www.ioirp.com
International Journal of Innovative Research in Technology, Science & Engineering (IJIRTSE)
ISSN: 2395-5619, Volume – 2, Issue – 6. June 2016

Charging of Vehicles using Wi-tricity for Empowering Green Environment

Vallipriya.S[1]
Vallipriyas94@gmail.com
Department of ECE,
AVS Engineering College,
Salem-636003.

Vasavi.A[2]
angapavasu@gmail.com
Department of ECE,
AVS Engineering College,
Salem-636003.

Vinothini.S[3]
vinothiniseranece@gmail.com
Department of ECE,
AVS Engineering College,
Salem-636003.

Prof. Ponlatha.S[4]
Department of ECE,
AVS Engineering College,
Salem-636003.

Abstract—Be a part of solution, not part of the pollution. EV's are rapidly becoming the forerunners in vehicle technology to empower green environment. Wi-tricity refers to wireless electricity. WPT using inductive coupling technique which is used for greater levels of convenience, connectivity, non-hazardous and freedom. Already they has been developed in four wheelers but we are going to implement it in two wheelers .There are two types of wireless charging methods. In this paper we are using non-radiative technique. It uses inductive coupling which means an emf is generated between the two non-contact coils. While an emf is transferred in wireless and the boost converter is needed to boost the voltage levels. Using Pic microcontroller, automatic charging and battery level is indicated in LCD display is made possible. In some critical cases, manual charging is also done by pressing buttons. We hope that the researchers should push forward the further development of EV's.

Keywords— EV's (Electrical vehicles) Wireless Power Transfer (WPT),Automatic charging, boost converter, pic-microcontroller, manual charging.

1. INTRODUCTION

For empowering the green environment the electrification of transportation is needed. Nowadays, the world has 53.3 years of oil left at the current rate of production where the oil is getting harder to extract, which is reflected in raising prices. In response to the raising costs and environmental concerns, engineers are looking further in to a new ways to create wireless electrical vehicle without usage of fuels. Hence, the global warming is decreased. Magnet is the father of electricity. Without magnet we cannot produce any electrical energy. In the year of 1890, Nikola Tesla developed a system of illuminating vaccum bulbs using wireless transmission technique. It was demonstrated using resonant transformers. The resonant transformers is also be called as tesla coils.

WPT can make remarkable change in the field of engineering science which eliminates the use of conventional copper cables and current carrying solid wires. wireless charging techniques falls into two categories. They are non- radiative and radiative. The non-radiative method is called as near field. The

radiative method is also be called as far field. The radiative method is harmful to our environment. So, we are using non-radiative technique which is harmless to our environment.

EV's charging can be done in both stationary and dynamic charging scenarios. WPT is an innovative charging technology where the charging is done with the help of two non-contact coils. Transfer of power is done by primary to secondary coil that is separated with considerable distance. The primary coil is fixed in the floor which is connected to the external power supply. The secondary coil is fixed at the bottom of the vehicle. When the external power supply is given to the primary coil, the primary coil gets energized. Due to mutual inductance, alternating electro-magnetic field (emf) is occurred between two coils and converts it back into a electric current to charge the battery.WPT operates with the non-radiative method which is more safer than the radiative method. This concept is an emerging technology, in future the power transfer distance can be enhanced as the research across the world is still going on.

2. RELATED WORK

The related work deals with EV, the battery is not easy to design because of the following requirements: high power density, good safety, high energy density, long cycle life time, affordable cost and reliability, should be met simultaneously. Lithium-ion batteries are recognized as the most competitive solution to be used in electric vehicles [1].

Minimizing energy leakage is very important because the goal is to have as much energy as possible be transferred from one object to another. However, the energy density of the commercialized lithium-ion battery in EVs is only 90-100 Wh/kg for a finished pack [2] .This number is so poor compared with gasoline, which has an energy density about 12000 Wh/kg. To challenge the 300-mile range of an internal combustion engine power vehicle, a pure EV needs a large amount of batteries which are too expensive. The lithium-ion battery cost is about 500$/kWh at the present time. Considering the vehicle initial investment, maintenance, and energy cost, the owning of a battery electric vehicle will make the consumer spend an extra 1000$/year on average compared with a gasoline-powered vehicle[1].

The first experiment to successfully wirelessly transfer energy consisted of two copper coils that were each a self –resonant system. One of the coil was connected to an AC power supply and acted as the resonant source. The second coil acted as the resonant capturing device and was connected to a 60-watt light bulb. The power source and the capturing device were about 2.5 meters apart and the light bulb was able to light up. Besides the cost issue, the long charging time of EV batteries also makes the EV not acceptable to many drivers. For a single charge, it take about one half-hour to several hours depending on the power level of the attached charger, which is many times longer than the gasoline refueling process .

It involves methods like capacitive coupling, Microwave and laser methods for far field region. Hence this technology uses magnetic resonance coupling has been found to be a viable technology for midrange energy transfer. Wireless energy transfer or Wi-Tricity is currently extending its applications in also in medical applications undergoing operations to replace the lithium ion batteries used for pacemakers. The EVs cannot get ready immediately if they have run out of battery energy. To overcome this, what the owners would most likely do is to find any possible opportunity to plug-in and charge the battery.

If really brings some trouble as people may forget to plug-in and find themselves out of battery energy later on. The charging cables on the floor may bring tripping hazards. Leakage from cracked old cable, in particular in cold zones, can bring additional hazardous conditions to the owner. Also, people may have to brave the wind, rain, ice, or snow to plug-in with the risk of an electric shock. Magnetic resonance is also being used for charging of EVs while driving on a highway. Since this technology can work even in water. It is an alternative to the hazardous batteries. The most important distinctive structural difference

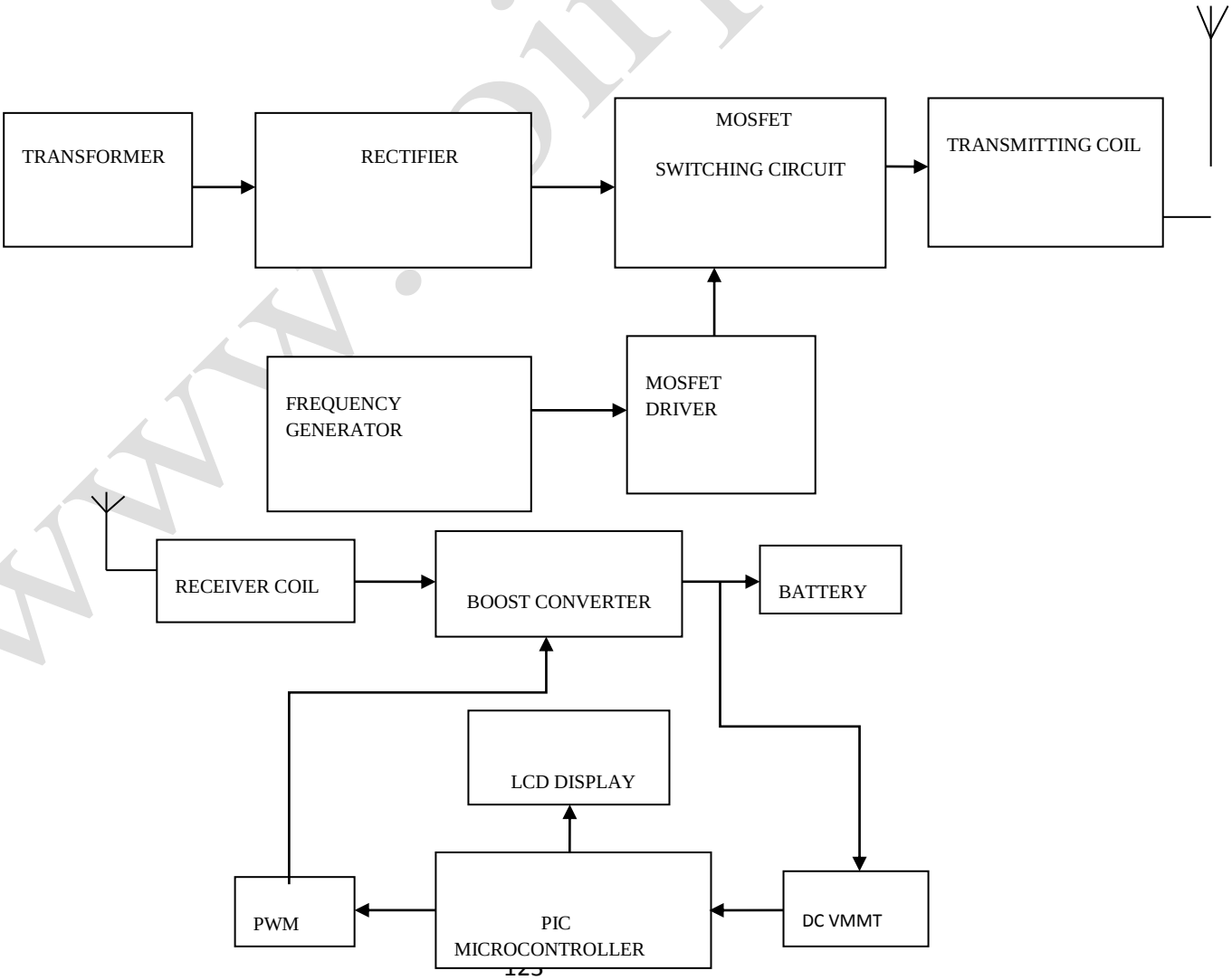
between contactless transformers and conventional transformers is that the two 'coils' in the former are separated by a large air gap.

Although the market demand is huge, people were just wondering whether the WPT could be realized efficiently at a reasonable cost. When the WPT is used in the EV charging, the MHz frequency operation is hard to meet the power and efficiency criteria. It is inefficient to convert devices. Moreover, air-core coils are too sensitive to the surrounding ferromagnetic objects. When an air-core coil is attached to a car, the magnetic flux will go inside the chassis causing high eddy current loss as well as a significant change in the coil parameters. To make it more practical in the EV charging, ferrite as a magnetic flux guide and aluminum plate as a shield are usually adopted in the coil design [12]. With the lowered frequency to less than 100KHz, and the use of ferrite, the WPT system is no different from the inductive power transfer (IPT) technology which has been developed for many years [13]. The Wi-Tricity corporation with technology from MIT released their WIT-3300 development kit, which achieves 90% efficiency over a 180 mm gap at 3.3 Kw output.

3. METHODOLOGY

In this method, we are using non- radiative method. In near field or non- radiative technique, the power is transferred over a short distances and its applications are charging of EV's like cars, buses or trains.

BLOCK DIAGRAM OF TRANSMITTER AND RECEIVER:



3.1 TRANSFORMER

A transformer is an electrical device that transfers electrical energy between two or more electrical circuits by the principle of electromagnetic induction. In electric power applications, the transformers are used to increase or decrease the voltages of alternating current. A varying current in the transformer's primary winding creates a varying magnetic flux in the transformer core and a varying magnetic field impinging on the transformer's secondary winding. This varying magnetic field at the secondary winding induces a varying electro motive force (EMF) or voltage in the secondary winding due to electromagnetic induction. A wide range of transformer designs are encountered in electronic and electric power applications.

3.2 RECTIFIER

A rectifier is an electrical device that converts an alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. This is called as rectification. Rectification may serve in roles other than to generate direct current for use as a source of power. Detectors of radio signals serve as rectifiers. The output of the rectifiers is smoothed by an electronic filter (usually a capacitor) to produce a steady current. The reverse operation of rectifier is inverter.

3.3 BOOST CONVERTER

A boost converter is a DC to DC power converter with an output voltage greater than its input voltage. It is also called as step-up converter. It is a class of switched mode power supply (SMPS) containing at least two semi conductors (a diode and transistor) and at least one energy storage element, a capacitor, inductor, or the two in combination. Filters made of capacitors (sometimes in combination with inductors) are normally added to the output of the converter to reduce the output voltage ripple. Although a DC supply, such as battery may be available, its available voltage is not suitable for the system being supplied. The low output level can be boosted back up to a useful level again, by using a boost converter the life of the battery can be extended. The DC input to a boost converter can be from many sources as well as batteries, such as rectified AC from this mains supply, or DC from solar panels, fuel cells, dynamos and DC generators.

3.4 PIC MICROCONTROLLER

Peripheral interface controller (PIC) is a family of modified Harvard architecture microcontroller made by microchip technology. Early models of PIC had read only memory (ROM) or field-programmable EPROM for program storage, some with provision for erasing memory. All current models use flash memory for program storage, and newer models allow the PIC to reprogram itself. The data memory and program memory are separated. The data memory is 8-bit, 16-bit, and in latest model we are using 32-bit wide. The hardware capabilities of PIC devices range from 8-pin DIP chips up to 100-pin SMD chips, with discrete input and output pins, ADC and DAC modules, and communications ports. Low-power and high speed variations exists for many types.PIC devices are low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, serial programming, and re-programmable Flash-memory capability.

3.5 PULSE WIDTH MODULATION (PWM)

It is a modulation technique used to encode a message into pulsing signal. It is also called as pulse duration modulation (PDM). The main use of PWM is to allow the control of the power supplied to electrical devices, especially to inertial loads such as motors. The main advantage of PWM is that power

loss in the switching devices is very low. PWM works well with digital control , can easily set the needed duty cycle. The PWM switching frequency has to be much higher than what would affect the load (the device that uses the power), which is to say that the resultant waveform perceived by the load must be as smooth as possible. It has been used in certain communication systems where its duty cycle has been used to convey information over a communications channel. To control the speed of motor is to regulate the amount of voltage across its terminal and this can be achieved using pulse width modulation.

3.6 MOSFET

Metal Oxide Semiconductor Field Effect Transistor (MOSFET) is a type of transistor used for amplifying or switching electronic signals. The main advantage of a MOSFET over a regular transistor is that requires very little current to turn on (less than 1mA), while delivering a much higher current to a load(10 to 50 times or more). It provides the basic switching functions required to implement logic gates and data storage.

3.6.1 Act as a switch

The n-channel enhancement mode MOSFET (e-MOSFET) operates using a positive input voltage and has an extremely high input resistance(almost infinite) making it possible to interface with nearly any logic gate or drive capable of producing a positive output .Also, due to this very high input(gate) resistance we can parallel together many different MOSFET's until we achieve the current handling limit required.

3.6.2 Act as a driver

Analog devices MOSFET driver family provides high speed, high current MOSFET drive capability for efficient switching conversion in ac to dc and isolated dc to dc converters. The driven family utilizes an industry- standard foot print, but adds over temperature and precision enabled protection features to enhance overall system reliability and performance.

3.7 TRANSMITTER COIL

Transmitter coil is also called as primary coil. The output of the MOSFET switching circuit is given to the transmitter coil. The transmitter coil is used to transmit the energy to the receiver coil without using any unconventional solid wires.

3.8 RECEIVER COIL

Receiver coil is also called as secondary coil. It is used to receive the energy from the transmitter coil without using inconvenient wires. The output of the receiver coil is given to the boost converter. In wireless power transmission, the boost converter is used to boost the voltage levels.

3.9 SUPER CAPACITOR

Super Capacitor is utilized as a short term energy storage device to meet the dynamic performance of the vehicle .It is also called as ultra-capacitor , formally electric double-layer capacitor (EDLC) high capacity electro chemical capacitor with capacitance values much higher than other capacitors (but lower voltage limits) that bridge gap between electrolyte capacitors and rechargeable batteries. They typically store 10 to 100 times more energy per unit volume or mass than electrolytic capacitors, can accept and deliver charge much faster than batteries, and tolerate many more charge and discharge cycle than a rechargeable batteries. They are however 10 times larger than conventional batteries for a given charge.

TABLE 1:COMPARISTION OF PARAMETERS IN EXISTING SYSTEM AND PROPOSED SYSTEM

S.NO	PARAMETERS	YOSMART	OPTIMA PLUS	PROPOSED WORK
1	Battery	Deep discharge, 20AH	Sealed lead acid , 48V 20AH	Lead acid ,48V 20AH
2	Speed	< 25 Kmph	25 Kmph	40Kmph
3	Charging Duration	6-8 hours	6-8 hours	3-4 hours
4	Range*/Charge(Mileage)	75kms	75kms	85kms
5	Motor	Permanent magnet (brushless dc motor)	Permanent magnet hub motor	Permanent magnet

4. CONCLUSION

This paper presented a review of electrical vehicles using Wi-tricity. Wireless charging techniques will provide many benefits compare with wired charging techniques. The EV's cause no pollution they are very eco-friendly and are the only answer to the increasing pollution levels from automobiles in the present scenario. In future, we can use solar energy as renewable energy for external power supply. This concept is an emerging technology and in future the distance of power transfer can be enhanced as the research across the world is still going on.

REFERENCES

[1] S. J. Gerssen-Gondelach and A.P.C. Faajj. " Performance of batteries for electric vehicles on short and longer term." *J.Power Sour*.. vol 212.pp. 111-129. Aug. 2012.

[2] V. Etacheri. R. Marom. R. Elazari. G. Salitra and D. Aurbach. "Challenges in the development of advanced Li-ion batteries: A review." *Energy Environ.* Sci.. vol. 4. No 9. pp. 3243-3262. 2011.

[3] Y. Nagatsuka, N. Ehara, Y. Kaneko, S.Abe, and T. Yasuda, "compact contactless power transfer system for electric vehicles," in *Proc. IPEC,* Jun. 2010, pp. 807-813.

[4] J. G. Bolger, F. A. Kirsten, and L. S. Ng, "Inductive power coupling for an electric highway system," in proc. *28th IEEE veh. Technol. Conf.,* Mar. 1978, pp. 137-144.

[5] A. K. A. Kurs. R. Moffatt. J. D. Joannopoulos. P. Fisher. and M. Soljacic. "wireless power transfer via strongly coupled magnetic resonances." *Science.* Vol. 317. no. 5834. pp. 83-86. 2007.

[6] B. L. Cannon, J. F. Hoburg, D. D. Stancil, and S. C. Goldstein, "Magnetic resonant coupling as a potential means for wireless power transfer to multiple small receivers," *IEEE Trans. Power Electron.,* vol. 24. no 7. Pp. 1819-1825. Jul. 2009.

[7] A. Kurs, R. Moffatt, and M. Solijacic. "Simultaneous mid-range power transfer to multiple devices." *Appl. Phys. Lett.,* vol. 96. no. 4.pp. 044102-1-044102-3. 2010.

[8] C. Sanghoon, K. Yong-Hae, S. Y. Kang, L. Myung-Lae, L.Jong-Moo, and T. Zyung, "Circuit-model-based analysis of a wireless enery transfer system via coupled magnetic resonances," *IEEE Trans. Ind. Electron.,* vol. 58. no. 7. Pp. 2906-2914. Jul. 2011.

[9] C. Kainan, and Z. Zhengming, "Analysis of the double-layer printed spiral coil for wireless power transfer," *IEEE J. Emerg. Sel. Topics Power Electron.,* vol. 1. no. 2. pp. 114-121. Jul. 2013.

[10] Z. Yimming, Z. Zhengming, and C. Kainan, "Frequency decrease analysis of resonant wireless power transfer," *IEEE Trans. Power Electron.,* vol. 29, no. 3, pp. 1058-1068, Mar. 2014.

[11] L. C. Kwan, W. X. Zhong, and S. Y. R. Hui, "Effects of magnetic coupling of nonadjacent resonators on wireless power domino-resonator systems," *IEEE Trans. Power Electron.,* vol. 27, no. 4, pp.1905-1916, Apr. 2012.

[12] M. Eghtesadi, "Inductive power transfer to an electric vehicle analytical model," in *Proc. IEEE 40th Veh. Technol. Conf.,* May 1990,pp. 100-104.

[13] A. W. Green and J. T. Boys, "10 kHz inductively coupled power transfer-concept and control," in *Proc. 5th Int. Conf. Power Electron. Variable- Speed Drives,* Oct. 1994, pp. 694-699.

[14] A. Kawamura, K. Ishioka, and J. Hirai, Wireless transmission of power and information through one high-frequency resonant AC link inverter for robot manipulator applications," *IEEE Trans. Ind. Appl.,* vol. 32, no 3, pp. 503-508. May/Jun. 1996.

[15]J. L. Villa, J. Sallan, A. Llimbart, and J. F. Sanz, "Design of a high frequency inductively coupled power transfer system for electric vehicle battery charge," *Appl. Energy,* vol. 86, no. 3. Pp. 355-363, 2009.