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Wireless Power Transfer for Electric Vehicles

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Abstract:*Roadway-powered electric vehicles (RPEVs) are attractive candidates for future transportations because they do not rely on large and heavy batteries but directly and efficiently get power while moving along a road. 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. Wireless power transfer (WPT), is the transmission of electrical energy without wires as a physical link. In a wireless power transfer system, a transmitter device, driven by electric power from a power source, generates a time-varying electromagnetic field, which transmits power across space to a receiver device, which extracts power from the field and supplies it to an electrical load. The technology of wireless power transmission can eliminate the use of the wires and batteries, thus increasing the mobility, convenience, and safety of an electronic device for all users.*

Keywords:*Roadway-powered electric vehicles, Wireless power transfer,*

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I. INTRODUCTION:

Wireless power transfer may be used to power up wireless information transmitters or receivers. This type of communication is known as wireless powered communication. When the harvested power is used to supply the power of wireless information transmitters, the network is known as Simultaneous Wireless Information and Power Transfer, whereas when it is used to supply the power of wireless information receivers, it is known as a Wireless Powered Communication Network .

An electric vehicle (EV), also called electrics 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.

During the last few decades, environmental impact of the petroleum-based transportation infrastructure, along with the fear of peak oil, has led to renewed interest in an electric transportation infrastructure. EVs differ from fossil fuel-powered vehicles in that the electricity they consume can be generated from a wide range of sources, including fossil fuels, nuclear power, and renewable sources such as tidal power, solar power, hydropower, and wind power or any combination of those. The carbon footprint and other emissions of electric vehicles varies depending on the fuel and technology used for electricity generation. The electricity may then be stored on board the vehicle using a battery, flywheel, or super capacitors. Vehicles making use of engines working on the principle of combustion can usually only derive their energy from a single or a few sources, usually non-renewable fossil fuels. A key advantage of hybrid or plug-in electric vehicles is regenerative braking, which recovers kinetic energy, typically lost during friction braking as heat, as electricity restored to the on-board battery.

An embedded system can be described as one consisting of a processor, associated peripherals and software used for a specific purpose. Embedded systems have already improved our lives in numerous ways. A good example is an automatic washing machine or a microwave oven. Embedded system does not require a complete operating system, which may make the system bulky, but only the basic functionalities of an operating system, is needed. All embedded systems not have the same software and hardware, which is why these systems perform, varied task.

All embedded systems need microprocessor and the kind of microprocessors used in them are quite varied. Embedded systems have already improved our lives in numerous ways. Such a system is in direct contrast to personal computer, which is not designed to do a specific task. The PC aids us in drafting a letter, in computing at a faster rate, in chatting with friends and so on, but an embedded system is designed to do a specific task within a given time frame, repeatedly, endlessly with or without human intervention.

Unlike a PC, embedded system does not require a complete operating system, which may make the system bulky, but only the basic functionalities of an operating system is needed. Software for the embedded system must handle problems beyond those found in application software for desk computers or mainframe computers. Embedded software often have several things to do at once, respond to external events, cope with unusual conditions without human intervention, while being subjected to deadlines etc.

II. MATERIALS AND METHODS:

A study about wireless power transmission system for electric vehicle to charge the battery during low-speed driving without stopping the vehicle is underway. Mutual induction based wireless power transmission is proposed. Time-varying magnetic flux is generated from the AC current of a power supply rail in accordance with Ampere's law. Voltage is induced from the pick-up coil, coupled with the power supply rail, in accordance with Faraday's law. Power is wirelessly delivered through magnetic coupling, where capacitor banks are used to nullify inductive reactance.

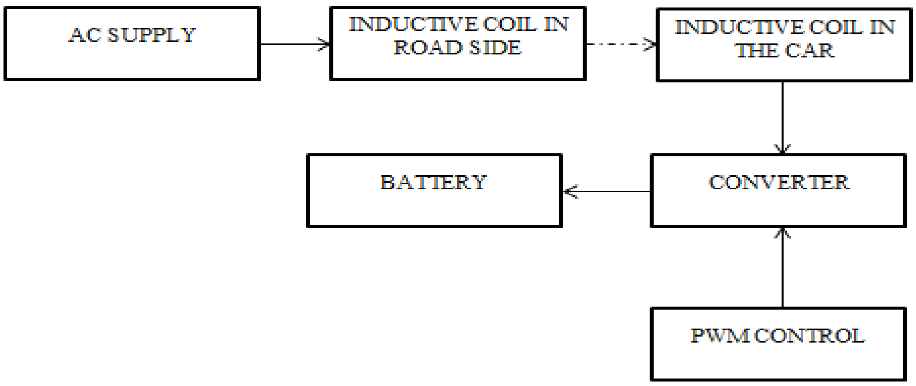

Figure 1. Proposed diagram

This paper starts with the basic WPT theory, and then gives a brief overview of the main parts in a WPT system, including the magnetic coupler, compensation network, power electronics converter, study methodology, and its control, and some other issues like the safety considerations. By introducing the latest achievements in the WPT area, we hope the WPT in EV applications could gain a widespread acceptance in both theoretical and practical terms. Also, we hope more researchers could have an interest and make more brilliant contributions in the developing of WPTtechnology.

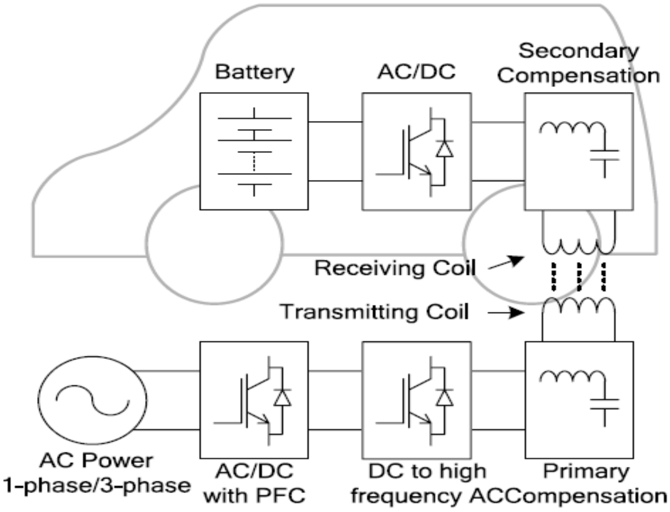

Figure 2 Block Diagram

A typical wireless charging system is shown in Figure 2. It includes several stages to charge an EV wirelessly. First, the utility ac power is converted to a dc power source by an ac to dc converter with power factor correction. Then, the dc power is converted to a high-frequency ac to drive the transmitting coil through a compensation network. Considering the insulation failure of the primary side coil a high-frequency isolated transformer may be inserted between the dc-ac inverter and primary side coil for extra safety and protection. The high-frequency current in the transmitting coil generates an alternating magnetic field, which induces an ac voltage on the receiving coil. By resonating with the secondary compensation network, the transferred power and efficiency are significantly improved. At last, the ac power is rectified to charge the battery.

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- The detached (or separated, loosely coupled) transmitting and receiving coils. Usually, the coils are built with ferrite and shielding structure, in the later sections, the termmagneticcouplerisusedtorepresenttheentirety,
- the compensationnetwork;
- The power electronicsconverters.

For stationary EV wireless charging, the coupling between the two coils is usually around 0.2. If both the sending and receiving coils have a quality factor of 300, the theoretical maximum power transfer efficiency is about 96.7%.

2.1 HARDWARE REQUIREMENT

2.1.1. PIC MICRO CONTROLLER

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output.

2.1.2. TRANSFORMER

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Commonly, transformers are used to increase or decrease the voltages of alternating current in electric power applications. Making use of Faraday's Law in conjunction with high magnetic permeability core properties, transformers can thus be designed to efficiently change AC voltages from one voltage level to another within power networks.

2.1.3. CONVERTERS

The converters convert one form of signal into another form. Real world processes produce analog signal which carry information pertaining to process variables such as voltage, current, charge, temperature and pressure. It is difficult to store, manipulate, compare, calculate and retrieve such data with good accuracy using purely analog technology. It is necessary to convert the analog signals from various transducers into its equivalent data which turn act as the input for digital systems

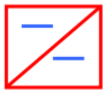
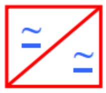
CONVERSION FROM/TO	NAME	FUNCTION	SYMBOL
DC to DC	Chopper	Constant to variable DC or variable to constant DC	
DC to AC	Inverter	DC to AC of desired voltage and frequency	
AC to DC	Rectifier	AC to unipolar (DC) current	
AC to AC	Cycloconverter, AC-PAC, Matrix converter	AC of desired frequency and/or magnitude from generally line AC	

FIGURE 3. CONVERTERS

III. RESULT:

This section presents in detail about the results of wireless power transfer for electric vehicles. Figure4 and Figure 5 presents the Forward motion and Right direction of electric vehicle with wireless power transfer.

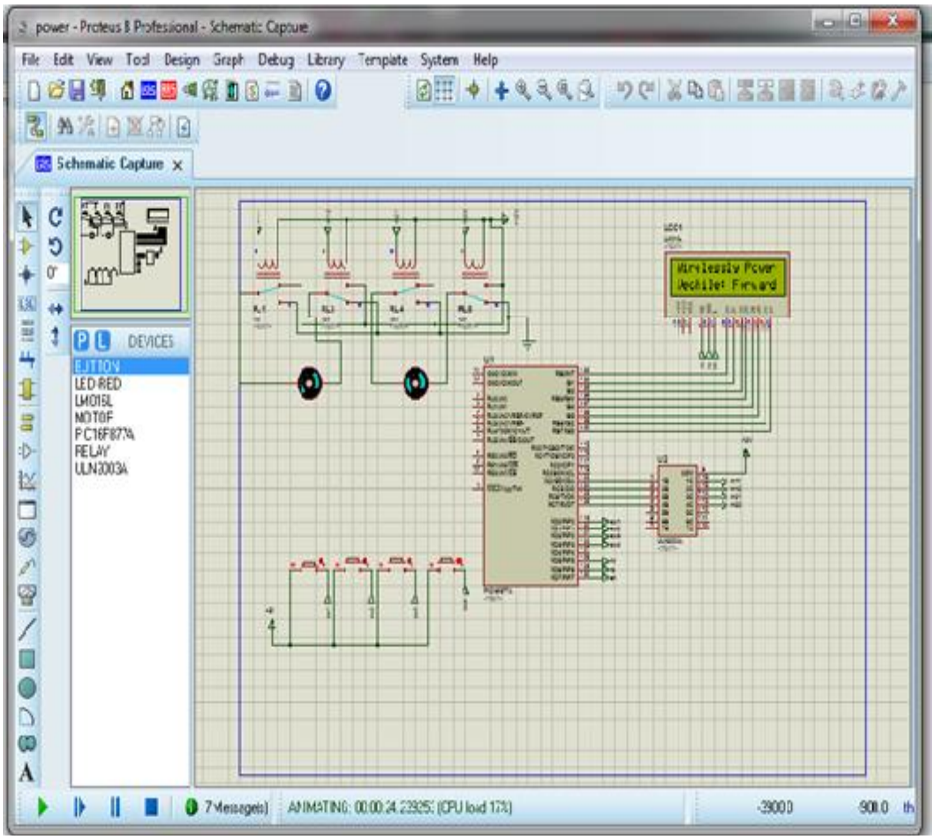


Figure 4. Forward Motion

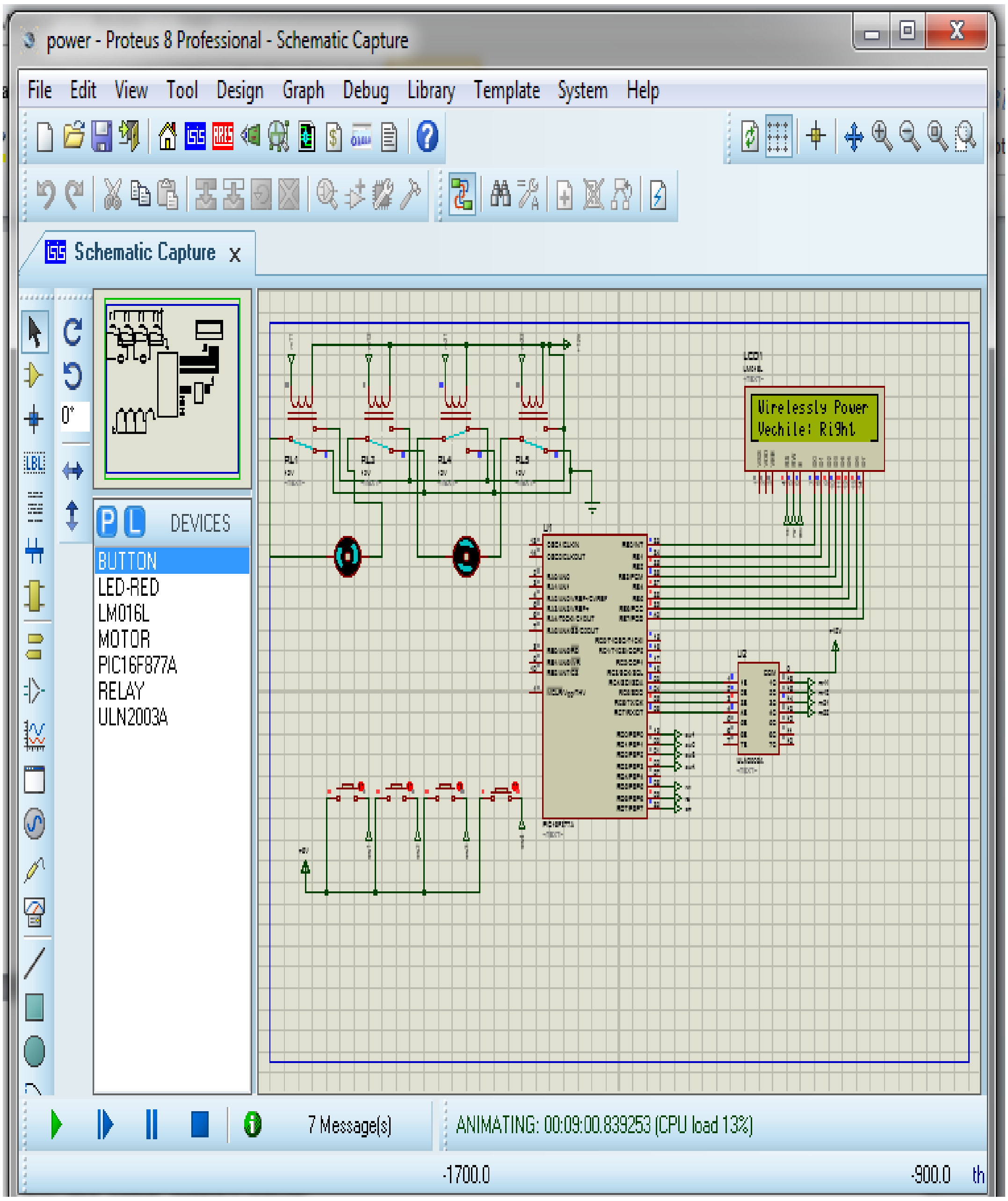


Figure 5. Right Direction

IV. CONCLUSION

It is clear that vehicle electrification is unavoidable because of environment and energy related issues. Wireless charging will provide many benefits as compared with wired charging. In particular, when the roads are electrified with wireless charging capability, it will provide the foundation for mass market penetration for EV regardless of battery technology. With technology development, wireless charging of EV can be brought to fruition. This technology offers an extremely efficient alternative to previous attempt at providing wireless power.

In the future, a wireless charging system of electric cars to charge their batteries will replace conventional system. In this project wireless charging was introduced. Inductive charging (also known as wireless charging) uses an electromagnetic field to transfer energy between two objects. This is usually done with a charging station. Energy is sent through an inductive coupling to an electrical device, which can then use that energy to charge batteries or run the device. Induction chargers use an induction coil to create an alternating electromagnetic field from within a charging base, and a second induction coil in the portable device takes power from the electromagnetic field and converts it back into electric current to charge the battery

Thus the study about wireless power transmission system for electric vehicle to charge the battery during low-speed driving without stopping the vehicle has been proposed in this paper

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