SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35.

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DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 23AUB201 – AUTOMOTIVE ELECTRICAL DRIVES AND CONTROLS

II YEAR / III SEMESTER

Unit 3 – Battery System

Topic : Battery Management System

BATTERY MANAGEMENT SYSTEM

- A Battery Management System (BMS) is a critical component in battery-powered applications, including electric vehicles (EVs), portable electronics, and energy storage systems.
- Its primary purpose is to monitor and manage the battery's performance to ensure safe and efficient operation.

COMPONENTS

- **Control Unit:** The brain of the system that processes data from sensors and determines control actions.
- **Voltage Sensors:** Measure the voltage of individual cells or modules.
- **Temperature Sensors:** Detect the temperature of cells to prevent overheating or freezing conditions.
- **Current Sensor:** Monitors the charge/discharge current to ensure it stays within safe limits.
- **Balancing Circuit:** Redistributes charge across cells to equalize their state of charge.
- **Communication Interface:** Allows the BMS to send data to external systems or receive commands from them.

KEY FUNCTIONS

❖ **Monitoring:**

- **State of Charge (SOC):** Indicates the remaining capacity of the battery, much like a fuel gauge in a car.
- **State of Health (SOH):** Reflects the overall health and degradation level of the battery over time.
- **Cell Voltage Monitoring:** Ensures that no cell operates outside its safe voltage limits.
- **Temperature Monitoring:** Keeps track of battery temperature to prevent overheating or thermal runaway.

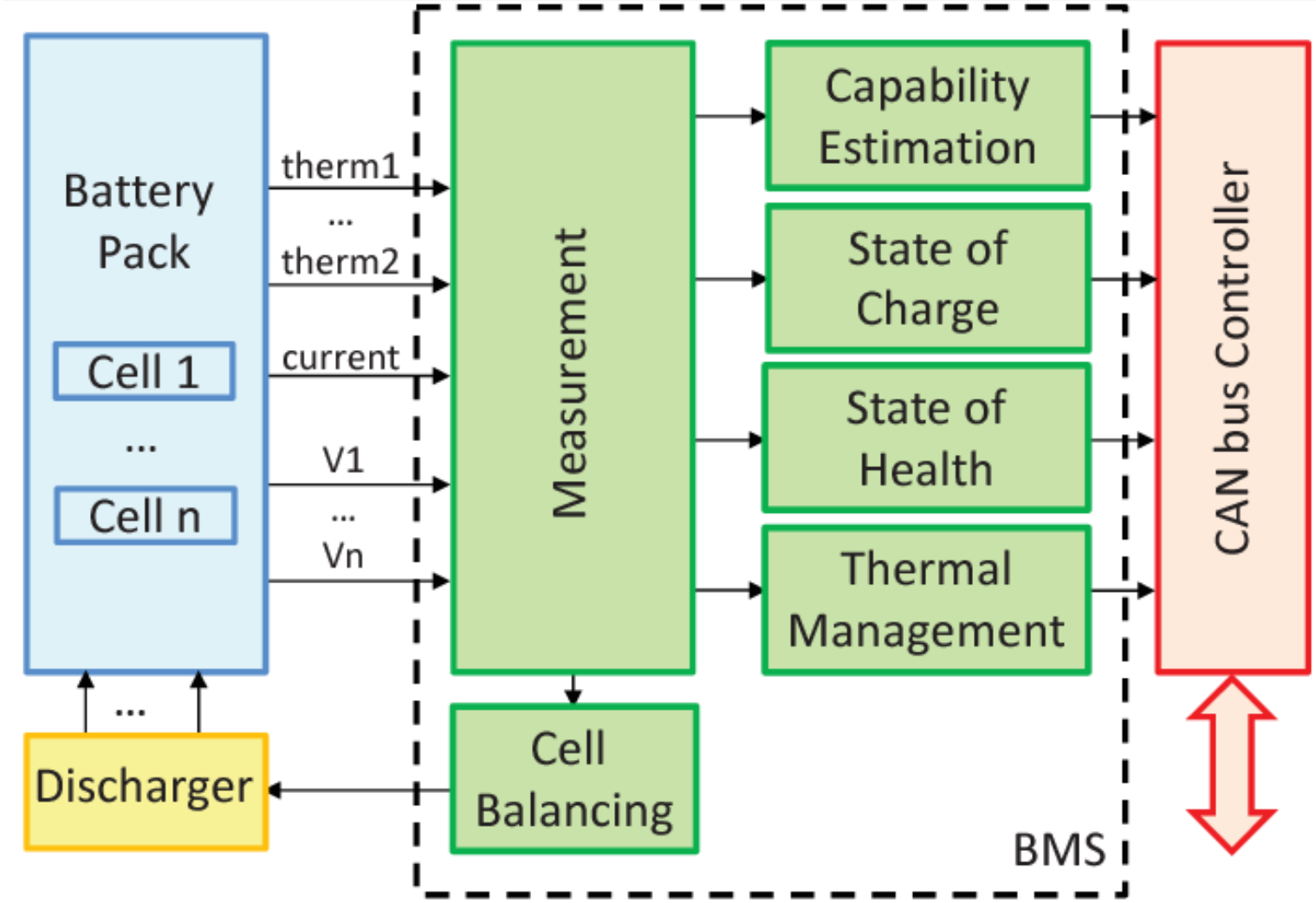
KEY FUNCTIONS

- **Protection:**
  - Prevents overcharging and over-discharging of the battery cells.
  - Protects against short circuits and overloads.
  - Manages thermal protection to prevent damage from extreme temperatures.
- **Balancing:**
  - Ensures equal charge distribution across all cells in a battery pack by balancing the charge levels of individual cells.
  - This prolongs battery life and optimizes performance.

KEY FUNCTIONS

- **Communication:**
  - Interfaces with external systems (such as a vehicle control system) to provide data about battery status and performance.
  - May implement fault diagnostics and reporting.
- **Optimization:**
  - Manages the charging and discharging cycles to maximize battery life and ensure optimal performance.

BATTERY MANAGEMENT SYSTEM



BATTERY MANAGEMENT SYSTEM ARCHITECTURE

- **Centralized BMS:** A single control unit manages all battery cells. It’s simpler but may have scaling limitations.
- **Distributed BMS:** Each battery module or cell has its own monitoring unit that communicates with a central controller. It's more scalable and often used in larger systems like EVs.
- **Modular BMS:** A hybrid system where groups of cells share a control unit, offering a balance between centralized and distributed architectures.

ADVANCED FEATURES IN MODERN BMS

- **Predictive Analytics:** Uses data to predict battery life and potential failures.
- **Wireless BMS:** Reduces wiring complexity by using wireless communication for cell monitoring, improving reliability and reducing weight.
- **Thermal Management Integration:** Manages battery cooling systems to ensure temperature uniformity across cells.

APPLICATION

- **Electric Vehicles (EVs):** A BMS ensures that the battery pack operates safely, efficiently, and with maximum range.
- **Energy Storage Systems:** In grid applications, the BMS ensures long-term storage stability and optimal energy release.
- **Portable Electronics:** BMS is used in devices such as smartphones and laptops to manage battery life and prevent safety hazards.

THANK YOU !!!