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RESEARCH ARTICLE

MOBILE TO MOBILE WIRELESS POWER TRANSFER TECHNOLOGY

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ABSTRACT

In this present mobile world where people find no boundary for this valuable devices ranging from banking, e-ticketing, entertainment, social contact, Internet etc. This valuable technology becomes the fundamental needs in the fast changing 21 century. But most importantly technology where we put all the valuable information, data of our life has *limited backup battery*. Our paper *Mobile to mobile wireless power transfer* aim to wipe out this limitation by giving another feature of charging through the matrix of air from mobile to mobile. In this paper the transfer of electric energy or power over a distance without the use of wires, here the energy to be transferred safely coupled resonators are used through transmitter and receiver Tesla coil. Coupled resonators are two objects of the same resonant frequency that exchange energy efficiently without much leakage. Minimizing energy leakage is very important because the goal is to have much energy as possible be transferred from one object to another. For tomorrow transfer of energy from one mobile to another will give wider vista of battery backup flexibility whenever we go for whatsoever we required for our information in real-time situation.

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INTRODUCTION

Human have achieve different heights in different dimension in the brief scale of Earth time. With the evolution of different feature in human genome starting before 10,000 year ago still it continuing with change of time and nature. Similarly technologies also evolve with us in a fast face, now again another technology which not only evolves in time but that can also revolutionize the world in the wireless power transfer technology. Conventional methods of charging mobiles are all wired. The chief advantage of using wired charging is that it is inexpensive. However, with the new technologies being developed, wireless charging will soon replace these traditional methods as an inexpensive. Wireless power transmission is the transmission of electrical energy from a power source to an electrical load without the use of physical conductors; here the power sources and portable devices are specially designed using magnetic resonators that efficiently transfer power over large distances via the magnetic near-field. The power is transferred at resonate frequency to increase the efficiency of power transferred wireless charging gives a protected connection. This paper provides an idea about how resonant inductive charging works, its advantages, limitations and different applications where it can be used. It works on the principle of mutual induction between the two, transmitter and receiver coils.

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The basic principle of an inductively coupled power transfer system. It consists of transmitter coil L1 and receiver coil L2. Both coils form a system magnetically coupled inductors. An alternating current in the transmitter coil generates a magnetic field which induces a voltage in the receiver coil. This voltage can be used to power a mobile device or charge a battery. The efficiency of the power transfer depends on the coupling (k) between the inductors and their quality (Q).

Literature Survey

The idea of inductive power was made possible in 1888 when German physicist Heinrich Hertz proved the existence of electromagnetic waves by creating a spark gap transmitter and receiver. A spark generated by the transmitter also created a small spark in the receiver, which could be seen with a microscope. Serbian American inventor and engineer Nikola Tesla learned of Hertz's work by the following year and began duplicating his experiments. By 1891, Tesla had developed a high-tension induction coil, which he used to demonstrate wireless energy transmission. He successfully presented his technique to the *American Institute of Electrical Engineers* and the *National Electric Light Association*. By 1894 Tesla had developed the equipment to wirelessly light incandescent lamps at his New York laboratory. This method used resonant inductive coupling, which involves tuning two nearby coils to resonate at the same frequency. By 1896 he had increased the range of transmission to 30 miles (48 km). Tesla began

construction on his Wardenclyffe Tower, designed for wireless broadcasting and power generation, in 1901. After several construction delays and technical setbacks, the project ran out of funds a few years later and was eventually demolished. After this, no significant advances were made for more than 50 years. In the early 1970s, experiments with RFID tags began and by the early 2000's Professor She Yuen (Ron) Hui and S.C. Tang developed a charger to provide resonant power transfer for small electronics. Today wireless power is used for everything from industrial motors to charging Smart phones and tablets. Researchers predict that wireless power will be making a significant contribution to energy supplies by the end of this decade. Power Mat 3X is a sleek, slim three position wireless mat from home and office. A magnetic attraction between every receiver and each access point on every mat assures that alignment is precise and the most efficient charging occurs.

Fig. 1. Power Mats 3X

Communication between the mat and the receiver allows the mat to deliver an exact amount of power for the proper length of time so that the transfer of power is safe and efficient and no energy is wasted. When the device reaches full charge, Power is shut off the device, which avoids overcharging of the device's battery as well as save energy; the system will monitor the status of the battery in the device.

Proposed System

The proposed system consists of voltage booster circuit, Buffer circuit, transmitter circuit, receiver circuit, one acceptor mobile unit and donor mobile unit. From the donor mobile unit we get 3.2 to 3.7 volt DC. This DC voltage is send to buffer circuit in order to reduce loading effect and then it is sent to the transmitter circuit. From transmitter circuit by using the Tesla coil it was radiated and received by the receiver circuit.

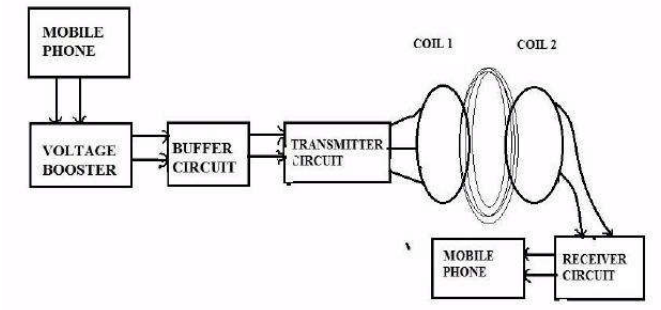

Fig. 2. Block Diagram

Due to induction process between the two coils, we get required EMF at the receiver coil of the receiver circuit. Then the AC component is rectified by rectifier. The output of the rectifier is given to a capacitor to reduce the ac voltage. Then output voltage is regulated by using a Zener diode of 5.6v. The final output is given to the acceptor mobile unit.

Voltage booster circuit increases the voltage from the donor mobile unit from 3.2-3.7 V to 12V. Due to fast Switching action of the Schottky diode 1N5822 and minimum voltage drop, we get our required voltage with minimum losses. The 680µf capacitor (c3) will remove unnecessary AC components.

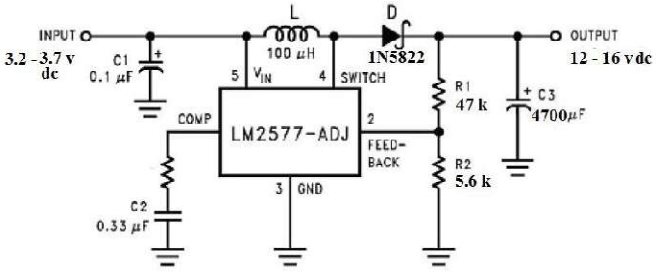

Fig. 3. Voltage Booster Circuit

Buffer circuit is to reduce the loading effect. The loading effect comes in to picture whenever we have connected our transmitter circuit to voltage booster the voltage is suddenly dropped to 0Volts so, in order to reduce this effect we are using voltage follower circuit along with current follower.

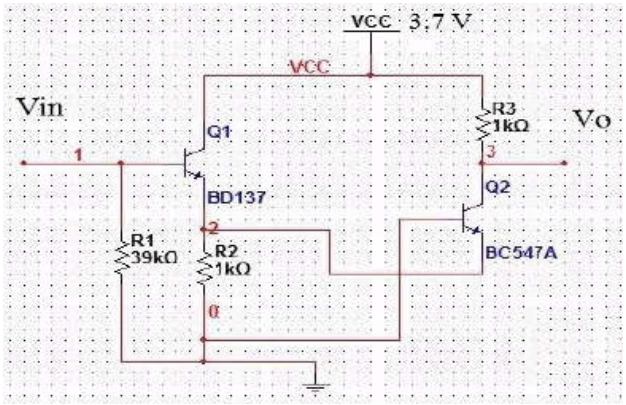

Fig. 4. Buffer circuit

The voltage driven from buffer circuit is fed to transmitter circuit here we are using required capacitor and resistor circuit which generates required frequency and it is fed to Tesla coils by using capacitors. Output of the buffer circuit is given as input to the transmitter.

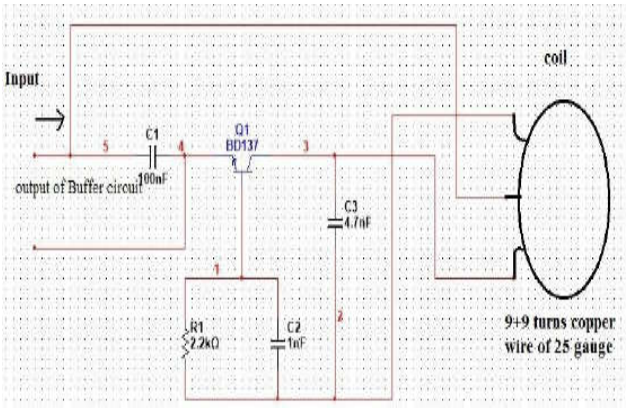

Fig. 5. Transmitter circuit

The receiver circuit uses Tesla coils to get sufficient power and by using capacitor the receiver is tuned to same frequency. By using bridge rectifier circuit we get output voltage as 5.6V max. Here the C1 is same as the capacitor used in the output side of the transmitter. The output of the capacitor C1 is given to the Bridge rectifier. There are three types of rectifiers in which bridge rectifier is efficient one. There are some reasons for using bridge rectifier, they are simple circuitry and less cost. The output of the bridge rectifier is given to the capacitor. This capacitor is called as smoothening capacitor. The smoothening capacitor is used to eliminate ac components presented in the input signal.

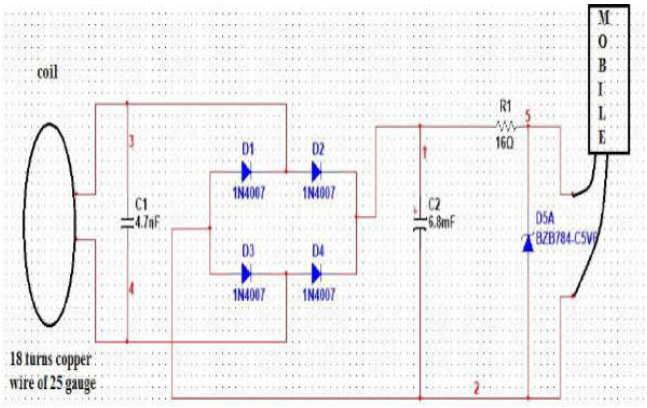

Fig. 6. Receiver circuit

The output of the smoothening capacitor is given to the Zener diode. The Zener diode is used for voltage regulation. The 5.6v Zener diode is used here, which means the maximum voltage output of receiver is 5.6v so, that we have achieve voltage regulation. Finally the voltage is given to the mobile unit which is acceptor mobile.

Wireless Power transfer

Wireless energy transfer or wireless power transmission is the process that takes place in any system where electrical energy is transmitted from a power source to an electrical load without interconnecting wires. Wireless transmission is useful in cases where instantaneous energy transfer is needed but interconnecting wires are inconvenient, hazardous, or impossible. Wireless energy transfer is different from wireless transmission of information, such as radio, where the signal-to-noise ratio or the percentage of power received becomes critical only if it is too low to recover the signal successfully. With wireless energy transfer efficiency is the more important parameter. The most common form of wireless power transmission is carried out using *induction*, followed by *electro dynamic induction*. Transmission of electrical energy from one object to another without the use of wires is called wireless transmission. Consider two self-resonating copper coil of same resonating frequency with a diameter 20 inches each. One copper wire is connected to the power source (transmitter), while the other copper wire is connected to the device (receiver). The operating frequency is determined by using formula f=1/ [2πRC]. The coils are wrapped around hallow ferromagnetic core in a circular shape. 25-gauge copper wire with enamel covering for insulation is used for windings. Note that the two coils will ideally only be separated by the thickness of the plastic.

Where F = Frequency in Hertz,
R = Resistance in ohms,
C = Capacitance in Farads.

Here we have used R = 2.2 KΩ, C = 1nF, then the equation becomes as below

F = 1/ (2π*2.2KΩ*1nF)
F = 76 KHz.

RESULT ANALYSIS

The basic characteristics of mobile to mobile wireless and contactless power transfer technology, reviewing advantages and limitations along with examples of typical applications has been implemented. The use of wireless inductive power transfer technology as the alternative way to charge a mobile unit. Mobile to mobile wireless power transfer technology project have been tested under sufficient conditions and thus result are recorded as follows

Homogeneous testing: Input voltage (3.2-3.7) V

Basic mobile to basic mobile testing:

Table 1. Basic Mobile to Basic Mobile Testing

Distance(cms)	Output Voltage(v)	Charging Condition
0.5	5.60	Yes
1.0	5.56	Yes
1.5	5.53	Yes
2.0	5.50	Yes
2.5	5.49	Yes
3.0	5.30	Yes
3.5	4.60	Yes
4.0	3.70	No
4.5	3.30	No
5.0	3.10	No

(ii) Smartphone to Smartphone testing:

Table 2. Smartphone to Smartphone testing

Distance(cms)	Output Voltage(v)	Charging Condition
0.5	4.50	Yes
1.0	4.45	Yes
1.5	4.43	Yes
2.0	4.40	Yes
2.5	4.21	No
3.0	4.00	No
3.5	3.80	No
4.0	3.60	No
4.5	3.40	No
5.0	3.29	No

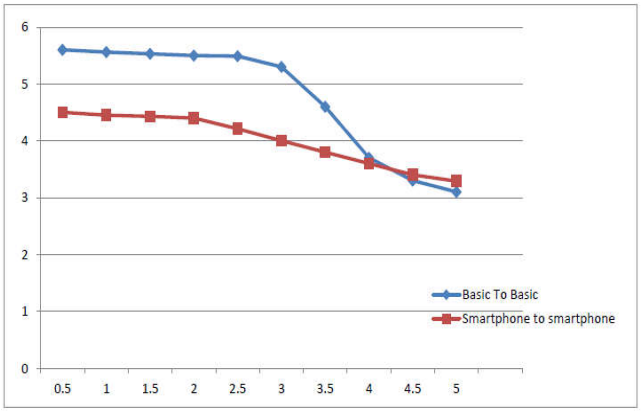

Fig. 7. Graphical analysis of homogenous testing

b) Heterogeneous testing: Input voltage (3.2-3.7) V

(i) Basic mobile to basic mobile testing:

Table 3. Basic mobile to Smartphone testing

Distance(cms)	Output Voltage(v)	Charging Condition
0.5	4.60	Yes
1.0	4.51	Yes
1.5	4.44	Yes
2.0	4.30	No
2.5	4.20	No
3.0	3.50	No
3.5	3.20	No
4.0	2.80	No
4.5	2.50	No
5.0	2.10	No

(ii) Smartphone to Smartphone testing:

Table 4. Graphical analysis of Heterogeneous testing

Distance(cms)	Output Voltage(v)	Charging Condition
0.5	5.70	Yes
1.0	5.66	Yes
1.5	5.60	Yes
2.0	5.50	Yes
2.5	5.35	Yes
3.0	5.00	Yes
3.5	4.50	No
4.0	3.80	No
4.5	3.50	No
5.0	3.25	No

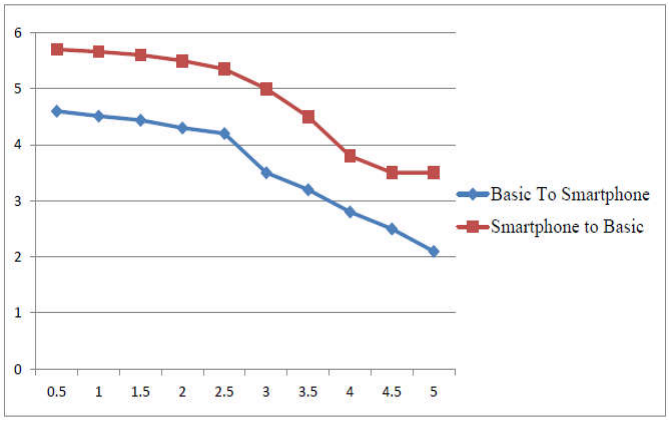

Fig. 8. Graphical analysis of heterogeneous testing

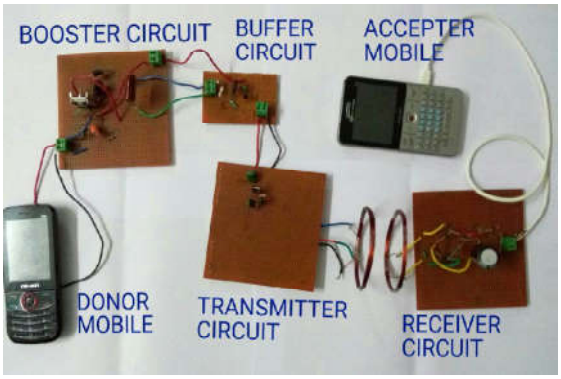

Fig. 9. Output prototype

By wireless induction process the power is transfer from on mobile to another mobile unit. When the induction frequency is around is 76 KHz we get our transmission power process in continuous momentum. According to the change of the receiver circuit from the transmitter circuit we get different voltage output. At around 2.5 cm of distance we are getting output for the mobile phone. Later on increasing distance we are getting different outputs at different distances.

Conclusions

Mobile to mobile wireless power transmission technology is developed to transmit electrical energy from mobile to mobile without using wires. This technology has improved substantially. Wireless mobile to mobile power transfer technology which works on the principle of resonance induction hols great promising future in the field of wireless charging. By using this technology we can charge our mobiles at some distance at any instant of time. This technology shows a lot of scope to replace a wired charging in the very near future it gives a future of charging. This technology has improved but still consists of various drawbacks which need to be researched upon in order to commercialize it in large scale.

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