ELECTRIC VEHICLE CHARGING USING RENEWABLE ENERGY

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ABSTRACT:

One of the ongoing major problems is **"The Hike on Petrol and Diesel Prices"**. This situation is because of the depletion of the **"FOSSIL FUELS"**. These Fossil Fuels includes Coal, Gas and Oil etc. Due to this hike on Petrol and Diesel Prices, Engineers, Scientists and researchers are doing research on/ finding for the alternatives for the Fossil Fuels. One of the best alternatives for the Fossil Fuel is use of the Electricity. With the help of the electricity, we can run a vehicle. The vehicles which run on the Electricity are called or named as **Electric Vehicles**. These Electric Vehicles (Shortly termed as EVs) replaces the traditional Internal Combustion Engine (IC Engine). For Electric Vehicles also, we need intermediate charging stations like intermediate Gasoline/Petroleum filling stations for the traditional Internal Combustion Engines. Charging of an Electric Vehicle mainly depends on the location and requirement. The EVSE (Electric Vehicle Supply Equipment) change from one country to another country and it is also called as the EV charger's specification and standards.

KEYWORDS:

Electric Vehicles, Batteries for storing, Charging Levels of EV, EV charging station requirements, Wind Power generation technology.

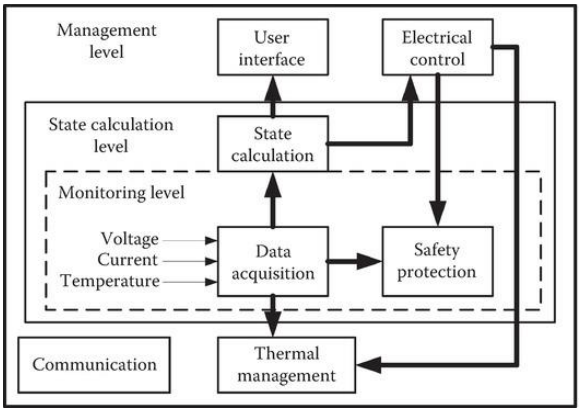
INTRODUCTION:

This paper mainly discusses about the infrastructure required for charging an electric vehicle. Infrastructure includes charging stations, battery specifications for different types of electrical vehicles. The charging includes fast charging and slow charging. Based on the type of vehicle, we may conclude the type of the connector should be used , the type of power supply should be given at the time of charging and the level of charging required. We know that, an electric vehicle uses the stored energy form the battery and to run the vehicle the motors are used. Based on the type of supply, the motor can be a d.c. motor or an a.c. motor. In an electric vehicle, we will have a B.M.S. (Battery Management System) which does the following function

- Monitors the voltage level, temperature etc.
- Recovering of energy from regenerative breaking, fed to battery.
- Computation which includes of computing State Of Charge (SOC), State Of Health (SOH), State Of Safety (SOS).
- Communication.

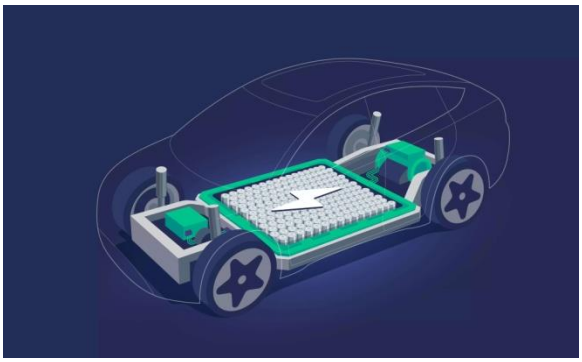
- Protection from faults like over current, over temperature, over pressure etc.

The block diagram of Battery Management system is showed in the below figure.



Block diagram of Battery Management System

BATTERY:



The basic element required in EV's charging infrastructure is battery. Battery is used to store electric energy which is further utilized for running the motors. In EV there are several types of batteries are used for charge storage purpose. Some of them are listed below.

1. Lithium –Ion battery.
2. Lead acid battery.
3. ZEBRA.
4. Nickel Metal-Hybrid.
5. Ultra Capacitor or Super Capacitor.

Lithium-Ion battery:

This is one of the most widely used batteries in electric vehicles. This battery has many applications rather than for EV like cell phones, laptops and even in traction battery pack. These batteries have very high power to weight ratio and are efficient to use in higher temperatures also. These batteries have slow self discharge level, it means it can maintain or hold up its full charge. Some of the types of lithium ion batteries are listed below:

a. Lithium Iron Phosphate
b. Lithium Nickel Manganese Cobalt Oxide
c. Lithium Titanate.

Lead Acid battery:

This is one of the oldest batteries which lose their capacity of storing charge and are heavier in weight. As compared to Lithium-Ion battery, this battery is relatively cheap and safe. These type of batteries are also used in EV as an a secondary storage system.

ZEBRA:

This is one of the batteries which were found in 1985. ZEBRA refers to Zeolite Battery Research Africa". These are low temperature variant of Sodium Sulphur.

Characteristics:

- This can work efficiently when the temperature is also more than 270^0.
- It has a normal operating voltage of about 2.5 volt to 2.6 volt.

Nickel Metal-Hybrid:

These types of batteries have long life cycle as compared to the other batteries like Lead acid battery, Li-ion battery. These are having high tolerance against the incorrect

use. The main disadvantage of this battery is the discharge rate is high as compared to remaining batteries and the cost is also high.

Ultra-Capacitor or Super-Capacitor:

This is one of the types of storing the charge. As we know that resistor dissipates the energy in the form of heat and that of capacitor, it stores energy in the form of electric flux. For storing high amount of energy, we need large sized capacitor.

$Q = CV$

- Where C is capacitance.
- 'Q' is charge.
- 'V 'is the voltage applied.

$C = \varepsilon(A / d)$.

Where,

- 'A' is the area of the parallel plate.
- 'd' is the distance between two parallel plates.

To store high amount of charge, we can increase the area of the parallel plate which increases the size of the capacitor.

CHARGING LEVELS FOR ELECTRIC VEHICLES:

There are three levels of charging available for electric vehicles. They are

- Level 1.
- Level 2.
- Level 3.

Level 1:

The charging process is slower as compared to other. This system charges the electric vehicle via 110 volts – 120 volts AC plug. With a charging time of 1 hour, the electric vehicle works for a distance of about 8km or 5miles. This type of charging is well suited for Plug-in electric vehicle charging. This level of chargingcan be done at any place due to low voltage charging like houses, apartments whose voltage input isabout 220 volts.

Connectors used for this type of charging are J1772, Tesla.

Level 1 connector or J1722 connector.

Level 2:

In this level, the charging process is made by using the voltage of around 220 volts to 240 volts ACcurrent. The charging equipment can be easily installed in domestic areas like houses andapartments, as the voltage level will be around 230 volts. The electric vehicle can travel around 12miles to 18 miles per 1 hour charge time. This type of chargers can deliver 80 Amperes of power.

The main advantage of Level 2 charging as compared to Level 1 charging is, the charging time ofLevel 2 charging will be around 10 times of the charging time of Level 1 charging.

Connector used for this Level of charging is J1772.

Level 2 connector or J1722 connector.

Tesla Super charger connector

Level 3:

In present days, the technology has greater improvements. This level of charging comprises of high speed charging than level 1 and level 2. The major difference between level1, level2 and level3 is the type of supply current. Here, we use D.C. current for charging. The cost of level 3 or dc fast chargers is very high as compared to level 1 and level 2 charging. The power range of this level of charging will be greater than 100 amps and this charging cannot be done in domestic areas like houses, apartments etc. the charging rate will be around 3 miles to 2o miles per 1 minute charge.

Connectors used for this technology are CHAdeMO, Tesla super charger etc.

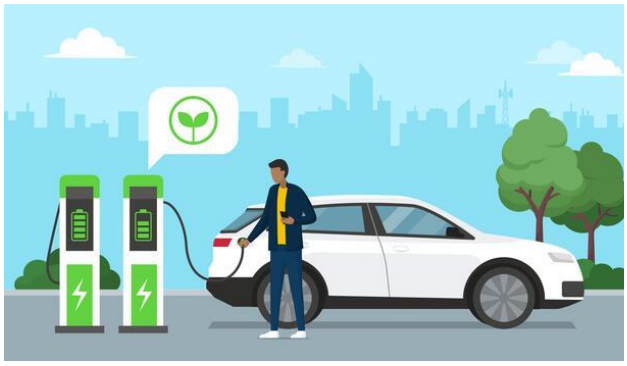
CHAdeMO connector.

Below table gives the quick information of all levels of charging.

LEVEL	CURRENT TYPE	VOLTAGE (V)	POWER (KW)	CHARGING TIME
Level 1	AC	120	1.4	5 miles for 1 hour of charge.
Level 2	AC	220-240	6	12 miles to 18 miles for 1 hour of charge.
Level 3	DC	400-500	50-120	20 miles for 1 minute of charge.

REQUIREMENTS FOR SETTING UP AN EV CHARGING STATION:

- Land space for setting up chargers and for charging vehicles.
- Installation of different types of charger models like level1, level2 and level 3 connectors.
- Power supply for the charging station.

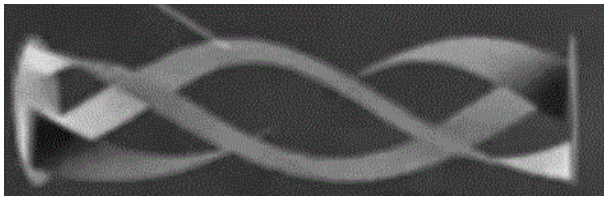


CAPTURING OF WIND ENERGY FOR CHARGING:

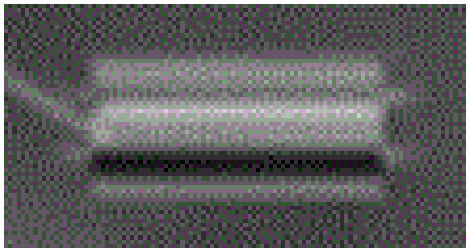
In this technology, the turbine blades are designed in the way to rotate in central axis which is housed in a cylindrical shaped object. We know the concept of generating electrical energy from wind energy. But this was not implemented for charging purpose because of some of the difficulties raised like noise, low amount of generation etc.

When the vehicle is moving, the wind direction is opposite to that of the direction of vehicle moving. Due to this the turbine blade rotates which further connected to generator. Through this type of generation, we can charge the battery of an EV.

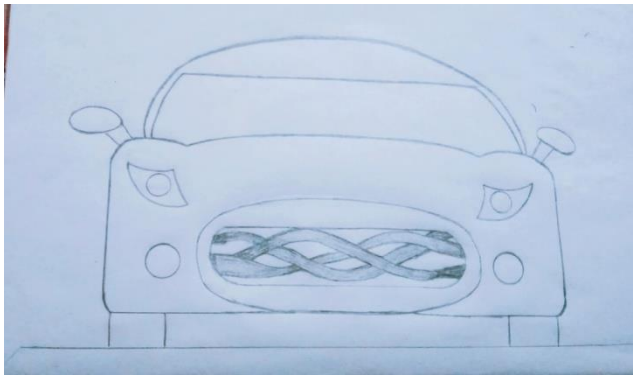
This technology consists of a 2.5 meters rotor system along with a generator whose diameter is 35 centimeters. The weight of the wind turbine will be around 50 kilograms and the output power will be around 2000Watts or 2 KW at the wind speed 12.5 meter/sec. this type of wind turbine operates at high efficiency and low noise. This axis is coupled to a shaft which has a connection with the generator shaft. All these parts are cased in a steel capsule which has a transparent net so that the air moment will be there. The generated power is fed to the charge controller and then the controlled voltage will be supplied to the battery for charging purpose.



Turbine



Generator



Proposed model