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Technologies used in BEV

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INTRODUCTION:

A battery electric vehicle (BEV) is a type of electric vehicle (EV). In that chemical energy stored in rechargeable battery packs, there is no secondary source of propulsion like hydrogen fuel cell, internal combustion engine. BEVs use electric motor & motor controllers instead of internal combustion engines (ICEs) for propulsion. They take all power from battery packs therefore they have no internal combustion engine, fuel cell, or fuel tank. BEVs include motorcycles, bicycles, scooters, skateboards, railcars, watercraft, forklifts, buses, trucks, and cars.

Keyword: BEV, Li-ion, Solar Panel, Grid

COMPONENTS OF BEV:

1. **Motor Controllers:** The motor controller receives signal from potentiometers linked to the accelerator pedal, and it uses this signal to determine how much electric power is needed. This DC power is supplied by the battery pack, and the controller regulates the power to the motor, supplying either variable pulse width DC or variable frequency variable amplitude AC, depending on the motor type. The controller also handles regenerative braking, whereby electrical power is gathered as the vehicle slows down and this power recharges the battery. In addition to power and motor management, the controller performs various safety checks such as anomaly detection, functional safety tests and failure diagnostics.
2. **Battery Pack:** Electric battery, consisting of electrochemical cells with external connections in order to provide power to the vehicle. To charge a vehicle, a group of multiple battery modules and cells are required that is referred to as a battery pack.
3. **Motor:** Traditionally, BEV used series wound DC motors, a form of brushed DC electric motor. Recent electric vehicles have made use of a variety of AC motor types induction motors or Brushless AC Electric Motor which use permanent magnets. Once electric power is supplied to the motor (from the controller), the magnetic field interaction inside the motor will turn the drive shaft and ultimately the vehicle's wheels.

TECHNOLOGIES IN BEV CHARGING:

1. Vehicle to Grid (V2G)

Vehicle to Grid is a key area of EV charging energy management, enabling two-way energy exchange between the vehicle and the grid. With V2G, energy stored in an EV can be fed back to the grid at times of peak demand to minimize the strain. This approach turns EV drivers into **“**prosumers” a consumer of the grid and a provider of energy thus enabling them to reduce their costs of EV charging and receive other discounts on their electricity usage.

2. Wireless EV Charging

Wireless EV charging is helpful for mass adoption of electric vehicles. With a high-powered wireless EV charging system, vehicles can automatically charge while parked in selected pick-up/drop-off locations; this is an ideal solution to keep taxis or autonomous vehicles timeless charged. The system requires no physical charger-vehicle connection; it consists of multiple charging plates installed underground that engage automatically.

3. Mobile charging

Mobile charging includes charging vans, portable chargers, and temporary chargers, where the chargers themselves are “on the go” and do not require infrastructure investments. With mobile charging, there’s no need for structural changes, no huge financial outlays, and no more problems for fleet EVs who need fast roadside charges

4. Ultra-fast charging

Ultra-fast charging is the logical next step in satisfying EV drivers’ demand for charging on the go. A fill-up at the pump with a traditional gas-powered vehicle takes only a few minutes, and EV drivers are demanding the same time savings. Ultrafast chargers are delivering 32 km (20 miles) of range in one minute, removing driver range anxiety, one of the major barriers that limits the adoption of EVs.

5. New battery technology

Range anxiety and battery cost are two issues preventing an even wider adoption of electric vehicles. However, new battery technologies are poised to solve both issues at once. Lithium-ion batteries have become the industry standard over the two decades of EV development. New technologies are being tested, such as graphene-based technologies, which charge in 15 seconds. These are expected to supplement, not replace, traditional EV batteries.

ADVANCEMENT IN BATTERY TECHNOLOGY:

Lithium-ion batteries are being used in EVs for a long time. Drawbacks of li-ion batteries made alternative research on chemicals to maximize the efficiency of batteries

1. **Aluminium - ion Batteries:**. Aluminium-ion batteries are good for energy storage, which is for their gravimetric and volumetric capacities. Aluminium is more abundant than lithium. Al-ion batteries provide four times more energy than Li-ion batteries at a low cost. In Al-ion batteries, Aluminium is used as a negative electrode and graphite as a positive electrode when graphitic materials are used.
2. **Foldable Batteries:** It is a lithium-ion battery that can be folded over 200,000 times without compromising performance. These batteries support fast charging and can be used to power up small components in EVs. It is stable even with bending fatigue and has a high energy density.

Foldable batteries have an operating temperature from -20^0 C to 60^0 C which makes them suitable for any climatic condition. The battery capacity is 30mAh and has passed the safety test along with being waterproof.

3. **Lithium-Air Battery**: The lithium-air battery (LiO2B) is yet another lithium battery that needs to be explored more due to its high capability in producing energy. In the cell, the anode is lithium metal, the cathode is porous carbon and the electrolyte used is non-aqueous. It can theoretically produce a high specific density of 3505 Wh/kg.

4. **Lithium Sulfur Battery:** Sulfur is an element that is abundantly present in nature and inexpensive. It is environmentally friendly so lithium-sulfur batteries are not toxic to the environment. Lithium metal is used as the anode and sulfur composite as cathode while the electrode being an organic liquid. Lithium-sulfur battery has a specific energy of 2567 Wh/kg.

5. **Li-ion batteries:** These are capable of fully charging in less time. In a Li-ion battery, graphite is used as one electrode. Materials should be selected in such a way that it decreases the time of charging. Red phosphorus can be used for its high-energy-density fast charging of Li-ion batteries. Lithium bisimide (flurosulfonyl) is mixed with the solvents of intrinsically flame-retardant trieythl phosphate and fluroethylene carbonate as a solid electrolyte interface. This enhances the electrochemical performance of P anode.

6. **Solar Panel** Usage of solar panels for producing power for EVs has been proposed by researchers. Solar panel module can be used to energize the battery packs automatically which reduces the driver's anxiety, unnecessary stops and increases the range of the EV. Production of batteries using renewable energy sources will reduce the toxic wastes caused by vehicles. This concept is perfectly environmentally friendly. The solar panel modules are installed on the roof of the EVs. The output from the battery depends on the solar light it absorbs. The solar panels yield maximum output at 25C. Electrical energy is generated when the sun's rays are captured by panels.

7. **Solid-State Battery Interfaces**: A solid-State battery (SSB) is made up of solid components which is fundamental in electron transfer and ion transport. A solid-state battery has higher energy when compared to the Li-ion battery which uses liquid as the electrolyte solution. SSB are safer than current battery systems. Since it is made up of solids, it is less risky, non-flammable, and there is no worry of electrolyte leaks. The flame-resistant electrolyte is used in SSBs. These batteries increase energy density per unit area since few batteries are used. A solid-State battery is perfect to make an EV battery system. Car manufacturers are working on Solid-State batteries to improve vehicle's efficiency.

8. **Super capacitors**: Super capacitors are an innovation built to store chemical energy but follow a completely different principle than that of a battery. Supercapacitor, also called electric double-layer capacitor (EDLC), has gained more importance lately due to its applications in the EV industry. They have more than half a million life cycles by storing their energy in an electrostatic field. The batteries have a shorter life cycle as compared to supercapacitors. EDLCs also have the potential to work under a wider temperature range of -40 to 70 C while batteries tend to cause problems in colder temperatures. The internal resistance is also lower than that of batteries contributing to lesser heat loss and higher energy efficiency.

DISCUSSION:

1. The new innovations will shape the future of EV charging, accelerating EV adoption. The new technologies will be game changers from an EV charging experience perspective, will support new business models for EV charging and generate new business opportunities for e-Mobility industry players.
2. **Material selection of electrodes for Fast charging:** The efficiency of the battery is determined by the material used for electrodes.
3. There are four types of batteries that are used as energy storage in electric vehicles are
   a) Lithium- ion batteries
   b) Lead- acid batteries
   c) Nickel- Metal Hydride batteries
   d) Ultra capacitors / Super capacitors

REFERENCES**:**

[1] M. K. Loganathan; Cher Ming Tan; Bikash Mishra, "Review and selection of advanced battery technologies for post 2020 era electric vehicles",2019 IEEE Transportation Electrification Conference (ITEC-India), Bengaluru , India, 17-19 Dec. 2019.

[2] B.G.Kim, F.P.Tredeau, Z.M.Salameh, "Performance Evaluation of lithium polymer batteries for use in electric vehicles",IEEE Vehicle Power and Propulsion Conference, 2008.

[3] Daisy Ranawat, M P R Prasad, " A Review on Elecric Vehicles with perspective of Battery Management System", International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques(ICEECCOT), 2018.

[4] Jan Haase,Fares AlJuheshi, Hiroaki Nishi, "Analysis of batteries in the built environment an overview on types and applications",43rd Annual Conference of the IEEE Industrial Electronics Society, IECON 2017.

[5] M.S.Duvall, "Battery evolution for plug-in hybrid electric vehicles", IEEE Vehicle Power and Propulsion Conference, 2005.