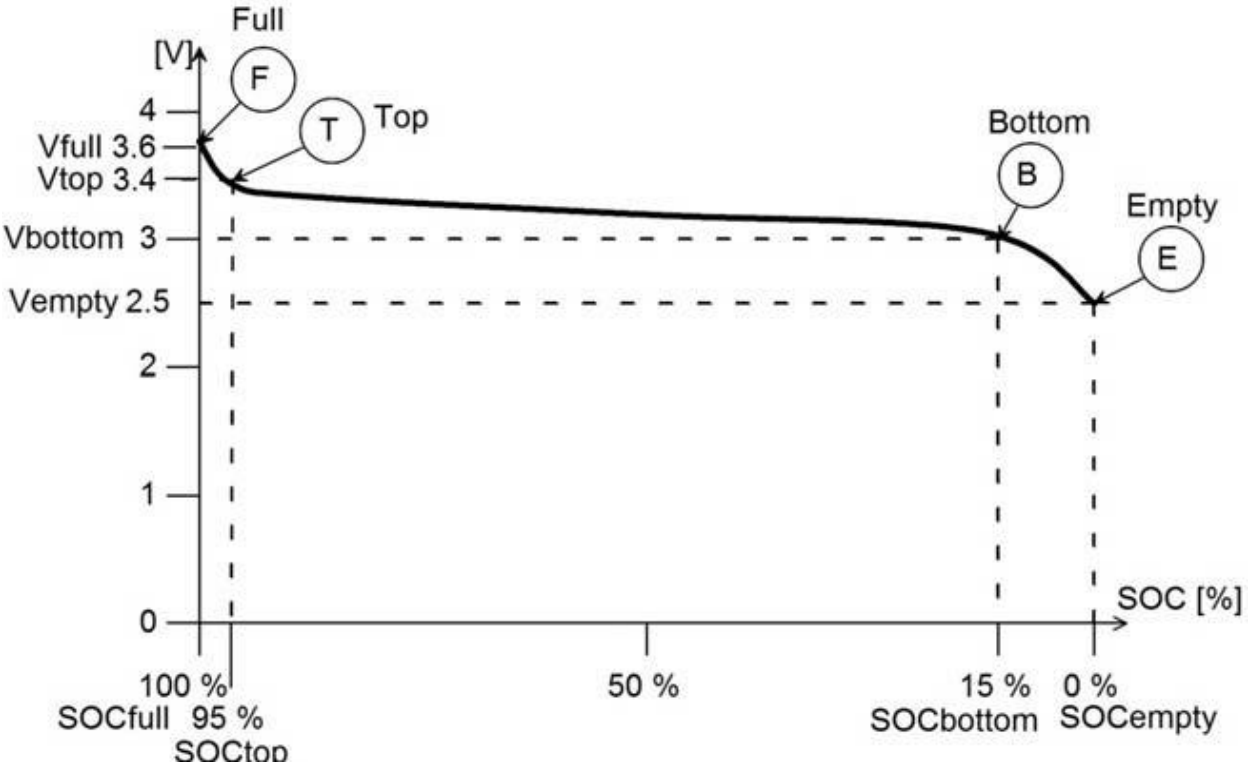
Coulomb counting

Voltage delay

Impedance methods

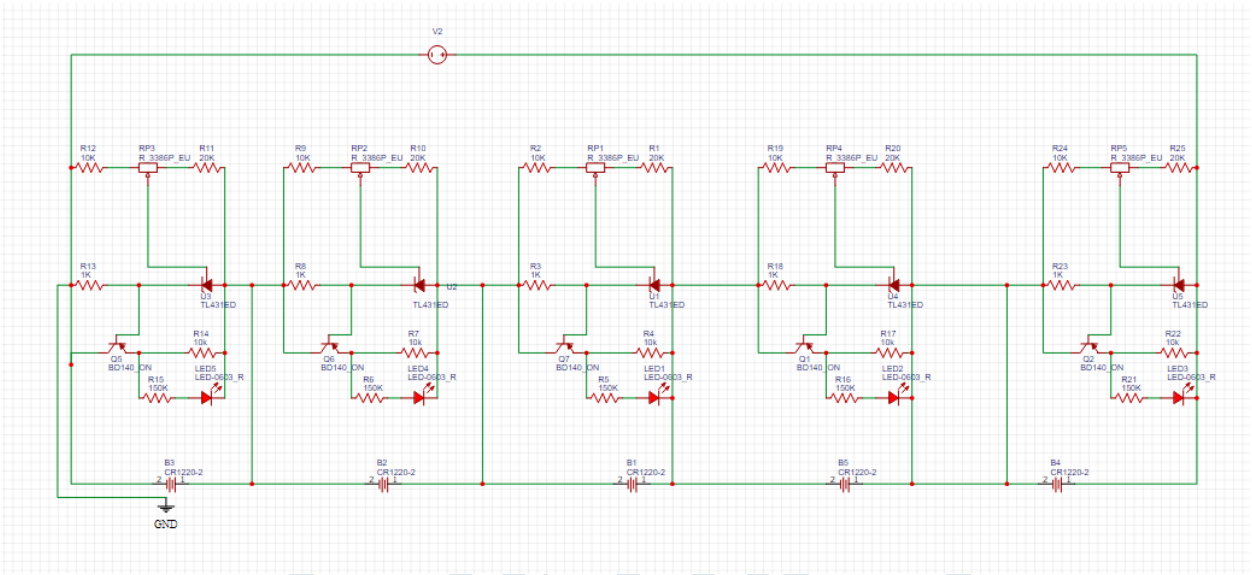
BATTERY SOC MODELING:

The SOC normally refers to the rated capacity of a new cell. It is not the fully charged capacity of the cell when it was last charged (i.e. the current charge-discharge cycle). This is because the cell capacity gradually reduces as the cell ages and it is also affected by temperature and discharge rate. At the end of the cell's life its actual capacity will be approaching only 80% of its rated capacity and in this case, even if the cell were fully charged, its SOC would only be 80%. This difference is important if the user is depending on the SOC estimation as he would in a real gas gauge application in a car. These ageing and environmental factors must therefore be taken into account if an accurate estimate is required. If the SOC reference was defined as; the current fully charged capacity of the cell, then the adjustment factors would have to be applied to the rated capacity to determine the new reference capacity.



In this case, a fully charged cell would have an SOC of 100%, but it would only have a capacity of 80% of a new cell. For cell balancing applications, it is only necessary to know the SOC of any cell relative to the other cells in the battery chain. Since all the cells will have been subject to the same influences during their lifetime, the ageing and environmental adjustments, which apply equally to all cells, can be ignored for this purpose. Based on the Peukert equation, the discharge current of a battery decreases with increasing the discharge time.

DESIGNED SYSTEM:



Used components:

1. Transistor BD140
2. LED 5mm
3. Regulated Zener Diode
4. Resistor 20k ,10k,1k,150 (.25W)
5. Resistor 10 ohm 1-2watt
6. Variable Resistor 10K

CONCLUSIONS:

Without BMS circuit when we charge all batteries, the current distribution will be different. Charge distribution will be different. And it can damage some of the battery or overcharge the battery. Therefore, the lifetime of battery will be decreased. So, with BMS circuit, current distribution in all 5 batteries will be same. Therefore, charge distribution will also be same. It will help to increase the lifetime of the batteries. And protects from overcharged.

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