Wireless power transfer for roadways electric vehicle

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***Abstract*—** A wireless power transfer system for roadway powered electric vehicles (EVs) is presented. Concept of this system is using inductive coupling of primary coils arranged in a linear array in the roadway to secondary coils in EVs. When the vehicles enter into the zone of copper coil, the vehicle will use the energy it gets from the roadway copper coils. Various electric vehicles use batteries for energy storage therefore heavily reply on the available batteries products and there technology development**.**

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. The weight of the battery pack can be reduced as the required energy storage is lower if the vehicle can be powered wirelessly while driving.

INTRODUCTION

Since a few years electric powered vehicles are available on the market, developed with the goal supersede cars with combustion engines. In this process there are three types of plants are used.

First plant is used to trap the solar energy by using the solar panel and store it in battery. This energy is transmitted by using copper coils which are placed. Transmitter part consists of Solar panel, voltage ripple circuit, battery (12v). Solar panel is a set of photovoltaic cells electrically connected and mounted on a supporting structure; voltage ripple circuit is used to remove ripples and 12v battery to store the charging.

Second plant is known as “STORAGE”. This transmitted energy is then received again by using copper coil which are placed in third plant known as “RECEIVER”.

WPT technology can be used as a solution in eliminating many charging hazards and drawbacks related to cables. The concept of dynamic WPT enabled EVs, which means the EV could be charged while moving in a road will increase the effective driving range while reducing the volume of battery storage. Not only from the consumer perspective, but also from sustainable energy point of view WPT enabled EVs are greatly beneficial.

EVs have not become an attractive solution to consumers. Major drawback of EV is with the energy storage technology. A short coming of today's battery technology includes cost, size, weight, slower charging and low energy density. This value is much smaller than that of gasoline engine. It would be infeasible to achieve range of a gasoline vehicle from a pure PEV with current battery technology. Long charging times

BLOCK DIAGRAM

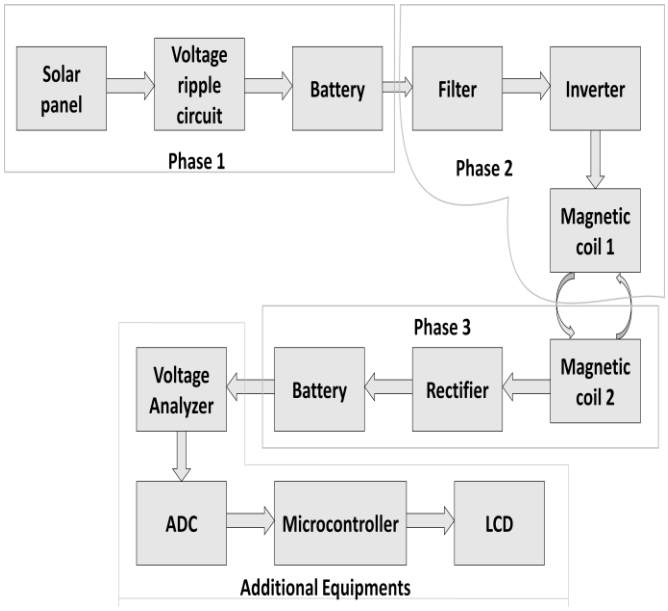

Figure 1: Block Diagram of storage, transmitter and receiver

DESCRIPTION OF BLOCK DIAGRAM

Our system consists of three parts such as Transmitter, Storage and Receiver.

- Transmitter

  Transmitter part consists of Solar panel, voltage ripple circuit, battery (12v). Solar panel is a set of photovoltaic cells electrically connected and mounted on a supporting structure; voltage ripple circuit is used to remove ripples and 12v battery to store the charging.

- Storage

  Platform is also called as track. It consist of filter-oscillator circuit, the main function of filter is to remove unwanted ripples and oscillator circuit is used to convert direct current into alternating current (D.C.- A.C.) and magnetic coil 1 which is deployed into track.

- Receiver

  Receiver circuit is the electric vehicle. At the base portion of electric vehicle magnetic coil 2 is connected and the connection is made as shown in block diagram.

Platform is also called as track. It consist of filter-oscillator circuit the main function of filter is to remove unwanted ripples and oscillator circuit is used to convert direct current into alternating current (D.C.- A.C.) and magnetic coil 1 which is deployed into track. Block diagram is as shown figure below by combining transmitter, platform and receiver part it help us to achieve wireless charging of electric vehicle.

WPT system powered using high frequency (HF) power source. HF source can either be an inverter or combination of a power amplifier (PA) and a signal generator (SG). PA and SG based setups are commonly used in laboratory prototyping, but PA and SG combination has to be replaced with a high frequency inverter in real world implementation. Receiver resonator is connected to the load through a battery charging circuitry.

All programs, services, gateway etc. supports various Codecs and it also introduce a digitizing delay since every algorithm needs a certain amount buffering data before it is processed.

Additional equipment

ADC:

An ADC is defined by its bandwidth and its signal to noise ratio. The bandwidth of an ADC is characterise by primarily by its sampling rates. The dynamic range of ADC is influence by many factors, Including the resolution, linearity , resolution and accuracy.

ADC perform the reverse operation of DAC , it convert the digital data to analog data. The conversion involves quantzation of the input. So it necessarily introduced a small amount of error.

Microcontroller :

A microcontroller is a small computer on single integrated circuit containing a processor core,memory, and programmable input/output device peripheral.

Microcontroller are used in automatically controlled products and devices, such as automobile engine control system.

LCD :

LCD is liquid crystal display. This is used to display output of any system. A liquid crystal display is a flat panel display or other electronic visual display that uses the light modulating properties.

LCD is used in wide range of applications including computer monitors, television, instrument panel, aircraft cockpit display, and indoor and outdoor signage.

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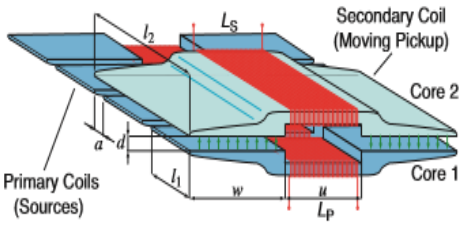

Figure 2: Construction of roadway

PEVs have been proposed as the prospective mode of transportation to address environment, energy and many other issues. In spite of receiving many government subsidy and tax incentives, EVs have not become an attractive solution to consumers. Major drawback of EV is with the energy storage technology. Short coming of today's battery technology includes cost, size, weight, slower charging and low energy density.

WPT technology is improving significantly covering aspects such as RF technology, near-field energy transfer, energy conversion and management, energy storage elements, novel materials and fabrication techniques EMC/EMI considerations. However, WPT is yet to fully mature in terms of power transfer efficiency, range, and power rating. Extensive research studies that have been carried out presently would bring the world closer to the futuristic concept of motor/capacitor/WPT EVs.

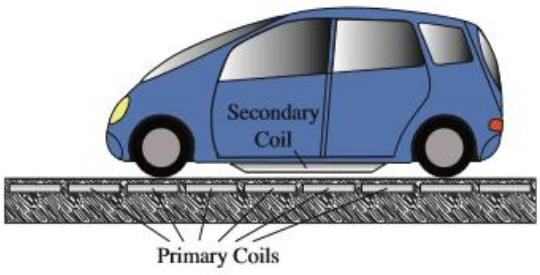

Figure 3: Ideal view

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 Energy Transfer Methods

Wireless power transfer methods encompass technologies such as Laser, photoelectric, radio waves (RF), microwaves, inductive coupling and magnetic resonance coupling. These technologies can be broadly categorized based on underlying mechanism, transmission range, and power rating. Based on the power transfer distance wireless energy transfer methods can be categorized into two types; near field and far field. If transfer distance is longer than the wavelength of electromagnetic wave, it is categorized in to far field technique. Laser, photoelectric, RF, microwave can be considered as far field energy transfer methods.

Inductive coupling and magnetic resonance coupling based methods are regarded as near field approaches. Even though far field techniques have transmission range up to several kilometres, they suffer from the trade-off between directionality and efficiency. Frequency range of far field approaches are typically very high (GHz range) compared to near field (kHz–MHz). Inductively coupled near field approaches can be used to transmit high power efficiently in very near range (up to several centimetres).

Efficiency of such systems deteriorates exponentially with the distance. The non-radiative WPT system demonstrated in 2007 by MIT based on magnetic resonance coupling can be used in mid-range application with an acceptable efficiency. This MIT experiment has gained accentuating attention from the research community because many real world applications require longer transmission range.

The relationship between the number of calls made in an Asterisk server and use of the processor in this server as the processor is one of the major hardware resources. In our project we are providing free calling system from one user to another user by using an app named Zoiper which work in absence of Internet. Zoiper is Android application

PROPOSED APPROACHES

- High power stationary charging
- In-motion power transfer

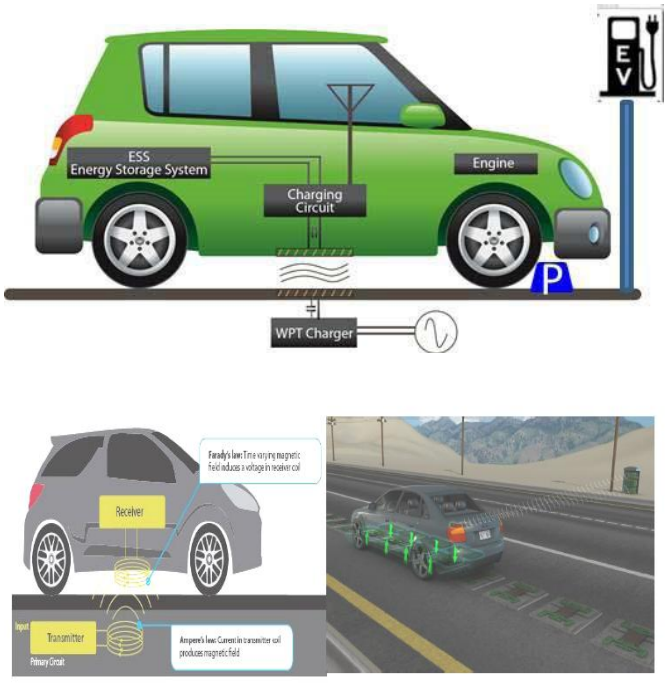

Figure 3: PROPOSED APPROCHES

Stationary WPT can replace the charging cable for PEVs. WPT system is activated when vehicle reaches to the charging area. WPT is a platform for EV charging. High frequency power

inverter converts low frequency utility power to high frequency AC power. Resonance electromagnetic field generated in the transmitting resonator transfers power to the receiving resonator. Received power at the secondary resonator is rectified to charge the battery pack. Power converters used for the WPT can mainly categorized in to two types, namely indirect power converters and direct power converters.

Utility power is first converted to DC and then invert to high frequency AC power in indirect conversion method. Energy conversion undergoes two conversion stages AC-DCAC in indirect method. Alternatively, direct conversion method converts energy directly from low frequency mains to high frequency in a single stage.

Inductive Coupling Versus Magnetic Resonance Coupling

Traditional inductive power transfer (IPT) systems based on inductive coupling resulting from the Faraday's law of induction and Ampere's circuital law. The integrated magnetic field due to current carrying loop (transmitting coil) is defined by the Ampere's circuital law. According to Faraday's law of induction, time-varying magnetic field induces electric field in receiving coil. Initial configurations of IPT systems used inductor in series with the coil . This is analogues to loosely coupled transformer. Later, IPT based topologies are adopted with capacitor compensation

Conversely, magnetic resonance technology originally used with self-resonance coils which resonates with its self-inductance and parasitic capacitance.

Frequency selection for IPT based designs are limited to several kilohertz while magnetic resonance based systems can operate in frequencies up to a few Megahertz. Typical IPT schemes are limited to a few centimeters whereas magnetic resonance WPT can be used with larger range.

Equivalent source resistance represents output impedance of the power source. In case of PA and SG combination, source impedance is typically 50 Ω. But in power converter based designs this value is much smaller than 50 Ω. Therefore, source resistance must be chosen with careful attention in the design process based on the type of the source.

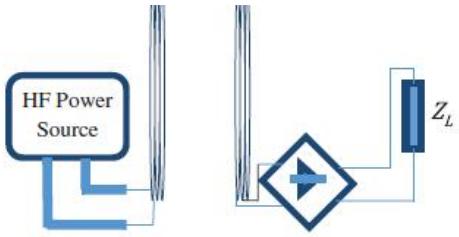

Figure 4: two reasonator WPT

Due to industrial requirements and advancements in technology, power transfer distance in WPT systems has increased from several millimeters to several centimeters. Although number of researchers working on the WPT technology, still there are numerous challenges to overcome in bringing it to commercial level. Acceptable power transfer efficiency at high transfer range, increasing power level, misalignment tolerance and safety considerations are major technical challenges.

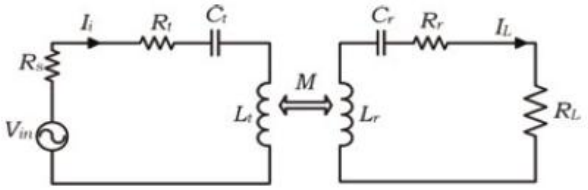

figure 5: equivalent circuit

The basic coupled magnetic resonance WPT system is consisted of 4 power stages, namely the power factor correction (PFC) converter, the RF amplifier, the coils or resonators, and the on-board rectifier. the system schematic of a 4-coil strongly

coupled magnetic resonance wireless EV charging system with uncontrolled pick-up. To archive 90% overall efficiency, both of the PFC and RF amplifier stages should have 97% efficiency at least, with the coil-to-coil efficiency higher than 96% and the rectifier efficiency close to 99%.

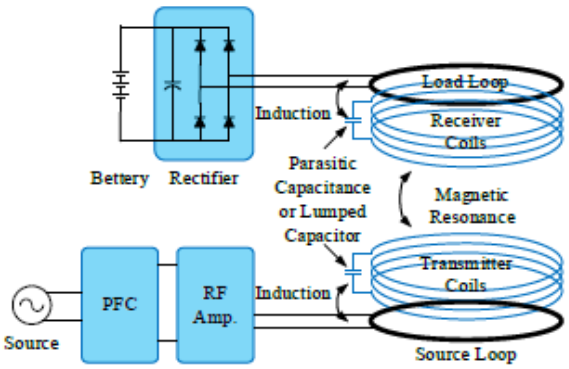

Figure 6: strongly coupled magnetic resonance for EV

ADVANTAGES

- Reduction of air pollution.
- It can be exploited when it is necessary or desirable to have.
- less power wastage.
- It provide an efficient, viable, safe, roadway-powered all EVs.
- The major advantage of this system is that there is no possibility of electric shock

APPLICATION

- The transfer distance increases from several Km to more than 100Km.
- By using wireless power transfer system in EVs the charging time, range and cost can be easily decrease.
- Instead of plugging in a mobile phone or laptop via power cord to charge the battery, wireless power can be harnessed and implemented in a home such that a laptop and phone charge continuously and wirelessly without the need for plugging anything in.

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