International Journal of Computational Intelligence Research
ISSN 0973-1873 Volume 14, Number 7 (2018), pp. 535-541

http://www.ripublication.com

Power Generation from Free Air Radiation

T.kalyani [1], K.Arunamanjusha[1], D.Sumanth[2], P.Mounika[2], G.Nagajyothi[2], M.jyothi[2]

[1] Assistant professor, Department of ECE, MLR institute of technology
[2] B.Tech student, Department of ECE, MLR institute of technology

Abstract

Electro-Magnetic radiation in the atmosphere is increasing day by day due to advance use of cellular communication. The transfer of information is done through cellular system which consists of antennas. The antennas used in cellular system will produce large amount of electromagnetic radiation. This electromagnetic radiation will cause damage to the environment. The basic approach is to generate power from these radiations. This concept can be used to reduce the radiation in an effective way, where the reduced radiation is stored as a re-usable energy and can drives for the growth of green communication.

Keywords: eletromagnetic radiation, green communication, antennas

I. INTRODUCTION

Previously, the use of cellular network is rapidly increasing which in turn leads to battery usage. This leads to some limitations such as replacing the batteries depending on its lifespan which is done manually. These problems can be overcome as well as remove completely by using this energy harvesting system. All possibilities of RF Sources are Mobile Communication Tower, TV Transmitter Tower, and Radio Transmitter Tower, WI-Fi router, Radio and mobile phones. Almost all the RF sources are producing RF Signals constantly but are not Completely Utilized by their Receivers. There are large amount of signals getting wasted. So this wastage of signals is to be collected by our GSM Receiver Antenna and we convert it into Electrical energy.

Energy harvesting can be done in many ways i.e., it can be produced through water, thermal energy, etc., this project deals with free radiations which in turn helps in generating power. As the cellular communication is increasing substantially the count of antennas are also increasing proportionally. Though there are many techniques

through which power can be generated this project produces power from free air radiations using antennas. To produce power it is necessary to use to units. One for transmitting the radiations and the second unit helps in receiving the transmitted energy. Here the two units consist of two different antennas. To transform the radiated energy to power it is necessary to use some rectifying circuitry.

With the increasing use of mobile and computing devices, the problem of energy (battery) consumption is a rising issue. Such computing devices are of two types: (i) the first type which is always within the reach of external power (laptop) and second type which are not always within the reach of external power (mobile phone, sensors etc). Hence, there are possible situations in which second type of products are in need of energy for making the product operational under adverse conditions. This challenging situation requiring instant and immediate energy in adverse environmental condition gives rise to evolution of the research topic termed as energy harvesting, which is the core discussion of this paper. The paper discussed that energy can be captured from nature in various forms, e.g. heat, wave, water, motion etc. Various evidences of ongoing research and product availability have been jotted in this paper for visualizing the current trends of research direction in energy harvesting. However, one of the significant challenge that has been observed is, although the energy can be trapped from ambient resources, it is quite difficult to store and process it for some of the low powered devices like sensors as they have high degree of hardware and resource constraints. Finally, the paper has reviewed some of the most recent studies done in the last 5 years and discussed the research gap and found that work towards energy harvesting for mobile devices is very little to find. Hence, our future work direction will be to formulate a novel framework that could fill up the gap explored in this study.

II. THEORY

DC voltage generated by harvesting circuit is very small and not sufficient to power normal microcontroller which operates on 5V DC .high power application so we are using a MSP430 madule.MSP430 is Ultra low power kit which operates on voltage below 3V DC. With the help of this kit we can run many low power WSN applications and we can charge 1.2V batteries.

System requirements:

1. Yagi-uda antenna
2. Micro controller
3. Resistors
4. Capacitors
5. Transducer

The directional pattern of the Yagi-Uda antenna is highly directive. The minor lobes are suppressed and the directivity of the major lobe is increased by adding up of

directors to the antenna. In a standard dipole the currents flowing along the conductors are in phase and as a result there is no termination of the fields and radiation occurs. When the second conductor is added to make the folded dipole antenna this can be considered as an addition to the standard dipole with the ends folded back to meet each other. As a result the currents in the new section flow in the same direction as those in the original dipole. The currents along both the half-waves are therefore in phase and the antenna will radiate with the same radiation patterns etc. as a simple half-wave dipole.

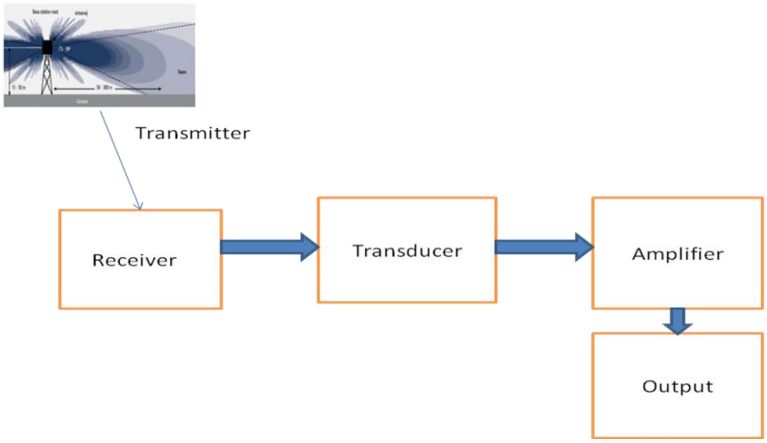
Not only is the gain of the Yagi antenna important as it enables better levels of signal to noise ratio to be achieved, but also the directivity can be used to reduce interference levels by focusing the transmitted power on areas where it is needed, or receiving signals best from where the emanate.

However if a flat feeder with a lower velocity factor is used, then this will have the effect of shortening the required length. The feeder effect also results in the folded dipole antenna having a flatter response, i.e. a wider bandwidth than a non-folded dipole. It occurs because at a frequency away from resonance, the reactance of the dipole is of the opposite form from that of the sorted transmission line and as a result there is some reactance cancellation at the feed point of the antenna. The frequency band of the antenna can receive is between 90MHz to 900 MHz. To capture a signal with frequency near the Antenna's Frequency limits, the filters corresponding should be tightly designed else the chances for low S/R ratio and voltage fluctuations can be a major problem in reception. High directivity limits the voltage reception highly with respect to the direction pointed outdoor.

III. WORKING

The signal received from the free air is sent through a transducer to convert it into a voltage signal. Later the voltage signal is passed through an amplifier and that amplified voltage can be used for our need. Here the receiver circuit goes hand in hand with the amplifier i.e. as soon as the signal is received the amplifier, amplifies the signal into voltage. Initially, the design of the power source demands the need to determine the best power carrying signals of the cluster of radiations in the free air around us. The next step would be designing filters and circuits/ICs that could handle and convert the signal voltages from the captured waves. The output is to be stabilised irrespective of fluctuations, if any from the captured radiation.

BLOCKDIAGRAM



1) ADVANTAGES

The following are the advantages of Yagi-Uda antennas −

- High gain is achieved.
- High directivity is achieved.
- Ease of handling and maintenance.
- Less amount of power is wasted.
- Broader coverage of frequencies.

2) DISADVANTAGES

The following are the disadvantages of Yagi-Uda antennas −

- Prone to noise.
- Prone to atmospheric effects.
- The standard dipole is widely used in its basic form. However under a number of circumstances a modification of the basic dipole, known as a folded dipole antenna provides a number of advantages.
- The folded dipole antenna or folded dipole aerial is widely used, not only on its own, but also as the driven element in other antenna formats such as the Yagi antenna.
- Folded dipole yagi uda antenna basics
- In its basic form the folded dipole antenna consists of a basic dipole with an added conductor connecting the two ends together to make a complete loop of wire or other conductor. As the ends appear to be folded back, the antenna is called a folded dipole.

IV. RESULTS

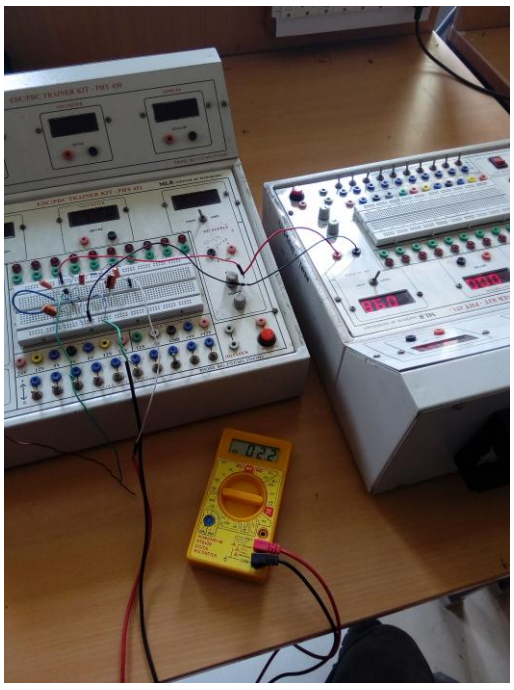
The whole project is aimed at capturing RF radiation from free air and turns the captured signal power into physical Voltage/ Current and uses the same for low – power applications.

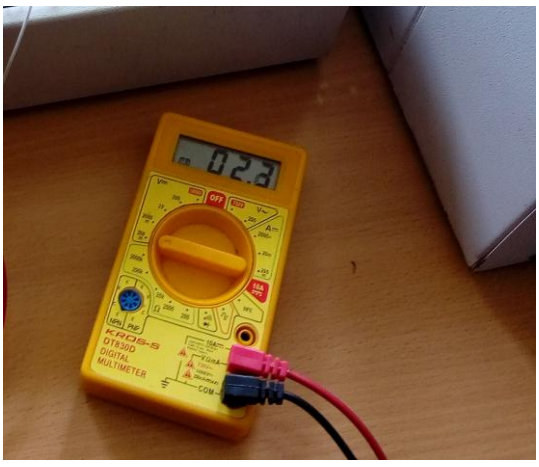
Electronics:

- Rechargeable Batteries : 1.2 V to 3 V (100mW on Average for AA Batteries)
- Ultra- low Power Micro controllers : 2.5V to 3.3 V, 50mA (150mW on average)
- Charging Adapters : 3.3V to 5 V

From the above details, it is clear that we atleast need 100mW of power for our daily needs and we could produce a raw power of 100uW (without amplification).Properly designed Amplifier with a considerable gain gave output powers ranging from 10mW to 130mW with gains ranging from 100 to 150 considering the practical external factors for power loss.

Refinement of the design and proper fabrication of the design can ensure power production of upto 150mW and hence can be used as an alternative for various Power sources especially in Bio-Medicine and Ultra- Low power Electronics.





Future scope: The approach to our project is we design a device which can handle excessive Electro-Magnetic radiation in the atmosphere using Antenna Arduino setup

and transform that into re-usable energy in the form of voltages and currents, which can be used as a power backup. Harvesting RF energy has an extensive variety of examination. While the logical investigation of energy conversion standards are unquestionable for quite some time, still their provision stayed limited to constrained spaces in industry and overwhelming business. The nature is encompassed by energy in the form of vibration, wave, sound, water, heat etc. The advancement of new era technology for energy preservation has the potential as well as capability to convert environmental energy into electrical energy. Energy harvesting is a mechanism which enables the remote devices run for extended periods without getting them charged. The availability of free energy is the prime target of energy harvesting mechanism. Additionally, energy harvesting technique is utilized as an alternative source of energy for supplying an essential energy source for low powered devices. At present, such types of energy are trapped from sun, wind, water, electromagnetic energy, and thermal energy for the purpose of harvesting energy. Preserving energy for low-powered devices like remote sensors exhibits another challenge as the energy harvesting tool in the present era find it difficult for miniaturization as well as resource (battery) constraint nature of such sensors.

V. CONCLUSION

Performance improvements in battery technology and the power requirements of electronics are not keeping pace with the increasing demands of many wireless sensor networking applications. For this reason, there has been considerable interest in the development of systems capable of extracting usable electrical energy from existing environmental sources. Such sources include ambient electromagnetic energy, thermal gradients, vibration and other forms of motion. In this paper, we have provided a feasibility study of harvesting electrical energy from RF signals. We conducted many experiments with various off-the-shelf diodes and current carrying conductor combinations. The results are promising in that with easily available components, up to 1-2 mw of power can be harvested. As future work, we intend to construct an inductor that is optimized for harvesting energy in this context. In this paper we have presented a comprehensive system for RF energy harvesting firstly, we have provided an overview of existing systems in RF energy harvesting. Then, we have reviewed the block diagram and circuit implementations. Afterwards, we have tabulated the results of mentioned circuit using two different types of diodes. We reviewed the study of energy harvesting based on RF Signals. We also discussed some design issues occurred in RF Signal harvesting. We try to improve the efficiency of energy harvesting via very small and simple circuit. At sufficient RF Signal this system can generate 2 to 3 DC Voltage which is sufficient to charge a batteries and used for further applications. as cost of this work is very less, we can use it in many applications such as sensors ,security systems ,indicating circuits ,drivers.

REFERENCES

[1] P. Chandrakasan, Anantha. "Ultralow-Power Electronics for Biomedical Applications." Princeton.edu, Anantha P.Chandrashekaran, 4 Apr. 2008, www.princeton.edu/~nverma/VermaLabSite/Publications/2008/chandrakasan_arbe2008.pdf.

[2] Quora, MILIND WANKHADE, 30 June 2016, www.quora.com/What-is-an-amplifier-What-is-the-difference-between-voltage-amplifier-and-current-amplifier-What-is-Class-A-B-and-C-amplifiers.

[3] Semanticscholar.org, Debbie Brandenburg, Jan. 1998, pdfs.semanticscholar.org/eb1f/47d32986de42e57a000cb38b6481621e9608.pdf.

[4] Researchgate.net, Cyril Mechkov, Jan. 2013, www.researchgate.net/post/Why_do_we_prefer_using_voltage_than_current_as_a_data_carrier_in_electronics_Why_are_most_of_electronic_devices_implemented_as_voltage_converters.

[5] Omron, IA-Omron, Dec. 2012, www.ia.omron.com/support/guide/63/introduction.html.

[6] EL-PRO-CUS, UC Patnaik, Oct. 2015, googleweblight.com/i?u=https://www.elprocus.com/design-of-yagi-uda-antenna/&hl=en-IN.

[7] Youtube, Vortex Technologies, 31 Jan. 2016, www.youtube.com/watch?v=jj5ROq_iK30.

[8] Free Energy Info, Patrick J. Kelly, Sept. 15AD, www.free-energy-info.com/Chapt7.html.