International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

Electric Vehicles: It's Perspectives and Issues

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ABSTRACT - *In a country like India, the usage of two-wheelers for daily activities is high. To bring the advancements in these two-wheelers, hybrid electric vehicle prototype is being developed. From the vehicles, mostly two-wheeler is used than the other vehicle. As the ICE (Internal Combustion Engine) is least efficient at low speed (traffic condition). The electric drive is not only silent but also dissipates low heat compared to petrol powered two-wheeler. The objective is to develop a hybrid two-wheeler with geared system powered by ICE and an electric motor with the help of fuel and battery supply.*

***Key Words*: Electric vehicle charging and interaction with grid, e-mobility and future trends, conventional car and electrical car**

1.INTRODUCTION

A vehicle is termed as an electric vehicle if it uses electric motors to drive the wheels directly through differential gears by receiving energy either fully contributed by the on-board DC source or contributed in part by the lower sized IC engine as compared to the conventional ICE based engines, with the objective of improved performance and reduced emissions. Pure electric vehicle is the one in which whole of the required energy for the traction is contributed by the on-board DC source whereas in hybrid electric vehicle, a part of the energy for the traction is contributed by ICE.

1.1 PURE ELECTRIC VEHICLE SUBSYSTEMS

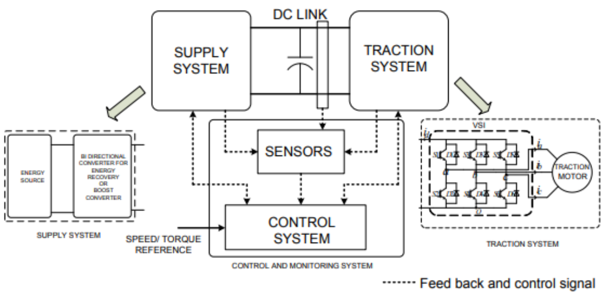

Fig 1. Pure Electric Vehicle Subsystems

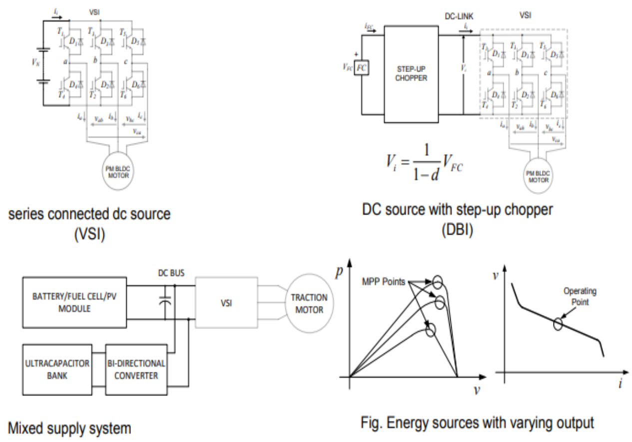

Fig 2. Supply System: Possible Configurations

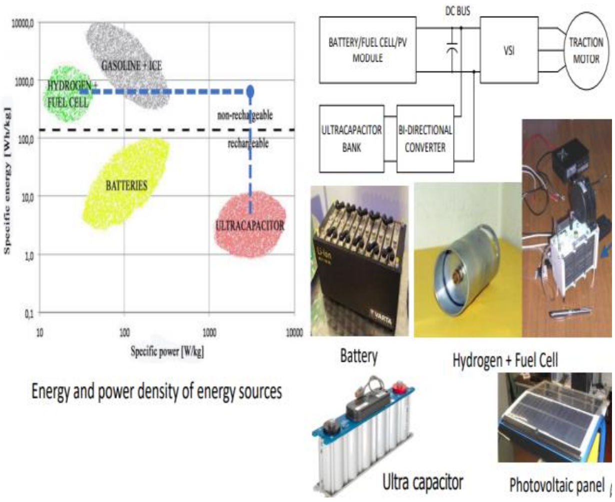

Fig 3. On-board Energy Management

The city electric car, Biro, has batteries connected in series as the main source of energy and is assisted by a bank of ultra-capacitors and photovoltaic panel mounted on the roof top of the city car. The ultra-capacitor bank is used to absorb and supply battery current ripples during regeneration and acceleration, this improves life of the battery as well as the extension in the autonomy of the city car. Photovoltaic panel assists the city electric car partially by harnessing solar energy to charge the vehicle when in parking or in motion. This results in considerable extension in the autonomy of the city car.

Fig 4. Biro with HESS

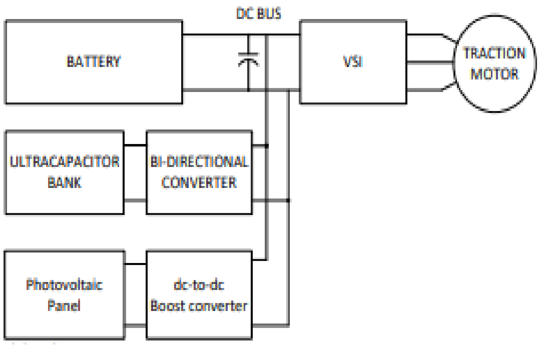

Fig 5. Block Diagram of Battery Management System

The process of submission of energy to a battery by forcing current into it is called as charging of a battery.

For fast charging, injection of the charging current into a battery to be charged at a rate higher than C/10 (normal charging) is termed as fast charging. The degree of fastness can be higher or lower and is represented by Kc/10 that is number of times the C/10.

Power level types	Charger location	Typical Use	Expected power level	Charging Time
Level-1 (AC) 120-230V	On-board 1-phase	Charging at home or office	1.4-1.9kW	4-11 hrs
Level-2 (AC) 240-400V	On-board 1-phase or 3-phase	Charging at private or public outlets	4-19kW	1-6hrs
Level-3 (DC-Fast Charging) 208-600V (AC)	Off-board 3-phase	Charging station	50kW	0.2-1hrs

Fig 6. Charging Levels

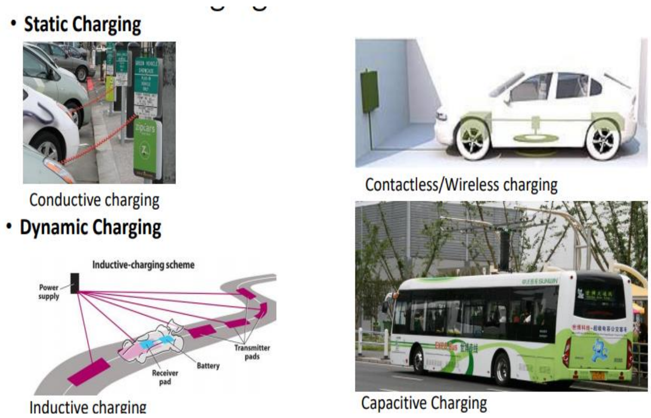

Fig 7. Means of Charging

Conductive charging is most common charging method and has two categories: AC and DC charge. The advantage of AC conductive charging method is that battery can be recharged wherever a standard electrical outlet is present. DC conductive charging method is suitable for high power design, and output power of fast charging is limited only by the ability of the batteries to accept the charge. DC charging request higher installation investment compared to AC charging.

Inductive charge is the energy transfer from the power supply to EV via magnetic induction coupling based on the principle of electromagnetic induction at a high frequency.

Dynamic charging is similar to static inductive charging and energy is transferred from the charger to the car through the magnetic induction coupling.

Battery swap is basically switching out the depleted battery and replacing the same with a fully charged battery.

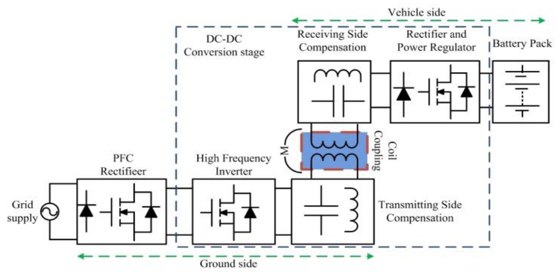

Fig 8. Inductive coupled wireless charging

Constraint in the fast charging is the increase in charging current which increases battery temperature, affecting the battery life. To regulate the rise in battery temperature, cooling arrangement is required and pulse charging or reflex charging is preferred. Smart charging is defined as the series of intelligent functionalities to control the EV charging power in order to create a flexible, sustainable, low cost and efficient charging environment.

1.2 OVERVIEW OF E-MOBILTY AND FUTURE TRENDS

India can save 64% of anticipated road-based mobility related energy demand and 37% of carbon emissions by 2030 by pursuing a shared, electric and connected mobility resulting in a net savings of approximately Rs. 3.9 lakh crore by 2030.

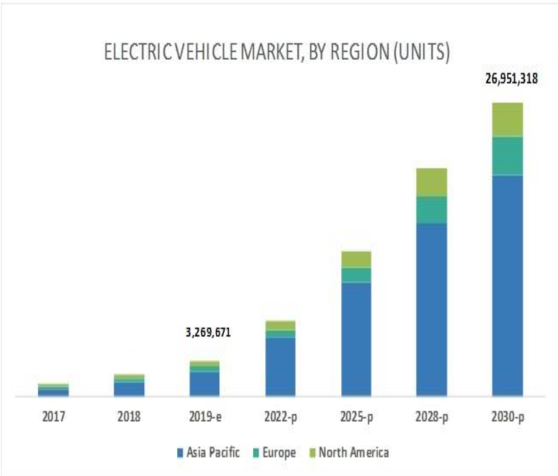

Fig 9. Electric Vehicle Market by Region

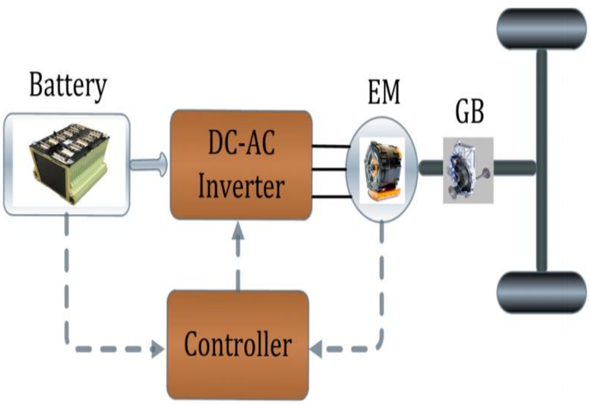

Fig 10. Schematic of Electric Vehicle

Limitations of Electrical Vehicle are the availability of the best suitable raw material like Lithium-ion needed for battery manufacturing, battery of good quality and its price, range limit, frequency charging and cycle time and disposal of battery.

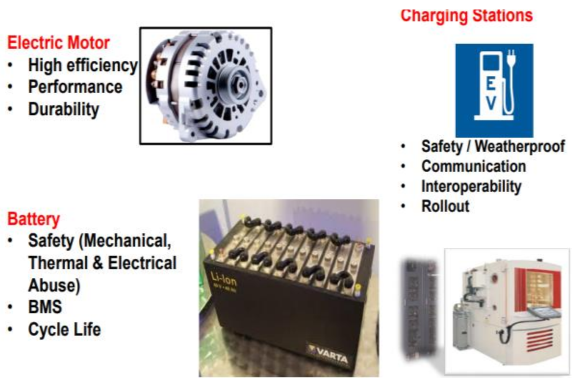

Fig 11. EV Components Development

2. ICT PROTOCOL FOR CHARGING

Charging electric cars is a part of an evolving ecosystem with many different machines and stakeholders that must be able to exchange information automatically. There are lots of protocols that are in use. Both protocol specifications and their applications are still emerging. Smart charging will become increasingly important as more electric vehicle will be out in the market and due to the growth and use of the intermittent and distributed source of renewable energy. It has advantages for the consumers, stakeholders regarding the electricity grid and for society as a whole. Open protocols will be crucial for development of the charging infrastructure market.

	Version	Maturity	Interoperability	Market Adoption	Openness	Testing tool (dedicated / specific)	Certification (official testlab)
SMART CHARGING							
OSCP	1.0	Low	High	Low	Medium	No	No
OpenADR 2.0	1.1	High	Medium / High	Medium / High	High	Yes	Yes
OCPI	v0.4	Very low	Very low	Low	Low	No	No
IEEE 2030.5	2.0	High	Medium / High	Low	High	Yes	Yes
CS – CP							
OCPP	1.6	High	High	High	High	Yes	No
IEC 61850(90-8)	-	Medium	Low	Low	High	Unknown	Yes
ROAMING							
OCHP	1.4	High	High	Medium / High	Medium	No	No
OCPI	2.1	Low	High	Low	High	No	No
OICP	2.1	High	High	High	Medium	No	No
eMIP	0.7.4	High	High	Medium	Low / Medium	No	No
EV – CP							
IEC 61851-1	-	High	High	High	High	Unknown	Yes
ISO / IEC 15118	-	Medium	High	Low	High	No	No

Fig 12. Protocol Comparison: Non-Functional

Amongst EV manufacturers it has now become unofficially recognized that EV in the future must have a battery capacity that can provide 200–300-miles range. This is more than sufficient for city commutes and it eases for long distance driving in combination with infrastructure of fast charging stations on the highways. Manufacturers are moving towards designing electric vehicles from the bottom up rather than building them based on existing combustion engine cars. This approach provides more flexibility in design, scope to add larger batteries and is expected to reduce cost of the vehicle in the long run.


Choice of the electrical machine and its control algorithm, high density power electronic converters and battery storage w.r.t size selection and monitoring health of the batteries can reduce the charging time.

3. NEXT GENERATION TRANSPORT

Potential transport of future is flying electric vehicle.

Fig 13. Flying Electric Vehicle

Flying electric vehicle has multiple rotors and motors. Safety and battery issues will be the concern in this mode of transport.

Fig 14. Hyperloop

Hyperloop is based on the MAGLEV concept in vacuum. It can attain a speed of 1200 kmph but passenger comfort and safety will be a concern.

The re-usable rocket as a mode of transport can reach anywhere in less than 2 hours.

CONCLUSION

Transport using Electric vehicle is the need of the hour for sustainable development. An electric vehicle can be designed in several possible ways. Main challenges in EV are the choice of the electrical machine and its control algorithm, battery selection and its management. But battery charging takes considerably longer time than re-fueling. While vehicles are being developed with batteries but an alternative to battery storage is focus of the future and an area of development. Future flying transport by using re-usable rocket vehicle is the next generation transport.

REFERENCES

1. Overview of e-mobility and future trends of EV by Sanjay Nibandhe.

2.Conversion of conventional car in to Electric car by Dr. A V. Ravi Teja.

3.Introduction of Electric vehicles charging and interaction with grid by Dr. Ritesh Kumar Keshri.

4.Battery charges and management system by Dr. Manoj Rathi

5.Electric cars Technology by DelftX Ecar.

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