A Review of Wireless Power Transmission using Pulse Width Modulation Technique

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Abstract: ***In a power system many technology use for transmitting power. We present here the transmitting of power without wire that is wireless transmitting power using pulse width modulation technique. We also discussed the technological developments in Wireless Power Transmission (WPT). The advantages, disadvantages, biological impacts and applications of WPT are also presented.***

Wireless power or wireless energy transmission is the transmission of electrical energy from a power source to an electrical load without man-made conductors. Wireless transmission is useful in cases where interconnecting wires are inconvenient, hazardous, or impossible. The proportion of energy received becomes critical only if it is too low for the signal to be distinguished from the background noise. With wireless power, efficiency is the more significant parameter. A large part of the energy sent out by the generating plant must arrive at the receiver or receivers to make the system economical. The most common form of wireless power transmission is carried out using direct induction followed by resonant magnetic induction. Other methods under consideration are electromagnetic radiation in the form of microwaves or lasers and electrical conduction through natural media

Keywords: Wireless Power Transmission (WPT), Resonance Inductive Coupling (RIC).

1. Introduction

As early as the beginning of the 20th century, Nikola Tesla foresaw the immense advantages of wirelesses power transmission. Much of his work in this field was spent trying to develop a means to transmit large amounts of power over great distances without the use of an electrical grid. Sadly his work went unfinished due to a number of technological and financial obstacles [1].The ideas of wireless power transfer originated from the inconvenience of having too many wires sharing a limited amount of power sockets. We believe that many people have the same experience of lacking enough sockets for their electronic devices. Thus by creating a wireless power transfer system, it would help to clean up the clutter of wires around power sockets making the space more tidy and organized. The technology for wireless power transmission or wireless power transfer (WPT) is in the forefront of electronic development. Applications involving microwaves, solar cells, lasers, and resonance of electromagnetic waves have the most recent success with WPT [2]. The inspiration for wireless power comes from wires being cumbersome and message. With numerous number of mobile electronics that we use today, there is a huge demand for convenience in supervision of their power supplies. Wireless communication has made a massive development in the way we interact with communication devices. We also observe that while the techniques of strongly coupled magnetic resonances allow efficient power transfer between a pair of transmitter and receiver coils, the efficiency greatly declines upon adding more receivers to the strongly coupled system due to the interaction between multiple coupled resonators. In tightly Coupled resonant wireless power transfer, we require a one to one contact between transmitter to improve and receiver. In addition, in order efficiency of power transfer, we intend to use a Lower switching frequency to drive the gate of the MOSFET [10].

2. Need of Project

The need of this project is to produce a platform which can detect the battery level of an electronic device, such as a cell phone, then be able to automatically charge the device when the battery level of the device drops below a certain threshold. Our project will use resonant induction charging which can charge multiple devices at the same time as long as they have the same resonant frequency.

3. Methodology

3.1 Induction

The principle of mutual induction between two coils can be used for the transfer of electrical power without any physical contact in between. The simplest example of how mutual induction works is the transformer, where there is no physical contact between the primary and the secondary coils. The transfer of energy takes place due to electromagnetic coupling between the two coils.

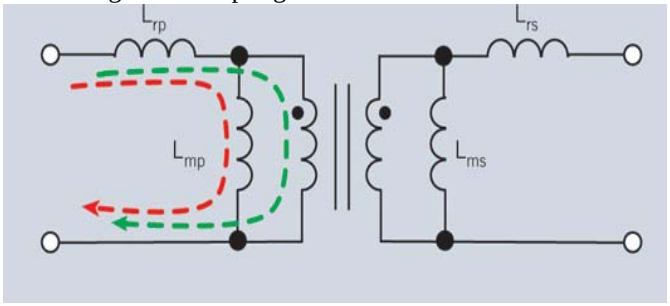

Figure: 1 Induction

3.2. Electromagnetic Transmission

Electromagnetic waves can also be used to transfer power without wires. By converting electricity into light, such as a laser beam, then firing this beam at a receiveing target, such solar cell on a small aircraft, power can be beamed to a single target. This is generally known as "power beaming".

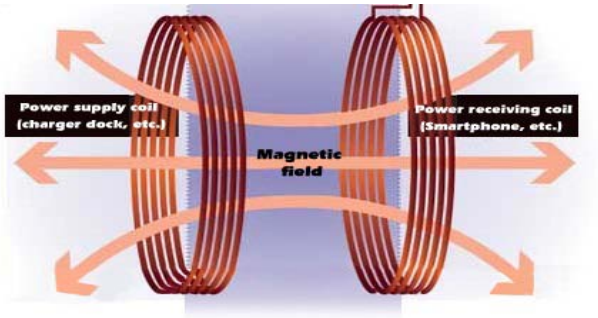

Figure: 2 Electromagnetic Transmission

3.3 Evanescent Wave Coupling

Researchers at MIT believe they have discovered a new way to wirelessly transfer power using non-radiative electromagnetic energy resonant tunneling. Since the electromagnetic waves would tunnel, they would not propagate through the air to be absorbed or wasted, and would not disrupt electronic devices or cause physical injury like microwave or radio transmission. Researchers anticipate up to 5 meters of range.

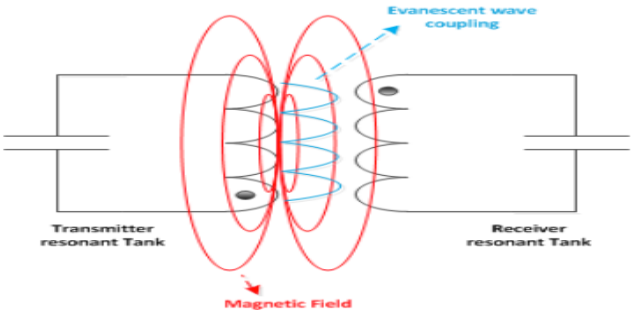

Figure: 3 Evanescent Wave Coupling

3.4 Inductive Coupling

Two devices are said to be mutually inductively coupled or magnetically coupled when they are configured such that change in current though one wire induces a voltage across the ends of the other wire by electromagnetic induction. This is due to the mutual inductance. Transformer is an example of inductive coupling. Inductive coupling is preferred because of its comfortable, less use of wires and shock proof.

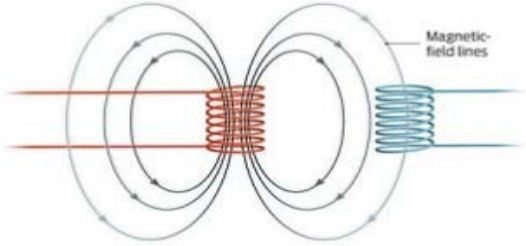

Figure: 4 Inductive Coupling

3.5 Resonance Inductive Coupling (RIC)

RIC is the combination of both inductive coupling and resonance. Using the concept of resonance it makes the two objects to interact each other very strongly. Inductance induces current in the circuit. As seen in the figure 7, the coil provides the inductance. The capacitor is connected in parallel to the coil. Energy will be shifting back and forth between magnetic field surrounding the coil and electric field around the capacitor. Here the radiation loss will be negligible

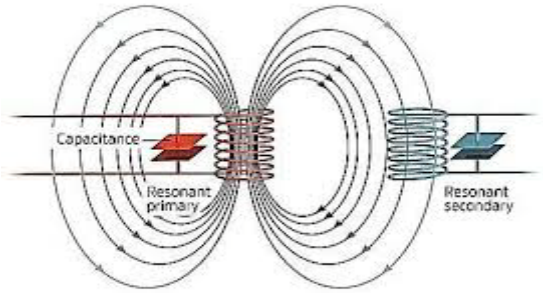

Figure: 5 Resonance Inductive Coupling

3.6 Pulse width modulation

We evaluate the wireless PWM technique for WNR application by exploring its potential sources of noise and inaccuracy. Our goal is to indicating the signal-to-noise ratio (SNR) on the receiver side as well as the overall winner system resolution. Various sources of error can be divided into those that are related to 1) the implantable transmitter unit and 2) the external receiver unit. Transmitter errors include errors in generating the triangular waveform, PWM comparator noise, offset, and hysteresis, and the VCO phase noise. On the receiver side, error is mostly due to the bandwidth and internal noise. One should, however, note that the purpose of the receiver in this architecture is not to reconstruct the exact transmitted PWM waveform but to accurately measure the time intervals between every two successive transitions in the received FSK carrier frequency.

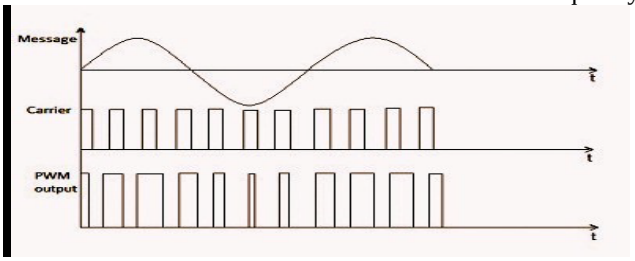

Figure:6 Pulse Width Modulation

4. Transmitter

The following diagram gives the entire transmitter section of the Wireless Power Transmission. The 230V alternating current is fed to the transformer is rectified with bridge rectifier in which the alternating current is converted to Direct Current and it is filtered and regulated with the voltage regulator. The flow of the signal without any interrupt to the transmitter input is denoted by an LED. It consists of a RESET switch denoted by which is used to reset the programming codes in the pic microcontroller. The signal is given to the PIC microcontroller PIC16F877A which has 40

pins and it has 5 input output pins and fifteen interrupts and its stability is maintained with a crystal oscillator circuit. This signal will be controlled by the pic microcontroller and the status of the signal is being informed with a help of an LCD display. This signal is being transferred to the RF module through MAX 232. Four MOSFET switches are being connected to each other so that current can pass through, by the switching between the ON and OFF states and the passcode will be generated in MAX 232 and sent through RF transmitter.

5. Receiver

The receiver operation is just the vice versa of the transmitter. The signal is being received to the receiving antenna from the transmitting antenna. The signal that transmitted from the RF transmitter will reachesthe RF module at the receiver. There is no separate power supply for the receiver section. The current induced in the induction coil is given to the secondary coil of the transformer. In the receiver section, only one MOSFET switch is used which allows current only in the ON state ie, when the signal reaches the RF receiver it will send the passcode to the MAX232 when the passcode matches then it will trigger the circuit and makes MOSFET switch in ON condition. The current passes to ensure that only the authenticated receiver receives the power signal.

6. Conclusion

In this paper, the concept of **Resonance Inductive coupling** it explicitily studied. The Wireless Power Transmission would replace the conventional inefficient technology. It will further reduce the dependence on the fossil fuel and other petroleum products that directly leads to the Global Warming.

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