Design And Implementation Of Efficient Wireless Power Transfer For Solar Powered Vehicles

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Abstract

Charging time and power transfer efficiency are the main challenges of Wireless Power Transfer(WPT) for electric vehicles. It is proposed in this paper to resolve both issues using the transformer induction concept. A high-efficiency WPT system for electric vehicle charging that carries a receiving coil. A prototype build and tested to verify the feasibility of the proposed design with unity power factor can be achieved over an air gap of 8cm to10cm under various power conditions and the output voltage is produced 15V approximately. It uses solar energy to produce an electric voltage.

Index Terms -Wireless power transfer, transformation induction, solar energy.

1.INTRODUCTION

WPT technology has numerous inherent advantages over conventional means of power transfer, this has received much attention in this past decade and has been proposed to apply on a wide range of applications, ranging from low power biomedical implants electrical vehicle charger to railway vehicles with efficiency up to 95% or higher in some prototype systems. Magnetic WPT systems rely on magnetic field coupling to transfer electric power between two or more magnetically coupled coils across the relatively large air gap. In this paper, a wireless charging system for a lightweight electric vehicle is designed, built and tested.

2.LITERATURE SURVEY

In 2010, ARTUR J.MORADEWICZ, MARIAN P.KAZMIERKOWSKI discovered the contactless energy transfer system with FPGA-controlled resonant converter. In this paper, power supply based on an inductive coupled contactless energy transfer system is presented in this paper.The energy is transferred using a rotatable transformer and a power electronic converter. To minimize total losses of the system, a series resonant compensation circuit is applied assuring zero current switching condition for an insulated-gate bipolar transistor.

In 2014, JUN-YOUNG LEE, KWANG-MIN YOO discovered a large air gap 6.6 kW wireless electric vehicle charger with self –resonant Pulse Width Modulation(PWM). In this, a large air gap wireless DC/DC charger for an electric vehicle (EV) is suggested. It is controlled by pulse width modulation with self- resonant frequency formed by self –inductance and a resonant capacitor so that constant frequency operation can be accomplished under a large air gap without an additional current chopper.

In 2014, RAFFAEL HALDI, KURT SCHENK design and hardware realization of a 3.5KW inductive power transfer system to charge electric vehicles is presented. The commercial success of such a wireless charger is highly dependent on the energy conversion efficiency. The presented design consists of a circular receiver coil mounted on a car and a large circular transmitter coil fixed in the ground.

In 2014, CONG ZHENG, JIH-SHENG LAI discovered the high-efficiency contactless power transfer system for electric vehicle battery charging application. In this paper, a contactless charging system for an electric vehicle battery is proposed. The system consists of three parts a high-frequency power supply from a full bridge inverter with frequency modulation, a loosely coupled transformer that utilizes series resonant capacitor for both the primary and secondary windings, and a rectification output circuit that uses a full bridge diode rectifier

In 2016, CHONG-YI LIOU, CHI-JUNG KUO discovered the wireless power transfer system using near field capacitively coupled resonators.This work presents the near field capacitively coupled wireless charging system consisting of a transmitting dock resonator and a receiving multiband resonator. The transmitting dock resonator comprises a planar strip and a ring-shaped metal plate to deliver power to the multiple folded strips as the receiving 3-dimensional multiband resonators at GHz band.

3.EXISTING SYSTEM

Solar based mobile was designed. As an advance, wireless charger, particularly for small load system, was implemented recently. Furthermore, a prototype of the whole system, consisting of a commercial panel, the thermal and electrical circuits, and innovative wireless remote data acquisition system has been set up.The latter, based on the open-source electronic platform, has the necessary accuracy, and remote data capture and flexibility features. The model has been carefully calibrated and simulated results based on the solar irradiance, the ambient temperature, and the wind speed, have been compared with experimental data. The results are analyzed and discussed in the paper. Such a validated model can be used to establish if and when it is more convenient to use a hybrid structure rather than two separate devices. The disadvantage is high complexity switching and high power loss.

4.PROPOSED SYSTEM

Electromagnetic induction in this proposed system we implement ARDUINO microcontroller based wireless power charging methodology in electric vehicles. This system consists of ARDUINO microcontroller, inductive coils, vehicle prototype module. solar panel system is implemented to transfer the power to the primary coil. The solar panel is connected to the battery directly. Then it can drive it to the rectifier circuit through an inverter. An inverter circuit is connected by ARDUINO microcontroller to switch in the power supply. The switched power is fed into the inverter through the driver circuit. The coil has a high capacity of inductance which can able to transfer the power with high frequency. This is named as the high-frequency coil. Those power inputs are connected to the high-frequency primary coil which is laid under the road segment

The vehicle has to receive a coil segment.The receiver section consisting of the receiver coil, rectifier, and regulator. When the vehicle moving along the primary coil, the receiver coil in the vehicle receives the power from the primary coil by the electromagnetic induction technique. That received power is driven to the regulator through rectifying circuit. Then the power is stored in the battery. The battery power is given to the controller and the motor driver circuit. The motor driver is used to control the motor of the vehicle. The vehicle can charge automatically when it crosses over the primary coil connected to the battery. By this, we can able to reduce the pollution of air and demand for petroleum products

5. BLOCK DIAGRAM

5.1 TRANSMITTER SECTION

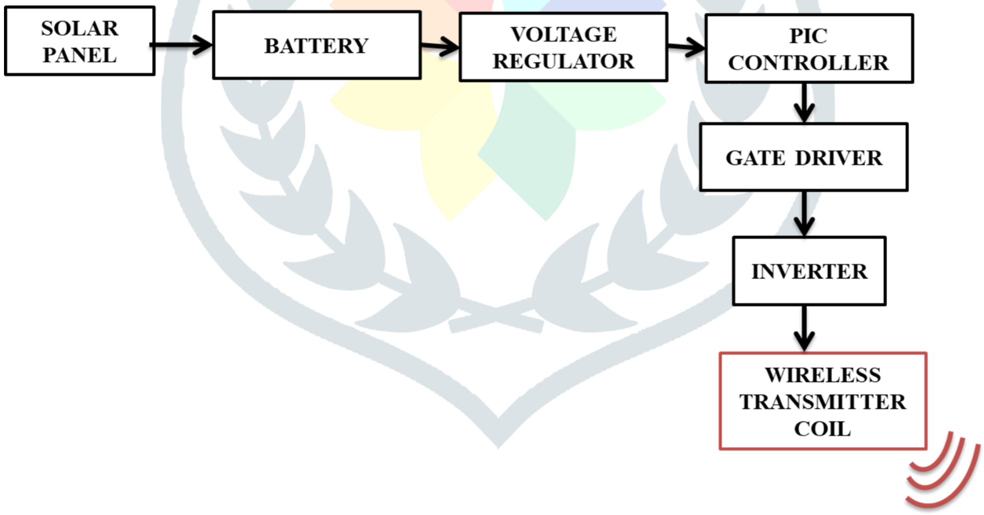


Fig. 5.1 Block diagram of Transmitter Section

In this system, transmitter block consisting of battery inverter, rectifier, and high frequency wireless transmitting coil the power supply is given from the solar panel. The solar panel power is stored in battery then delivers its power to the inverter circuit. The power is rectified by the rectifier circuit and rectified power is transferred to high frequency transmission coil. In transmitter circuit PIC microcontroller has been connected with the inverter circuit to switch the transmission power. The transmission power efficiency has been increased by switching the power. Then the switching power is transferred to the inverter circuit through the driver circuit.

5.2 RECEIVER SECTION

The receiver block has receiving coil which receives the power from the transmitter coil .Then the power is fed into the rectifier circuit and drive to the regulator circuit and battery. The regulated power is given to the controller to drive the motor of the vehicle .LED indicated the charging status and LED shows the information about power transfer and charging. Motor driver is used to control the 12V motor by the controller. Also it can control the rotation of each motor

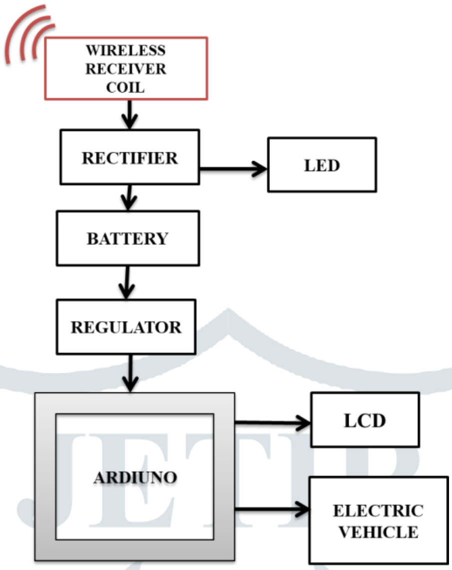


Fig.5.2. Receiver Block

6. CIRCUIT IMPLEMENTATION

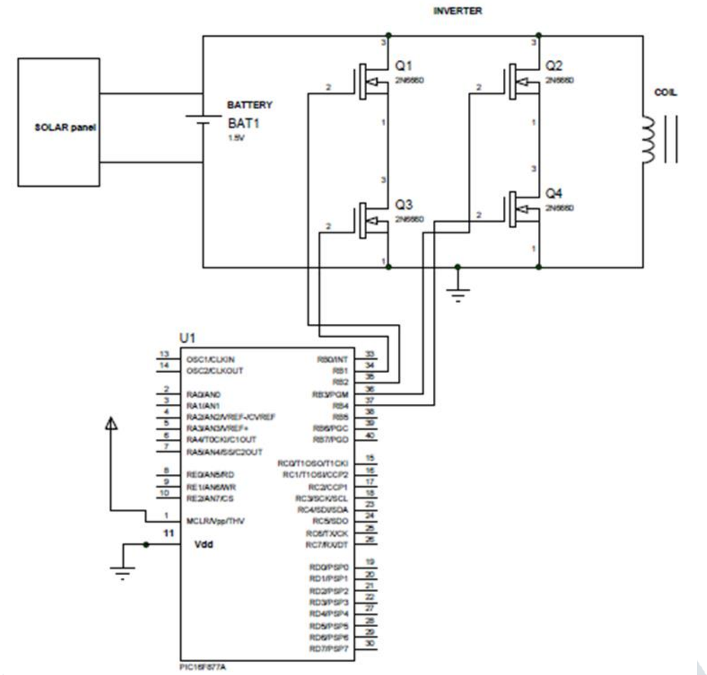


Fig.6.1 Transmitter section

In transmitter section the solar panel is connected to the battery(1.5V), the positive and negative side are connected to the PIC Microcontroller, Pulse Width Modulation(PWM) pin is connected to the inverter. Then the inverter is connected with the transmitter coil.

In receiver section the receiving coil is connected to the bridge rectifier, the battery where received energy stored is connected to the bridge rectifier, then the ARDIUNO is connected to the battery. The LCD is connected to the ARDIUNO which displays whether the power is transferred or not the Geared DC motor is connected to the ARDIUNO thus the transferred power is given to the motor

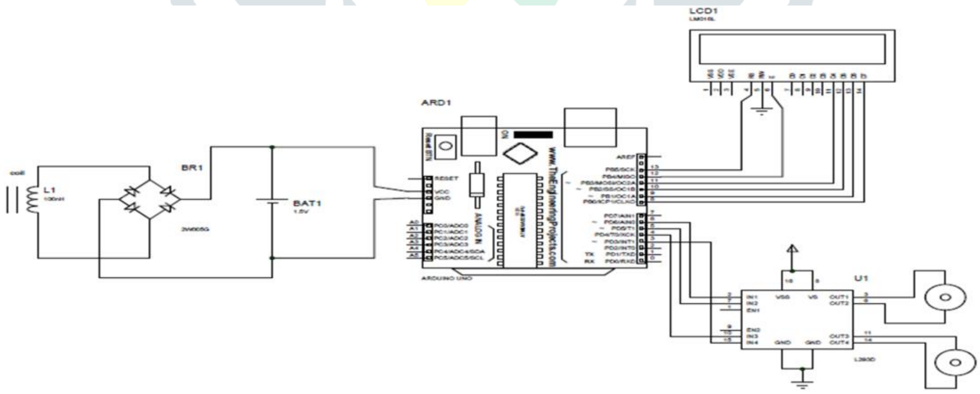
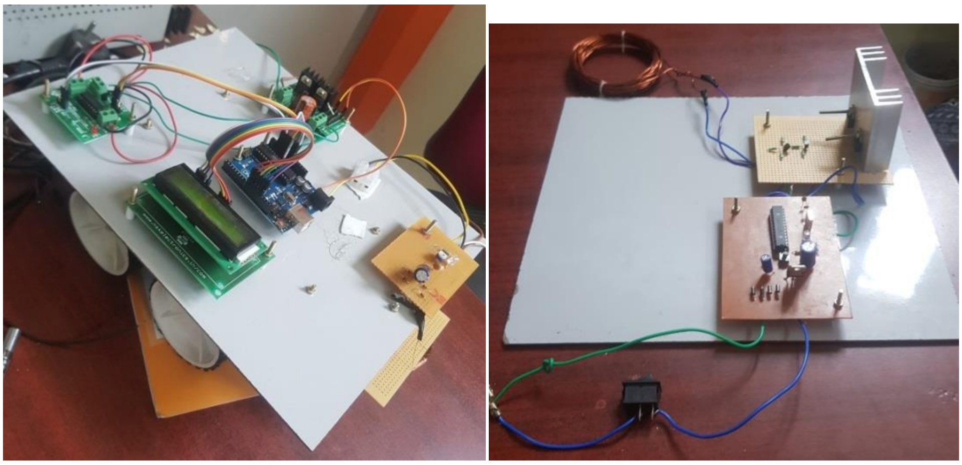


Fig.6.2 Receiver section

7.RESULT AND DISCUSSION



(a) Receiver section **(b) Transmitter section**

Pic.9.1 (a) and(b)WPT Electric Vehicle

The project was successfully implemented .The wireless power transfer is achieved by using solar energy.

8.CONCLUSION& FUTURE WORK

A high efficiency wireless power transfer system for electric vehicle charging application is proposed. System configuration and design consideration application is proposed. System configuration and design considerations were analysed and discussed in details. The popular renewable sources of energy, Solar energy source is individually modelled and them combined together to represent a distributed generation system in the Simulink model. A prototype was designed, built and tested with solar panel to verify the circuit performance of the developed WPT charging system.

9. REFERENCES

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