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Some Aspects Of Electric Vehicle Charging Station In Shopping Mall

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Abstract

This paper describes design of solar powered charging station for charging of electric vehicle that solves the key downside of fuel and pollution. While EV charging has traditionally been grid-based. use of solar powered chargers has emerged as an interesting opportunity. As worlds resources are diminishing, government agencies and non-government organization are pushing greener solution through the use of renewable energy sources. In order to reduce the pollution through the motor vehicles, there is a large scope of increase in electric vehicles all over the world To run the electric vehicle the fuel required is the electricity which can be storable through the use of solar energy. Electric vehicles that run on the Electric vehicle smart charging station which is the promising alternative and environmentally sustainable solution to meet up the energy crisis. This paper investigates the possibility of charging the battery of electric vehicles at a various working place like offices, colleges, hospitals. universities etc. in India using solar energy. In this paper the charging station successfully developed as desired features for electric vehicle from renewable energy resources with solar panel, solar charge controller, batteries storage and DC-DC Convertor.

Keywords: Batteries; DC/DC converter; Electric Vehicle; Photovoltaic; Solar Charge Controller

1. Introduction

An electric vehicle, also called an EV, uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels or an electric generator to convert fuel to electricity.

Figure No. 1.1 ELECTRIC VEHICLE CHARGING STATION

An **electric vehicle charging station**, also called EV charging station, electric recharging point, charging point, charge point and electronic charging station (ECS) is an element in an infrastructure that supplies electric energy for the recharging of plug-in electric vehicles—including electric cars, neighbourhood electric Vehicles and plug-in hybrids.

Nowadays, energy efficiency is a top priority, boosted by a major concern with climatic changes and by the soaring oil prices in countries that have a large dependency on imported fossil fuels, which leads to the demand of EV charging station in the country.

2. Methodology

The Rearche Paper for Currently the battery of new versions of electric vehicles has a capacity that varies between 38 and 64

kWh, except for high-end cars such as the Taycan by Porsche and the Model S by Tesla, whose

capacity varies between 70 and 100 kWh. In most electric cars the internal charger is 7.2 kW except

for Tesla which is

10 kW. Figure 1 shows the electric vehicle charging system [1].

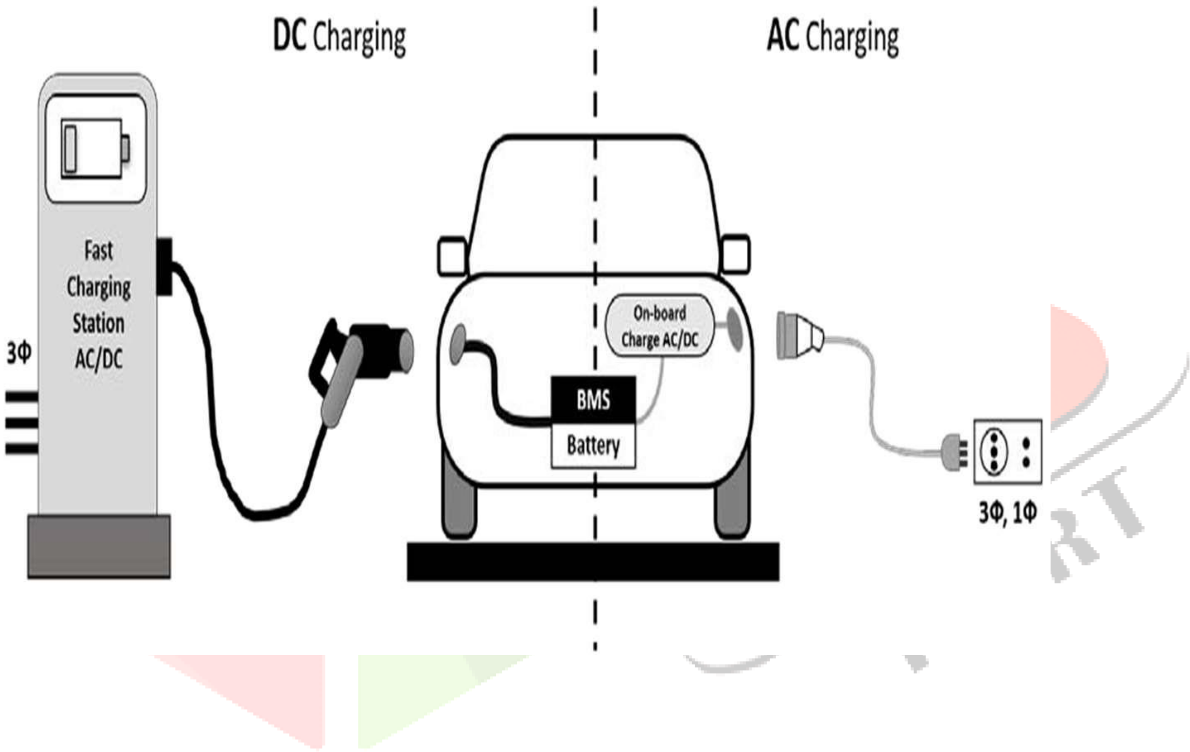


Figure No. 2.1: Electric vehicle charging system

The time (hours) of charging in AC of the battery (kWh) of the electric vehicle will depend on the power of the

internal charger (kW) of the electric vehicle.

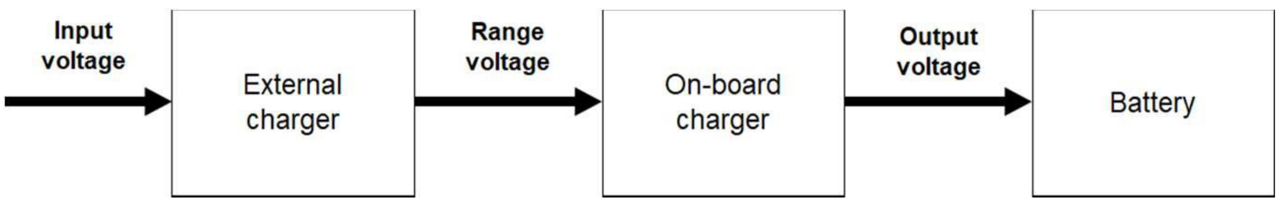


Figure No..2.2:Charging an electric vehicle with an external charger

EV Charging station Market Analysis

In the first phase of Electric Vehicles (EV) rollout plan, the power ministry is targeting 4 billion-plus population cities under the EV policy initiative. It plans to cover all the state capitals, union territories, major highways and key cities under the second phase.

The electric vehicle charging infrastructure market in India is anticipated

to grow at a CAGR of over 40% during the forecast period 2019-2025.

Increasing government support is one of the major factors driving the electric vehicle charging infrastructure market in India.

Based on component, the electric vehicle charging infrastructure market in India is segmented into hardware and software & services. Hardware comprises sockets, cables, and charging units. Software & services include installation and maintenance of charging units, platform as a service, and other services. Other services include battery delivery service and towing service, which are in a very nascent stage in India.

Table 1: Technical data of electric vehicles

Make and Model of the Car	Hyundai Ioniq Eléctrico	Kia eSoul Standard	Kia eSoul Autonomía Extendida	Nissan Leaf S	Nissan Leaf S Plus	BYD E5-400
Type	EV	EV	EV	EV	EV	EV
Year of production	2019	2019	2019	2019	2019	2019
Maximum speed (km/h)	165	155	167	144	157	130
Battery capacity (kWh)	38.3	39.2	64	40	62	60.5
Autonomy (km)	293	277	452	270	385	400
Motor power (kW)	100	100	150	110	160	160
Torque (N.m.)	295	395	395	320	340	310
Internal charger power (kW)	7.2	7.2	7.2	6.6	6.6	7
Fast charge time from	54	42	42	40 (50kW) 45 y 60		

100 kW to 80% (min)					(50 kW)	
Price (USD.)	38639.00	40121.00	47320.00	29990.00	36550.00	34760.00

Table 2: **Battery capacity and autonomy for one hour of charge.**

2.2 Some working components of EV vehicle Charging Sation

2.2.1 Working of EV Charging station.

The electric vehicle charging station is composed of several electrical vehicle charging machines, each electric vehicle charging machine is composed of transformer, capacitor, control unit having a good quality processor with inbuilt memory for software to operate the station.

The charging station has a charging cord and plug which connects to the vehicle via an appropriate plug, it is designed with stand dimensions to fit the charging port of the vehicle.

The electrical power received from grid is transferred to an electrical vehicle charging machine via an appropriate distribution and control panel which essentially has various safety and fail safe devices required to handle appropriate electric load.

The electrical power is supplied to electric vehicle charging machine which utilizes its

Brand and model of the car	Battery capacity for one hour of charge (kWh)	Autonomy for one hour of charge (km)
Hyundai Ioniq Eléctrico	**7.2**	**55.08**
Kia eSoul Standard	**7.2**	**50.88**
Kia eSoul Autonomía Extendida	**7.2**	**50.85**
Nissan Leaf S	**6.6**	**44.55**
Nissan Leaf S Plus	**6.6**	**40.98**
ByD E5-400	**7.0**	**46.28**
Porsche Taycan 4S	**9.6**	**49.33**
Porsche Taycan Turbo	**9.6**	**46.25**
Tesla Model S - Perfomance	**10**	**56.00**
Average	**8.00**	**49.00**

Level 1 Charging option provides 110-120V AC alternating current at charger point, Level 2 Charging option provides 220 to 240V AC at charging point, while Level 3 charging requires 3 phase input AC supply which is then passed through transformer and then rectifier, followed by the ripple factor reducing circuit so as to obtain the DC power supply which is supplied to charging point.

The various interface and control actions are governed by the control system as per the software feed.

in the machine based on which its classified into smart or dumb charging machine. The processor present in the control unit processes the data algorithm built in the software as per which the input are requested from the user, based on these input charging of vehicle takes place.

3. Results and Analysis

1. CC Mode of Charging

Until the SOC of battery reaches 95% of its total charge, CC mode of charging is done. After it reaches 95% SOC, CV charging mode is done. In CC mode a; shown in Fig.2, load current is constantly compared wa.th reference current and the difference (error) is given to a PID controller. The output signal from PID is compared with a saw tooth wave by a comparator and the duty cycle of output wave varies accordingly. This comparator is used to drive the buck converter.

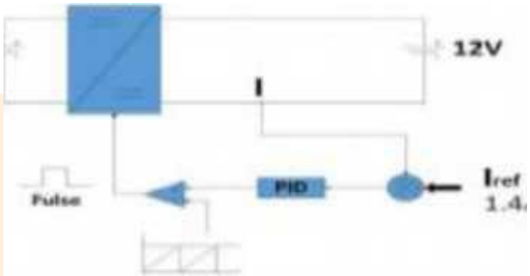


Figure 3.1.1: CC Charging mode

2. CV Mode of Charging

In CV mode of charging, the voltage across battery is constantly compared with a reference value of 12V. The difference in the errors is used to calculate he reference current and this current is compared with the load current. The difference is fed to a PID controller and the output from PID is compared with saw tooth wave and the duty cycle of output wave varies accordingly. When the SOC of battery reaches 95%, a relational operator and a switch toggles from CC mode to CV mode of charging.

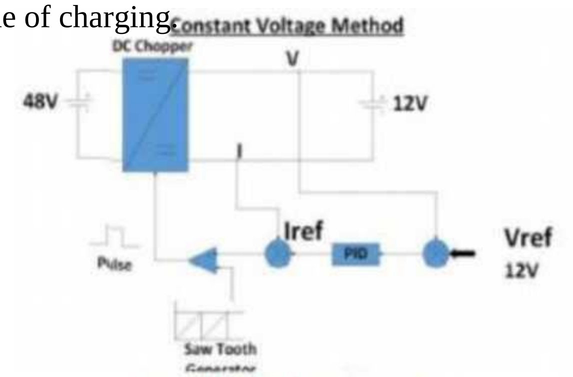


Figure 3.1.2: CV Charging mode

Boost Convertor

Working Range: DC 8.5V to 50V input voltage, 10V to 60V continuously adjustable output voltage, 15A maximum input current, 12A maximum output current. High Conversion: 96% maximum conversion efficiency, stable and reliable performance [8]. Easy to Connect and Disconnect: Input and output are designed with screw terminals, you can connect or disconnect the wire conveniently 19) Faster Dissipation: Designed with two heat sinks, better dissipation performance. Widely Applications: Suitable for electric equipment, digital products, laptop, etc. Type: Non-isolated boost module. Input Voltage: DC 8.5V to 50V. Output Voltage: DC 10V to 60V (continuously adjustable, default 19V). Max. Input Current: 15A (please enhance heat dissipation if more than 8A). Max. Output Current: 12A (related to the input and output voltage difference, the greater voltage difference is, the smaller output current will be. please enhance heat dissipation when current is over 7A).

Figure 3.1.3.: Boost Converter

Quiescent Current: 10mA (will increase when convert 12V to 20V) . Constant Current Range: 0.2A to 12A. Output Power Input Voltage*Current. Operating Temperature: -40°C to 85°C(if temperature is too high, please en hence heat dissipation). Frequency: 150KHz. Max. Conversion Efficiency: 96% (Efficiency is related to input/output voltage, current and voltage difference). Over Current Protection: Yes (if input current is more than 15A, it will automatic reduce

output voltage.

Figure 3.1.4: Block diagram of solar charging station

Testing Of Circuit

3.5.1 Open Circuit Voltage Test of Solar Panel when the Sun Radiation is Low

Figure 3.1.5: Open circuit voltage test of solar panel witth multimeter

Results (typical)

12V nominal panel: 18 to 28V. 24V

nominal panel: 34 to 56V

Output Voltage Test of Battery with Solar Charge Controller

Output voltage is the voltage which was exhibited by the battery under normal conditions. The battery that used in this project is a lead acid battery which was shown above. Output voltage test of battery is as follows: Connect the positive lead of the solar charge controller to the positive wire (or terminal) of the battery, and the negative lead of the solar charge controller to the negative wire (or terminal) of the battery. The solar charge controller will now show the output voltage of the battery[12].

Figure 3.1.6: Output Voltage Test of Battery with Solar Charge Controller

Result:

12V DC under normal condition.

Input Voltage Test of DC-DC Boost Converter

Figure 3.1.7: Input Voltage Test of DC-DC Boost Converter with Multimeter

Input voltage is the voltage which was accepted by the boost converter under normal conditions. Input voltage test of Connect the positive lead of the multimeter to the positive wire (or terminal) of the boost converter, and the negative lead of the multimeter to the negative wire (or terminal) of the boost converter. The multimeter will now show the input voltage of the boost converter.

Result:

12V under normal conditions

Output Voltage Test of Boost Converter(28V

Figure 3.1.8: Output voltage test of DC-DC boost converter with multimeter

Output voltage is the voltage which was exhibited by the boost converter under normal conditions. Output voltage test of DC-DC boost converter is as follows: Connect the positive lead of the multimeter to the positive wire (or terminal) of the boost converter, and the negative lead of the multimeter to the negative wire (or terminal) of the boost converter. The multimeter will now show the output voltage of the boost converter. output voltage of the boost converter.

Result:

28V under normal conditions.

Figure 3.1.9: Output voltage test of DC-DC boost converter with multimeter

Output Voltage Test of Boost Converter(36V):

Output voltage is the voltage which was exhibited by the boost converter under normal conditions. The above picture depicts that the output voltage of boost converter can be boost up to certain values till its maximum range. Output voltage test of DC-DC boost converter is as follows:

Connect the positive lead of the multimeter to the positive wire (or terminal) of the boost converter, and the negative lead of the multimeter to the negative wire (or terminal) of the boost converter. The multimeter will now show the output voltage of the boost converter.

Result

36.9V under abnormal conditions

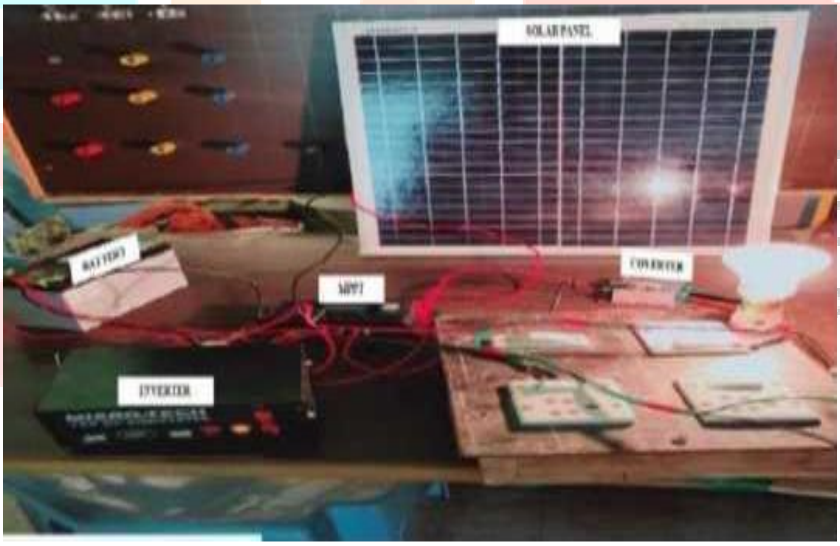
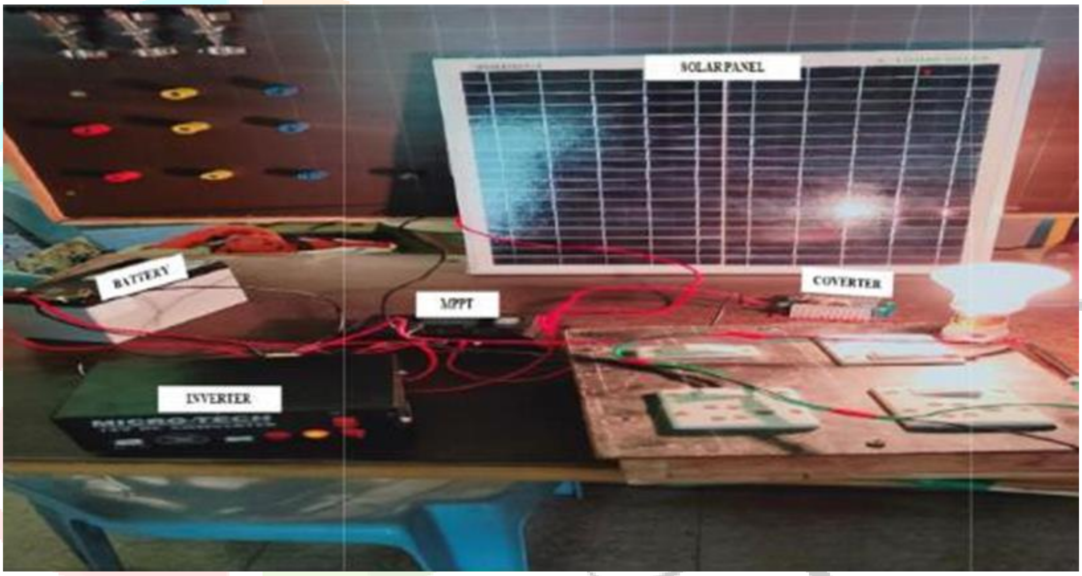


Figure 3.1.10: Output voltage test of DC-DC boost converter with multimeter

Complete Circuit for DC Charging:

By connecting all the required components together with perfect connections then we can get the required output When the boost converter connected across the battery then it converts the battery output voltage i.e DC to DC. That boosted voltage is used for the purpose of DC charging. So the above picture is the result of testing an AC bulb by connecting its terminals to converter terminals to the bulb.

Complete Circuit for AC charging



By connecting all the required components together with perfect connections then we can get the required output When the inverter connected across the battery then it converts the battery output voltage ie DC to AC That AC is used for the purpose of AC charging. So the above picture is the result of testing an AC bullb by connecting is terminals to inverter terminals to the bulb.

Framework of the Project.

Figure 3.1.11 : Framework Of Project

Figure 3.1.12: Final Output Of Project.

Results

Open circuit voltage is a common term in solar cell applications. VOC is the open circuit voltage, which is the maximum voltage that is available for drawing out from a solar cell and occurs at zero current [11]. The open circuit voltage resembles the forward bias amount on the solar cell as a result of the bias of the solar cell junction with light generated current. Connect the positive lead of the multimeter to the positive wire (or terminal) of the solar panel, and the negative lead of the multimeter to the negative wire (or terminal) of the solar panel. The multimeter will now show the open circuit voltage of the solar panel.

4. Conclusion

This paper is to make every individual to feel comfortable as it was movable and portable. As today's world is fully covered with a huge amount of pollution that is being caused by the automobiles, electric vehicles are the best replacement for the future generation. So, in order to feed the electric vehicles this paper that is charging station helps a lot to the public in the way of economic and also helps in instant charging where one can't be able to find the electric grid. The final conclusion of this paper is to use renewable energy resources to the maximum extent and to promote the electric vehicles as they are eco-friendly so that there may be a chance of reduction in pollution in future. In order to run the electric vehicles, there is a requirement of fuel that is electricity. So, this paper provides that electricity which is required by the vehicles to be get charged. As our designed charging station is movable and portable, each individual can use it even in the absence of grid.

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