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# E- VEHICLE CHARGING SYSTEM (CHARGING METHODS)

Sandeep Jhamb  
Assistant Professor  
Mechanical Engineering  
Arya Institute of Engineering and Technology, Jaipur, Rajasthan

Atul Soni  
Assistant Professor  
Electrical Engineering  
Arya Institute of Engineering and Technology, Jaipur, Rajasthan

ANUSHKA MEENA  
Research Scholar  
Electrical Engineering  
Arya Institute of Engineering & Technology, Jaipur, Rajasthan

NISHITA KANWAR  
Research Scholar  
Electrical Engineering  
Arya Institute of Engineering & Technology, Jaipur, Rajasthan

**Abstract**—As we all know that today the era is changing IC engine or Petrol engine vehicles to the electrical vehicles and their demand is increased day by day which is also increase the demand of charging station . The demand of electrical vehicles is increased because they help as t reduce the fuel consumption and help in improve the environment and also create less noise pollution . There are many advantage of E- vehicles. As a demand is increased so we have to focus on the improvement in the electrical vehicles battery life because we know that the battery is heart of an E- vehicle. We have to focus on these issues , development of efficient charging system , charging power level ,quality of supply used for electrical vehicles, different types of chargers , effect of load on the E- vehicles etc.

Basically, In this article we talk about the charging of E-vehicles like how a electrical vehicle is charged ,method of charging ,type of chargers are used and which type of battery are used.

**Keywords**—*Electrical vehicle ,methods of charging system , types of chargers*

## **Introduction**

Nowadays the pollution is increased day by day so most of the country try to replace the IC engine vehicles by the electrical and hybrid vehicle. Because IC engine produce a lot of air pollution and green house gases but E- vehicles are run by the use of electricity so they are eco-friendly. Even they help us in reduction of fossil fuel and also not emit any harmful gases during the run time.

E-vehicles have many advantages but they also have many some disadvantages like charging infrastructure, frequent charging , limited battery , high charging cost , high maintenance etc. So we have to solve all these problem for making the e-vehicle 100% useable as well as profitable.

### Electric Vehicle

These are those vehicles which use only batteries as energy source and are run by the help of the electricity. In this instead of using petrol or diesel we use battery which are charged by the electricity.



Fig. Electric Vehicle

E-vehicles are chargeable and they can be charged any time. The batteries we use in E- vehicles are as follows :- lithium ion , nickel-metal hybrid, lead acid and ultra capacitor. Among these batteries lithium ion is mostly used for EV. E-vehicles can be classified as follows :- BEV, PHEV and HEV.



Fig. Types of E-Vehicle

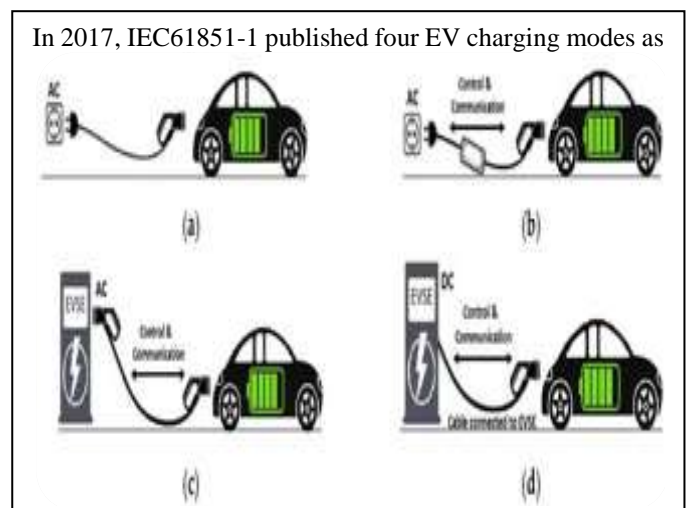
1. BEV are called Battery E-vehicle. They have rechargeable batteries with no IC engine. These type of e-vehicle are generally called Electric Vehicle .
2. PHEV are those type of E-vehicle which can be recharge the battery through both regenerative braking and plugging into an external source of electric power.
3. HEV are called hybrid e-vehicle . This type of vehicle used both gasoline and electricity.

Fig. modes of E-Vehicle

### Modes of E-Vehicle

In 2017 , IEC61851-1 published four EV charging as shown in fig.as follows :

1. Mode -1: Schuko charging mode .It is also called as AC charging mode .This charging mode use a basic extender cable in a standard household socket without use of any protective system. This mode is very slow and extremely unsafe. For that reason the schuko charging mode is not used in many part of world .
2. Mode-2: it is also AC charging mode with protection system installed inside the cable. Mode-2 is less dangerous in compare to mode -1.
3. Mode-3: It is AC charging station mode with a power range 3.7kW to 43kW.



4. Mode-4: It is DC charging mode. This type of charging is not use at domestic level.

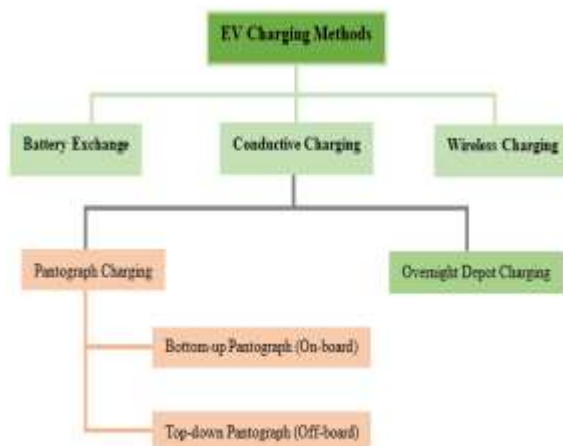
### EV charging methods :

As we know that e-vehicle have limited capacity to store the energy .So we have to recharge the battery again and again and is also increased. So we require a proper charging infrastructure.

The charging system of e-vehicle mainly consist of a charge control unit, charging cable and vehicle control unit.

We have three ways of charging an ev’s battery. They are :

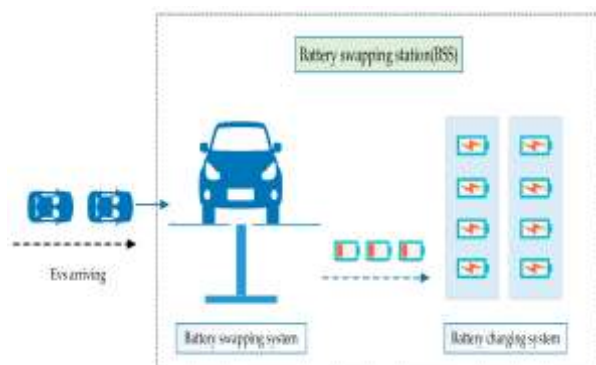
1. Battery exchange
2. Wireless charging



### 3. Conductive

These above mention method are mostly used for charging the e-vehicle. The information about these method is given below:

1. Battery Exchange method :- This method is also called **Battery Swapping Method** .



In this method the discharged batteries are replaced by the charged batteries. In this there is no waiting time. It require only 5 to 7 minutes for changing the battery. This method is suitable for forklift but replace the discharged batteries to charged battery is not easy because the batteries are heavy and sealed. As all e- vehicles have different size of battery so it require huge investment for developing BSS i.e. Battery swapping station.

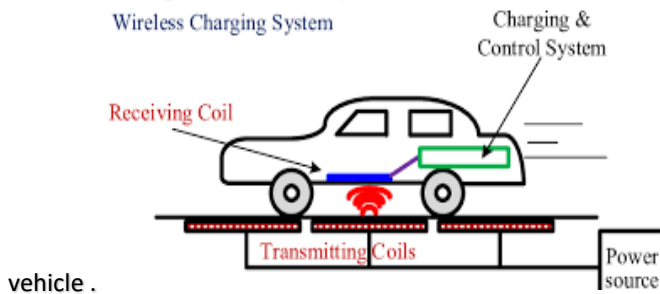
2. Wireless charging :- This method is also called as a **Inductive method**.

In this method we use the electro magnetic field to charge e-vehicle .

We can say that this method is enhance version of smart charging with several differences. This method allow the e-vehicle to charged automatically without using the wires or cables.

This charging method works on the principle of electromagnetic induction . In this the electricity is transfer by the help of air as a magnetic field .

In this method we have two coil. One is at charging station and other is at the vehicle grid . The magnetic resonance is rated between these two coil and then electricity is transmitted through these coil . The coil are of same frequency and then energy transfer take place b/w these coils. So in this there is no physical contact between the charger and



vehicle .

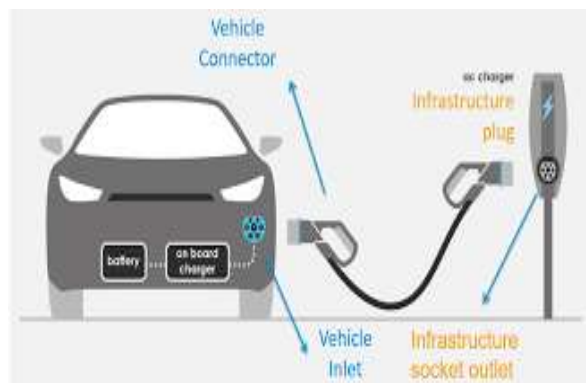
By using this we can overcome from the problem of plug in and safety. In a present time this method is developing method so this method is not efficient present scenarios the high losses , large charging time huge investment and less efficiency.

Rigth now we are not use this method because it is still in developing but once this method is fully developed then may be this method is fully developed but one of the best method for charging the e-vehicles .

3. Conduction charging method : - In this method we have a direct contact between the vehicle and charging point . Here the energy transfer take place with the help of the cable or wire b/w the vehicle grid and charging point .

This method provide V2G facility ( vehicle to Grid ) reduce the grid loss and also maintain the voltage level. This method is commonly and mostly used methods among the charging method.

In this to charge the battery , e-vehicle users have to connect the vehicle with the charging point.



This method is dangerous if we not used it's safety.

There are also two type of conduction charging as follows

- 3.1 Over night dipot charging
- 3.2 Pantograph charging

### 3.1 OVER NIGTH DIPOT CHARNGING

This method is design for both slow and fast charging .This method used for the night- time charging. It is usually connected at the end of the lines.

This method is not useful for the higher battery capacity.

### 3.2 PANTOGRAPH CHARGING



This method is mostly use for the higher battery capacity vehicles like buses and trucks. This technique offers less investment. Further this technique is divided into two parts are

3.2.1 Top- Down Pantograph

3.2.2 Bottom up Pantograph

The advantage of this method are charging time and it's maintenance free. It only take 5 to 20 minutes for charging.

So, these are ways to charge E- vehicles

### **Conclusion :-**

For the E- vehicle charging method are very important as well as type of charger.

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