

# Wireless Power Transfer Based Street Light Feeding System

Sanket M.Kanchan<sup>1</sup>, Prof. K Sujatha<sup>2</sup>

M.E ( VLSI& Embedded Systems ) (Appeared), Department of Electronics & Tele-Communication Engineering,

Shree Ramchandra College of Engineering Lonikand (Pune), Maharashtra India<sup>1</sup>

Ph.D. H.O.D. Department of Electronics & Tele-Communication Engineering, Shree Ramchandra College of

Engineering, Lonikand (Pune), Maharashtra India.<sup>2</sup>

**ABSTRACT:** Electricity is an important aspect of our daily life. we need Electricity almost for everything in our day-to-day life. Generally this Electricity is Transmitted through wire .over the long period of time the transfer of electricity is dominated by only wired communication and losses from this communication was neglected till 1990 as there was absence of option to the wired power transfer until Wireless power transmission (Witricity) evolved. Witricity is based on strong coupling between electromagnetic resonant objects to transfer energy wirelessly between them. This differs from other methods like simple induction, microwaves, or air ionization. The system consists of transmitters and receivers that contain magnetic loop antennas critically tuned to the same frequency. Due to operating in the electromagnetic near field, the receiving devices must be no more than about a quarter wavelength from the transmitter. Unlike the far field wireless power transmission systems based on traveling electro-magnetic waves, Witricity employs near field inductive coupling through magnetic fields similar to those found in transformers except that the primary coil and secondary winding are physically separated, and tuned to resonate to increase their magnetic coupling. These tuned magnetic fields generated by the primary coil can be arranged to interact vigorously with matched secondary windings in distant equipment but far more weakly with any surrounding objects or materials such as radio signals or biological tissue. Wireless Power Transmission was first described by Nicola Tesla in 1893 using microwave frequencies..

**KEYWORDS:** Electricity, Wireless Power Transfer, Electro- Magnetic waves, Witricity.

## I. INTRODUCTION

The Demand of Electricity is increasing day by day as the population of world is increasing. so use of electricity efficiently and in controlled manner has become the most important aspect of today's power system. most of the power system uses wired transmission of power and loss occurred due to this is enormously high .about 30% of the total loss in power is just because of wired power transmission and distribution. the main reason behind this loss is the resistance of wires during transmission. the efficiency of wired transmission can be improved composite over head conductors and underground cables that use high temperature super conductor. but , the transmission is still inefficient .

Wireless power Transfer can be effective option to curb these losses as Wireless Power Transfer uses Wireless mode of transmission. Wireless Power Transfer and its application can be extremely useful in Electricity Generation and transmission. Wireless Power transfer is basically works on the principle of Transformers. We can say that transformer is a motive of Wireless Power Transfer. it is analogues to Wireless Data Transmission only power is transmitted instead of data. the concept can be used efficiently in Electricity to minimize Cost, losses and maximize the Efficiency. Concluding to this we can Develop a a system that could provide much higher Efficiency, low Transmission Cost and Secured to power theft. In proposed system we are Developing a Wireless Power transmission system in which Vehicles Battery power is used to feed a street light system. Generally any road have more than thousand vehicles running on it per day. If we collect energy from each vehicle without hampering its operation this energy can be used for feeding street lights on that road. Can be effective option to curb these losses.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 8, August 2016

## II. RELATED WORK

The History of Power Transmission is found in the period Starting after world war II where Wireless power transmission is tested at microwave frequencies. Nicola Tesla who is indeed a " Father of wireless " is the one who first developed the idea of power transmission in wireless mode. In 1893 , Tesla demonstrated the implementation of Vacuum Bulbs without using wires for transmission at the world Exposition in Chicago. in 1997. . In 1904 , an Airship motor of 0.1 Horsepower through space from a distance of least 100 feet . In 1961 Brown comes with first research paper proposing microwave waves used for power transmission and in 1964 he Demonstrated a breakthrough in wireless power transmission technology by transferring all the power needed to microwave powered helicopter through microwave beam at 2.45 GHz. from the range of 2.4 GHz -2.5 GHz frequency band. from this event the research in Wireless power transfer accelerated at high speed. during 1975-1997 time period various Experiments Demonstrated On the application of wireless power transfer. Experiments in power transmission without wires in the range often of kilowatts have been performed at Goldstone in California in 1975 and at Grand Bassin on Reunion Island in 1997. Research on Use of Wireless Power Transfer in Transport and Electric Vehicle System is Going Continuously With Greater pace. According to Survey Done by Rajen Pudur, Vivek Hanumante, Santosh Shukla, Krishna Kumar In the Period of 2007 to 2013 there are More than 500 Research Papers are Published in IEEE and other reputed Journals. Most of the Work done by Researchers on Wireless Power Transfer is based on its Applications and Minimizing Transmission loss with increased Efficiency. First Use of Wireless Power transfer in Transport and Vehicle Technology was Proposed In 20th Century. in 2010 Yoichi Hori purposed use of Wireless Power Transfer in Future Vehicle Technologies in Which he Used Supercapacitor and Electric Motors to apply ii Wireless Power Transfer.

After 2010 Many Researchers Came With Innovative Researches on Wireless Power Transfer In Electric Vehicles and also in Other Transportation Fields like Trains, Metros etc. In 2014 Jaegue Shin, Member, IEEE, Seungyong Shin, Yongsu Kim, Seungyoung Ahn, Member, IEEE, Seokhwan Lee. Designed and Implemented a System for Electric Vehicle Charging using Magnetic resonance for Wireless Transfer. In 2015 Siqi Li, Member, IEEE and Chunting Chris Mi, Fellow, IEEE Developed an autonomous System for Electric Vehicle Charging using Wireless Power transfer Mode. Concluding this We Can Say that Wireless Power Transfer Have a heavy and Vast Scope in Transportation field and other field which are Directly related to Electricity.

## III. METHODOLOGY

The proposed system is an extended application of Witricity where we are reversing one of the implemented applications of wireless power transfer. We are referring the wireless charging of vehicle application for the proposed system and reversing it to implement this innovative technology. This system is basically works on the principle of Witricity. In general, Witricity is based on transfer of energy in wireless mode using resonance. The main objective of the project is to propose the method and critically discuss the properties of wireless power transfer and develop a system on the basis of this technology to feed the street light. The proposed system consists of a transmitter at the vehicle and a receiver at the street light.

Witricity employs near field resonant inductive coupling through magnetic fields similar to those found in transformers, except that the primary coil and secondary winding are physically separated, and tuned to resonate to increase their magnetic coupling. These tuned magnetic fields generated by the primary coil can be arranged to interact vigorously with matched secondary windings in distant equipment but far more weakly with any surrounding objects or materials such as radio signals or biological tissue.

**IV. BLOCK DIAGRAM**

**4.1 CONCEPTUAL SYSTEM DIAGRAM**

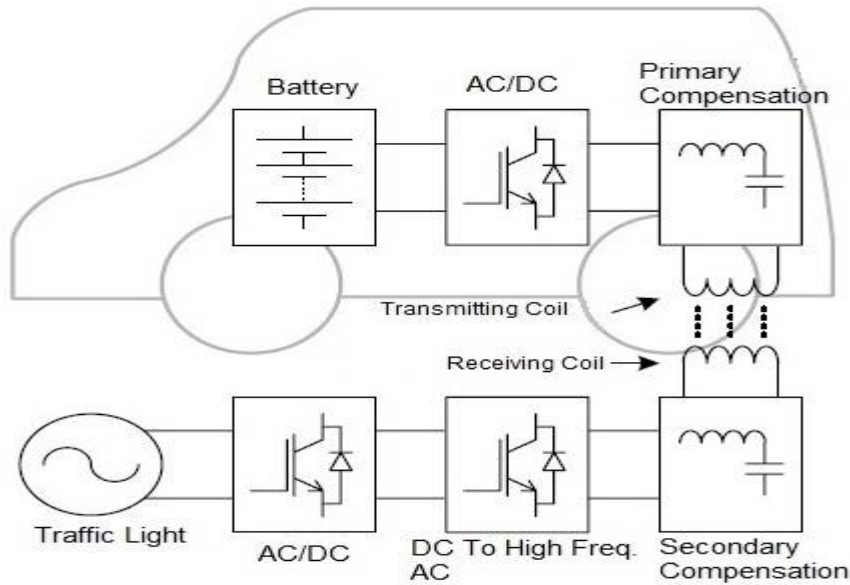


Fig.1. Conceptual Diagram

Above Figure Shows Conceptual diagram of Proposed System Transmitter Section is incorporated in Vehicle where input from Vehicles Battery is taken. as per Wireless Power transfer requirement DC to AC Converter is used and the Current produced by Converter which is in AC nature is used to fed the Primary Compensation. i.e Coil. this will produce a charge in secondary Compensation using Resonant inductive Coupling. Secondary Compensation is at the receiver end. to provide power to the traffic light the Ac current generated by Secondary Compensation is again Converted into DC Current. this is the basic Working principle of The System.

**4.2 SYSTEM BLOCK DIAGRAM**

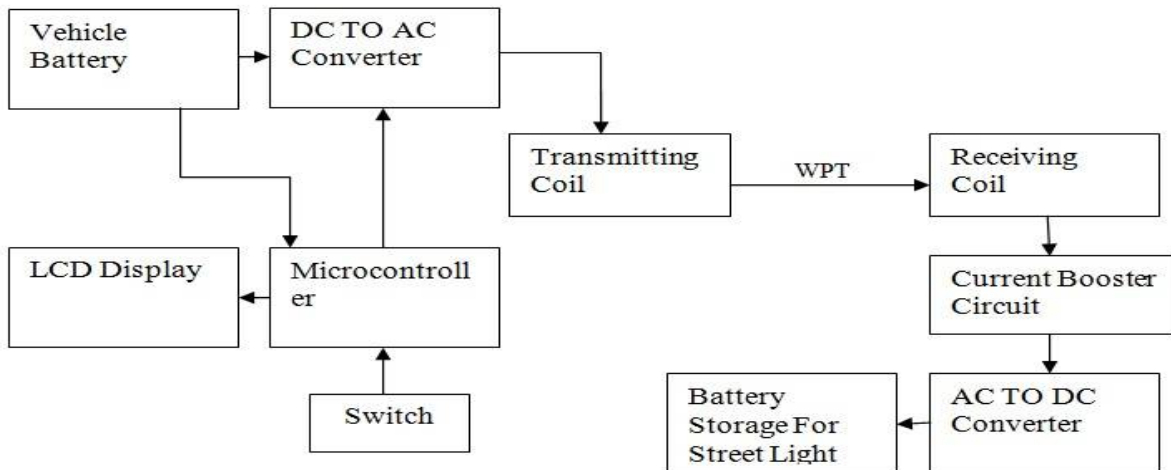


Fig.2. System Block Diagram

## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 8, August 2016

Fig 2 Shows Block Diagram .The System Has Transmitter and Receiver Section. The Transmitter Section Includes Following Components.

**Microcontroller :-** The System Uses Controller For Controlling The Wireless Power Transfer and Display Function. We Can Use any Controller Considering Cost, Programming and Availability of the Controller.

**DC to AC Converter :-** DC Current From Vehicle battery Will be Converted Into AC Using DC to AC Converter. and this AC Current Will be fed to Transmitting Coil.

**Switch :-** Switch is provided to Start and Stop the Power Transfer. whenever Switch is pressed the Controller will pass the start signal and DC to AC Converter will Convert DC into AC and will pass it to Transmitting Coils. after pressing switch again Controller will pass the the Stop Signal.

**LCD Display :-** In Proposed System we are using 16\*2 Serial LCD which Displays the Power Transfer Activity i.e Power Transfer start/ Power Transfer stop.

**Transmitting Coil :-** for Demonstration purpose here we are using Copper Coils with high number of turns. Coil stores charge in proportion to Voltage and AC current Flowing through it.this Charge is then transmitted in Wireless mode using Resonant Inductive Coupling. For Higher Efficiency Tesla coils or Magnetic Brush Lines can also be used.

The Receiver Section Consist Of Following Components.

**Receiving Coil :-** The Receiving Coil is again same as a Transmitting Coil where it receives Voltage and current from Resonant Inductive Coupling. and it Stores the Power and this power is then used for Street Light Feeding.

**Current Booster Circuit :-** As the Vehicles battery Current and voltage Specifications are low to Feed Street lights which need moderately high power For this we are using current booster circuit in this System. we are implementing Current Booster Circuit using N Channel MOSFET and Capacitor and Resistors.

**AC to DC Converter :-** The AC Power is Converted Into DC power using this Converter and then this Power is Stored into Battery. this power is then used to feed street light Specially Traffic Light whenever needed.

### V. PRACTICAL IMPLMENTATION AND WORKING

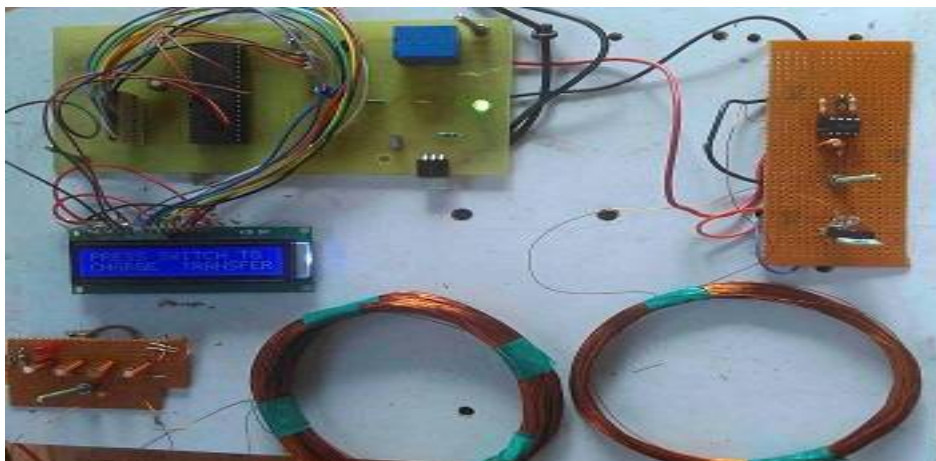


Fig.3 System Implementation

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 8, August 2016

Above Figure Shows the practical implementation of The System. for demo purpose instead of vehicle battery we are using step down transformer to convert 230 volt into 12 volt. First when we make System on LCD will display "press Switch to Start Power Transfer ".after Pressing the Switch the Controller Will pass the Control Signal and the AC current Will Start Flowing through Transmitting Coil. this will generate magnetic Flux in the Coil Which is Directly Proportional to the Current Flowing Through the Coil. Now Using Resonant Inductive Coupling Transmission technique the Power is transmitted in Wireless Mode to the Receiving Coil.

At The Receiver End The Power Received by Receiving coil is given to Current Booster Circuit Which boosts the Current and then using AC to DC Converter the Power is again Converted into the DC power. this Power is Stored into the Charging battery. and when the Battery Is Charged Full the charging is Stopped using Circuit Breaker. it should be Noted that this is the Prototype System and for Demonstration purpose We are using 12 volt 2 amp battery in transmitter Section and 6 Volt 2 amp charging Battery at Receiver Section. However For large Scale Application we Can use High Specification Batteries.

## VI. OBSERVATIONS

Sr. No.	Parameter	Observations
1.	Power Transfer Efficiency	65-70 %
2.	Maximum Distance Between Transmitter and Receiver	250 mm
3	Transmitted Voltage	12 Volt
4	Received Voltage (Without Current Booster)	6-7 Volt
5	Received Voltage (With Current Booster)	30-40 Volt

Table No. 1 Observation of Various Parameters.

Above table Indicates Observation of various Parameters including Efficiency and maximum Distance between Transmitter and receiver. We Can Increase The Efficiency and Distance By Following Remedies

1. By Increasing Coupling Factor of Coils :- Efficiency is Directly Proportional to Coupling Factor and hence by Increasing Coupling factor we Can increase Efficiency. We Can Increase The Coupling Factor By Following Methods

- By increasing number of turns in the coil
- By reducing the gap between turns of coil.
- By Increasing Inductance.

2. By using Light Magnetic Brush and Core Installed under the road.

## VII. RESULTS

Wireless Power Transfer based On Resonant Inductive Coupling Can be Efficiently Used to Feed The Street Light System Specially for Traffic Light Signals Using Normal Vehicle or Electric Vehicle without Hampering performance of Vehicle Battery Too much.

## VIII. APPLICATIONS

Wireless Power Transfer Can Be Used in Various Fields Like Biomedical, Automobile Electronics , Wearable Implants, Industrial Applications. It Can be also used Efficiently In Low Power Consumer Electronics. Wireless Power transfer With Combination of Wireless Data Transfer Can be Used Effectively In Wireless Sensor Networks. It Can be Also used in Space Solar Energy Harvesting.

## IX. CONCLUSION

Wireless Power Transfer Based On Resonant Inductive Coupling is The Efficient Solution to Wired Power Transmission. Using Wireless Power transfer We Can Reduce The Losses and Transmission Cost in this Electricity

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 8, August 2016

Eating Era. With Combination of Wireless Data Transfer it Have Strong Future In Coming Years and it can change the game for Wireless Communication.

Proposed System in this Paper Can prove to be Breakthrough in Wireless Power Transfer in Automobile Industry and Electrical Vehicle Technology. System Can Be Extended To Wireless Power Transfer Based Transceivers in Vehicle and Automobile Systems.

## X. ACKNOWLEDGEMENT

I take this opportunity to express my profound gratitude and deep regards to my guide Prof. K.Sujatha madam for her exemplary guidance, monitoring and constant encouragement throughout the course of this seminar. The blessing, help and guidance given by her time to time shall carry me a long way in the journey of life on which I am about to embark.

I would like to express my special thanks of gratitude to our PG coordinator Prof. Harshvardhan Upadhyay sir as well as our principal Dr. A.D. Desai who gave me the golden opportunity to do this wonderful Seminar on the topic "Wireless Power Transfer in Automobile technology. ", which also helped me in doing a lot of Research and I came to know about so many new things I am really thankful to them.

I am obliged to staff members of SRCOE, Lonikand, Pune for the valuable information provided by them in their respective fields. I am grateful for their cooperation during the period of my assignment.

## REFERENCES

- [1] Siqi Li , Chunting Chris Mi " Wireless Power Transfer For Electric vehicle applications" IEEE journal of Emerging and Selected Topics In Power Electronics, Vol. 3, No.1, March 2015
- [2] 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.
- [3] P. Sample , D. A. Meyer, and J. R. Smith, "Analysis, experimental results, and range adaptation of magnetically coupled resonators for wireless power transfer," IEEE Trans. Ind. Electron., vol. 58, no. 2, pp. 544–554, Feb. 2011.
- [4] 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.
- [5] Askin Erdem Glindogdu and Dr. Erkan Afacan " Some Experiments Related to Wireless Power Transmission " Cross Strait Quad-Regional Radio Science and Wireless Technology Conference 2011
- [6] Yoon Do Chung , Chang Young Lee , Hyoung Ku Kang and Young Gun Park " Design Consideration and Efficiency Comparison of Wireless power Transfer with HTS and Cooled Copper Antennas. " IEEE Transactions On Applied Superconductivity, Vol. 25, No. 3, June 2015
- [7] S. J. Gerssen-Gondelach and A. P. C. Faaij, "Performance of batteries for electric vehicles on short and longer term," J. Power Sour., vol. 212, pp. 111–129, Aug. 2012.
- [8] A.Kurs, R. Moffatt, and M. Soljacic, "Simultaneous mid-range power transfer to multiple devices," Appl. Phys. Lett., vol. 96, no. 4, pp. 044102-1–044102-3, 2010.
- [9] C. Sanghoon, K. Yong-Hae, S.-Y. Kang, L. Myung-Lae, L. Jong-Moo, and T. Zyung, "Circuit-model-based analysis of a wireless energy transfer system via coupled magnetic resonances," IEEE Trans. Ind. Electron., vol. 58, no. 7, pp. 2906–2914, Jul. 2011.
- [10] 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.
- [11] 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.
- [12] C. J. Chen, T. H. Chu, C. L. Lin, and Z. C. Jou, "A study of loosely coupled coils for wireless power transfer," IEEE Trans. Circuits Syst., vol. 57, no. 71, pp. 536–540, Jul. 2010.
- [13] M. Budhia, G. A. Covic, and J. T. Boys, "Design and optimization of circular magnetic structures for lumped inductive power transfer systems," IEEE Trans. Power Electron., vol. 26, no. 11, pp. 3096–3108, Nov. 2011.
- [14] C. Wang, O. H. Stielau, and G. A. Covic, "Design considerations for a contactless electric vehicle battery charger," IEEE Trans. Ind. Electron., vol. 52, no. 5, pp. 1308–1314, Oct. 2005.
- [15] M. L. G. Kissin, G. A. Covic, and J. T. Boys, "Steady-state flat-pickup loading effects in polyphase inductive power transfer systems," IEEE Trans. Ind. Electron., vol. 58, no. 6, pp. 2274–2282, Jun. 2011.

# International Journal of Innovative Research in Science, Engineering and Technology

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 5, Issue 8, August 2016**

## BIOGRAPHY

### **Mr. Sanket Manik Kanchan.**

M.E ( VLSI& Embedded Systems ) (Appeared).  
Dept. Electronics & Tele-Communication Engineering,  
Shree Ramchandra College of engineering, Lonikand (Pune),  
Maharashtra India.



### **Prof. K. Sujatha. (Ph.D)**

H.O.D.  
Dept. Electronics & Tele-Communication Engineering,  
Shree Ramchandra College of engineering, Lonikand (Pune),  
Maharashtra India.

