Solar Wireless Electric Vehicle Charging System

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***Abstract*— Wireless power transmission (WPT) is popular and gaining technology finding its application in various fields. The power is transferred from a source to an electrical load without the need of interconnections. Wireless power transmission (WPT) is useful to power electrical devices where physical wiring is not possible or inconvenient. The technology uses the principle of mutual inductance. One of the future applications finds in automotive sector especially in Electric Vehicles. This project deals with research and development of wireless charging systems for Electric vehicles using wireless transmission. The main goal is to transmit power using resonance coupling and to build the charging systems. The systems deal with an AC source, transmission coil, reception coil, converter and electric load which are battery.**

***Index Terms*— WPT, EV, WCEV, IPT, Wireless EV Charging Station, etc.**

I. INTRODUCTION

Electric Vehicles (EVs), represents a new concept in the transport sector around the world. It is expected that the market share of EVs will exponentially grow, comprising 24% of the U.S. light vehicle fleet in 2030, representing 64% light vehicle sales in this year. In this context, the EVs battery charging process must be regulated to preserve the power quality in the power grids. Nevertheless, with the proliferation of Evs a considerable amount of energy will be stored in the batteries, raising the opportunity of the energy flow in the opposite sense. In the future smart grids, the interactivity with the EVs will be one of the key technologies, contributing to the power grid autonomous operation. The concept of the on-board bidirectional charger with V2G and V2H technologies is introduced.

An electric vehicle (EV) is a vehicle that uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels, fuel cells or an electric generator to convert fuel to electricity. EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. EVs first came into existence in the mid-19th century, when electricity was among the preferred methods for motor vehicle propulsion, providing a level of comfort and ease of operation that could not be achieved by the gasoline cars of the time. Modern internal combustion engines have been the dominant propulsion method for motor vehicles for almost 100 years, but electric power has remained commonplace in other vehicle types, such as trains and smaller vehicles of all types.

To research innovative wireless charging station technology for electric vehicles. We will discover about the design, construction, and operation of charging stations for electric vehicles from the above case study, as well as the future scopes and requirements of EV charging stations. Wireless Power Transfer (WPT) technique requires no physical contact between vehicle and charging device, therefore overcomes the inconvenience and hazards caused by traditional conductive method. The initial objective is replacing conductive charging method by the novel WPT technology, while maintaining a comparable power level and efficiency. The long-term goal is to dynamically power the moving vehicles on road. This will lead to a much reduced battery pack but extended driving range. Then, the main concerns of EV, namely the high battery price and the range anxiety, will be addressed. Wireless power transmission, wireless energy transmission, or electromagnetic power transfer is the transmission of electrical energy without wires. Wireless power transmission technologies use time-varying electric,

magnetic, or electromagnetic fields. Wireless transmission is useful to power electrical devices where interconnecting wires are inconvenient, hazardous, or are not possible.

II. LITERATURE REVIEW

1. Wireless Power Transfer For Electric Vehicle Applications

Author :- Siqi Li, Member, IEEE, and Chunting Chris Mi, Fellow, IEEE

Wireless power transfer (WPT) using magnetic resonance is the technology which could set human free from the annoying wires. In fact, the WPT adopts the same basic theory which has already been developed for at least 30 years with the term inductive power transfer. WPT technology is developing rapidly in recent years. At kilowatts power level, the transfer distance increases from several millimeters to several hundred millimeters with a grid to load efficiency above 90%. The advances make the WPT very attractive to the electric vehicle (EV) charging applications in both static and dynamic charging scenarios. This paper reviewed the technologies in the WPT area applicable to EV wireless charging. By introducing WPT in EVs, the obstacles of charging time, range, and cost can be easily mitigated. Battery technology is no longer relevant in the mass market penetration of EVs. It is hoped that researchers could be encouraged by the state-of-the-art achievements, and push forward the further development of WPT as well as the expansion of EV.

2. Wireless Power Transfer System via Magnetic Resonant Coupling at Fixed Resonance Frequency Power Transfer System Based on Impedance Matching

Author:- TeckChuan Beh1, Masaki Kato1, Takehiro Imura1, Yoichi Hori1

To increase the usage of electric vehicles (EV), a safe and convenient method to charge the vehicles is essential. Recently, an efficient mid range wireless power transfer that uses magnetic resonant coupling, WiTricity, was proposed, and has received much attention due to its practical range and efficiency. Studies show that the resonance frequency of the antennas changes as the gap between the antennas change. However, when this technology is applied in the MHz range (which allows small sized antennas), the usable frequency is bounded by the Industrial, Science, Medical (ISM) band. Therefore, to achieve maximum power transmission efficiency, the resonance frequency has to be fixed within the ISM band. In this paper, the possibility of using impedance matching (IM) networks to adjust the resonance frequency of a pair of antennas at a certain distance to 13.56MHz is studied. The simulations and experiments show that the IM circuits can change the frequency to 13.56MHz for different air gaps, improving the power transfer efficiency. Experiments also show that IM can be achieved just by observing and minimizing the reflected wave.

3. Modeling And Analysis Of Wireless Power Transmission System For Inspection Robot

Author:- Mingbo Yang, Guodong Yang, En Li, Zize Liang, Hao Lin

A wireless power transmission technique based robotic power management system for prolonging continuous working time of one transmission line inspection robot is introduced in this paper. Magnetic resonance coupled WPT (wireless power transmission) unit is designed and analyzed in form of electrical circuit mode theory. Impedance matching is introduced and a special matching method for four coils resonance coupled based WPT is given. The output power of WPT unit is modeled and relationship between coupled coefficient, angular frequency and amount of output power is given and energy consumption of each unit in power management system is quantified. Experiment shows that models can precisely describe the character ofvWPT system and it performs to be applicable for charging the inspection robot wirelessly

4. Wireless Power Transfer (WPT) for Electric Vehicles (EVs)—Present and Future Trends

Author :- D.M. Vilathgamuwa and J.P.K. Sampath

100 year old gasoline engine technology vehicles have now become one of the major contributors of greenhouse gases. Plug-in Electric Vehicles (PEVs) have been proposed to achieve environmental friendly transportation. Even though the PEV usage is currently increasing, a technology breakthrough would be required to overcome battery related drawbacks. Although battery technology is evolving, drawbacks inherited with batteries such as; cost, size, weight, slower charging characteristic and low energy

density would still be dominating constrains for development of EVs. Furthermore, PEVs have not been accepted as preferred choice by many consumers due to charging related issues. To address battery related limitations, the concept of dynamic Wireless Power Transfer (WPT) enabled EVs have been proposed in which EV is being charged while it is in motion. WPT enabled infrastructure has to be employed to achieve dynamic EV charging concept.

5. Safe Wireless Power Transfer to Moving Vehicles: Design of Radiation less Antenna
Author:- Dr. Sven Beiker, Dr. Richard Sassoon, Sunil Sandhu
This project aims at the feasibility of wirelessly charging the electric vehicles cruising on the high way. We explored a wireless power transfer mechanism utilizing high quality magnetic resonances. We demonstrated numerically and experimentally that the energy could be transferred efficiently between two magnetically coupled resonating coils in a complex electromagnetic environment.

III. SYSTEM DESIGN

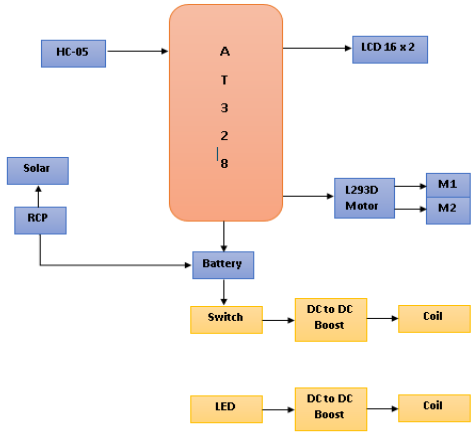

Figure 1: Block Diagram

The Block Diagram consists of Arduino, HC05 module, LCD Display, L293D Driver, DC Motors, Transceiver coil, Solar Panel and Battery.
DC voltage can be stored in the battery bank by a charge controller. An inverter is employed to convert the DC voltage from the battery bank to 110-volt AC at 60 Hz frequency that is identical to the power from the electric outlet. This project will address the fundamental concepts of designing and developing charging systems for charging electrical vehicles.
Commands will be transmitted through Bluetooth APP and commands are read, by microcontroller.
With that Commands, the movement will happen with the help of L293D motor driver of two DC motors.
Vehicle motion will happen with two wheels & One 360 rotating wheel. (Right / Left/ forward / backward)
With the help of magnetic coil charge transmission will happen wirelessly.
Those should be two magnetic coils

- Transmitter Coil
- Receiver Coil.

Whatever Battery voltage is there that will be displayed on LCD Display.
After switch on project name will be shown on LCD Display.
We will use Solar Panel, main power source to charge battery.

IV. RESULT AND DISCUSSION

After successful assembling of the hardware parts and the configuration of the software components, the functionality of the system was tested on a built model. The system makes use of a battery, regulator circuitry, copper coils, AC to DC converter, Solar Panel, Atmega controller and LCD display to develop the system.
This project will address the fundamental concepts of designing and developing charging systems for charging electrical vehicles.
Hardware assembly of project:

V. CONCLUSION

The development of the Solar Based Wireless Charging system for EV project comprised of various disciplines like electrical, electronics, and mechanical engineering technologies. This project attempted to provide a framework for the battery charging station. The proposed charging system will be one of the initiatives taken to achieve a Green campus. It is clearly evident that the proposed battery charging system is better than the existing electrical charging system both in terms of operation and economical aspects. Researchers work on this project get a basic idea of the design and building of systems for several useful applications such as electrical vehicle system.

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