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Recharging Phone Using RF Energy

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Abstract

This project proposes to extract RF energy, display the output received on LCD using microcontroller AT89S52, boost and store the charge and to use it to charge devices like mobile phones.Here the power is transferred from the antenna, by using impedance matching. To gain more power from the tower and the rectifier circuit, we convert an incoming RF signal to DC signal that is fed into the battery.The system can harvest energy from GSM900 (Global System forMobile Communications), GSM1800, UMTS (Universal Mobile Telecommunications System) and WiFi bands. RF-to-DC conversion efficiency is measured at 62% for a cumulative -10 dBm input power homogeneously and reaches 84% at 5.8 dBm.The relative error between the measured dc output power is less than 3%..

Keywords: *Energy harvester, WiFi, GSM 900/1800, Matching, RF signal, relative error.*

1. Introduction

The proposed project provides a valid contribution in the field of electronics as stated above. It is an economical, sustainable and environmental friendly setup whose function is to charge low powered electronic devices. If the prototype is developed considerably by making use of hardware that can amplify the power and capture more of RF energy then, then it can be used to provide power for some low-medium power consuming devices

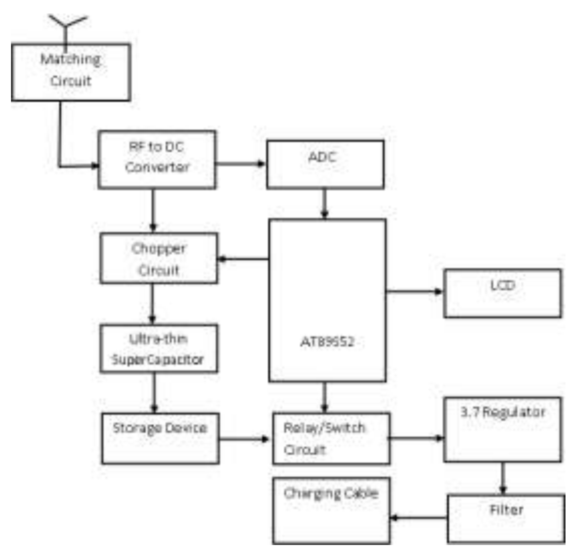
2. Materials and Methods

The idea is to place a RF receiver within the field of emitted Radio waves so as to extract it, with an efficient matching circuit. RF energy harvester is positioned for optimal directional alignment and polarization with respect to the transmitting antenna.

The obtained DC value can be traced by making it flow from the IC which helps in displaying the instantaneous values of DC on the LCD. This obtained DC output tends to be fixed, hence, we use a switching circuit like the chopper circuit , in order to to convert the fixed into a variable DC. The variable DC ,when crosses a certain threshold voltage charges the super capacitor .This charge is stored in a 12v battery.

By regulating the output from the battery and using a wire/cable we can charge the prescribed low power consuming device.

2.1 Block diagram



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2.2. Hardware Requirements

Description	Engineering Standards / Specifications
Matching Circuit	Impedance matching is the practice of impedance of an electrical load or the output impedance of its corresponding signal source to maximize the power transfer or minimize signal reflection from the load.
AT89S52	It is a great family microcontroller compatible with Intel MCS-51. AT89S52 is created by Atmel, indicated by the initials "AT". This microcontroller has a low consumption, but 8-bit CMOS CPC gives high performance with internal flash memory of 8K Bytes.
Chopper Circuit	It is used to refer to numerous types of electronic switching devices and circuits used in power control and signal applications. A chopper is a switching device that converts fixed DC input to a variable DC output voltage directly.
Circuit Board	ATMEL MC-02 assembled PCB
Transformer	Step down conversion 230V - 12V
Super Capacitor	MKP52 275-X2 A super capacitor (SC) ultra capacitor, also called electric Double layer capacitor (EDLC)) is a high-capacity electrochemical capacitor with capacitance values much higher than other capacitors (but lower voltage limits) that bridge the gap between electrolytic capacitors.
Relay Circuit	A relay is an electrically operated switch. Many relays are an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.
Regulator	A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops. It may use an electromechanical mechanism, or electronic components.

Description	Engineering Standards / Specifications
Antenna	Antenna using frequency bandwidth between 800 MHz to 960MHz
GSM	900 MHz frequency transmitter ;1800MHz frequency transmitter
Wireless Fidelity	802.11 IEEEstd.;2– 2.4 GHz

2.3 Circuit Diagram

Fig. 1 - Working Circuit Diagram

2.4 Experiment- Working And Result

- The Radio frequency is detected and matched by the piggy-tail antenna made of 2400 wound copper wire and followed by a germanium diode rectifier to convert DC.
- The antenna is connected to a NE555 and channel 0 of ADC.
- The input reading is displayed on the LCD by the micro-controller in accordance with the power provided by the ADC with a maximum value coming upto 120mV generated from a cell phone as a source.

- The chopper circuit converts the DC continuous to discrete value which is sent to the ultra-capacitor.
- The fast charging ultra-capacitor charges the battery .
- The relay circuit acts as a switch which enables the connection to the voltage regulator if the current exceeds the threshold of 5V.
- The regulator limits the value to 3.7 V optimum for the phone to charge!

Fig. 2 – LCD Reading

3. Results and Discussion

1. The input energy of 240 V is stepped down to 12V. This is used to power the relay circuit.
2. 7805 is used to further regulate the 12 V into 5 V, used to operate the ATMEL 89S52.
3. The received power is converted to digital using ADC.
4. The maximum input RF power detected from the source is150mV.
5. The detected RF power is boosted to 5V and is subjected to a voltage regulator.
6. The voltage regulator provides the output voltage which charges the device connected via the cable.

4. Conclusions

In today's world a lot of energy is wasted that could have been consumed. We try to implement a practical model of how this energy can be extracted and used. If successfully implemented, the energy draining system such as Wifi will be used to indemnify the energy. The current model is a prototype which can be further enhanced on factors such as size, portability, efficiency and cost.If achieved the setup will open a gateway to renewable mode of charging.

Acknowledgments

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