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A Novel Approach For Contactless Mobile Battery Charging Using RF Signal

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ABSTRACT
Mobile phone is a portable device which is most commonly in use and a major source of business & personal communication. Wireless charging is an emerging technology and have been recently developed for charging portable electronic devices such as mobile phones, laptop and computers. The objective of this paper is to use RF and convert it into DC, so that we can power some portable devices.GSM 900 and GSM 1800 signals are used for charging cellular phones. This paper highlights the performance of energy harvesting in an efficient way by using P1110.The ability to extract RF energy from the ambient source enables wireless charging of low power devices. Improving RF sensitivity allows RF to DC power conversion at greater distances from RF energy sources. This paper is a contribution to the concept of the wireless energy transmission.

KEYWORDS: ***RF,GSM, P1110,Voltage Doubler, Wireless charging***

I.INTRODUCTION

In recent days the most of the countries strengthens their effort to increase the electricity from renewable sources. This motivated us to realize power generation by different ways. According to a survey in 2010, nearly 2.5 billion of portable electronic products with chargers are made. But the charging protocol is not convenient for the consumer.The growth of mobile phones are phenomenal in recent years and there is a need for charging mobile battery is required anytime and anywhere. The battery life is the factor which encourages the companies and researchers to come up with new idea and technology to drive wireless mobile devices for enhanced period of time.

The industries is expecting to provide a common wireless charging for a wide range of portable electronic devices , leading to the possibility of the drastic reduction of electronic waste arising from the number of portable electronic products. The number of mobile phones manufactured in 2010 is approximately exceeded to 1.2 million. Electronic waste caused by the large variety of battery chargers for portable electronic products has become an increasing Global problem. Our universe is running out of all natural resources due to its maximum utilization. So, there is a need for an alternative for the production of electricity. Practically it is not possible to carry chargers wherever we go and expect availability of power supply everywhere. Contactless power transfer technology has been developed to supply power.If the mobile can drive RF power signal form the mobile tower, why it is not possible to extract the power from the received signal?

This paper is organized as follows. In Section II, an introduction to mobile phone batteries is given. In Section III, state of charge is given.in Section IV different types of charging techniques is explained. Section V introduces the proposed architecture scheme. Section VI explains the results.

II.MOBILE PHONE BATTERIES

The mobile phones at first ran with Nickel Cadmium (NiCd) batteries, which is very heavy type of battery supply. In current days , the most common one which is being used are lithium ion(Li- ion) batteries. There are also slim cell mobile batteries, which are very thinner, but offer less power for talking and for the mobile's standby time. It should be noted that the mobile phones used today are in standby mode approximately 98% of the time. In standby time, the current drawn from the battery is in the range of the 1mA.

1)Nickel Based Cell Batteries:

NiCd batteries were very popular in 1980's and 1990's.

They are very heavier than modern mobile batteries. Nickel metal hybrid (NiMH) batteries are used in late 1990's.They are used still in some mobile phones,specifically in phones designed far out of normal telecommunication range. NiMH do not have the memory as like NiCd.

2)Lithium-Ion Batteries:

Li-ion battery have been in mass production in 1997. The energy density of the Li-ion is typically twice that of the standard NiCd.The Li-ion is a low maintenance battery. There is no memory,no scheduling cycle is required to prolong the battery's life. Li-ion also has some drawbacks. It requires a protection circuit, is subject to aging even if it is not used,expensive to manufacture.

3)Li-ion polymer battery:

For ultra slim geometry (less than 4mm) the only choice is Li-ion polymer. This is most expensive system in cost-to-energy ratio. The Li-polymer differentiates itself from the electrotype used in that. Most of the commercial Li-polymer batteries used today for mobile phones are hybrids and contain electrolyte which is made of gel.The exact term for this kind of system is "Lithium ion polymer".

III.STATE OF CHARGE

To determine the battery's state of charge(SOC),a number of methods are proposed. These methods are divided into 3 categories.

1)Direct measurement
2)Book keeping
3)Adaptive

In direct measurement method ,the measurement of battery variables, such as the battery voltage, battery impedance and voltage relaxation time after application. The book keeping method is used for SOC indication that is based on current measurement and integration. The other data used by book keeping system is Discharging efficiency, self-discharge and capacity loss.The main problem in designing an accurate SOC indication is the Unpredictability.In this case, adaptive system is used. This is based on direct and book keeping method.

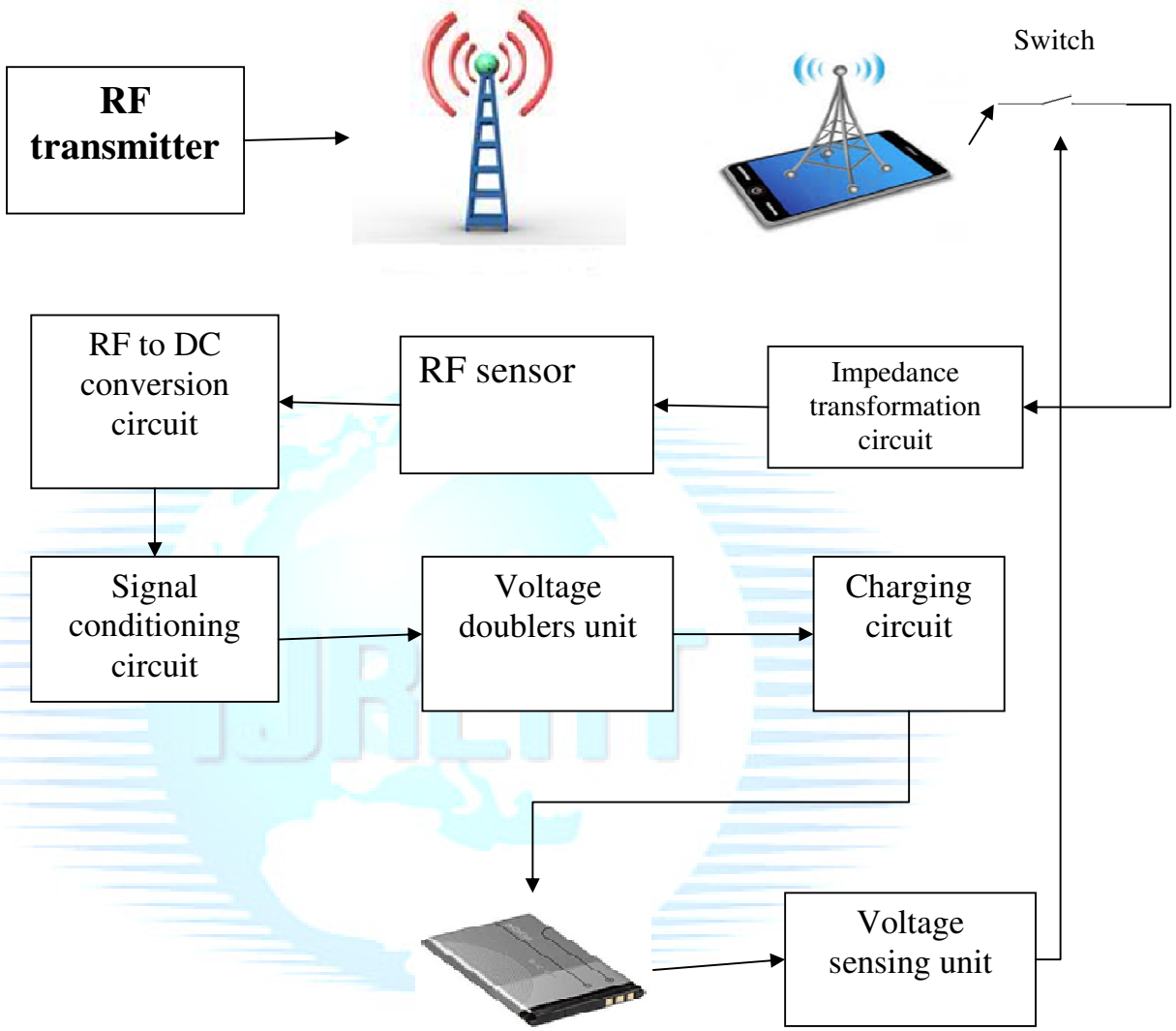
IV. DIFFERENT TYPES OF CHARGING TECHNIQUES

Recent breakthrough in wireless energy transfer provides a promising alternative to charge mobile devices.

There are also some techniques which are experimentally verified. In 2001, a contactless charger for lithium ion battery is designed. In this, the primary core of the transformer is in the charger unit and secondary core is in the telephone. For maximum coupling coefficient the transformer core design is presented on the secondary side. There is also a different technique in which the power is transmitted as microwaves from one place to another for reducing transmission and distribution loss. Magnetron is used to produce Microwaves and given to rectanna for converting microwave into electricity.In 2011, a planar contactless battery charging system is presented. A single layer winding array and receiver coil structure with cylindrical ferrite cores are designed for a planar contactless battery charging system.In 2013, A Capacitively Coupled Power Transfer (CCPT) charging platform is designed with contactless matrix charging pad for charging mobile phones.In the same time, a Gas gauge system for mobile phone applications. Natural resources like human speech, human body temperature and room temperature are also converted into power for charging mobile phones. An different approach is proposed by using coin and solar system to charge the mobile.Very recently wireless charging pads are used for charging portable devices. In this type, the transmission and reception signals are reduced.It is mitigated by using RF repeater and FSS(Frequency selective Surface).

V.PROPOSED ARCHITECTURE SCHEME

The objective of this work is to use the concept of energy harvesting i.e. to receive Radio Frequency (RF) present in the atmosphere and converting these RF signals into Direct Current(DC), for storing it or to power some devices like charging a mobile phone. For implementing this concept, a rectangular antenna is required to capture RF. RF signals cannot be used to drive a load such as battery of a mobile, so rectification and amplifying is required done.



A complete implemented system is being proposed in this paper with successful demonstration of using GSM- 900 and GSM-1800 signals for charging a cellular phone. In most of the RF communication systems such as in the case of mobile networks, out of the total available RF energy, only a major portion (approximately 70%) is being utilized for communication purposes whereas the remaining portion (approximately 30%) is being radiated without any usage or purpose. The RF energy being wasted is utilized in this system. The RF power harvesting system is equipped with an RF power receiving antenna, a power harvester device, and a charge storage element.

The unused RF energy in the RF communications is being captured with the help of an RF power receiving antenna and is converted to DC voltage with the help of a power harvester device.

ANTENNA DESIGN

"Rectangular Patch Antenna" was designed as this type of Antenna is easiest to design and fabricate. It is low profile and has a very low fabrication cost . Main parameters of the patch antenna depends on the substrate used for in the fabrication, some important parameter of the substrate are dielectric constant and height of the substrate. Using this information the width and length of the patch at a desired frequency can be calculated.

VOLTAGE DOUBLER

Antenna captures high frequency RF signal. RF signal is rectified to charge a device. To generate high DC voltage from low voltage AC charge pump is used. Thus charge pump has two main functions, rectifies the AC signal, generate high voltage DC signal at output. Charge pump is not an amplifiers, charge pump has stages of voltage doublers.

P1110:

An RF energy harvesting device converts RF energy to DC voltage. For mobile and other portable electronics devices, a convincing solution is available in capturing and storing the RF energy from external ambient sources. This technique is known as RF energy or power harvesting. The P1110 power harvester receiver is an RF energy harvesting device which efficiently converts the captured RF energy to DC voltage and stores it in a capacitor within the power harvester module. When a charge threshold on the capacitor is achieved, the P1110 boosts the voltage to the set output voltage level and enables the voltage output to be obtained. When the charge on the capacitor declines to the low voltage threshold, the voltage output is turned off and hence no output is obtained.

REAL LIFE MOTIVATION

The main real life motivation is that this system captures the unused RF energy and converts it to effectively usable charge or DC voltage, which can either be temporarily stored or utilized instantly for charging purposes. Also this system can be placed anywhere in range of RF power source which is an alternative. The majority of the recent research in wireless energy harvesting and information processing has considered point-to-point communication systems.

PROBLEM DEFINITION AND STATEMENT

RF power harvesting is the method of capturing the undesirably radiated RF energy in RF communication systems such as in mobile networks, and converting it to DC voltage which can be efficiently stored as charge in a storage element and utilized to charge wireless networks or other low power electronic devices.

VI. ANALYSIS OF RESULT

As compared to the existing power harvesting techniques using various dedicated sources such as solar energy, thermal sources and so on, there is a driving innovation and commercialization of wireless power based on RF energy in RF power harvesting for prototype charging systems. This system assures reduced wiring and reduced maintenance requirements as compared to the wired charging systems.

COMPARISON OF RESULT

As compared to previous cases,the proposed system does not require any external bulky device.The powerharvesting system not only captures near maximum output power from electromagnetic waves in the RF or microwave region of the electromagnetic spectrum but also captures any RF energy within the frequency range 902 – 928MHz, which provides charging facility beyond the system.The usage of powerharvester device P1110 provides an inbuilt efficiency for RF to DC conversion as compared to the ant The proposed system antenna. It captures unused RF energy whenever available and converts it to DC voltage, which can be used for charging wireless networks in contrast to MIMO system , which captures RF energy from multiple inputs only when it is above a threshold value.Therefore, energy harvesting in such networks is particularly important as it can enable information relaying. Optimal performance results from system design that focuses on minimizing power. It provides wire-free operation and is completely portable. Also the RF power is reliable and is available on demand. This system is applicable in various fields as in, wireless communications and so on.

EXPECTED RESULT

INCREASE IN

- **S PARAMETER**
- **SENSITIVITY**
- **DIRECTICITY**
- **IMPEDANCE IS MATCHED.**

CONCLUSION

Thus this paper demonstrates a novel method for using the power of Radio Frequency to charge the mobile phones without the use of the wired chargers. This method provides great advantage to mobile phone users to carry their phones anywhere. In RF communication in 100% of energy only 70% is used for communication. 30% energy is radiated without any usage. The main advantage of this concept is the unused RF signal is effectively used for charging purpose.

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REFERENCES

- Zhong , WX; Liu, X; Hui,SYR , **A novel single layer winding array and receiver coil structure for contactless battery charging systems with free positioning and localized charging feature,** September 2011
- Sakthi abirami.B, Vidhyalakshmi.S, **Wireless Charging Of Mobile Phones Using Microwaves,** 2012
- Chao liu, aiguo patrick hu, bob wang, nirmal kumar C.Nair, **A capacitively coupled contactless matrix charging platform with soft switched transformer control,** January 2013
- K.S.Tamilselvan, R.Aiswariya, K.Ayesha parveen **, A hybrid approach for automatic Mobile phone charging system using Natural resources**, May 2013
- S.B.Sridevi, A.Sai Suneel,K.Nalini **,Coin based mobile charger using Solar Tracking System,** September 2013
- Kwun Chiu Wan,Quan Xue, Xun Liu S.Y.(Ron)Hui, **Passive Radio Freqyency Repeater for enhancing Signal Reception and Transmission in a Wireless Charging Platform**, April 2014
- Sheng Zhang,Jie Wu, Sanglu Lu **Collaborative Mobile Charging,** July 2014
- Peng Wu,Fan Bai,Xun Liu,S.Y.Ron Hui,**Use of Frequency Selective Surface for Suppressing Radio Frequency Interference from Wireless Charging Pads,** August 2014

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