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Electrical Vehicle Charging by Electromagnetic Induction Via Loosely Coupled Coil

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ABSTRACT

In this project, a method of electric vehicles charging with the use of large bus vehicles moving along national highways and provincial road proposal and described. This method relies on charging vehicles from bus while moving either with plug-in electric connection or by electromagnetic induction via loosely coupled coils. Open research challenges and several avenues or opportunities for future research on electric vehicle charging are outlined. Wireless charging of gadgets is one of the new arriving technologies in the world at the moment. The most widely used method at the moment is wireless power transfer by inductive coupling. Wireless power transfer is one of the simplest and economical ways of charging as it drop the use of conventional copper cables and current carrying cable. The system consists of transmitters and receivers that contain magnetic loop sky wire critically tuned to the same frequency due to operating in the electromagnetic near field, the receiving devices must no more than about a one-fourth wavelength from the transmitter.

Keywords: WPT-Wireless Power Transmission, Inductive Coil, Transmitter Circuit, Receiver Circuit, Electric Vehicle, Electromagnetic Induction.

I. INTRODUCTION

Electricity is today necessity of modern life. It is challenging to imagine passing a day without electricity. In the future transport area electric vehicles are consider as replacement of internal combustion engine driven vehicles. Principle of wireless electricity works on the principle of using coupled resonant body for the transference of electricity. By deploying wireless power transmission we can reduce the transmission and distribution losses and increase efficiency to some extent. Wireless energy transfer can be useful in such applications as providing power to independent electrical and electronic devices. This energy which is transferred can be derived from renewable sources. With the help of resonant magnetic field that wireless electricity produces, while reducing the wastage of power. The receiver works on the same principle as radio receivers where the device has to in the range of the transmitter. The system consists of wireless electricity transmitters and receivers that contain magnetic loop sky wire critically tuned to the same frequency.

II. SYSTEM DESCRIPTION

Energy Coupling:

Energy coupling occurs when an energy source has a means of transferring energy to another body. One simple example is a locomotive hauling a train car the mechanical coupling between the two enables the locomotive to haul the train, and overcome the forces of friction and inertia that keep the train can still the moves. Magnetic coupling occurs when the magnetic fields of one gadget. An electric transformer is a device that transfers the energy from its primary winding to its secondary winding, without the windings being connected to each other. It is used to "transform" AC current at one voltage to AC current at another voltage. Interacts with a second gadget and induces an electric current in or on that gadget. In this way, electric energy can be transferred from a energy source to a powered device. In divergence to the example of mechanical coupling given for the train, magnetic coupling does not require any physical contact between the gadget generating the energy and the gadget receiving or capturing that energy.

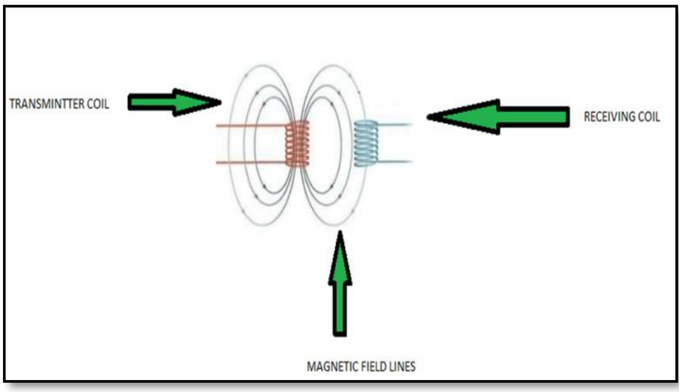

Figure 1. Inductive loosely coupled coil

Transmitter Circuit:

The input from mains is given to the power frequency controller. The output of this system is given to MOSFET/IGBT. The main purpose of using MOSFET/ IGBT is to convert DC to AC and also for amplifying square wave at the gate input. The voltage given to the transmitting coil generates the magnetic field around it. The capacitor is connected to the coil parallel and hence the resonating circuit is formed. Until the resonant frequency of receiving coil matches with the resonant frequency of the transmitting coil magnetic field won't get induced in the receiving coil. For this purpose of matching the resonant frequency we used different values of "L" and "C" for resonant frequency matching purpose. To match the resonant frequency of the receiver and the transmitter coil we used the switches to vary the time periods of the square wave by which we are controlling the frequency at output.

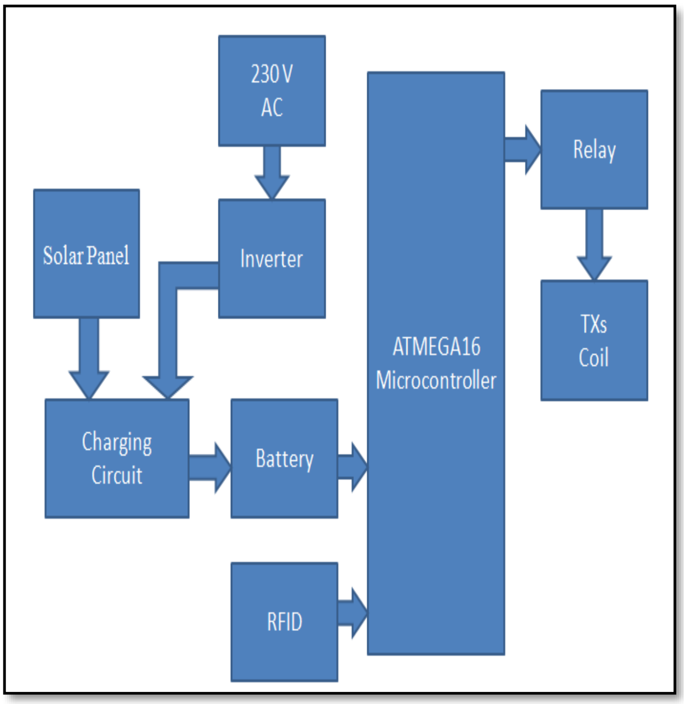

Figure 2. Transmitter Circuit

Receiver Circuit:

As the receiving coil comes in the range of the magnetic field of the transmitting coil, the voltage across the transmitting coil gets induced in the receiving coil because of mutual inductance and matching of resonance frequency. The received voltage is in AC form, we have to convert it into DC for DC load hence we used a rectifier circuit which provides constant DC at the output for driving the load. And if the load is ac load then we can give direct output to it.

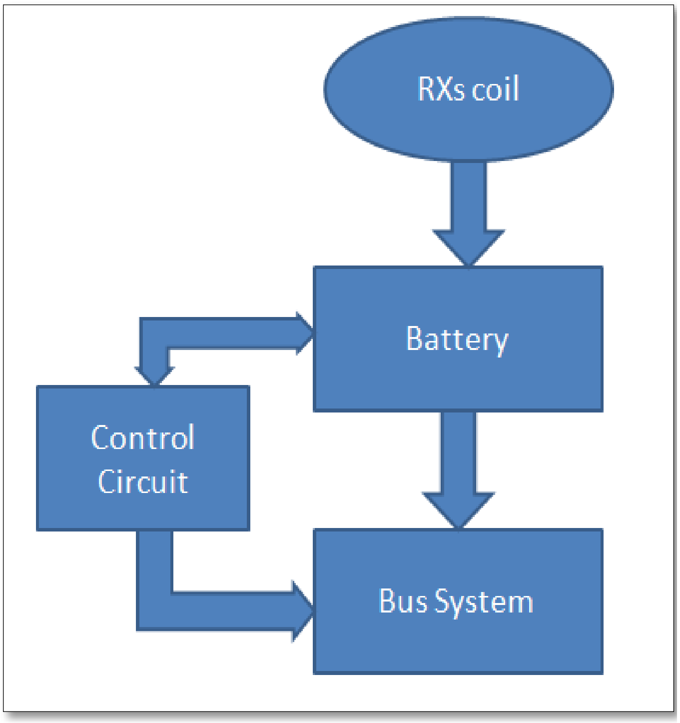

Figure 3. Receiver Circuit

III. CONCLUSION

The objectives of the project were met. An electronic device that wirelessly transmits power and then charges batteries was developed. We were able to design discrete components such as the oscillator, coils and a full bridge voltage rectifier for the system design process.

Conclusions that were drawn from the project study are as follows:

1. It can also be concluded that WPT can be used in other applications. In the project we were able to charge a electrical vehicle battery from power that was transmitted wirelessly.
2. From the analysis it was seen that at 0cm separation distance, the power transfer was most efficient as seen by the charging of EV battery.
3. From the project WPT for short range or near field occurred up to a distance increases which the power transferred began to significantly drop.
4. Lastly, we can conclude that WPT is not affected by non-magnetic materials shielding the two coils. This therefore means that it can be effectively used in the medical field to charge pacemakers and other devices.

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