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# Battery Management System의 응용과 전망

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남 공 역

((주)파워로직스)



# Battery Management System

## 응용 과 전망



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**Ltd.**



## **AGENDA**

### Application Technology

- Introduction
- Protection Circuit
- Smart Battery System
- Battery Management Sys.

# Battery Pack Considerations

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- **Battery Pack Design**

- ✓ Battery space and weight of system
- ✓ Operating voltage of components
- ✓ Total system power requirements
- ✓ Desired operational life

**Optimize** - Battery Usage

- Run Time
- Sys. Power Management
- Life Cycle



**Design Cell capacity, Voltage, and Pack Configuration**

- **Safety**

- ✓ Safety Circuits

to monitor overvoltage, undervoltage, overcurrent and short circuit conditions.

- **Cell Balancing**

- ✓ Mismatch of the voltage between cells → Using Bypass Technology caused by manufacturing variations and/or accelerated by temperature.

- **Fuel Gauging (SOC)**

- ✓ to provide information of possible run time and precise system control.
- ✓ Factors in temperature, cycle history, battery chemistry, charge/discharge state and application usage.

## Why State of Charge (SOC)?

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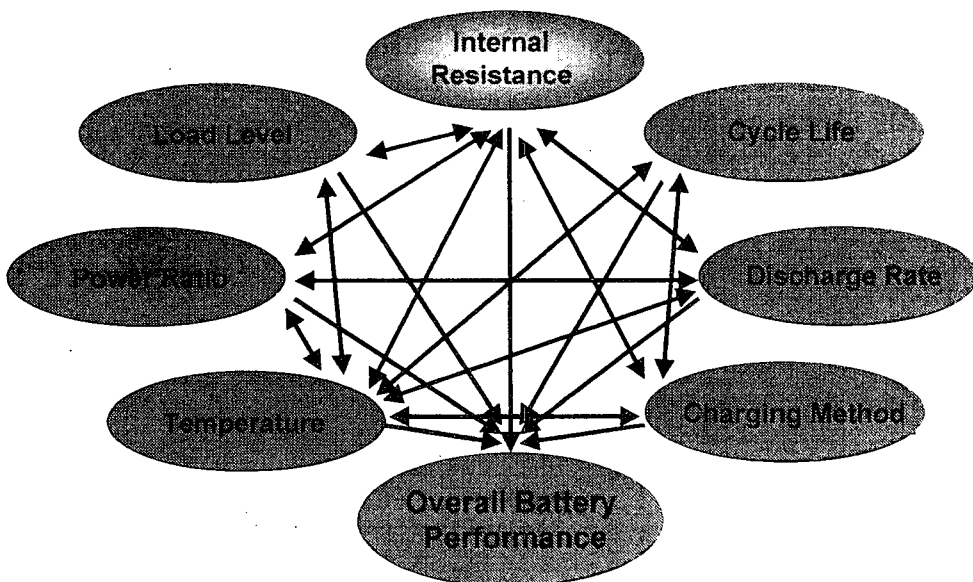
- **State of Charge is need to be compensated for;**

- to ensure accurate runtime remaining predictions.
- to provide commands for precise system control.

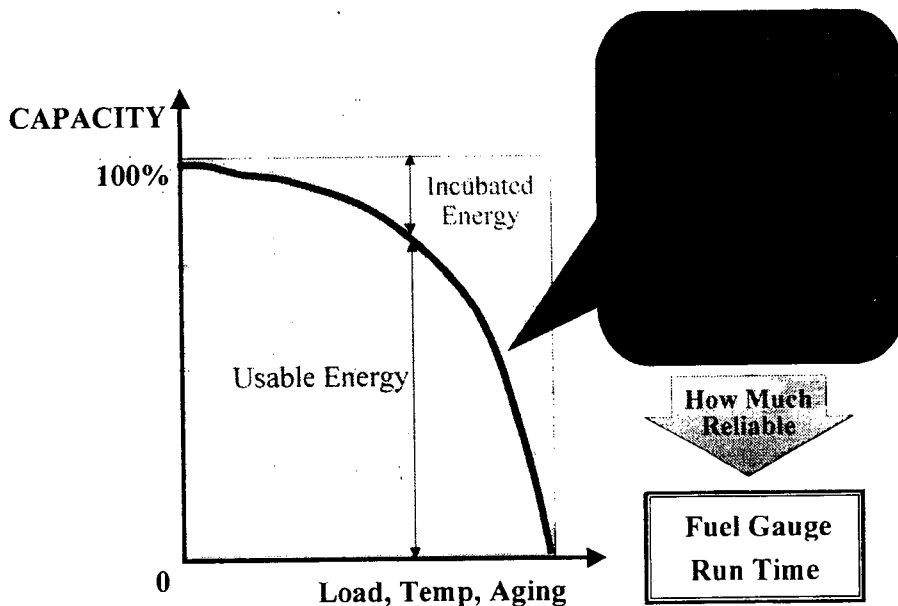
- **State of Charge is a function of;**

- applied load (charging/discharging current)
- environmental temperature
- age of battery
- self-discharge effects
- charge efficiency

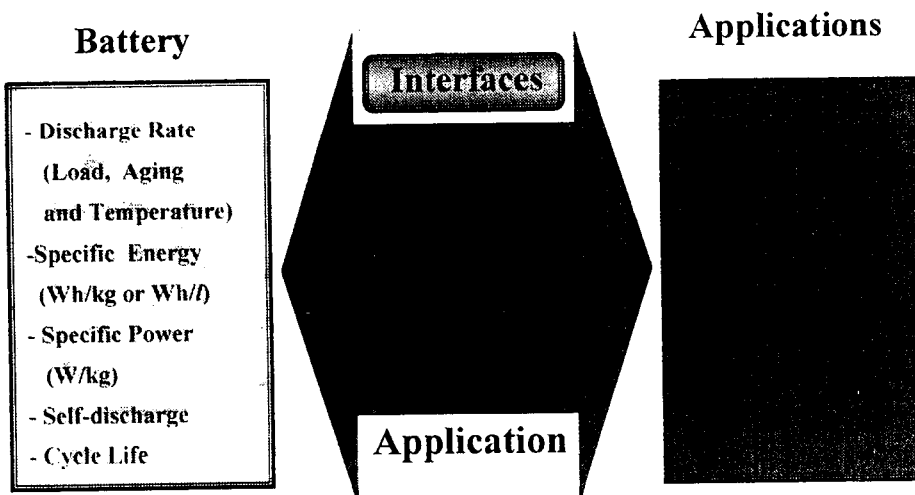
- Batteries are very non-linear devices;
  - Significantly affected by Load, Heat and Age
- Batteries provide very few parameters to measure
- Many differences between battery chemistries
  - Different type of chemistry
  - Same type of battery, but different company indicates different properties.



# Battery Characteristics



# Battery Interfaces Designs



1 <sup>st</sup> Gen	2 <sup>nd</sup> Gen	3 <sup>rd</sup> Gen
Analog	Digital	
AMP	GSM, CDMA, TDMA	IMT-2000
Voice	Voice/Data	Voice/Data/Media
NiMH	(NiMH) Li-ion	Li-ion Li Polymer
3/4 Cell	2 Cell → 1 Cell	2 Cell (?)

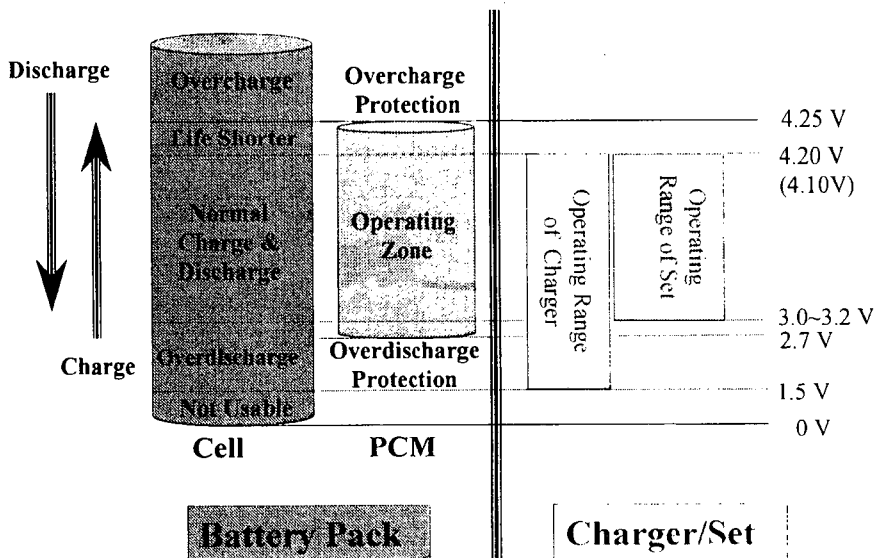
**Protects Sensitive Li-ion Cells from;**

- **Overcharging Protection**
- **Overdischarging Protection**
- **Overcurrent Protection**
- **Short-Circuit Protection**
- **Reverse Charging Protection**
- **Thermal Protection**

# Pack Protection Types

Number of cells protected	Protection Types	Key Features
3 or 4	Overvoltage Undervoltage	Very low power
2	Overcurrent	Internal MOSFET (80mΩ total)
1	Overcharge Overdischarge Overcurrent	
3 or 4	Overvoltage Undervoltage Overcurrent	Smart-discharge Circuitry
1	Overcharge Overdischarge Overcurrent	Internal MOSFETS (50mΩ total)

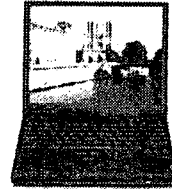
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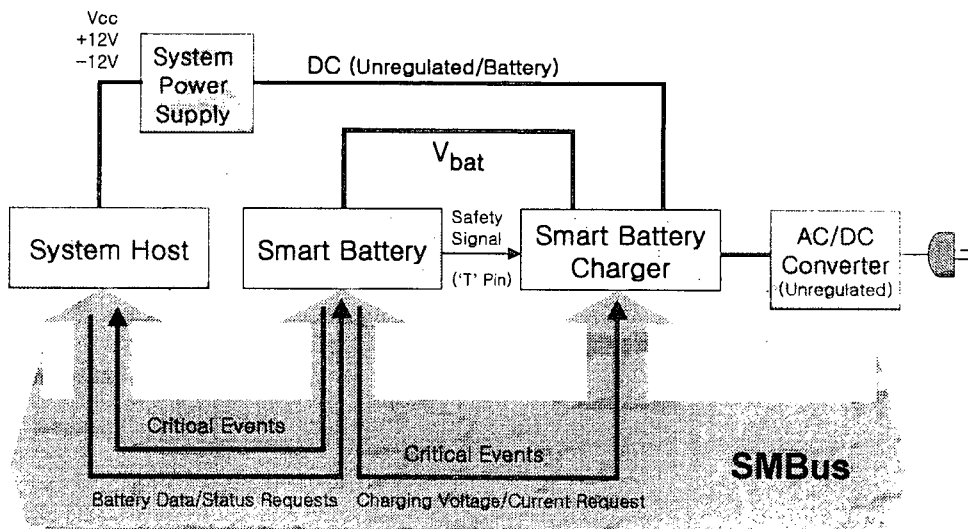


# Smart Battery Devices

- Safety Units
  - Li-ion Protection
  - Battery Pack Shutdown/monitor/control
- Gas gauge
  - Monitors available charge in battery cells
- Controller
  - Read, monitors and controls battery functions
  - Provides information useful to smart batteries
    - Cycle Counts
    - Battery History
    - Battery Manufacturer Details
    - Time Remaining
    - Average Current
    - Charging Information
  - Has a communication protocol (Like SMBus)
- Charger
  - Provides voltage and current to battery pack according to particular algorithm or requests from battery



## SBS Structure in Notebook PC



# What BMS Do?

**(1) Monitoring**

- Voltage, Current, Temperature

**(2) Managing**

- Charging Algorithms (Balancing, Overcharge)
- Communication and Control
- Autonomous Operation
- Fully Integrated System

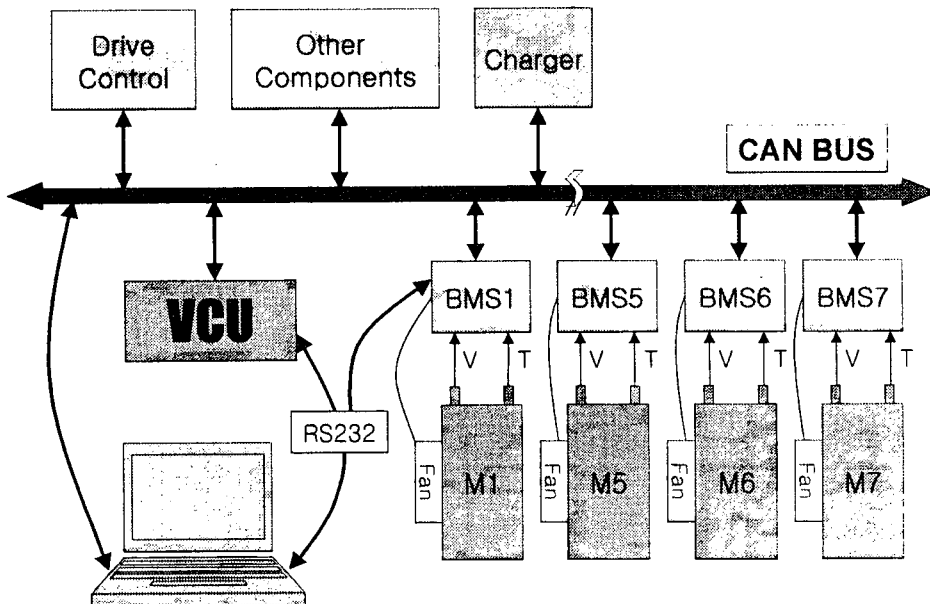
**(3) Reporting and Editing**

- Data Gathering and Storage (V, I, T, SOC)
- PC Interface for Service & Diagnostics

**(4) Protecting**

- Battery Cell, Bank, Module and Pack Protection
- Safety Disconnect Unit

## BMS Structure in Vehicles



## *Who are the Users of BMS?*

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### **1. Battery Manufacturers**

- LiPB/LiB/NiMH/NiCd/PbA

### **2. Instrumentation and Electronics Manufacturers**

### **3. Power Conversion System Suppliers**

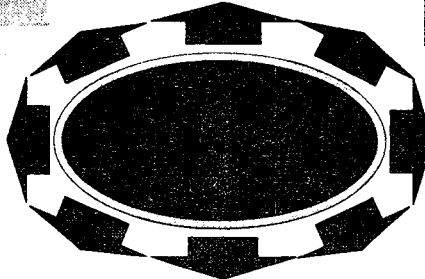
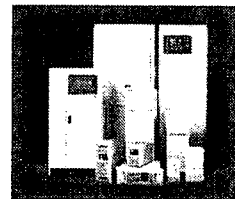
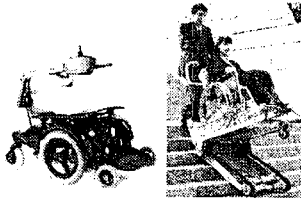
- Battery Powered Vehicles (EV/HEV/NHV)
- Electric Bike/Scooter/Wheelchairs
- Golf-cart
- Uninterruptible Power Supplies (UPS)
- Telecommunication Sites (Load Leveling)

### **4. Network System Integrator**

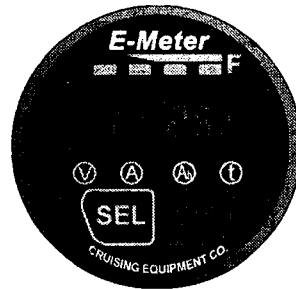
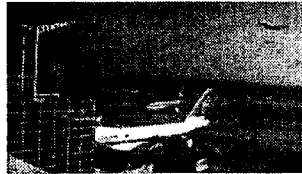
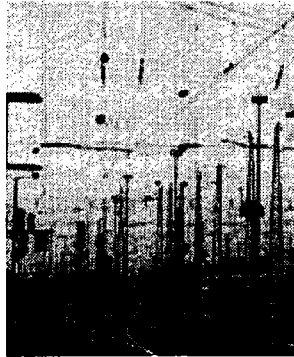
### **5. Outsourced Maintenance Contractor**

## *BMS Applications*

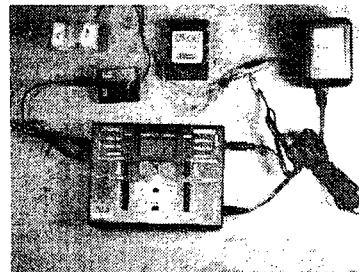
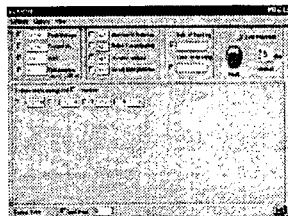
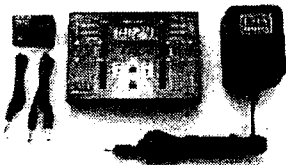
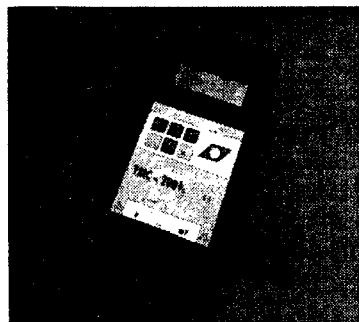
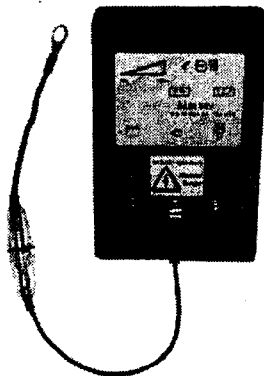
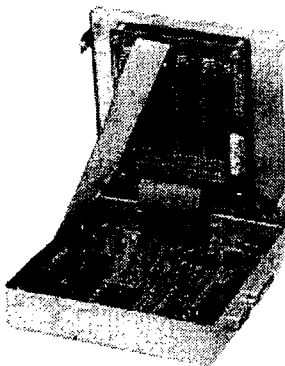
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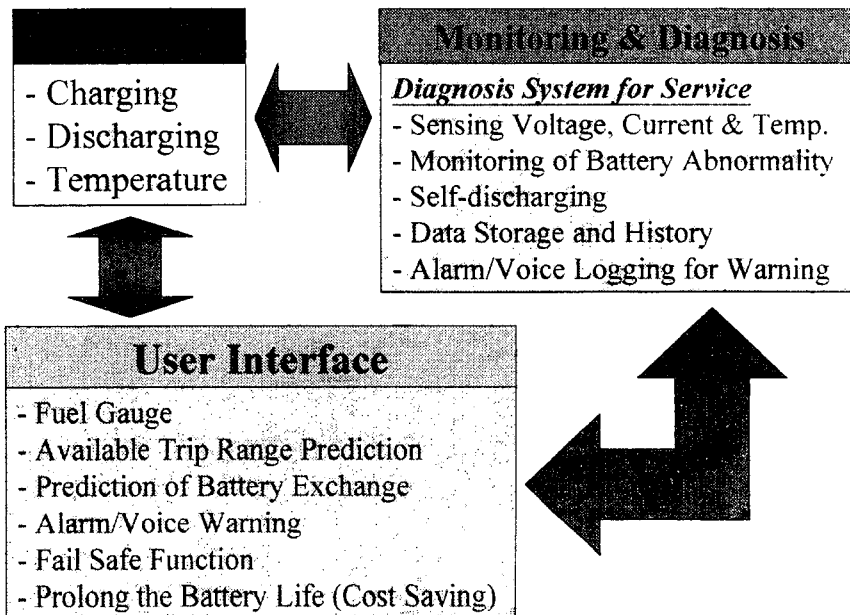


# Products and Application Fields



# Products in Use





- **Compatible with all Types of Battery (PbA/NiCd/NiMH/LiB)**
- **Smart Fuel Gauge While Charging or Discharging**
- **Monitoring of Current, Voltage and Temperature**
- **Data Storage and Report**
- **Lifetime and Range Prediction**
- **Cooling Control at Higher Temperature**
- **Smart Maintenance of Battery Block**
  - *Aging (Cycle Counting)*
  - *Network Maintenance and Warning System*
  - *Fail Safe and Fail Records*