

Electric Vehicles for Smart Village

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Abstract: *Today transport accounts for about 60 % of total world oil consumption. This global problem of Energy for propulsion motivates the automotive industry to turn to the electric drive. All major automobile manufacturers attentions are shifted to electrically propelled battery-operated electric vehicles (BEV). Improve the existing power system efficiency, alternate fuels, new materials or alternate power systems like electric vehicles. EV is a road vehicle based on modern electric propulsion consisting of electric machines, power electronic converters, electric energy sources and storage devices, and electronic controllers; EV is a broad concept, including BEV, HEV, FCEV, etc.*

Keywords: EV, Vehicle, Hybrid, Battery Management System

I. INTRODUCTION

Electric Vehicles (EV) was invented in 1834. During the last decade of the 19th Century, a number of companies produced EVs in America, Britain, and France. Due to the limitations associated with the batteries and the rapid advancement in internal combustion engine (ICE) vehicles, EVs have almost vanished from the scene since 1930. In the early 1970's, some countries, compelled by the energy crisis, started the rekindling of interests in EVs. Massachusetts Institute of Technology (MIT) suffered from failures in virtually every critical component; whereas a commercially built EV in 1998 running from Los Angeles to Detroit exhibited a success with no component failures. Within the 1970's, EVs were still in research and development stage.

The Tesla Roadster is a Battery Electric Vehicle (BEV) Sports Car, which was produced by the Tesla Motors (now Tesla, Inc.) In California (USA) from 2008 to 2012. The Roadster was the first highway legal serial production all-electric car to us. Lithium-Ion Battery cells and the first production all-electric car to travel more than 320 kilometers per charge.

However, since both specific energy and energy density of batteries are much lower than that of gasoline, the development of fuel cells for EVs has taken on an accelerated pace in recent years. Meanwhile, the development of commercial hybrid electric vehicles (HEVs) is also going on rapidly. HEVs essentially improve the range and performance of EVs at higher complexity and cost because of the additional energy source, engine and other accessories. As per configurations of EVs, it was observed that the conversion EV is becoming less attractive than the purpose-built EV while the HEV is of growing interests. It was observed that EVs are on the verge of commercialization, demonstration as well as standardization and marketing of EVs. In the next few decades, it is anticipated that both EVs and HEVs will be commercialized, and will have their market shares.

II. CONFIGURATION OF ELECTRIC VEHICLE

Fig. 1 shows an overview of an electric vehicle indicating all the key components such as battery, electric motor, battery management system, charging port, DC/DC Converter etc. Power Inverter/Controller converts energy from DC to AC to power the electric motor to drive the vehicle. Battery Charger/ Onboard charger receives 230V single phase from mains supply and then converts to DC in order to store in the battery.

BMS shown in Fig. 2 acts as a CPU of the vehicle that manages the output power, charging and discharging of the battery. It is used to meet critical features such as voltage, temperature and current monitoring, battery state of charge (SoC) and cell balancing of lithium-ion (Li-ion) batteries.

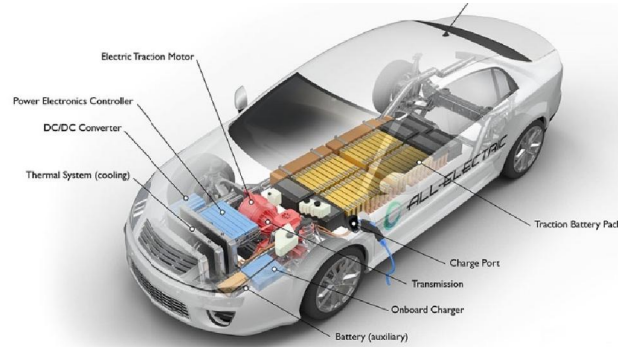


Fig. 1 Electric Vehicle

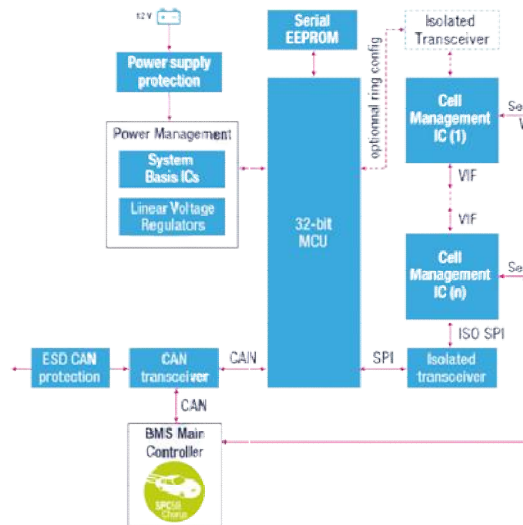


Fig. 2 Battery Management

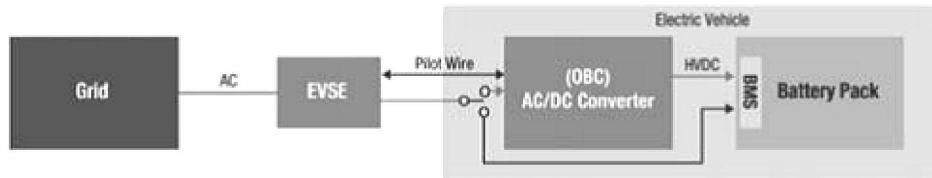


Fig. 3 OBC (On-Board Charger)

As shown in Fig. 3, on-board chargers (OBC) allow plug-in hybrid (PHEV) and battery electric vehicles (BEV) to charge anywhere there is AC power, not just at charging stations. An AC charger powers the battery through the vehicle's onboard charger.

III. POWER INVERTER/CONVERTER

It is a key component in EV, similar to the Engine Management System (EMS) of IC Engine vehicles, which determines driving behaviour and supplies proper voltage and current. The electronic controller commands the power converter by providing control signals to it, and then controls the operation of the electric motor to produce proper torque and speed, as per the command from the driver. The electronic controller is divided into three functional units i.e., sensors, interface circuitry, and Processor. The sensor is used to translate measurable quantities such as current, voltage, temperature, speed, torque, and flux into electric signals through the interface circuitry.

Energy Sources: The energy sources are batteries, fuel cells, ultracapacitors, flywheels, and various hybrid systems.

ELECTRIC MOTORS

The motors used in EVs and HEVs require frequent starts and stops, high rates of acceleration/deceleration, high torque and low-speed hill climbing, low torque and high-speed cruising, and a very wide speed range of operation. Commutator Motors are a traditional motor that needs commutators and brushes to feed current into the armature, thus making them less reliable and unsuitable for maintenance-free operation and high speed.

- **Commutator less Motors:** Induction motors are widely accepted as a Commutator less motor type for EV and HEV propulsion. Field oriented control (FOC) or vector control of induction motors has been accepted to overcome their control complexity due to their nonlinearity.
- **Permanent Magnet brushless AC Motors** field winding of conventional synchronous motors is replaced with Permanent magnets (PM). It has no conventional brushes, no slip rings, and no field copper losses. Actually, these PM synchronous motors are sinusoidal-fed PM brushless motors, because of their sinusoidal AC current and brushless configuration. These motors can run from a sinusoidal or pulsed waveform modulation supply (PWM supply) without electronic commutation.

PLUG-IN HYBRID ELECTRIC VEHICLE

PHEV is a hybrid electric vehicle whose battery can be recharged by plugging it into an external source of electric power, as well by its on-board engine and generator.



Fig. 4 Charging Station

Fig. 4 shows an electric vehicle being charged at charging station such as petrol pump for IC engine vehicle.

IV. CONCLUSION

EVs will become more affordable than ICEs if the cost of batteries goes down. Combined with the lower costs of EV maintenance and repair, and assuming the cost of electricity.

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