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Piezoelectric Wireless Mobile Charger

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Abstract : *When a person walks, there is a pressure exerted on the path.The pressure exerted is being wasted.This wasted energy can be utilized in many ways.with the presence of new technology, the wasted energy is used for charging portable devices via mid-range wireless power transfer technique.The principle behind wireless power transmission is electromagnetic induction. Piezoelectric generator is placed in the sole of a shoe in order to harness the wasted energy. Energy produced by piezoelectric generator will be approximately 1Volt, in order to get sufficient voltage for charging the device, an interleaved boost converter is used.*

Keywords : *Electromagnetic induction, piezoelectric generator, portable devices, wireless power transfer (WPT)*

I. Introduction

In recent years, 97% of total members are smartphone users. As we know, smartphone has short battery life. So every smartphone utilizer wishes if he had more battery life. In order to satisfy their wish we present a new technique-piezoelectric wireless power transfer mobile charger. In this paper, we mainly focus on wireless power transfer technique.

Utilization of wasted energy from human locomotion is much relevant. The wasted human bio-energy if it can be made for utilization, it will be a subsidiary energy source [2]. Piezoelectricity is the electrical energy which is obtained from mechanical pressure such as walking running etc. When a person walks with piezoelectric shoe, the pressure exerted is maximum at toe and heel. When pressure is applied to the shoe, a negative charge will be produced on the expanded side and a positive charge on compressed side of piezoelectric generator. As the pressure is released, electric current flow across it. The piezoelectricity produced from this pressure is used for charging the mobile, through WPT technology.

II. Literature Survey

The idea of harnessing energy by using shoes came out by mentioning that "the average person spends a significant part of the day on foot, dissipating abundant energy into the sole of a shoe. With appropriate adaptations, shoe-mounted energy-scavenging systems are likely to power portable devices[4]. In our paper a Mobile charging system is designed by a piezoelectric generator is placed in the shoe. The power that is generated by piezoelectric generator when a person walks is transferred to the device for charging purpose.

Piezoelectric Disc is used to convert vibrations of feet into electrical energy. Energy is AC which is converted to DC and then boosted by using DC to DC boost convertor. For storing the electrical signal, "Lithium Batteries" are used [1].Our paper also deals with the same concept of [1] except that the harvested energy is used for mobile charging technique. Practical miniature devices are available for harnessing kinetic energy as a substitute for batteries in medical, and many other, low power applications. This paper main goal is being able to utilize the data we've accumulated in the shoes to something subsidiary[5]. High power high efficiency WPT system using the class E operation for transmitter via inductive coupling technology is used. Our project deals with electromagnetic induction technique[3].

III. Methodology

Generation- transmission unit

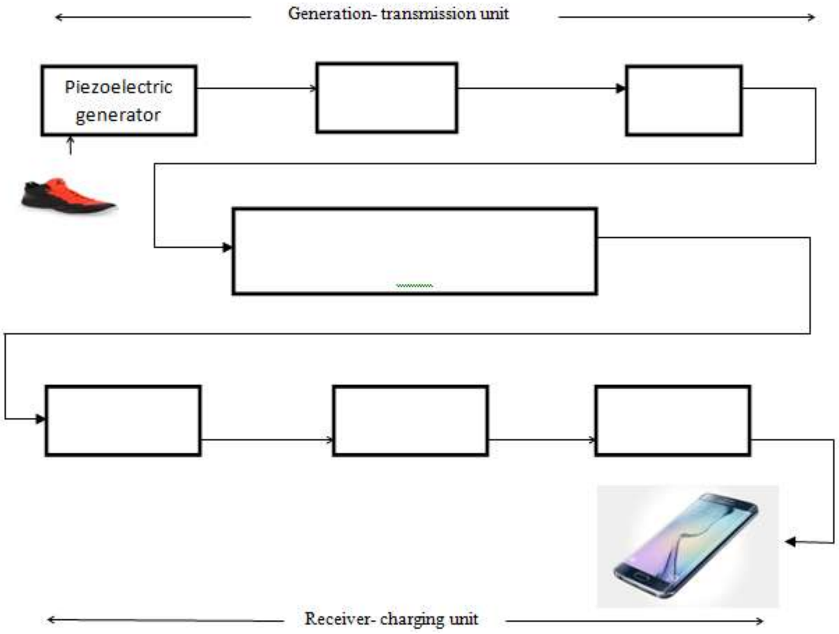

Fig.1 Block diagram of Piezoelectric wireless power transfer mobile charging technique.

The block diagram of piezoelectric wireless mobile charging technique consists of two units. Generation- transmission unit and receiver- charging unit. The Generation- transmission unit side consists of a shoe where the piezoelectric crystal is being placed, rectifier where rectification takes place and inverter converts dc into ac. The transmitter (TX) unit it transmits the energy produced from piezoelectric to the receiver coil. This unit is integrated inside the shoe. Receiver- charging unit consists of rectifier converts ac into dc, boost convert increases the rectified voltage and charging circuit where the mobile is charged. Capacitor bank is used for energy storage. Rectification circuit convert ac to dc. This can be either designed mobile independent or embedded inside the mobile. Here we are designing it independently. Piezoelectric generator is placed inside the sole of the shoe. A shoe has two points, heal and toe where the pressure exerted is maximum. This is the place where piezoelectric unit is placed and they are connected in series. At the front panel the units are placed in linear arrangement and the rear panel the units are placed in a circular arrangement. Energy obtained from the piezo is stored in the capacitor bank and it is transmitted wirelessly through electromagnetic induction. Receiver side receives the energy and is converted to dc for charging purpose.

IV. Simulation

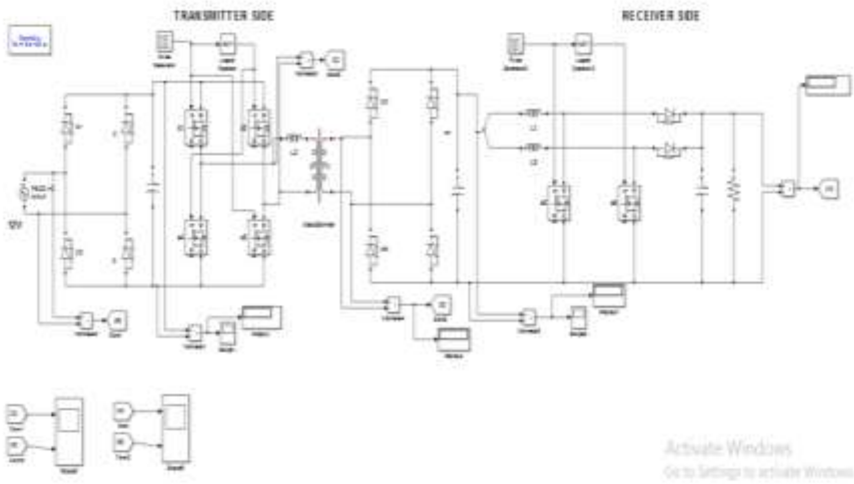

Fig.4 simulaton circuit

In the simulation circuit it mainly consists of two parts first is transmitter side and the other is reciever side.Transmitter side consists of rectifier, inverter and a transmitting coil (TX).The reciever side consists of receiving coil (RX),rectifier, interleaved boost conveter and charging circuit.Piezoelectric generator is the ac source in this circuit ,which is coverted into dc by means of a rectifier and filter the waveform by using a capacitor.Inverter circuit convert the dc into high frequency pulsating ac for wireless tranmission via TX coil.RX coil recieves the high frequency ac and is converted into dc for charging the portable devices.

Output and Results

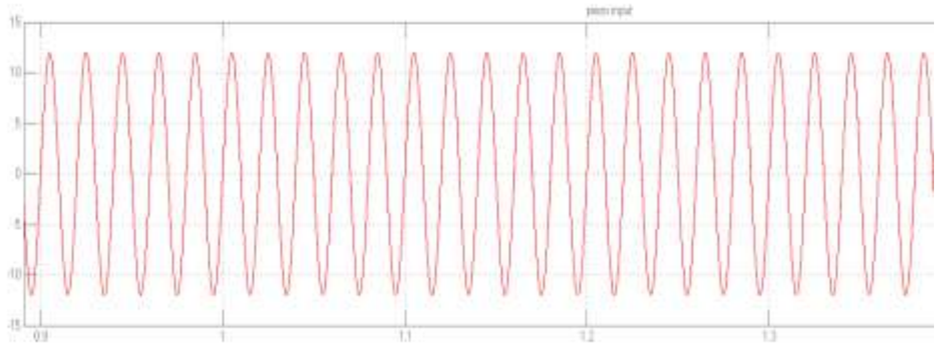

Fig.5 Piezoelectricgenerator input

Fig.5 shows the input ac source from piezoelectric generator.In the graph X axis represent the time and Y axis represent voltage.Theorytically the voltage produce by the piezo is set as 12V as shown in the above graph.

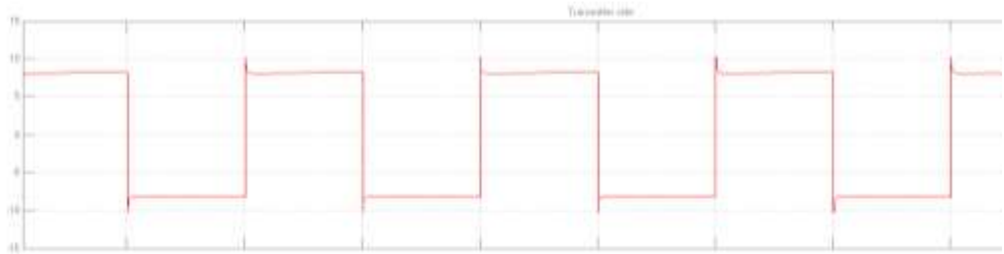

Fig.6 input at coil Tx. (after inverter)

Fig. 6 shows the graphical representation of output from the inverter. Output of the inverter is approximately 8V.

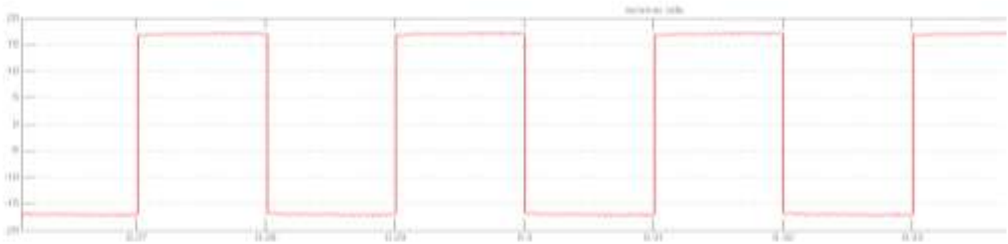

Fig.7 output at coil Rx.

From the graph it can be seen that, the output got at the receiver coil is approximately 16V. This is obtained because the number of turns ratio is 1:2.

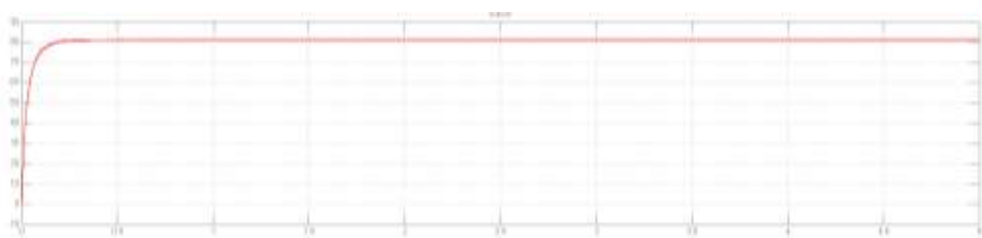

Fig.8 final output

Fig.8 shows the output voltage of the interleaved boost converter. From the graph it can be seen that, the boosted voltage is 80V.

V. Hardware

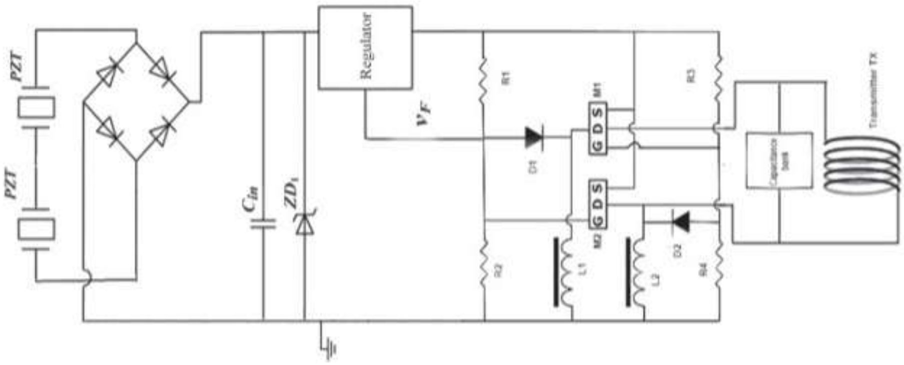

Fig.2 Generation and transmission circuit

Generator and transmission side of the piezoelectric wireless power transfer mobile charging technique is given in Fig 2. Piezoelectric generator produce ac output, this is converted into dc using rectifier. The output obtained from rectifier will be a pulsating dc and this pulsating dc is converted into a constant dc using the capacitor, it also helps to reduce the ripples. Zener diode is used for producing constant voltage. Here MOSFET act as an inverter circuit, where dc is provided to the source(S), colpittz oscillator acts as a self-producing ac oscillator. This ac is transmitted wirelessly through the coil.

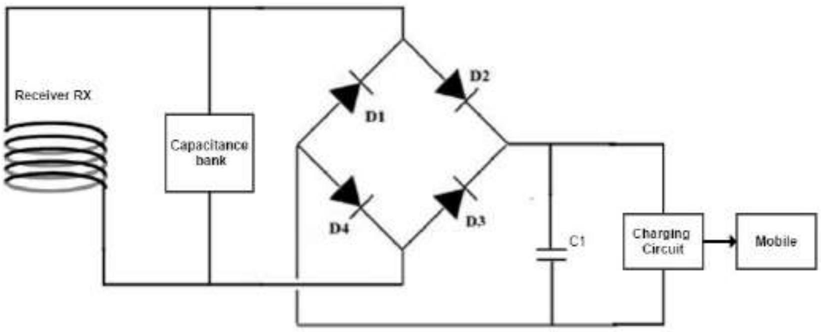

Fig.3 Receiver and charging circuit

Circuit of the receiver and charging side is shown in Fig 3. It can be seen that the receiver and the capacitance bank are connected in parallel and a rectification circuit is also connected. This circuit converts the supply into DC form, and the charging circuit is powered which in turn charges the battery in the device.

VI. Conclusion

In this paper we have illustrated the design of system which can harness the power generated by the human movements and this power is transfer to a device wirelessly. Harvesting mechanical energy from human motion is a very attractive method for obtaining sustainable electric energy. There are several methods available for harvesting human energy. From all of these methods piezoelectric energy harvesting is the most promising method.Piezoelectric materials associated with DC-DC step up converter provide maximizing the harvested energy. By using Wireless power transmission we can reduce the transmission and distribution losses and increase efficiency to some extent. The techniques used for wireless power transmission are Induction, Electromagnetic transmission,Evanescent wave coupling, Electrodynamics induction, Radio ,microwave Electrostatic Induction ,Laser etc. Wireless electricity technique used here is based on strong coupling between electromagnetic resonant coils to transfer energy wirelessly between them. It ranges the power transmission over a distance less than 2 m. This technology is very attractive for low power portable electronic devices such as pacemakers, flashing LEDs at night, mobile phones and hearing aid devices. This paper holds the solution to the quandary virtually every smartphone users. Around 1.8 Billion people use Smartphone, and almost every smartphone user wishes he had more battery and a way to charge it anytime. We believe that this research holds the key to an uninterrupted way of using smart phones. This project has its root in all the areas of consumer electronics.

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