Solar Based Wireless EV Charger

P. Krishnagandhi[1] , K. Gowrisankar[2] , Akshay Shaji[3] , R. Karthi[4] , D. Kavin[5]
[1]Assistant Professor, Dept of EEE
[2, 3, 4, 5]Dept of EEE
[1, 2, 3, 4, 5] Nandha Engineering College (Autonomous), Erode, Tamil Nadu, India.

Abstract- *The industry is rapidly transforming from an IC engine vehicle to an electric vehicle. The demand for an electric vehicle is increasing, these lead to an in- crease in charging station as well. In this project, a wireless charging system is used to charge the vehicle wirelessly via inductive coupling. We just simply need to park the car on the charging spot. The transmission of electrical energy from source to load from a distance without any conducting wire or cables is called Wireless Power Transmission. The system checks if the person has sufficient balance and then deduct the charging charges and update the balance. The Internet of Things describes the network of physical objects that uses sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems.*

I. INTRODUCTION

Electric vehicles are poised to be the future of transportation, and improving charging station efficiency will be critical to their widespread adoption. The lack of a reliable charging infrastructure has been a primary factor hindering EV demand in the market. To address this issue, we have developed a portable EV charger that leverages renewable energy to reduce charging time. The vehicle battery charging station employs a hybrid power system and provides a unique service to travelers looking to cover long distances in their electric vehicles. Often, there are no electric charging stations available for such users between motorways to recharge their vehicles. In this scenario, a wireless EV charger is the ideal alternative for charging their electric vehicles.

II. METHODOLOGY

Solar power has increasingly become popular over the past year. With its uncountable improvement and cost-effective ways, more and more people are opting to switch over to solar energy rather than their regular form of energy. Solar charging is based on the use of solar panels for converting light energy into electrical energy (DC). The DC voltage can be stored battery bank. There is Reverse charging protection circuit is provided for the backflow of energy from the battery to a solar panel. The transfer coil is located at charger side and receiver coil is placed on vehicle side. A wireless power transfer module (WPT) is used for transferring electric power which is generated from the solar panel to the Electric vehicle by using the principle of Electromagnetic Induction.

To measure battery voltage, a voltage sensor is used. The battery voltage will be measured by microcontroller & showed on a 16x2 LCD. It will also display battery low status, whenever battery voltage falls below a certain level. L239D is the motor driver which is used for movement of wheels of that vehicle.

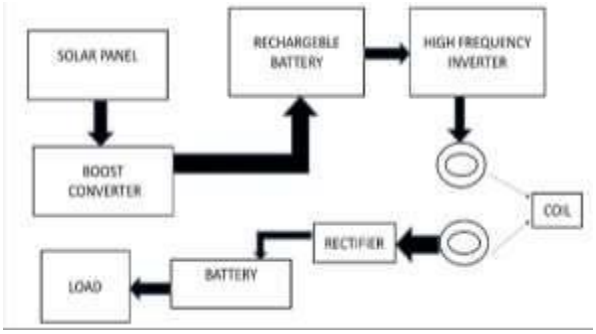

Fig.1 Block diagram of solar-based wireless EV charger

Wireless power transfer module (WPT): In electric vehicles charging of battery through a charger and wire is inconvenient, dangerous, and expensive. The existing gasoline and petrol engine technology vehicles are responsible for air, and noise pollution a well as for greenhouse gases. The implemented wireless charging system of batteries for Electric vehicles by the inductive coupling method has been studied in this paper. The transmitting circuit is used between the transmitter coil & receiver coil where MOSFET is usedfor switching operation. The system is achieving a 61% efficiency level while providing safety, reliability, low maintenance, and long product life. This is easy to use Wireless Power Transfer Module. This module consists of Transmitter Section & a receiver Section. Both the sections have a coil that acts as a transmitting/receiving antenna. This product can be used for wireless charging of mobile phones and various small electronic products. It is in a very small form factor and is extremely easy to use efficient & low costing. It can be used for wireless charging of your product thus making the product completely sealed, dustproof & waterproof thus increasing your product's life.

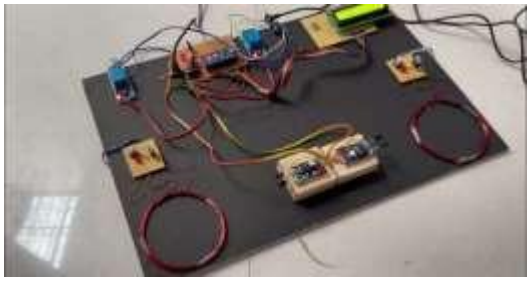

Fig. 2 Wireless power transfer MODULE

Specification:

- Transmitter Module Input voltage: 9-12 Volts
- Receives the output voltage: 5V
- Receiving the output current: 350-500mA
- Receiving usual distance: 3cm- 4cm

Due to the limited availability of resources, it has become essential to develop different methods to generate approaches to noiseless, cost-efficient, and convenient charging. It is estimated that losses incurred due to wires are about 20-30%. Hence WPT attempts to minimize these losses along with a reduction in pollution levels caused due to resources used presently. But for electric vehicles, traveling range and charging process are the two major issues affecting their adoption over conventional vehicles. The method of dynamic wireless charging allows keeping the vehicle charged while running. To overcome the problem of the charging process, a wireless charging & battery management unit for an electric vehicle is designed. The basic working principle of inductive WPT Charging is that there are two parts to the inductor.

The primary winding is at the charger side and the other secondary winding is placed at the vehicle side. If an EV vehicle is stopped on the road because of battery is dead and there is no charging station around it then a movable charger is the most suitable method for charging that vehicle at that place with less effort and without wasting our time.

Reverse charging protection (RCP):

Many batteries powered applications use diodes for reverse battery protection. However, a diode does not always protect a battery charger.

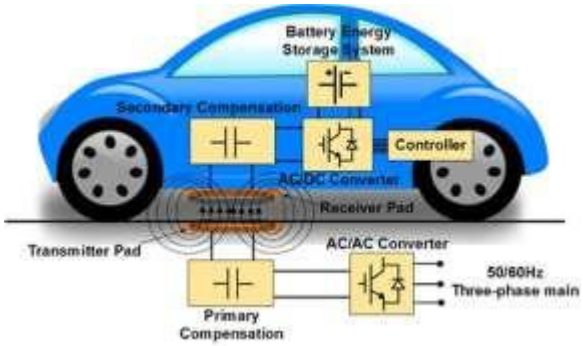

Fig. 3 Reverse protection circuit

Sometimes when the battery is fully charged from the solar panel then to have proper protection, inserted backward it can cause a large amount of current to flow through the charging circuitry, possibly destroying both the battery and solar panel. A diode and resistor are placed in series with the battery. The diode in series with the main supply is to blockcurrent from the battery into the solar panel. Two resisters are in series with the battery to prevent reverse charging.

PIC CONTROLLER: A microcontroller is the heart of every automation system. It is a small, low cost and self-contained on- chip computer. Microcontrollers usually must have low-power requirements since many devices they control are battery- operated. As per our requirements, the microcontroller matches perfectly. PIC Controller is a high-performance yet low- power consumption 8-bit AVR microcontroller that can achieve the most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture. It can commonly be found as a processor in boards. PIC Controller is one of the high-performance AVR technology microcontrollers with a large number of pins and features. It is designed with 8-bit CMOS technology and RSIC CPU which enhance its performance and its power efficiency get improved by auto sleeps and an internal temperature sensor.

The following parameters are mainly conceded for microcontroller selection:

- Number of input-output pins
- Need for inbuilt ADC & DAC
- Processing speed & capacity
- Power requirement for operation

III. CONCLUSION

The proposed hardware for Electric Vehicle to Grid integration was designed and tested efficiently, and it incorporates a novel control technique called Adaptive Neuro Fuzzy for Inductive Coupled Wireless Power Transfer

(ICWPT). The performance of the Neuro Fuzzy control system was evaluated, while also emphasizing the challenges associated with inductive magnetic WPT in the V to G context. The proposed hardware has a maximum wireless power transfer capacity of 70 watts and includes both a transmitting and receiving side inverter control system. The transmitter section features variable frequency tuning options to increase the WPT distance, while the receiver section is designed with a constant switching frequency to reduce the risk of integrating the receiving power into the Grid.

REFERENCES

[1] Karima Kouka, Lotfi Krichen "Energy management strategy of a photovoltaic electric vehicle charging station", 19th International Conference on sciences and techniques of automatic control and computer engineering, Tunisia 2020.

[2] Fangcheng Liu, Jinjun Liu, Bin Zhang, Haodong Zhang "Fast Charging System of Electric Vehicle (EV) Based on Hybrid Energy Storage System" vol- 978, no-1, pp4577-1216- 7 year©2012 IEEE.

[3] Debbou, M., & Colet, F. (2016). Inductive wireless power transfer for electric vehicle wireless charging. 2016 IEEE PELS Workshop on Emerging Technologies: Wireless Transfer (WoW) doi: 10.1109/wow.2016.7772077

[4] Driss Oulad-about, Said Doubabi, Ahmed RACHID, "Solar Charging Station for Electric Vehicles" vol-978, no-1, pp -4673-7894-9/15, the year 2015 IEEE

[5] Viral Shah al., "Smart Medicine Box," Imperial Journal of Interdisciplinary Research, vol. 2, no. 5, 2016.

[6] Fred Chiou, Ph.D., Member, IEEE Electronics Engineering Technology, Weber State University, "Solar Energy for Electric Vehicles" vol- 978, no-1, pp4799-1802-7/15, year-2015 IEEE.

[7] Sanjeevi kumar, Padmanaban, Lucian Mihet- Popa3, Mohammad Nurunnabi Molla EklasHossain4," A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development Fuad Un-Noor 1,* Academic Editor: Sergio Saponara; Published:17 August.

[8] R.SanthoshKumar,P.Krishnagandhi," Distributed Generation for Real Time Scheduling in PEVs charging & Optimization Industrial Micro grid "International Journal of Advanced and Innovative Research; Published:2015/4.

[9] R Santhoshkumar, Pg Scholar, P Krishna Gandhi," Optimal Scheduling For Distribution System Using Advanced Metering Infrastructure with Smart Micro Grid:Published:2014.

[10] 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.