ANALYSIS AND IMPACT OF E-MOBILITY ON POWER GRID

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Abstract - *The exponential growth of electrical vehicles in future, utilities should be set up to keep up unwavering quality of the framework. The primary impacts on electrical systems are generation adequacy, generation flexibility, transmission grid capacity, and distribution grid capacity. The main challenge of electrification of transportation expansion lies in the distribution networks and the overloading of network assets. E-Mobility can help mitigate utility pin points and provide new means of opportunity. Utilities are a critical partner for connecting vehicle charging stations to the matrix to work, and bolster the charging framework. This paper approach is for a real and reactive power analysis and harmonics in a charging current at the grid side. The simulation model developed in a MATLAB Simulink tools and verified with corresponding factors.*

Key Words: **Electric vehicle, Distribution Grid, real and reactive power, harmonics.**

1. INTRODUCTION

In recent years, the use of Electric vehicles is increasing as a solution for reduction of air pollution and global warming. EV has the ability to increase energy efficiency and decrease fossil fuel dependency in road transportation. It likewise assesses the hindrances and difficulties of conveying an extended system of EV charging stations and causes proposals to assist with institutionalizing and speed up EVSE foundation organization to help the quickening development of EVs. Noteworthy progressions are being made in PEV advances, and numerous PEV fabricates have close term desires for cutting edge battery innovation that will give a movement run equivalent to that of routinely fuelled vehicles. The charging characteristics analysis in charging port, power analysis (Real and Reactive) and charging current harmonics classification is simulated and verified by using Simulink model.

1.1 EVSE

The hardware, associated with an electrical force source that gives the Alternating flow or the direct flow supply to the electric vehicle that is expected to charge the vehicle's footing batteries. EVSE charging limit choices are a significant thought as they have an immediate bearing on how quick the batteries can be energized.

For instance, Level 2 EVSE is accessible in 20, 30 and 40 amp limits and higher amperage likens to quicker revive times. Be that as it may, the PEV's ready charger must be able to coordinate the full yield of the EVSE to understand the quickest energize times.

1.2 Electric Vehicle Connector

The gadget appended to the EVSE link that gives the physical association between the EVSE and the PEV. There are three transcendent connectors being used today: the SAEJ1772 based connector created by the U.S. auto guidelines advancement association SAE, the CHADEMO connector created by the Japanese auto principles improvement association, and the Tesla created Supercharger connector that is utilized only for charging Tesla electric autos.

2. RELATED WORK

Wikstr�. M et.al [1] Various kinds of EVs and P Hybrid Electric Vehicles are accessible in the market and these are ordinarily alluded as Plug-in Electric Vehicles. Aside from the ecological benevolent nature of PEVs, the charging of PEVs may show extensive effect on appropriation framework unwavering quality. The expansion of framework stacking because of the PEVs charging lessens the substation save limit and feeder request move capacity. Request move capacity assumes a key job during framework reclamation utilizing exchange feeders also. This directly affects the framework dependability. Notwithstanding these, in the event that PEVs are charged from the traditional force sources, at that point the target of the PEVs use isn't met. Be that as it may, the utilization of sustainable power hotspots for PEVs' charging upgrades the advantages of PEVs.

Hemakumar Reddy et.al [2] At first, PEVs were associated with the lattice for the battery charging as it were. The circulation framework administrators are answerable for offering the types of assistance for shoppers' .They are additionally liable for giving the system moves up to PEVs charging stations. DSOs have no influence over the charging areas and periods. As an outcome, the framework activity gets basic because of vulnerability in PEVs charging. As of late, some important research work is being done on the effect of PEVs reconciliation on age framework, Kempton and Denholm et.al [3] An assortment of techniques has been created to oversee supply vacillations of shifting timescales; these incorporate stockpiling, dispatchable burdens and option producing limit. Electric vehicles with an electric lattice association can bolster these procedures; accordingly the wide-spread reception of EVs could assume a significant job in the reconciliation of sustainable power source into existing power frameworks. The essential objective of this paper is to survey and evaluate the effect of e-portability, which offer is bit by bit expanding. The investigation will be done in the recreation program GridLab-D, which has instruments for mimicking variable interest just as force creation of photovoltaic force plants reliant on genuine climate conditions

3. EV CHARGER

Level 1 and 2 charging utilizes the PEV's inside battery charger to change over the EVSE Alternating current stock to the Direct current expected to charge the vehicle's footing Batteries. DC Fast Chargers supply high-flow DC power legitimately to the PEV's footing batteries; the installed charger change of AC to DC isn't required and this capacity of the on-board charger is by-passed when a DCFC is utilized. On-board battery charger choices are a significant thought when buying a PEV as they have an immediate bearing on how quick the batteries can be revived. There are several options available, some of which do not provide an option for DCFC.

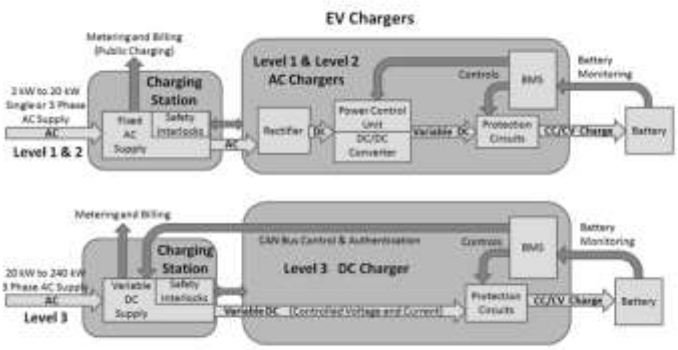

Fig-1: Level 1, 2, 3 EV Chargers

4. PHASE SHIFTING

Ila changes during the overlapping time of the low side switch and the high side switch. By decreasing overlapping time, iLA peak can be decreased. The maximum overlapping time is shown when the phase difference between two PFC converter units is 180 degrees. By applying phase-shifting control, phase difference and the overlapping time can be controlled. With proper phase difference, not only the ZVS turn-on is achieved, but also the conduction loss of switches and LA, and the core loss of LA can be minimized. Ideally, Ila peak can be same with Ireq by reducing iLA.

To calculate the required phase difference, the information of Vac, VO, iLB1 and iLB2 is required. However, since this required information is already sensed in the conventional PFC converter with the CCM operation, the phase-shifting control can be accomplished without any additional sensing or components.

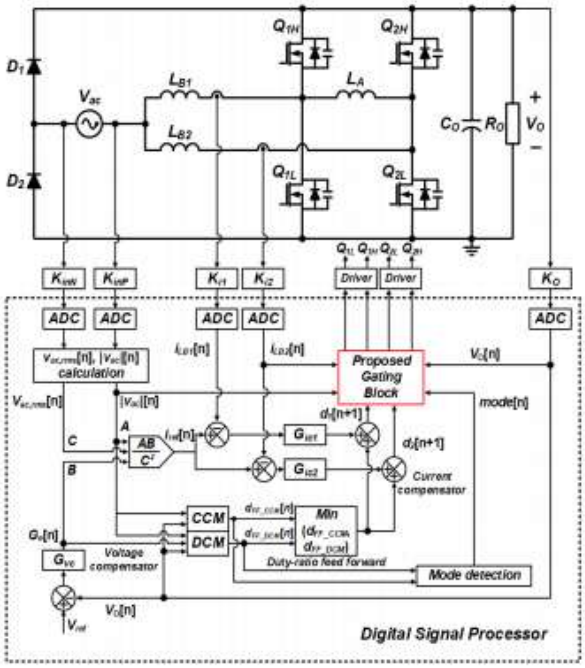

Fig-2: Phase shifting control

5. PROPOSED ARCHITECTURE

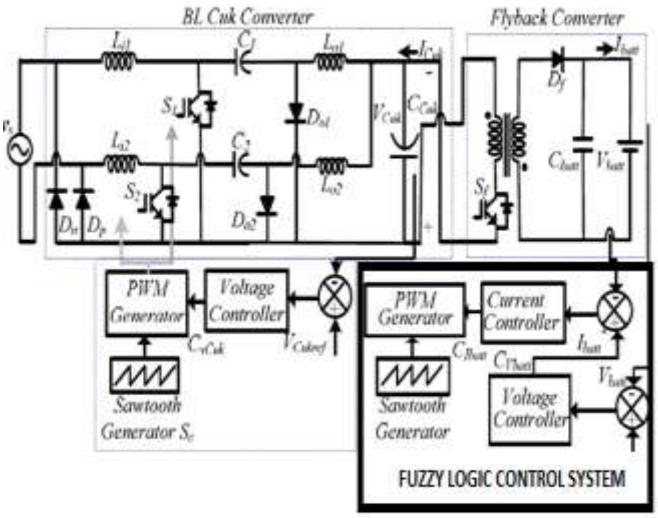

Fig-3: Power quality improved Unit Charger

The projected greenhouse emission Cuk convertor operates for positive half cycle with switch S1, input electrical device Li1, output diode Do1 and output inductance Lo1. Similar shift pattern is followed for next half cycle with the switch S2, input inductance Li2, output diode Do2 and inductance Lo2. The DC link voltage of PFC Cuk convertor is maintained constant mistreatment single loop voltage feedback management, that reduces the charger value thanks to use of single voltage device. The flyback convertor controls the battery current for charging in constant current and constant voltage regions using fuzzy logic controller.

5. RESULTS AND DISCUSSIONS

The proposed charger shows better performance than previously developed DBR fed charger with no PFC and conventional boost PFC based charger, in terms of efficiency, size, cost and improved PQ indices. This analysis confirms that the proposed charger shows an 8-10% improvement in efficiency due to reduced conduction losses in each cycle, as compared to conventional boost PFC fed charger.

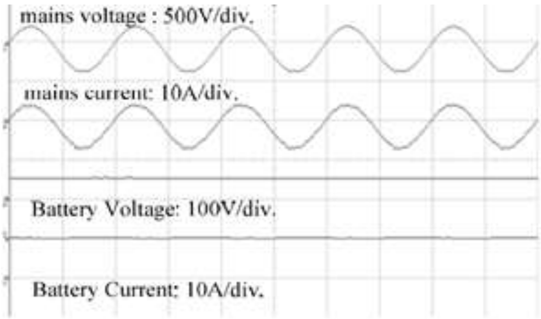

Fig-4: Source and Battery side quantities

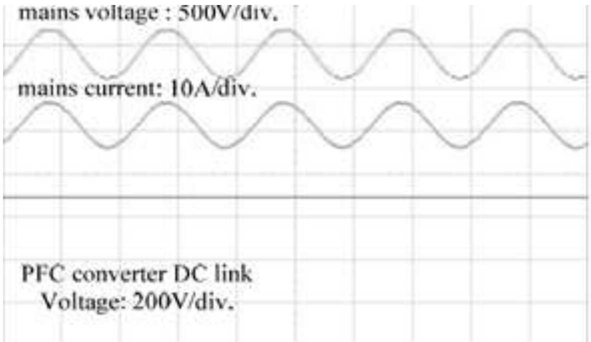

Fig-5: PFC and DC link voltage

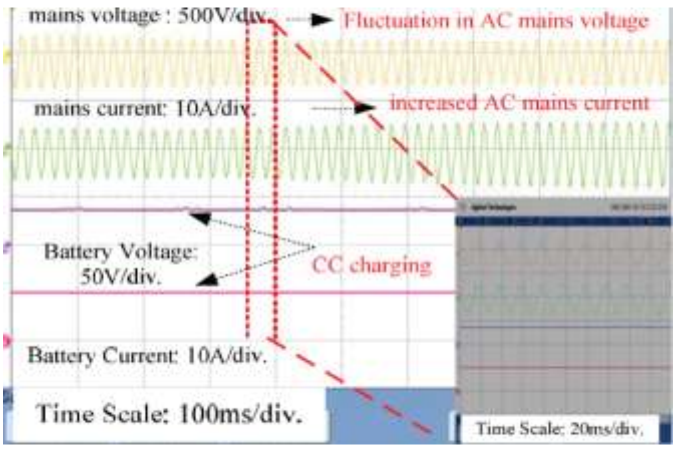

Fig-6: Charger performance in voltage dip

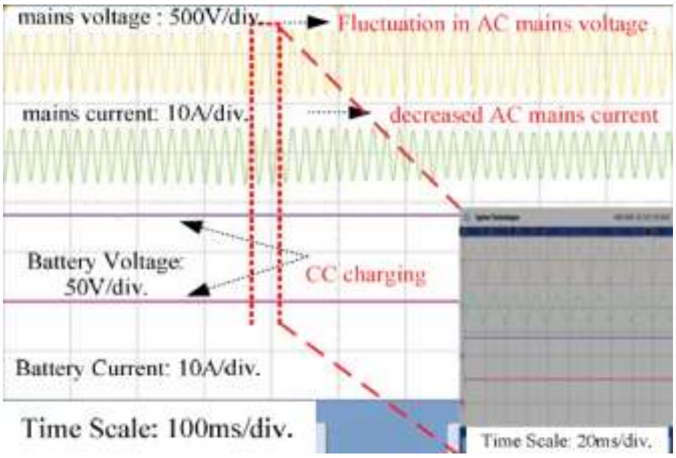

Fig-7: Charger performance in voltage rise

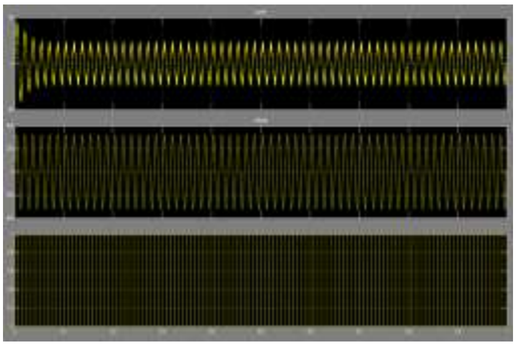

Fig-8: Input and output voltage and current

6. CONCLUSION

The control of hybrid power design for EV charger with less number of elements conducting over single shift cycle. Therefore, the scale of the charger is reduced. The proposed charger shows satisfactory charging characteristics for steady state and sudden fluctuations in supply voltage. The charger shapes the mains current to follow the mains voltage as well as the current is reduced as low 2.8%, in contrast to the supply current of 55.3% in standard charger.

REFERENCES

[1] Martina Wikstrom, "Introducing plug – in electric vehicles in public authorities, "Research in Transportation Business & Management". Volume 18, March 2016.

[2] Galiveeti Hemakumar Reddy,"Impact of plug in electric vehicles and distributed generation on reliability of distribution systems", Engineering science and Technology, 2018.

[3] Willett Kempton, "Electric vehicles as a new power source for Electric Utilities",Transpn Re-D,vol 2, No.3, 1997