Development and Market Introduction of New-Generation Electric Vehicle with High-Performance Lithium-Ion Batteries




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1. Abstract

Previous electric vehicles (EVs) had issues associated with battery and motor performance, such as heavy, bulky batteries and motor, limited driving range and long charging time, which have made their practical use difficult. Finally, the development of component technology such as high-performance lithium-ion battery and vehicle integrated control technology paved the way for mass production of electric vehicles, and Mitsubishi Motors Corporation (MMC) introduced the world's first mass-produced electric vehicle "i-MiEV" into the market in July 2009.

2. Technical Features

(1) Motor System

The motor system consists of motor and Motor Control Unit (MCU) – which is an integrated function of motor control and electric power conversion (Inverter). Compact and powerful synchronous permanent magnetic motor is employed for the electric motor. The specifications of the motor system are shown in Table 1. Advantages offered by the electric motor compared to an internal combustion engine are higher torque output and wider power band, which allows for remarkable vehicle acceleration particularly from a standing start - even better than our turbo-equipped gasoline "i".

(2) Battery System

The battery system consists of the traction battery - an 88 lithium-ion battery cells; bus-bars that electrically connect terminals of adjacent battery cells; contactors that supply and cut off high voltage power from the battery pack; a ground fault detector to detect any leakage from the high voltage system; an electric current transducer to constantly watch over the battery pack current; and a service plug to disconnect high voltage circuit for vehicle service. High-capacity and high-power lithium-ion battery developed specifically for electric vehicles is employed for the traction battery. (Fig. 1).

(3) Vehicle Integrated Controlling System

For the purpose of controlling the vehicle system, each component needs to be controlled and operated based on driver inputs, such as shift lever selection, throttle position, brake pedal position, etc. To ensure enhanced safety, it is desirable for the each respective component to be comprehensively controlled by the master controller which monitors the status of each component, rather than allowing for independent control by these components. For i-MiEV, the system is structured so that the entire component is operated based on the command from the vehicle integrated controlling system - "EV-ECU". The EV-ECU provides a comprehensive control of vehicle operations, such as driving and charging, and failsafe operations by utilizing information gathered from across the entire vehicle. (Fig. 2)

While gearing towards mass production of the electric vehicle, MMC aimed at developing a well-balanced vehicle in terms of safety, driving, and durability performance by focusing our efforts on EV system management that properly controls the whole vehicle, while promoting development of an EV component including battery.

MMC will continue to enhance our technology for more affordable, range extended electric vehicles as well as components unique to EVs, in order to make a sustainable contribution to society and the environment through our innovative and environment-friendly electric vehicles.

Table 1: Specifications of the Motor System

	i-MiEV	Gasoline "i"
Max. Output	47kW	47kW
Max. Torque	180Nm	94Nm
Max. Speed	8500rpm	7500rpm
Type	Permanent magnet synchronous	Turbo-charged

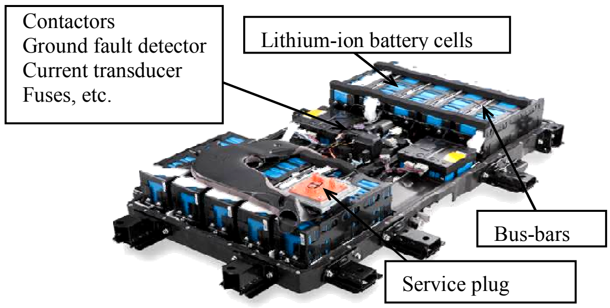

Fig.1. Traction Battery Configuration

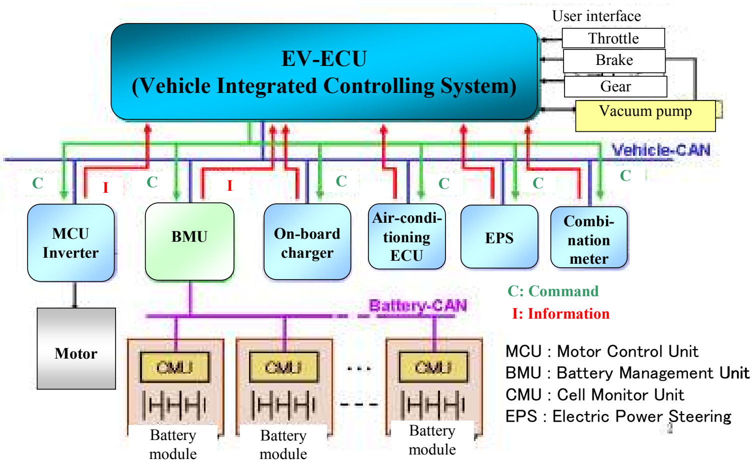

Fig.2: Vehicle Integrated Controlling System

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