Design & Implementation of Solar Powered Electric Vehicle using Wireless Power Transfer

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Abstract— The major reason for the pollution of environment is the Burning of fossil foils. To overcome this problem Electric Vehicles were introduced and an important usage of renewable sources. This paper undergoes charging scenarios for the Electric vehicles. Instead of charging the Electric vehicles at the workplace for the day those vehicles can be charged through the solar energy by using the photovoltaic cells. This charging concept for power flow in Wireless Power Transfer technology using the primary and the secondary coils which provides dynamic charging. The energy generated from the Photo Voltaic cells reduces the emissions from the power grid. It overcomes the drawbacks from the plug-in based charging method. The use of wireless power transfer using solar energy will improve the reliability and the spatial issues.

Key words: Electric Vehicles, Plug-In Electric Vehicles, Photo Voltaic Cell

I. INTRODUCTION

In recent years, the cost of fossil fuels like petrol, diesel etc. has been steadily increasing, the major reason for this problem is the increase in the usage of the vehicles. As we live in the automotive technology world, it is forcing towards the Electric vehicle which is the first advancement in the electric drive technology. The next advancement is the grid-chargeable batteries which these can enable 10-to40-mile all electric driving ranges. Advanced Technologies are growing quickly due to the development of the PHEV. Charging PEV requires electric vehicle supply equipment. The charging unit which consists of the two types of energy which is used for charging the vehicles coming to the plot as well as the vehicles can be charged while the vehicle is moving i.e., dynamic wireless charging. Magnetic Inductance and The Magnetic resonance principles were used in wireless charging. This could help significantly with infrastructure problems by making charging secure and convenient. Due to the wireless power transfer 12V will be generated in the secondary coil. This will further be given to the battery and energy will be stored.

By using a regulator of 12V the secondary coil is provided with the required voltage reduced to 5V and is sent as an input to microcontroller. The output of the current sensor will be analog. This analog output is converted into digital with the help of ADC which is interfaced with LCD using microcontroller. Which an EV is detected LCD displays whether the wireless power transfer occurs or not.

II. EXISTING SYSTEM

In the existing system using the concept of wireless power transfer earlier only stationary wireless charging exists. With stationary wireless charging, the user simply parks the vehicle over a charging pad on the floor, and a corresponding charging pad mounted on the underside of the vehicle picks up the signal and charges the vehicle. Stationary wireless charging lacks in its interoperability, centre frequency selection, magnetic fringe field suppression.

III. PROPOSED SYSTEM

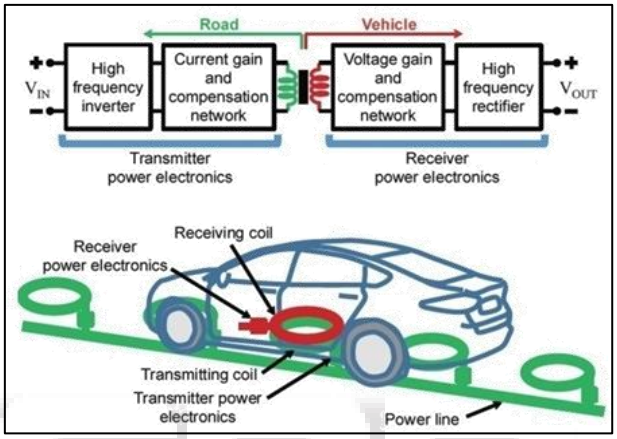

Fig. 1: Proposed System

The project proposes a new analysis concept for power flow in wireless power transfer is the electric vehicle can be charged through the solar power instead of the power obtained from the electric grid. The tuned 1'& 2' provides frequency selection. It resembles the transmission network having reactive power voltage control. It also provides dynamic wireless charging that is charging of the EV while it is moving.

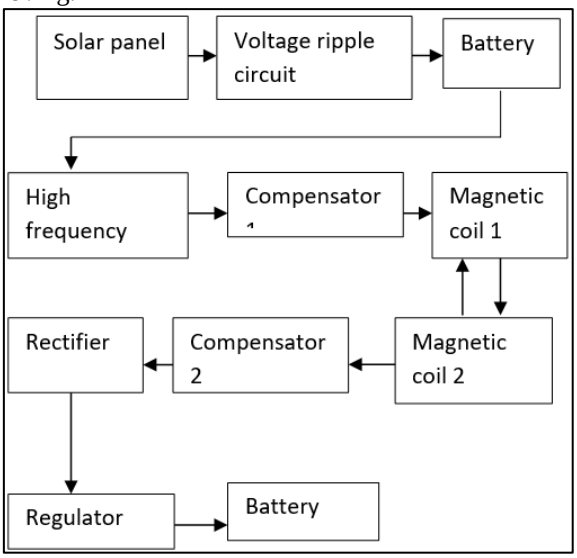

Fig. 2: Block Diagram

The solar panels are kept at a height, which provides shades to the vehicles and generates the supply for this model. It uses the solar energy and coverts it into electrical energy through photovoltaic effect. Two voltage ripple circuit

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removes the ripples from the input supply and provides a constant dc supply voltage ant it is stored in a battery, which supplies the high frequency inverter. The high frequency inverter generates high frequency AC current by using power electronic switches. According to Ampere circuital law, this high frequency ac current flowing in the primary coil produces variable flux in the vicinity.

The primary coil, which is made up of copper wire, is placed on a track below the parking station floor. A compensator circuit is connected in parallel to the coil in this model, which cancels the inductive power at resonating frequency and eliminates the harmonics. The track consists of aluminum shielding which concentrates the flux to the receiver. The receiver is basically a secondary coil placed at the bottom of electric vehicles. Due to the electromagnetic induction principle, emf is induced in the secondary coil. A compensator is connected in parallel to the secondary coil, which forms a resonating tank circuit in order to remove the harmonics and the ripple contents. The secondary is connected to the full bridge rectifier which converts AC to DC. A regulator circuit is used to get a contact DC supply, which charges the battery of the electric vehicle.

IV. Literature Survey

[1] Conductive charging is the metal contact between EV charge inlet. This method needs cable to transfer power become a major concern. On the other hand, inductive charging uses a magnetic coupling between the transmitter and receivers to transfer energy. Once the energy is received at the receiving coils, the vehicle adapter will convert the energy into electrical current to charge the EV. EV battery requires some PE converts which is sends back the excessive harmonics to the utility grid. Which can increase the stress on low voltage altering current public main network.

[2] The Electric Vehicle is charged through wireless power transfer technology. When the vehicle passes over the charging lane which is installed over the roads. In such loads the power is transferred through wireless technology. This miniature model will be able to analyze the designing method and the power transfer through the Inductive coil.

[3] The principle used is Electromagnetic Induction. Inductively coupled power transfer is not widely used method for short distances. The Transmitter, Receiver and the track are the considered parts in this project. The design for the coupler for both the static and dynamic charging of electric vehicles. It also denotes the effect of compensator in both 1' & 2' coils. The primary and secondary coils are energized by using the solar power and the compensators which are placed on both sides which eliminate harmonics produced in it. Rectifier that converts AC to DC and the energy is being stored in battery.

V. Objectives & Methodology

Aim of the project is to Design and develop the Electric vehicle charge an Electric Vehicle battery using Wireless Power Transfer Technique.

A. Objectives

1) To design primary and secondary coils using suitable material.
2) To design a wireless power transfer circuitry,and obtaining its performance characteristics.
3) To design a power electronic circuit for converting AC to DC and charging Electric Vehicle (EV) battery.
4) To write an embedded program to know the charge level of the battery.

B. Methodology Adopted

1) Methodology for objective 1

- Literature survey will be made to understand the current National and intrnational status and developments made in wireless power transformation circuit and power electronic converter systems.
- The specifications and suitable material used for primary and secondary coils are extracted from various journals and spcification manuals.
- Designing the coils for better power transfer.
- Winding the primary and secondary coils and testing the performance for effective electromagnetic induction.

2) Methodology for objective 2

- Testing and determining the amount of losses occurred in wireless power transfer.
- Analysing and simulating the obtained losses for the amount of power to be transferred.
- Designing the power electronic components and connecting them to reduce power losses in electro-magnetic induction process.

C. Methodology for objective 3

The design will focus on the following specifications:

- Development of hardware power rectifier and voltage regulator.
- Designing the power electronic circuit for better rectification.
- Integrating the circuitry on the Printed Circuit Board.
- Selection of the battery to be used in electric vehicle.
- To charge the Rechargeable electric vehicle battery from the rectifier output obtained.

D. Methodology for objective 4

The hardware testing to be performed which will include the following steps:

- Assembly of all the required components on PCB.
- Winding the primary and secondary coils for effective induction.

VI. Conclusion

Wireless power transmission system and control of power converter circuit gave a broad idea on WPT by using solar power energy systems. Based on the experimental result, the study on wireless power transfer using inductive coupling has much aspect in terms distance of primary and secondary coil, number of turns, area of the coil. Proper alignment and positioning of the coil is achieved in this project.

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