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Witricity for Mobile Charging Application

Praveen Paul[1], Vishnu Velayudhan[2], Arunkumar K.T[3], Ejin Thomas[4], Ashna Joseph[5]

Student Dept. of EEE, MBITS Engineering College, Nellimattom, Kerala, India[1 - 4]

Assistant Professor, Dept. of EEE, MBITS Engineering College, Nellimattom, Kerala, India[5]

ABSTRACT: Witricity is a recent technology for wireless power transfer over a limited distance. In this paper, the application of witricity for mobile charging is investigated. Wireless charging through inductive coupling could be one of the next technologies that will bring the future near. Here it has been possible to charge mobile wirelessly via inductive coupling. It minimizes the complexity that arises out of existing charging system. In addition, this paper also opens up new possibilities of wireless systems for our day to day needs like charging iPod, laptop battery, pace makers, propeller clock wirelessly. This concept is an Emerging Technology and in future the distance of power transfer can be enhanced as many researches are going on.

KEYWORDS: Witricity, Transmitter, Receiver

I.INTRODUCTION

In this era of modernization, electricity has become an inevitable part of life. Conventionally electricity is transmitted and distributed by using electric wires. Continuous research and development has brought forward a major breakthrough, which provides electricity without the use of wires called witricity. Wireless power transmission is in fact the means to power devices without a built in power source such as generator or battery. Wireless charging through inductive coupling could be one of the next technologies that will bring the future near. In this paper it has been possible to transmit electrical energy without the use of connecting wires. The principle used is electromagnetic induction. If a portion of the magnetic flux established by one circuit interlinks with the second circuit, then two circuits are coupled magnetically and the energy may be transferred from one circuit to the another circuit[1-2]. This is called electromagnetic induction. This paper uses the simple but effective transformer principle to transfer power wirelessly[3]. Instead of an iron core like that in a transformer, the proposed uses air core, as in a transformer the device also uses air core. Also as in a transformer the device also uses primary and secondary coil and works with AC current only[4-5].

The paper organisation is as follows. Section II presents the working principle of witricity with block diagrams. Sections III discuss the operation of the proposed circuit for mobile charging application. Section IV throws an insight b concludes the paper.

II.PRINCIPLE AND BLOCK DIAGRAM

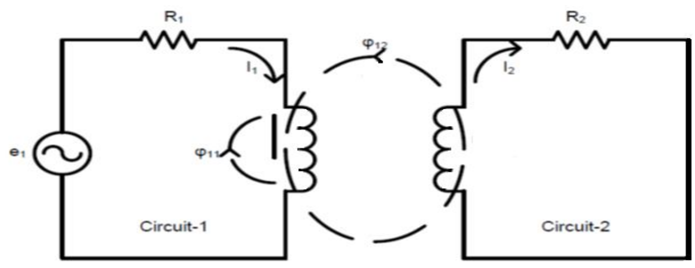

Fig.1 Inductive coupling

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As a new wireless power transfer technology, witricity is based on the concept of near-field, strongly coupled magnetic resonance. The fundamental principle is that resonant objects exchange energy efficiently, while non resonant objects interact weaklyIn electromagnetism and electronics, inductance is the ability of an inductor to store energy in a magnetic field. Inductors generate an opposing voltage proportional to the rate of change in current in a circuit. Inductive or Magnetic coupling works on the principle of electromagnetism. When a wire is proximal to a magnetic field, it generates a magnetic field in that wire. Transferring energy between wires through magnetic fields is inductive coupling. If a portion of the magnetic flux established by one circuit interlinks with the second circuit, then two circuits are coupled magnetically and the energy may be transferred from one circuit to the another circuit. This energy transfer is performed by the transfer of the magnetic field which is common to the both circuits.

TRANSMITTER SIDE

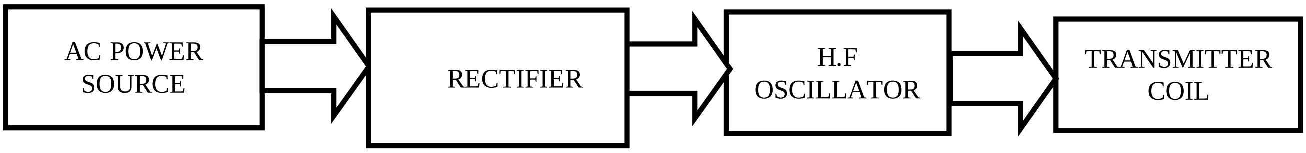

Fig.2 Block diagram description of transmitter section

In transmitter side 230V supply is given, which is converted to dc by using a bridge rectifier. Then this dc is converted to high frequency ac using a transistor switch. This high frequency ac is transmitted through transmitting coil.

RECEIVER SIDE

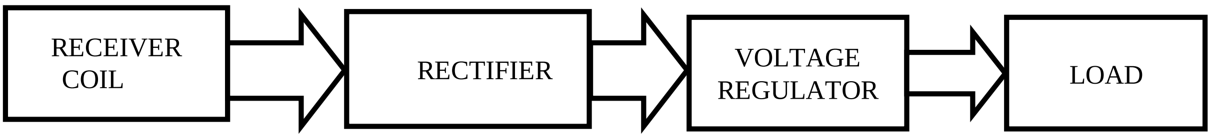

Fig.3 Block diagram description of receiver section

The receiver coil first receives high frequency. The rectifier here used coverts ac to dc. The voltage regulator provides rated power for the proposed application. The system described above follows the same concepts of Faraday's laws of electromagnetic induction but for two main differences.

Firstly the proposed system uses an air core transformer ie, there is no solid magnetic core that confines the flux produced at the primary. That means there can be high flux leakage and only a portion of the flux generated induces an emf across the secondary coil.

Secondly the primary and secondary coils are at some distance apart. This results in low flux linkage, low coupling coefficient and even lower power transfer also.

The biggest challenge of the proposed system is to maximise the flux linkage between transmitter and receiver section so as to enable the charging of mobile phones effectively.

III.CIRUIT DIAGRAM

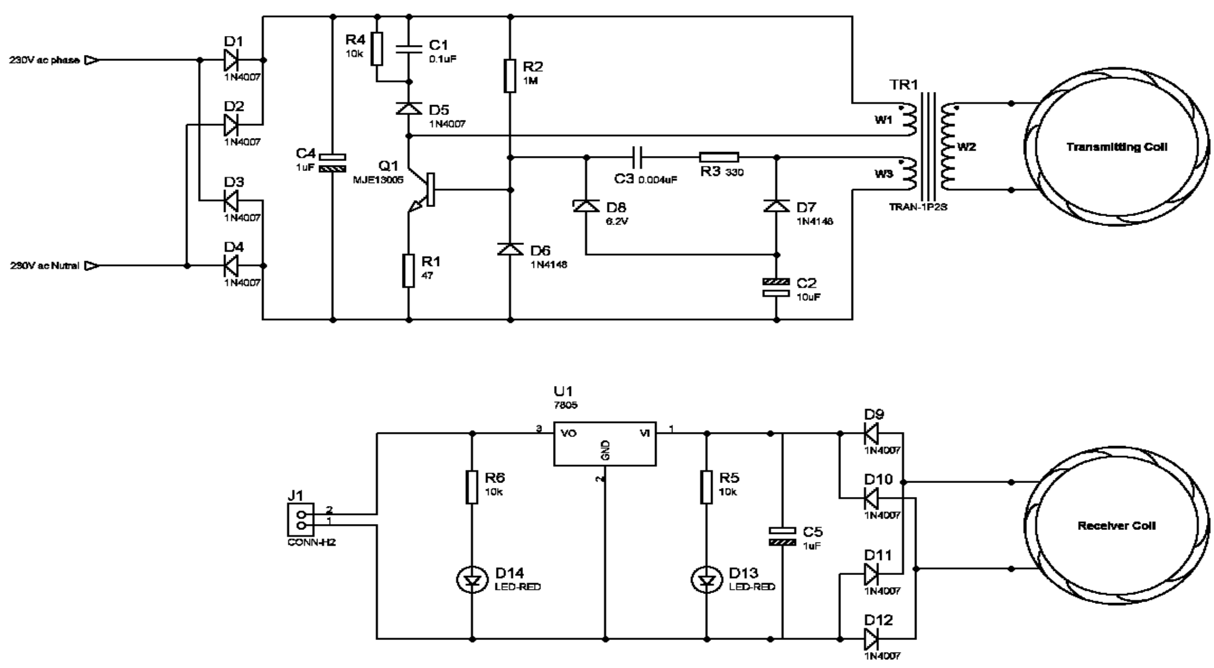

Fig .4 Circuit Diagram of Transmitter and Receiver side

When the power is supplied to the circuit, the bridge rectifier converts the AC into a fluctuating DC and the filter capacitor eliminates the fluctuations and converts it into pure DC supply. The DC voltage thus generated charges the primary winding W1 of the fly back transformer. The charging of primary winding induces an emf in the secondary windings W2 and W3. The emf induced in the winding w3 charges the capacitor C3, which then discharges through the zener diode D8 and capacitor C2. The voltage across the zener diode makes the transistor ON and the charging of capacitor makes the transistor OFF. This process continues to give a high frequency AC.

Apart from receiver coil receiver section is divided into two sections. One section consists of the rectifier unit and the other contains voltage regulator section.

The receiver coil receives the high frequency ac transmitted from the transmitter. The four diodes act as bridge rectifier and it converts the ac voltage to dc voltage. Then the voltage regulator converts the voltage to required voltage level for mobile phone charging application.

IV. HARDWARE IMPLEMENTATION

All the components and circuit discussed in previous section are finally integrated to form the complete hardware structure.

The components used for hardware implementation are listed in table 1 and 2. Table 1 describes the transmitter side which is the primary circuit. Table 2 lists the components designed for receiver side which is the secondary circuit.

All the above components are integrated to form the complete hardware structure as in figure. excited to the secondary coil side the mobile phone is attached. As the primary is excited, the mobile phone starts its charging operation.

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TRANSMITTER SIDE	
Component's Name	**Component's Value or code**
Voltage source	230V
Diode, D1	1N4007
Diode, D2	1N4007
Diode, D3	1N4007
Diode, D4	1N4007
Diode, D5	1N4007
Diode, D6	1N4148
Diode, D7	1N4148
ZenerDiode, D8	6.2V
Capacitor, C1	0.1uF
Capacitor, C2	10uF
Capacitor, C3	0.004uF
Capacitor, C4	1uF
Transistor	MJE13005
Resistor, R1	47 ohm
Resistor, R2	1M
Resistor, R3	330 ohm
Resistor, R4	10k
Transformer, TR1	TRAN-1P2S
Transmitter coil, L	

Table.1Transmitter side components name and values

RECEIVER SIDE	
Component's Name	**Component's Value or code**
Diode, D9	1N4007
Diode, D10	1N4007
Diode, D11	1N4007
Diode, D12	1N4007
Capacitor, C5	1uF
LED, D13	
LED, D14	
Resistor, R5	10k
Resistor, R6	10k
Voltage RegulatorIC	ICLM 7805
Receiver coil, L	

Table.2 Receiver side components name and values

V.RESULT AND DISCUSSION

By using the proposedcircuit the change in operation of mobile phone was obtained. Fig.5 illustrates the output. Experiment was also conducted by varying the distance between transmitter and receiver coils to study the effect of distance on power transmitted. Table 3 lists the observations made.

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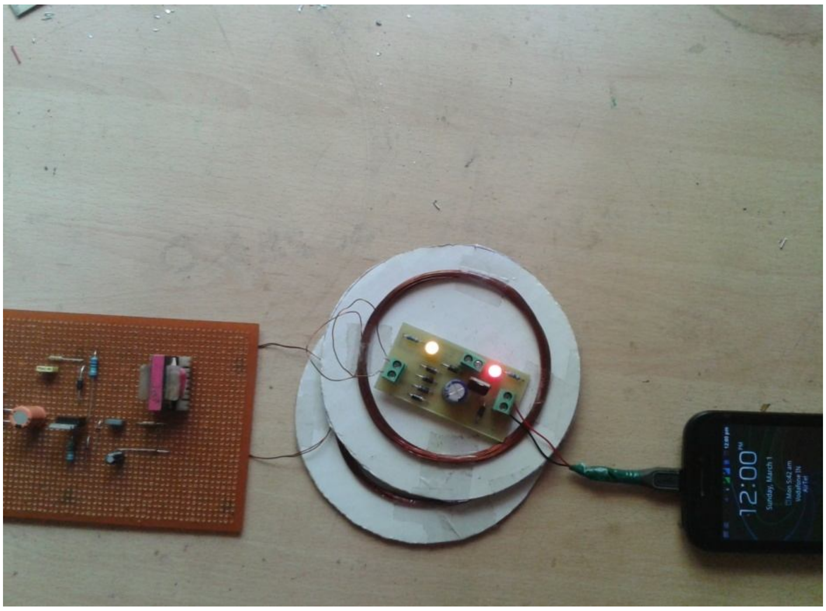

Fig.5Mobile in charging mode

INPUT(AC)	OUTPUT (DC)	DISTANCE(cm)
230	12.58v	0
230	7.2	1
230	5.3	2
230	4	3
230	3.2	5
230	2.8	6

Table 3.Output voltages at different distances

VI.CONCLUSION

The paper discusses the theory and implementation of a wireless charger for mobiles via inductive coupling. The paper describes and demonstrates clearly that inductive coupling can be used to deliver power wirelessly from a source coil to a load coil and thus charge a mobile phone. This topology is a potentially robust means for charging mobile phones wirelessly.

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