IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661, p-ISSN: 2278-8727
PP 01-05
www.iosrjournals.org

A Socket-Free Charging Technique By Utilizing The Wi-Fi Signals

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ABSTRACT- This study is focused on equipping wireless devices (including sensors) with high-efficiency circuitry to harvest and convert ambient radio frequency (RF) power to direct current (dc).
Our objective is to obtain energy effectively from electromagnetic radiations, radio waves. A Wi-Fi spot is only used to get connected to a network, but here we provide a means for collecting energy and using it to charge devices that are connected in that network. The Wi-Fi signals contain some amount of energy that is 100mW approx as it is very small it goes unnoticed. The signals are sensed and by using artificial intelligence this is employed using smart phones, if there is any case of dying charge, we provide a method to automatically retain the power from Wi-Fi signals amplify it and then transfer it into a consumable form and then utilizing it in low power consuming devices like smart phones to serve the purpose of emergency by charging these devices while accessing the Wi-Fi.This is an alternative optimized way to charge devices rather than to use electricity.
Keywords- amplification, artificial intelligence, minimizing electricity usage, socket/plug-free charging wireless networks Wi-Fi.

I. INTRODUCTION

In our proposed system we introduce a technique which helps in charging low power consumption devices resulting benefits in better product design, usability, and reliability .the reason is that when a user gets connected to a network there is a gradual decrease in the charge. So in such an environment if our idea is implemented then the user can browse and also charge the device simultaneously.

As already mentioned we bring into apply the radio waves and RF energy in them .RF energy is currently broadcasted from billions of radio transmitters around the world, including mobile telephones, handheld radios, mobile base stations, and television/ radio broadcast stations. The ability to harvest RF energy, from ambient or dedicated sources, enables wireless charging of low-power devices .The obvious appeal of harvesting ambient RF energy is that it is essentially “free” energy. This 'free energy' is utilized for charging low power consumption devices. Battery life could be extended by scavenging surrounding Wi-Fi signals.
The aim is to obtain the ‘free energy' in the Wi-Fi signals which would rather go unnoticed and maintain an eco-friendly environment.

II. PROPOSAL

1. Introduction

Energy harvesting is the process of extracting a small amount of energy from ambient sources. Indoor Wi-Fi energy harvester with multiple antennas for low power wireless applications is used to provide maximum efficiency by providing better battery life. Indoor wireless sensors may be powered by energy harvesting from indoor RF sources widely available from Wi-Fi networks. However practically the power density in the indoor areas is very low (<-50 dBm, or 1x10-8 W), making indoor RF harvesting very challenging. A variety of ambient energy sources that exist for energy harvesting are electromagnetic energy, solar energy, thermal energy, etc.The energy harvester will capture RF energy from different channels available in 2.45 GHz Wi-Fi transmission systems. As energy collected from a single Wi-Fi transmitter is very small effective combining and amplifying circuits are required.

2. Working

This section explains the functioning of the entire energy harvesting system i.e. the input, processing and the output part in detail.

1.1 WI-FI signals

Wi-Fi is wireless fidelity. Wi-Fi is a set of product that uses wireless LAN standard to deliver internet and LAN services in distinct area. The Wi-Fi standard leaves connection criteria and roaming entirely open to the user's needs. This also means that one wireless adapter may perform substantially better than the other. A wireless [4] network uses radio waves. [4] A computer's wireless adapter translates data into a radio signal and transmits it using an antenna and on the receiver side the signal is obtained and decoded

1.2 Reasons for choosing Wi-Fi signals

Wi-Fi signals have a few notable differences from other signalsWi-Fi signals can easily pass through walls and cross obstacles .Their transmission frequencies are of 2.4 GHz or 5 GHz. This frequency is considerably higher than the frequencies used for cell phones etc. The higher frequency allows the signal to carry more data and hence more energy. Wi-Fi is used in most places so with ease one can connect to the network.

2.3 Detecting Wi-Fi signals

To detect the presence of Wi-Fi signals and to obtain the data packets (energy) along with power the IR sensors are used that will detect even invisible radiations.
Fig 1 shows an IR sensor with transmitting [3] IR LED (left) and receiving IR photo sensor (right)
An IR (infrared) sensor is a common, inexpensive, and easy to use wireless technology. IR light is very similar to visible light, except that it has a slightly longer wavelength. This means IR is undetectable to the human eye - perfect for wireless communication. For example, when you hit a button on your TV remote, an IR LED repeatedly turns on and off, 38,000 times a second, to transmit information (like volume or channel control) to an IR photo sensor on your TV.

2.4 Antenna -Rectenna

The compact rectenna [1] has been engineered to capture the shorter in length, radio frequency waves emitted by wireless devices employing high frequency radio waves. The rectenna can convert radio waves moving around in the air, to electricity. It is a combination of rectifier and antenna [1], where antenna is used to detect signals and conversion of current is performed by rectifier by a process called rectification [1].
Built in filters actively weed out frequencies outside of the 2.4 GHz– 6 GHz range. This allows for confident measurement of sources within the desired frequency range i.e. it only Detects RF radiation generated by WLAN/Wi-Fi (2.4 – 5.0 GHz).

2.5 RF Meter

To check the amount of current obtained from Wi-Fi signals we use a calibrated meter that would give us readings based on the severity of the connection. It is mentioned in TABLE 1.

The above data gives the measurement of current from Wi-Fi measured by RF meter. Readings increase when the antenna is pointed in the direction of or moved closer to offending sources. A calibrated RF meter can be used to find the strength radiated by Wi-Fi signals.

2.6 Amplifier

Amplifier [2] is an electronic device, which is used to increase the value of current. Only 100mw of current is obtained in the process. So, combining and increasing the value of current is significantly done by the amplifier circuit. [2]It does this by taking energy from a power supply and controlling the output to match the input signal shape but with larger amplitude. In this sense, an amplifier modulates the output of the power supply. So, combining and increasing the value of current significantly is done by the amplifier circuit.

The entire working of the energy harvester is presented through a block diagram. Fig 2 explains the architecture of charging the mobiles using Wi-Fi signals.

3. Integration

Software or a mobile app could be developed, so that the users can smartly make use of this system. When the charge in a mobile goes down, the app automatically searches for Wi-Fi signals and prompts the user to use the Wi-Fi signal's power to charge the mobile.

The open source Operating system Android is used for implementing the energy harvester application in smart phones.fig 3, fig 4 and fig 5 show the design phases of the application done using android.

Fig 3 shows how the application appears in the "apps" tab of the mobile. Fig 4 displays "low battery" and prompts the user for charging through Wi-Fi and when the user chooses to charge through Wi-Fi severity concerns are shown. Fig 5 gives the final conceals that the battery is charged using Wi-Fi.

III. INDENTATIONS AND EQUATIONS

The power required for charging a smart phone is calculated.

The energy present in 1 packet of signal=100mW

Energy required	=approx (1000mW) or more
No. of packets further required	= 10 or more
Total power obtained if 15 packets are combined.	=15000mW

So, for effective charging each time 15 packets are combined and energy in them is captured and amplified.

IV. FIGURES AND TABLES

Fig 1 IR Sensor

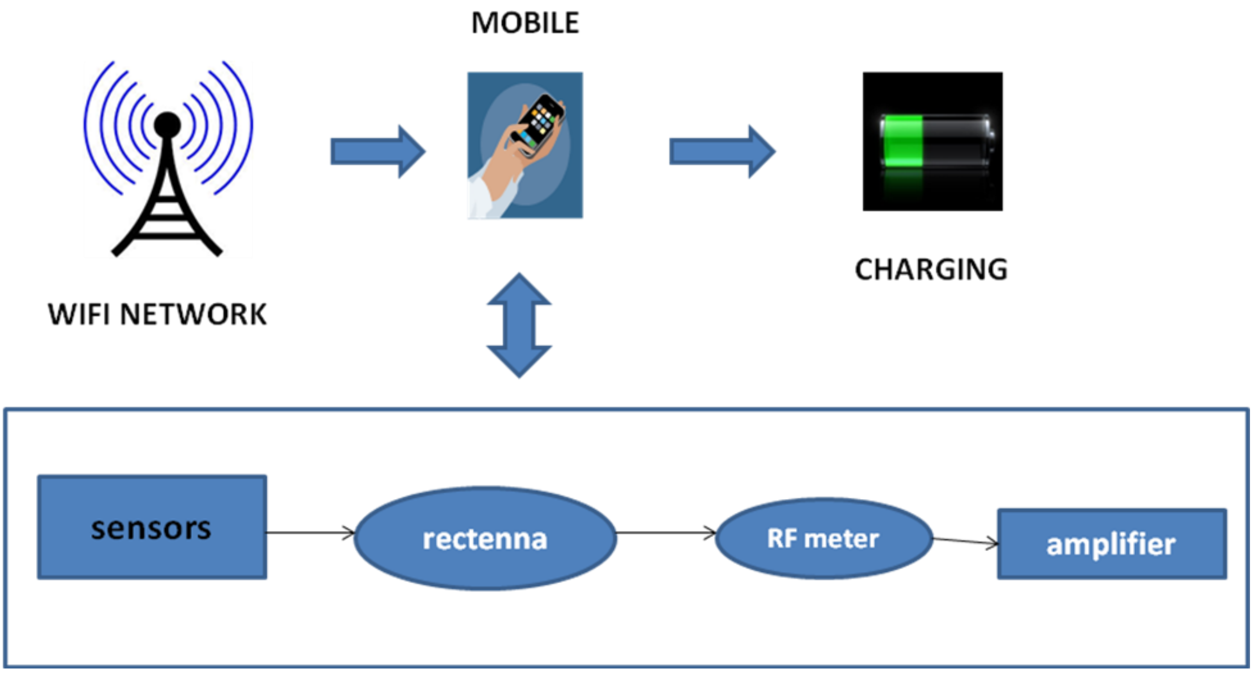

Fig 2 Architecture diagram for charging the mobile using Wi-Fi signals

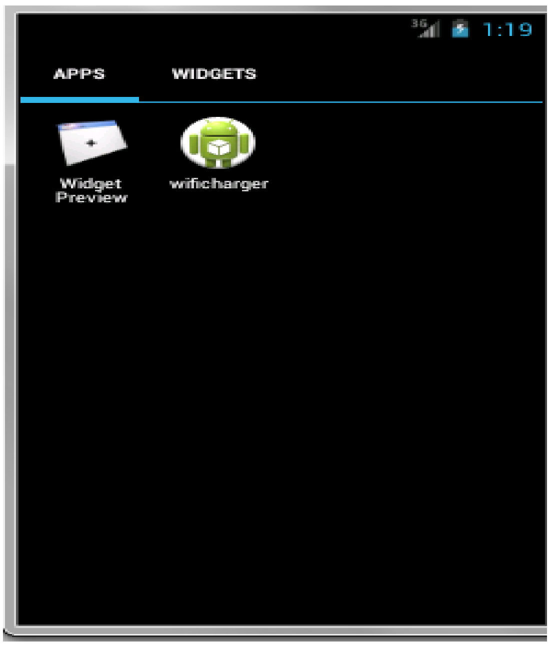

Fig 3 "Wi-Fi charger" application

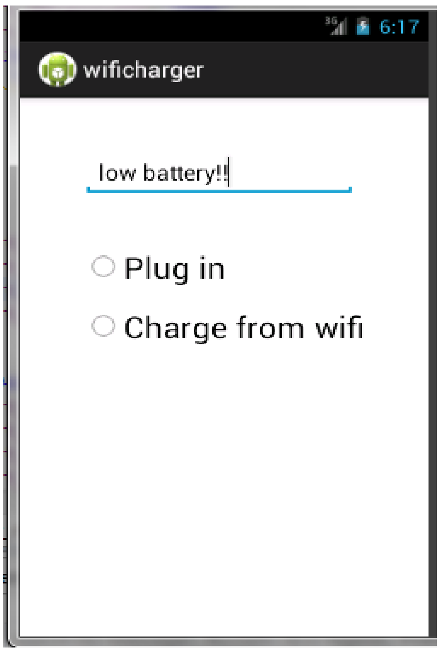

Fig 4 Indicating the user of low battery

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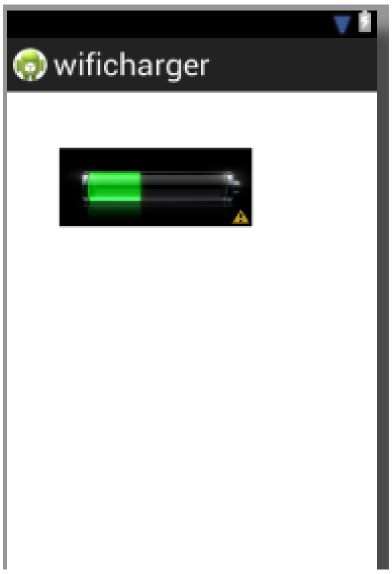

Fig 5 Final charging phase

Charging concern	Energy present	Severity of charging
No concern	<0.10mW/m2	Not possible
Slight concern	0.10 – 10	Not possible
Severe concern	100-1000	30%
Extreme concern	>1000	>50%

TABLE 1

V. CONCLUSION

The energy harvester would be an effective solution for charging the smart phones which consumes lot of power where current is already in demand. With continued decreases in the power consumption of electronic components, increased sensitivity of passive receivers for RF harvesting and improved performance of low-leakage energy storage devices, the applications for wire-free charging by means of RF-based wireless power and energy harvesting will continue to grow. Thus, our proposal aims that a smart environment is created utilizing the resources efficiently.

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