Task 1.3

Box of Shame

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-First, we need to calculate the current in LED branch:

Current (I) = V / R = 12 / 3.3 = 3.636 A

-Then, we need to calculate LED's power consumption:

*Power (P) = V * I = 12 * 3.636 = 43.636 watt*

-After that, we need to calculate Energy consumed by LED in 5 hours:

Energy (E) = Power * time = 43.636 * 5 = 218.182 Wh.

-Since the batteries are connected in parallel, the total capacity of the parallel batteries should be greater than or equal to 218.182 Wh.

-The total energy provided by the batteries can be calculated using the formula:

*Total Energy = Battery Capacity * Battery Voltage*

*= 5.2 * 0.8 * 11.1 = 46.176 Wh.*

-Finally, we need to calculate the number of batteries needed:

Number of batteries = Energy consumption in led branch / Total Energy

= 218.182 / 46.176 = 4.725 *≈ 5 batteries.*

BMS

BMS stands for "Battery Management System." It's an electronic system designed to monitor and manage the charging, discharging, and overall health of rechargeable batteries. BMS is commonly used in various applications, including electric vehicles, energy storage systems, laptops, smartphones, and more. Its main functions include:

1. Cell Monitoring: BMS monitors the voltage and temperature of individual cells within a battery pack. This is crucial because each cell can have slightly different characteristics, and monitoring helps ensure that cells are balanced and not overcharged or over-discharged.

2. State of Charge (SoC) and State of Health (SoH) Estimation: BMS estimates the amount of charge remaining in the battery (SoC) and assesses the health of the battery (SoH) based on factors like charge cycles, internal resistance, and voltage characteristics.

3. Charge and Discharge Control: BMS manages the charging and discharging processes to ensure they stay within safe limits. It might prevent overcharging, over-discharging, and overheating, which can extend battery life and prevent safety risks.

4. Balancing: In battery packs with multiple cells, BMS can balance the charge between cells to prevent some cells from becoming overcharged or over-discharged compared to others.

5. Safety Protections: BMS provides various safety features, including protection against short circuits, overcurrent, overvoltage, undervoltage, and over-temperature conditions. It can disconnect the battery from the load or charger if unsafe conditions are detected.

6. Communication and Reporting: BMS often includes communication interfaces (such as CAN bus, UART, or SMBus) to allow external devices or systems to monitor battery status, control charging, and receive alerts or data from the BMS.

7. Cell Monitoring: BMS monitors individual cell voltages and temperatures. If a cell behaves abnormally, the BMS can take corrective actions to prevent damage to the battery.

8. Thermal Management: In some advanced systems, BMS can control cooling or heating elements to maintain optimal operating temperatures within the battery pack.

- BMS plays a vital role in ensuring the safe and efficient operation of battery systems, especially in applications where multiple cells are connected in series or parallel. It helps prevent catastrophic failures, optimizes battery performance, and prolongs battery life by managing the cells in a way that minimizes stress and ensures proper charging and discharging profiles.
  Certainly, here's some additional information about Battery Management Systems (BMS):

  BMS Components:
  A typical BMS consists of several key components:

  1- Voltage Measurement Circuitry: Monitors the voltage of individual cells or cell groups within the battery pack.
  2- Temperature Sensors: Measures the temperature of the battery cells to prevent overheating and ensure safe operation.
  3- Current Sensors: Monitors the current flowing in and out of the battery, helping to manage charging and discharging rates.
  4- Control Logic: Executes the algorithms and decision-making processes to manage the battery's operation based on the measured data.

5- Cell Balancing Circuitry: If the battery pack consists of multiple cells, the BMS can balance the charge levels among cells to ensure uniform performance.
6- Communication Interface: Provides a means of communication between the BMS and external devices, allowing for monitoring, control, and data exchange.
7- Protection Circuitry: Implements safety features to prevent overcharging, over-discharging, short circuits, and other potential hazards.