

Wireless Power Transmission between Phones - Review

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ABSTRACT: In this era of Smartphones, when these have become the backbone of our life, charging them is one of the most essential tasks of our day to day life. For charging them, we are still dependent upon the conventional method of using wired charger. Sometimes we are in immense need of charging our phones but we don't have our charger or we don't find the power source. In that case, we use our power-banks but we all know that they are not handy. They are like a burden, which we have to carry everywhere. But what if we can share charge among phones just like we share files. In this review, Bidirectional dc to dc converters will be used to transfer power in both directions. Bluetooth will be used to trigger the circuit and for the connection of phones. So, if both mobiles have built in transmitter and receiver, they can easily share charge between them. This is very helpful to transfer the charge from one mobile to another in case of urgency and difficult situations.

KEYWORDS: WPT, Wireless Power Transfer, Wireless Power Transmission between Phones, Qi, Reverse Wireless Charging

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1. INTRODUCTION

An American science fiction film, named "In-time", portrayed the imagination of using time as the currency. It was shown in the movie that the age of all the people stopped at the age of 25. The time from 25 years of age till death of a particular person was converted into money, as the person approached death, day by day and everyone had watch on their wrist which counted down how much they have to live.

So, there was a pressure of decreasing wealth over every individual, with every passing moment. Our present situation is also relatable with the movie's scenario. The only difference being that the wealth has been replaced by phone charge. Although our smartphones are provided with a certain battery life, we occasionally find us in situations when our battery is dead and there is no way of charging it.

In this review, we present a research on Reverse Wireless Charging (Wireless Power Transfer within two phones). This will allow one phone user to share charge with another phone user. This would make charge a sharable commodity. Wireless power transfer (WPT) or wireless energy transmission is the process of transmission of electrical energy from a power source to an electrical load or a consuming device, without using the wires or any other conductors. Wireless Power Transmission is basically, a category of power transfer which includes a number of different power transmission technologies using time-varying electric, magnetic, or electromagnetic fields. In wireless power transfer, a wireless transmitter draws energy from the power source and transfers it via electromagnetic field across an intervening space to one or more receivers and then the receiver converts it back to an electrical current and then utilizes it [1]. This technique is much beneficial as it eliminates the use of interconnecting wires and thus reduces the electrical hazards such as getting electrical shock. Wireless

Power Transmission can be categorised in 2 ways, non-radiative and radiative [2]. In non radiative technologies, magnetic field is generated by producing magnetic field by the principle of induction and Faraday's laws of electromagnetic induction, between two wire coils.

It can also be done by producing electric field by applying voltage across two metal plates (capacitor). These magnetic or electric fields are then used to transfer power. This technique is used in RFID tags [6], Smartcards, artificial cardiac pacemakers and also in charging of electric vehicles. In radiative far field techniques, power is transferred by beams of electromagnetic radiation, directed from transmitter to receiver, like microwaves or laser beams. This technique is more efficient way of transmitting power as it can transport energy to a longer distances but must be aimed at the receiver. But we can't use this method for our purpose as it can be hazardous to health. Also the receiver should be in line with receiver, making it a bit incompatible. So in most of the cases, the concept of inductive charging through electromagnetic resonant coils is used. The transmitter and receiver are made sensitive to a specific resonant frequency by adding a coil and a LC circuit to it. This allows efficient transfer of power for close coil proximity and it drops quickly as distance increases. Although the applications of WPT were traditionally limited (like in implanting pacemakers), nowadays it is receiving huge attention from mobile manufacturers. In commercial market, there are some wireless power standards like Qi. Qi is an open wireless power transfer interface standard. It uses the method of inductive charging over distances of up to 4 cm (1.6 inches). It has been developed by the Wireless Power Consortium. In this system, there is a charging pad and a device, which is compatible with wireless power transfer, is placed on the top of the pad. The pad then, charges it

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by resonant inductive coupling. According to the Qi specification, a power below 5 W is delivered using inductive coupling between two planar coils. These coils are typically 4-5 mm apart but can be up to 40 mm and possibly farther apart[3].

But now WPT is not only restricted to charging the Wireless Charging supported devices, rather it has expanded its domain. Samsung and Huawei have introduced Reverse Wireless Charging in their respective flagship phones. The theory of electromagnetic radiation by Maxwell was one of the major building blocks of today's much considered wireless technology. Later to this discovery, a series of inventions and theories came in front that further increased the interest of researchers towards the wireless era.

The great scientist, Nikola Tesla, invented an apparatus namely, Tesla coil, which produced an alternating current of high voltage and high frequency, that could light up 200 lamps simultaneously, without even using the wires. This putting a big step forward towards the modern wireless era.

2. PROPOSED MODEL

To overcome the disadvantage of the wired charging system we use wireless charge transfer between two devices. One of them acts as transmitter and other acts as a receiver. An app has to be used to control the whole process, which will use Bluetooth for its communication with other device. It should have ON and OFF switch in transmitter phone. Pressing the ON button will mean that we have initiated the charge transfer while pressing the OFF button will indicate that there is no transferring of charge. Since, all our proposed circuit will be external for experimental practices, we need to use a small LCD(Liquid Crystal Device) to display the information regarding the receiver device whether charge is transferring or not from transmitter to the receiver.

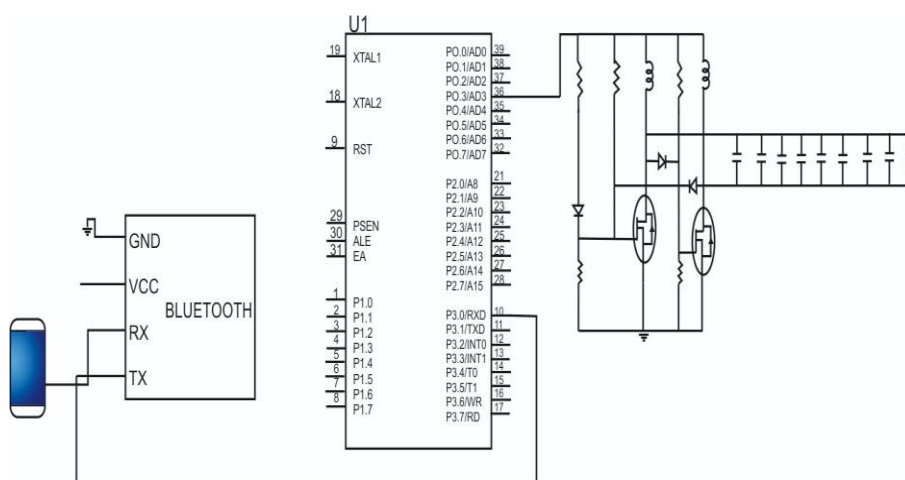
3. THEORY

3.1 TRANSMITTER SECTION

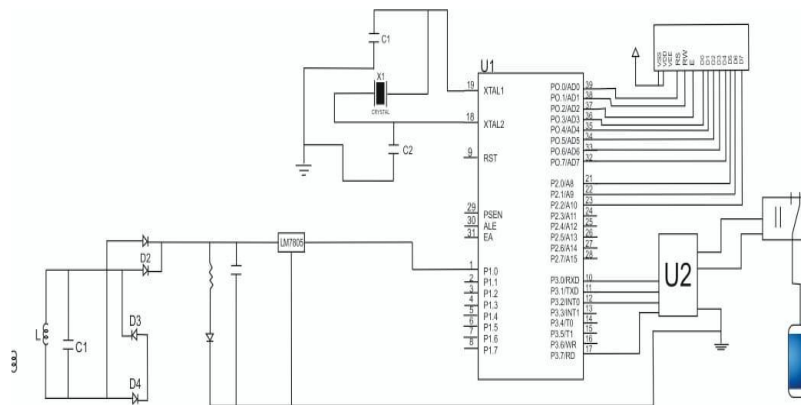
In a wireless power transmission system, a transmitter is a device, which transmits power across space to a receiver device by generating an electromagnetic field which varies according to time and then receiver generates power from the field and supplies it to an electrical load. Basically, it is the section from which, charge has to be transferred. In our case, it is that mobile phone from which, we want to transfer charge to our device. When we initiate the circuit, the charge from the transmitter needs to be converted to DC. For this purpose; we can use Diodes and Capacitors. Now this obtained DC current is given as an input to the microcontroller.

Here, PIC(Peripheral Interface Microcontroller or Programmable Intelligent Computer) has been used. But we need to tune the microcontroller kit first. For this, we will use Crystal Oscillator. Oscillators are used to provide clock to the microcontrollers. It provides timing for different operations to be performed by microcontroller, as every instruction is executed in synchronization with clock. We have used crystal oscillator instead of other oscillators as they are more accurate, low cost, small size, low power consumption and can be used to produce high frequencies. They work on the principle of inverse Piezoelectric Effect, i.e, when we apply electric field across certain materials (piezoelectric materials), mechanical deformation is produced in them[4]. Thus, it generates electrical signal of specific frequency by using the resonance of the vibrating crystal. For our purpose, oscillator should be of 10Mhz, ideally.

Now, we need to transfer required charge to WPT section. This is done by using a relay driver. This WPT in turn heats up the primary coil in transmitter section. We here use RS232 interface in the transmitter section in order to make efficient interface for transferring of data over the components. RS-232 is a standard communication protocol used to establish a link between a computer and its peripheral devices to allow serial data exchange. In simple terms, RS232 is used for exchanging data, bit by bit, between the computer and its peripheral devices[5]



3.2 RECEIVER SECTION



It is the device, which extracts power from the field produced by transmitter. Since we are transferring charge from mobile phone to mobile phone, receiver section is also a mobile phone here.

When we bring primary coil (of transmitter section) near the receiver's mobile, the secondary coil gets induced, which results in the production of current. The current produced due to this induction is given as an input to the receiver module. This current in-turn initiates the receiver circuit. But we need a voltage regulator, in order to tune the required voltage. Here also, we use a PIC Microcontroller to interface with the external peripheral devices. Since, all our proposed circuit is external, so we made output port as the USB port, so when the current is regulated and supplied by the circuit the mobile at the other end of the USB gets charged.

4. IMPLEMENTATION

Since we are working on wireless charge transfer and it needs the communication of two mobile phones, there must be an app which we can use to regulate the process. We can develop this app according to our requirements using XAMARIN or ANDROID STUDIO or whatever platform we want to use. But it is advisable to develop an app which is independent of OS so that an Android device can communicate with an IOS device or a Windows device. We have already discussed that it must have ON and OFF buttons for initiating and stopping charge transfer. Also, we need to have a bluetooth in Tx section and we need a bluetooth to search Tx Bluetooth as the circuit is external. In future enhancements, we won't need to search bluetooth.

5. CONCLUSION

Wireless Power Transfer for Mobile Phone Applications has been successfully designed by us. The component that we developed can be used in 2 ways,

i.e., either as external component or as internal component. This entire circuit when designed and made Nano, it can be definitely adjusted in a smartphone as on an average smartphones have a size of 5.5 inch. So it can easily be made as a design in the backside of the mobile (internal component). This can also be used as an external device that has a USB output port, the input for this device will be the charge from the mobile from which charge is to be transferred. Whatever may be the device that is connected at the other end of the USB port gets charged easily.

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