Smart Wireless Charging System For Electrical Vehicle

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Abstract- *Wireless Power Transfer (WPT) is an innovative technology in which power is transferred without physical contact. As technical knowledge is proceeding, most of the wired technology is also converting into wireless technology through different techniques. Electric Vehicles and plug-in hybrids may be fresh and feasible but it is not enough if it is forgetting to plug in the power source the night before. Electric Vehicles will automatically charge when it will park in the special parking space where the transmitter circuit has already been developed, when an electric vehicle parks on that place, charging will start automatically. A preceding review of a few methods for wireless charging discovered that Inductively Coupled Power Transfer System (ICPT) is an advantageous method for wireless charging of EVs (Electric Vehicles).*

This paper presents a IPT (Inductively Coupled Power Transfer) system which is appropriate for Vehicle systems. For EV charging a WPT is a stable dynamic and effective system. Wireless power techniques fall into two categories, non-radiative and radiative. This project follows the non-radiative field using magnetic inductive coupling between coils of wire. After the usage of charging the DC Power is inverted and then the excess power is given to the Grid automatically. In this project mutual inductance technique is used between two coils. This paper will also enhance the feasibility, reliability and efficiency of the system.

Keywords- Inductively Coupled Power Transfer System, Vehicle to Grid, Wireless Power Transfer, Zero voltage resonant transition, Adaptive neural fuzzy inference system

I. INTRODUCTION

Nowadays, there is no life without electricity. From the beginning of mankind, there always has been the necessity of power, which brought us to the inventions of fire, steam engines and most importantly, electricity. The power grid electric supplies are used for residential and commercial applications. In general, the resident and commercial consumers need alternating supply only because the generated power is alternating supply only, hence it may be preferable for further applications. At the same time the generated power is fully utilized by the resident and commercial consumers then for the industrial consumers the generated power is transmitted through overhead transmission lines with respect to step up and step-down operation of the transformer.

Over all the electric supply played a vital role in our daily life means without considering the electric supply nothing will improve or satisfied. Hence, it’s important to keep the electrical supply in our life.

Till now the electric supplies are transmitted only through the electrical conductors, if its bulk power either UG cable or Overhead line is used for power transferring, then in the low power like residential or commercial powers are transmitted through the electrical wire. Hence in the power transmission electrical conductor or electrical wire is used to obtain the voltage or current.

The above system or wire based electrical power transmission may useful and it also have some advantages but it’s also creating the several issues like wire burn / conductor burn, shortcircuited, plug in/out etc. That’s why the researchers had a look on the issues and they are trying to provide the better solution for the case.

Among the various literature and research the wireless power transmission may suggest to replacing the wiring systems and introduced the smoother control / transmission techniques.

II. SYSTEM ANALYSIS

Wireless Power Transfer (WPT) innovation is developing in ubiquity as of late because of its non-physical association between the source and the heap, and it has been generally utilized in differing situations, for example, toothbrushes, PDAs, electrical vehicles, and self-governing submerged vehicles (AUVs). Vitality is a central point limiting the long-haul ceaseless activity of the AUV in the sea. Abstaining from conveying such a large number of batteries, WPT innovation can be utilized to charge the AUV in the crucial, which can comprehend long haul persistent activity issue.

There is a very limited beneficiary measure and weight of the recipient side on the AUV, so the collector ought to be as minimal as could reasonably be expected. The examination center covers the power gadgets converters, curl improvement, pay topologies, outside item recognition and security issues. Among these fields, the pay topologies, or the coordinating systems, are pivotal to build the general effectiveness and limit the VA rating of the power gadgets converters by utilizing extra inductors and capacitors to alter the receptive power. Be that as it may, the extra segments increment the size, weight, and cost of the framework.

In addition, certain pay topologies can be received to accomplish a steady current yield without complex control strategies, which is useful to the battery charging. The arrangement (SS) topology is broadly used on the grounds that it has a consistent current yield trademark, which is useful for the charging current control. Moreover, the full recurrence is autonomous of the coupling coefficient and the heap, which is profitable for remote charging. In any case, the yield control increments with the diminishing coupling coefficient, which will result in overcurrent under the skewed case.

III. PROPOSEDMETHODOLOGY

The innovation of remote charging is the method to involve and its develop the more advantages at the same time wireless power transfer (WPT) and Inductive power move (IPT), implemented to the low power level, for example, applications in the restorative field or in little gadgets, for example, advanced mobile phones Along with the quickly developing enthusiasm for electric vehicles (EVs) and module half and half electric vehicles (PHEVs), remote charging is turning into another method for charging batteries. In this paper, the structure of a WPT framework for electrical transport quick remote charging stations will be introduced. The framework is composed by a two-phase exchanging power supply, for example a multiphase delicate exchanging buck converter controlling the yield control and a high-recurrence resounding full-connect converter associated with an arrangement pay topology.

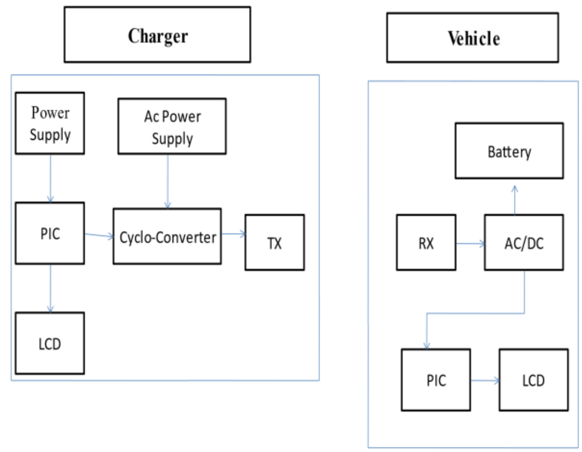

Figure1.Block Diagram

IV. SYSTEMDESIGN

In this proposed WPT framework the air conditioner supply is converter into low level de supply with the assistance of the air conditioner dc PFC circuit, after that the dc supply is given to the high recurrence exchanging gadgets. The exchanging gadget will trigger the essential side twisting by the delicate exchanging system. The optional side of the framework comprises of the auxiliary winding which can get the moved power from essential side. From that point onward, the power is changed over to the dc structure with the assistance of AC-DC converter and moved to the battery charging reason.

V. EXPERIMENTALSETUP

The battery produces 12 V/ 5 V power supply to the regulator that ensures a constant voltage supply through all operational conditions. It regulates voltage during power fluctuations and variations in loads. Then the constant voltage is passed to the PIC microcontroller which is the main brain of the system which is responsible for both computing and communication tasks. It regulates voltage during power fluctuations and variations in loads.

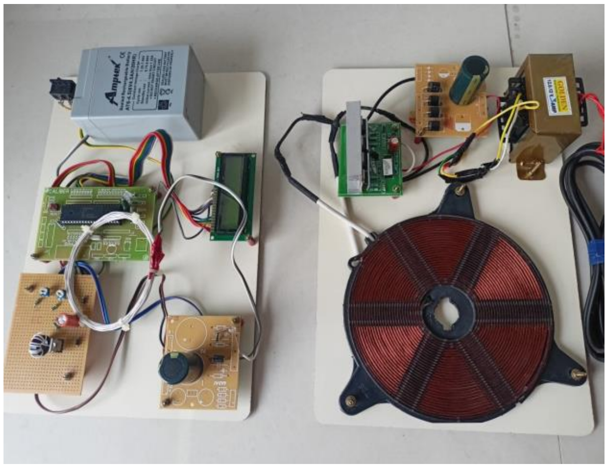

Figure 2. Snapshot Of Proposed Hardware Kit

A power supply unit is required to provide the appropriate voltage supply. This unit consists of transformer, rectifier, filter and a regulator. AC voltage typically of 230Vrms is connected to a transformer which steps that AC voltage down to the desired AC voltage level. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a DC voltage. This resulting DC voltage usually has some ripple or AC voltage variations. Regulator circuit can use this DC input to provide DC voltage that not only has much less ripple voltage but also remains in the same DC value, even when the DC voltage varies, or the load connected to the output DC voltage changes. The required DC supply is obtained from the available AC supply after rectification, filtration and regulation. Block diagram of power supply unit is shown in Figure 2.1

The main components used in the power supply unit are Transformer, Rectifier, Filter and Regulator. The 230V AC supply is converted into 9V AC supply through the transformer. The output of the transformer has the same frequency as in the input AC power.

This AC power is converted into DC power through diodes. Here the bridge diode is used to convert AC supply to the DC power supply. This converted DC power supply has the ripple content and for normal operation of the circuit, the ripple content of the DC power supply should be as low as possible. Because the ripple content of the power supply will reduce the life of the circuit. So to reduce the ripple content of the DC power supply, the large value of capacitance filter is used.

PARAMETERS	EXISTING SYSTEM	PROPOSED SYSTEM
Speed of charging	5 HOURS	2 HOURS
Efficiency	80%	95%
Charging port	Only 2	Multiple port is available
Battery type	Only lead Acid Battery	Use lithium ion Battery
Battery Life	400 Cycles	600 Cycles
Technique used	Fuzzy Technique	Soft Switching Technique

Table. 1 Comparison of proposed system with existing system.

V. RESULT AND DISCUSSION

Broadly speaking, there are three types of wireless charging, according to David Green, a research manager with IHS Markit. There are charging pads that use tightly-coupled electromagnetic inductive or non-radiative charging; charging bowls or through-surface type chargers that use loosely-coupled or radiative electromagnetic resonant charging that can transmit a charge a few centimetres; and uncoupled radio frequency (RF)wireless charging that allows a trickle charging capability at distances of many feet. Both tightly coupled inductive and loosely-coupled resonant charging operates on the same. A magnetic loop antenna (copper coil) is used to create an oscillating magnetic field, which can create a current in one or more receiver antennas. If the appropriate capacitance is added so that the loops resonate at the same frequency, the amount of induced current in the receivers increases. This is resonant inductive charging or magnetic resonance; it enables power transmission at greater distances between transmitter and receiver and increases efficiency. Coil size also affects the distance of power transfer. The bigger the coil, or the more coils there are, the greater the distance a charge can travel

Figure3.STATUS OF CHARGING

Power Consumption: Smart Wireless Charging System for Electric Vehicle uses less power than existing charging systems.

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Reliability: The Smart Wireless Charging System for Electric Vehicle is designed for reliable charging and long-term use. It can withstand power outages, temperature spikes, and other environmental factors.

Running Cost: The Smart Wireless Charging System for Electric Vehicle is more cost-efficient than existing charging systems as it requires less energy to charge the vehicle.

Charge Time: The Smart Wireless Charging System for Electric Vehicle can charge a 30% battery in approximately 30 Min, a 60% battery in approximately 60 Min, a 90% battery in approximately 130 Min, and a 100% battery in approximately 133.5 Min.

Approximate Value of Voltage and Frequency: The Smart Wireless Charging System for Electric Vehicle operates at a voltage of 5V and a frequency of 1MHz.

Proposed System is Better than Existing System: The Smart Wireless Charging System for Electric Vehicle is more reliable, cost-efficient, and efficient than existing charging systems. It also offers a faster charging time and higher voltage and frequency for safer charging.

Figure4.30% battery in approximately 30 Min

Figure5.60% battery in approximately 60 Min

Figure6.90% battery in approximately 130 Min

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Table. 2 Comparison of proposed system with existing system.

VI. FUTURE SCOPE

The time limitations of the technology such as its shorter range and longer charging durations have been discussed throughout out the study, and a handful of future research possibilities have been emphasized.

VII. CONCLUSION

The proposed Electric Vehicle to Grid hardware was designed and tested efficiently. The new control technique (Adaptive Neuro Fuzzy) was proposed for ICWPT. The performances of Neuro Fuzzy control system were tested. The challenges related to inductive magnetic WPT in V to G were emphasized. The maximum wireless power transfer capacity of the proposed hardware is 70 watts. In both transmitting and receiving side inverter control system was introduced. Transmitter section is designed with variable frequency tuning option which increases the WPT distance. Receiver section designed with constant switching frequency which reduces the risk factor to integrate the receiving power to the Grid

REFERENCES

[1] A. A. S. Mohamed and O. Mohammed, "Physics-Based Co- Simulation Platform with Analytical and Experimental Verification for Bidirectional IPT System in EV Applications," IEEE Trans. Veh. Technol., vol. 67, no. 1, pp. 275–284, Jan. 2018.

[2] G. A. Covic and J. T. Boys, "Modern Trends in Inductive Power Transfer for Transportation Applications," IEEE J. Emerg. Sel. Top. Power Electron., vol. 1, no. 1, pp. 28–41, Mar. 2013.

[3] R. Bosshard, U. Badstubner, J. W. Kolar, and I. Stevanovic, "Comparative evaluation of control methods for Inductive Power Transfer," in 2012 International Conference on Renewable Energy Research and Applications (ICRERA), 2012, pp. 1–6.

[4] F. Capitanescu, L. F. Ochoa, H. Margossian, et al. "Assessing the Potential of Network Reconfiguration to Improve Distributed Generation Hosting Capacity in Active Distribution Systems," IEEE Trans. on Power Syst., vol. 30, no. 1, pp. 346-356, Jan 2015.

[5] M. Bojarski, K. K. Kutty, D. Czarkowski, and F. De Leon, "Multiphase resonant inverters for bidirectional wireless power transfer," in Electric Vehicle Conference (IEVC), 2014 IEEE International, 2014, pp. 1–7.

[6] L. Zhao, D. J. Thrimawithana, and U. K. Madawala, "A hybrid bi directional IPT system with improved spatial tolerance," in Future Energy Electronics Conference (IFEEC), 2015 IEEE 2nd International, 2015, pp. 1–6.

[7] M. J. Neath, U. K. Madawala, and D. J. Thrimawithana, "A new controller for bi-directional inductive power transfer systems," in 2011 IEEE International Symposium on Industrial Electronics (ISIE), 2011, pp. 1951–1956.

[8] U. K. Madawala, M. Neath, and D. J. Thrimawithana, "A Power #x2013; Frequency Controller for Bidirectional Inductive Power Transfer Systems," IEEE Trans. Ind. Electron., vol. 60, no. 1, pp. 310–317, Jan. 2013.

[9] M. Loos, S. Werben, and J.C. Maun, "Circulating currents in closed loop structure, a new problematic in distribution networks," IEEE, Power and Energy Society General Meeting, 2012.

[10] M. J. Neath, A. K. Swain, U. K. Madawala, and D. J. Thrimawithana, "An Optimal PID Controller for a Bidirectional Inductive Power Transfer System Using Multi objective Genetic Algorithm," IEEE Trans. Power Electron., vol. 29, no. 3, pp. 1523–1531, Mar. 2014.

[11] A. A. S. Mohamed, A. Berzoy, F. G. N. de Almeida, and O. Mohammed, "Modelling and Assessment Analysis of Various Compensation Topologies in Bidirectional IWPT System for EV Applications," IEEE Trans. Ind. Appl., vol. 53, no. 5, pp. 4973–4984, Sep. 2017.

[12] F. Turki and U. Reker, "Further design approaches of the standardization: Inductive charging of electric vehicles," in Electric Drives Production Conference (EDPC), 2012 2nd International, 2012, pp. 1–6.