A NOVEL APPROACH FOR ELECTRIC VEHICLE CHARGING USING INTELLIGENT WIRELESS POWER TRANSMISSION

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ABSTRACT

Electrified Transportation will aid to diminish emission of flu gases and increasing petrol prices The major concern in the advancement of electric vehicles is to improve the charging method. This paper gives an idea on charging the battery of electric vehicle with wireless power transmission using inductive coupling .The advancement in wireless power transmission makes it attractive charging mechanism in both static and dynamic conditions in electric vehicles This paper describes about

Electric vehicle charging with intelligent power transmission.

List of Keywords
Electric Vehicles (EV), Wireless Power Transmission (WPT), Battery charging, Inductive Coupling, Royer Oscillator

Introduction

Wireless power transfer (WPT) is the electromagnetic power transfer without connecting wires ..In wireless power transfer method, transmitter receives power from source and transmits time varying electromagnetic field to the receiver. Power is extracted from receiver and supplied to the load. The heart of wireless power transmission is power electronic circuits. The efficiency of power transfer mechanism in WPT can be improved by closed loop control.

The driver circuit between transmitter and receiver are MOSFET circuit. Whenever vehicle is present, transmitter coil circuit is turned ON. The features of this system are safety, less maintenance, long life and reliability. The proposed system ensures the adequate power transfer wirelessly in battery charging system.

When electrical energy is transferred to EV wirelessly, charging of battery becomes easier. The driver has to park the car and leave for a stationary WPT system. In dynamic WPT system, Electric vehicle is charged without stopping it. Battery capacity of EV's with wireless inductive charging could be reduced to 20 % when compared with conductive charging method.
If tightly magnetic coupled circuit is used with magnetic resonance condition, 60 W power can be transferred for 2m distance. For efficient power transfer, air cored coils can be used. In EV charging, ferrite is used as magnetic flux guide with alumnium plate shield. the frequency is limited to 100kHz for inductive power transfer. The inductive power transfer technique can be used for various applications like under water vehicles, mining systems, cordless robots etc.

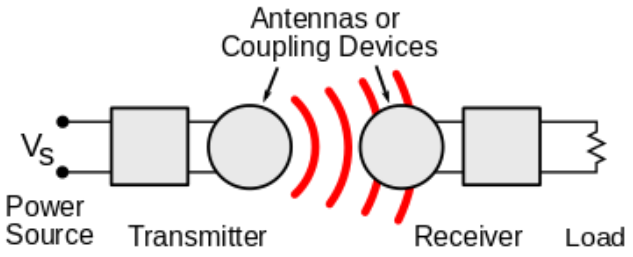


Figure 1: Wireless Power Transmission

Electric vehicle batteries are designed for giving constant power for specified time period. Deep cycle batteries used in electric vehicles are mainly characterized by high power to weight ratio.
In this paper, the discussion about the design and simulation of charging station is done There is no carbon dioxide emission generated when electric vehicle is running.so that air pollution is reduced. Electric charging station supplies electric energy for recharging of electric vehicles. By using dv-dc converter with continuous input cutting edge helps to increase the dynamic performance of the system. Electric charging station integrated with solar power and battery energy storage system is the new advancement nowadays. The availability of battery capacity and the location where EV is plugged into power grid has a major role for the better performance of the system. The proposed system shows the controlled smart charging can reduce the operational cost of charging station.

METHODOLOGY

Figure 2 shows the block diagram of proposed wireless power source for battery charging of electric vehicle .AC power is supply is stepped down and rectified to DC power. Driver circuit controls the variable DC output to constant DC and given oscillator circuit which gives high frequency AC signal. This output power is transmitted to receiver coil by electromagnetic induction. The output of the receiver coil is rectified to constant DC source for the battery charging of Electric vehicles .IR sensor will sense the presence of vehicle so that signal is transmitted to MOSFET circuit and power is transferred to the receiver section. When there is no vehicle in the path, IR sensor send high active signat to MOSFET circuit to turn OFF power supply. By using microcontroller, energy wastage problem is solved.

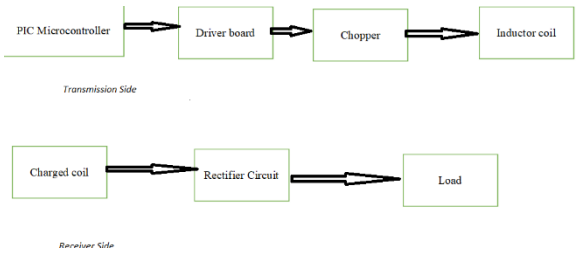


Figure 2: Block Diagram of Wireless Power Transmission System

The charging station consists of a constant current constant voltage charging which is fed through converter The PWM generated in the microcontroller is fed to the driver circuit which will convert a low power PWM pulses to high power pulses in order to switch ON and OFF MOSFET.

MATERIALS REQUIRED

Atmega 328 Microcontroller
16 X 2 LCD
Power MOSFETS IR540
Coil26 gauge
Diodes
Resistors
Capacitors
LM7805 voltage regulator
16 MHz crystal
Inductors
IC Sockets
Vero board

SYSTEM DESCRIPTION

Transmitter coil and receiver coil is the main part of the whole system. Tightly coupled coils have same size and same configuration. Tightly coupled configuration with small distance power transfer technique is used to achieve high efficiency for electric vehicle application. Tuning frequency of coils are at same frequency. Transmitter and receiver are copper tube with 16 cm and has 48 number of turns with self-inductance of 56 Micro Henry. An airgap of 6cm is maintained between the coils.

Transformer

230V , 50 Hz AC supply is stepped down to 12 V AC by using 230/ 6-0- 6 V center tapped transformer . Its output is given to bridge rectifier which rectifies to 7.2 V DC.

Voltage Regulator

LM7805 is used as voltage regulator which step down 7.2 V DC to 5 VDC. This regulator provides a constant output even if input changes.

c)Driver Circuit

DC- DC Boost converter is used to increase 5V DC to 30 V DC. LM2577 is used which can operate in continuous or discontinuous mode so that output voltage is higher.

d)Royer Oscillator (Transmitter- Receiver Coil)

Output of the driver circuit is applied to Royer circuit which converts DC into AC at high frequency. It uses MOSFETs which produce large current. Transmitter circuit contains of two power MOSFET(IRF540) with voltage biasing. Circuit uses inductors and capacitors to ensure the coils are tuned at resonant frequency.

Receiver coil receives power by electromagnetic induction and is rectified to DC. The output contains voltage ripples and are eliminated with the help of capacitors. This rectified output is fed to voltage regulator LM2621 so that regulated constant DC voltage of 5V is obtained.

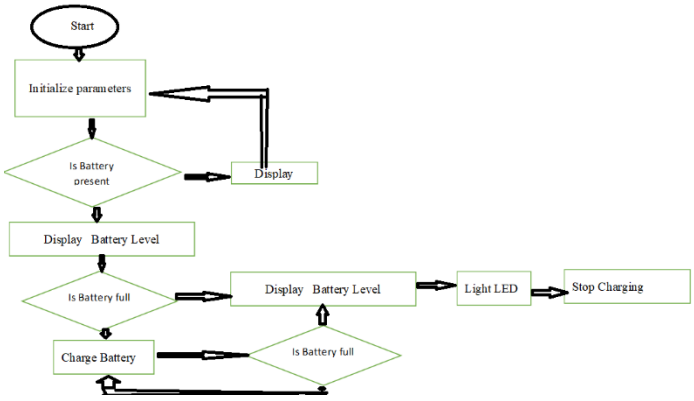
e) Battery Charging Unit

It contains Atmega328 microcontroller, a 16X2 LCD and a CD 4066 switch.CD4066 switch is used to detect the battery charging and will turn off when the battery is fully charged. The Controller Atmega328 is used to control charging of battery. Here a voltage divider circuit is used so that 5v DC output of controller is raised to 9V. The measured output is displayed in LCD display unit.

f) Rectifier Unit: AC signal is converted to DC signal with the help of full wave bridge rectifier IN4007 diodes are used.

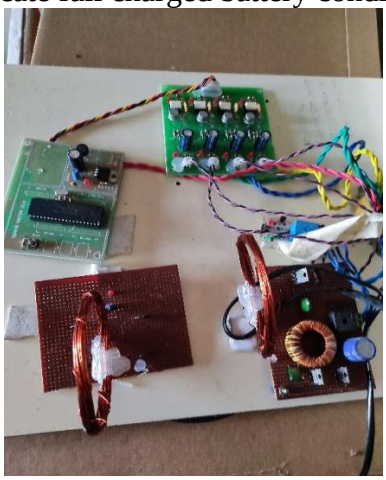
V.SIMULATION

This system uses assembler language which has less memory space, less execution time and real time applications. During the programming process, following flow chart were used



VI HARDWARE IMPLEMENTATION

AC supply was stepped down to 12 V AC and was rectified to 5V DC using diode bridge rectifier circuit . With the aid of boost converter 5V DC was increased to 30 V DC. Transmitter and receiver coil was developed with Gauge 26 coil of length 3metres. Atmega328 microcontroller, 16X2LCD, CD4066 switch , LM2621 are used for battery charging circuit. All components were assembled and fabricated on vero board. LED bulbs is used to indicate full charged battery condition.



VII Results:

When the power was transferred from transmitter coil to receiver coil, LED bulb strip glowed. When the distance between these coils were increased, the brightness was reduced. The current induced in the receiver coil was determined by the separation distance of the two coils. The maximum brightness in LED bulb occurred when the separation distance between the coils was about 5cm. Power transfer was decreased when the separation distance was above 5cm. An RGD LED was used in the battery charging unit which get glow when battery was fully charged.

VII conclusion:

Wireless power transmission using inductive coupling is a promising alternative for the currently used battery charging technique in electric vehicles The proposed system utilizes an ac switch which can control the power transfer. The distance between transmitter and receiver coils, resonant frequency, coil turns ratio will determine the efficiency of WPT. An exponential decay of power occurred when the distance between the coils was increased. The proposed system helped to charge 9V battery from WPT. This technique can be effectively used in medical fields to charge pacemakers and other devices.

VIII references

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