

AN EFFICIENT IMPLEMENTATION OF WITRICITY USING PIEZOELECTRIC EFFECT

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Abstract: “Witricity” or wireless electricity is the fast growing technique in the real world. Several applications of “Witricity” have been developed. More than a hundred year ago the concept of WPT was proposed by Nikola Tesla. More portable electronic devices and consumer electronics are developed and used by WPT technology. The objective of this paper is to develop a concept of an efficient wireless recharging of mobile phone system. This system uses the concept of piezoelectric energy. In this paper, two mobiles are simultaneously charging and the charge is developed from a shoe embedded piezoelectric energy harvester. Therefore the system results WPT technology and thereby the device can charge at anywhere and anytime.

Keywords: Witricity; WPT; Harvester; Resonance; Metamaterials

I. INTRODUCTION

Wireless electricity is a fast growing technology at global research. Electricity is most essential in our daily life. There is a tremendous rise in the use of electronic devices. Most of them need recharging. So the WPT minimises the complexity of existing system. That means it avoids the use of external wires for charging the electronic devices. In this paper a shoe embedded piezoelectric energy harvester is used; that is fed on a mobile phone:1 for charging. Here a mobile phone:2 is charged by using “Resonant inductive coupling” [1] with mobile phone: 1. The main advantage of this system is to acquire energy in our smart phone [2] wirelessly. It avoids the complexity and the efficiency of this system is higher. Every smart phone users wishes a fully charged system at any time. By the development of wireless technologies, it becomes easily.

II. PIEZOELECTRIC POWER GENERATOR

It is an attractive approach for obtaining clean and sustainable electric energy from human motion. This means harvesting [4] mechanical energy. Piezoelectricity is electrical energy produced from mechanical pressure (such as walking, running). When pressure is applied to an object, a negative charge is produced on the expanded side and a positive charge on the compressed side of the piezoelectric crystal. Once the pressure is relieved, electrical current flows across the material. Wireless power or energy transmission is the transmission of electrical energy from a Power source (piezoelectric Power) to a load (such as any electrical device) without any physical connector; mainly such as chargers, cables/wires etc...

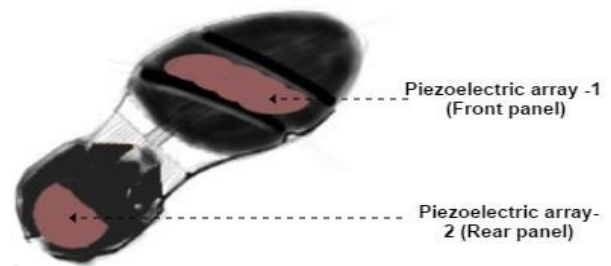


Fig: 1 Piezoelectric generator inside a shoe.

In this paper an energy harvester using piezoelectric effect is implemented. This concept can be used with a shoe. That means, here a shoe embedded piezoelectric energy harvester is the power source. The “Piezoelectric generator” is placed inside a Shoe[4]. A shoe has two points where the pressure exerted in maximum and they are the heel and the toe, and this is the exact place where the piezoelectric unit is placed. Fig: 1 shows the arrangement of the piezoelectric generator inside a shoe.

III. METHOD OF WORKING

Wireless power transfer uses “Inductive Coupling” by using resonant circuits [3]. “Electromagnetic induction” is the principle of operation in it. It works as a primary coil generating a predominant magnetic field and a secondary coil being within that field so a current is induced within its coils. This causes a relatively shorter range. This is due to the amount of power required to produce an electromagnetic field. Over greater distances, the non-resonant induction method is inefficient and wastes much of the transmitted energy just to increase range. An efficient WPT based mobile charging system can take from this paper. At a time, two smartphones can charge simultaneously. If the smartphone users are standing outside a building, then they can charge their phones easily by this technique. The method of working mainly based on “Witricity” technique. Power generated by the piezoelectric generator is stored in a capacitor bank. This is processed and transferring from primary to secondary coils; here secondary part consisting in smart phone.

1. Block diagram

The block diagram contains two sections; one is transmitter section and the other is receiver section. This system demonstrates an efficient wireless mobile charging system.

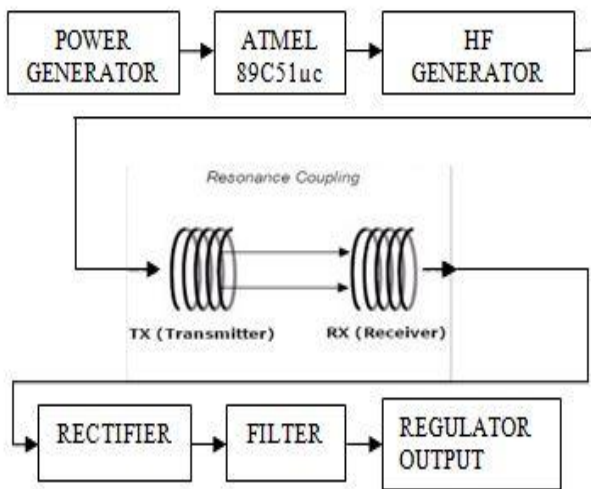


Fig: 2 Block diagram of WPT.

The power generator outputs are collected by a capacitor bank. A bridge rectifier [6] then rectifies these outputs. The rectifier having four diodes and the output is a pulsating DC. To get a pure DC output; the direct current is again filtered by capacitor filter. The filtered signal has low frequency range. That is fed to an ATMELEL microcontroller. Here "AT89c51 μ c" is used to generate HF (high frequency-20kHz) pulses. It is an 8 bit controller. The high frequency signal output from HF generator is given to primary coils. Primary coil is the transmitter coil. The principle of electromagnetic induction produces a current in the secondary coil. Here the secondary coil is the receiver coil. Here the principle of mutual induction takes place. Thus the developed current at the receiver is then rectifies by a bridge rectifier. Then it filtered for purification. Then a regulated output is obtained by using voltage regulator. For the application of mobile charging we create a low voltage DC supply.

2. Theoretical background

Coupling between two resonators produces current due to electromagnetic induction. Power is transferred over short distances by magnetic fields by using inductive coupling. This will occur in the case of near field or it is irradiative techniques. But in the case of radiative or far-field technique, transmission of power is takes place by beams of electromagnetic radiation. Spiral coils are used as transmitting and receiving coils for power transfer. In figure below, it shows the spiral geometry of coils. The efficiency of inductive energy transfer via high-frequency fields is, nothing like one would get were a wire connection to be used. But, in theories, the use of the metamaterial [6], it should be capable of increasing the efficiency of the power transfer system when it can only be placed where the transmitting coil can also be placed. The "metamaterial" is placed at the position of the transmitting coil for high efficiency.

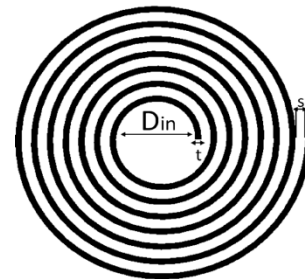


Fig: 3 Spiral geometry of coil.

It is the most critical part of the high frequency excitation and transmitter coil and the receiver coil design. Radio frequency excitation directly determines the entire frequency range of the energy transmission system, and the parameter transmitting coil and a receiving coil for energy transmission efficiency.

3. Power supply and rectifier units.

The power supply generates a dc output power. In this paper a power supply unit is used for to initiate the microcontroller unit. A bridge rectifier is used here to convert AC to DC. Filter circuit is used for filtering pulsating DC to make it pure.

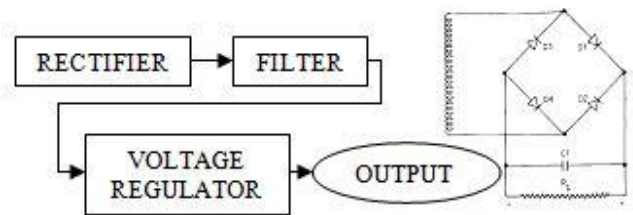


Fig: 4 Schematic blocks of power supply unit and a bridge rectifier diagram simultaneously given.

The use of bridge rectifier is preferred because of their important features compared with other types. They are;

- High current output of full-wave rectifier has been retained.
- Here the center tap has been eliminated from secondary winding.
- Peak inverse voltage impressed on the non-conducting diodes has been reduced from 2E to E volts.
- The AC ripple frequency has been maintained at twice the line-voltage frequency.
- An output voltage equal to secondary peak voltage.

It is the simplest and cheapest circuit. We can generate various DC output powers depending on the application.

IV. PARALLEL CHARGING

It may consider three phones are charging together. In this paper; first smart phone gets charge from piezoelectric effects. It always acts as an energy transmitter and this allows WPT technology to other mobiles. It is easy to charge multiples smart phones simultaneously even if the users are in a remote area. When a person walks, pressure is exerted on the ground and this pressure can be converted into electrical energy and it can be used to power smart phone.



Fig: 5 Charging a smart phone using another smart phone.

Note that the two smart phones are parallel placed. The electromagnetic induction takes place between the mobiles; thus energy is transmitting. Here one of the smartphone is acts like a transmitter while the other is a receiver. The WPT technology is inserted in these phones for its proper operation.

V. ADVANTAGES

- It avoids external cable connectors and adapters. So the physical complexity of the system decreases and therefore the system can carry easily.
- Multiple devices can charge easily. That means it allows a great platform for charging surface.
- It is not a harmful technique to the ecosystem. Because it produce non radiative energy transfer.
- The use of metamaterial allows high efficiency. Its mode of transmission is omnidirectional.
- This system reduces e-waste.

VI. CONCLUSION

The transmission of electricity without wires is not a theory; it is an implemented technology. Also it is an improving technique. The electrical energy can be economically transmitted wirelessly to any terrestrial location. This paper presenting an improve WPT technique. Under these, an efficient power atmosphere can be creating. It is an easy way to build a multiple smart phone charging method. Without the use of any external electricity; WPT is developed here. For that purpose, an embedded shoe works on piezoelectric effect is presented here.

VII. FUTURE SCOPE

WPT is a fast growing technique and is developing in day by day. There is a wide future path for experimenting different metamaterials. The efficiency of the system doesn't reach at its fulfillment. So it can make as possible. This will stimulate additional creative ways in which to apply the technology, not only bringing convenience to some everyday tasks such as battery charging, but also enabling uses in ways only limited by one's imagination. There is another path for harvesting energy without any use of complex systems. Many aspects are need to developing a WPT system.

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