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DESIGN OF SOLAR POWERED WIRELESS CHARGER FOR SMARTPHONES

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Abstract - *This is special kind of charging system in which, there is no need of any kind of communication wire to connect the power supply to charge it. The device can charge smartphones or smart devices wirelessly in a short range of distance. This device depletes the use of cables, no need to sit around the phone and cable in a very specific position just to make it charge. Even we do not require electricity to charge the phone. Our proposed method utilizes non-conventional source of energy (solar cell) to wirelessly charge the device. Wireless charger increases life span of mobile in compare to ordinary charger. The proposed device is environmental friendly, user friendly and cost effective. We will use "receiver pad" to make all mobile wireless compatible. The technology proposed by us is capable to charge any smart phone, anywhere at any time.*

Key Words: Wireless charger, Solar Cell, mutual inductance, Wireless power Transfer

1.INTRODUCTION

The appearance of renewable energy sources has given rise to the technological evolution and development of societies. In 1890s, Nikola Tesla displayed the world that electricity could be

transferred wirelessly. He discovered Tesla coil that could transmit electricity over the air. Today's era Wireless power transfer technology is growing very rapidly. Now a day everyone is fed up with wires, cables and plugs which is being used in electronics gadgets. Smart world requires smart technology which do not utilizes wires and cables, it should run wirelessly and automatically. Hence wireless charging becoming the biggest boom of the market because of enormous application in smartphones, portable computers, Bluetooth headsets, tablets, cordless phones and game controllers [7].

Technology of Wireless charging has various application not only in the electronic industry but in electrical, mechanical, biomedical and many more. For Wireless power charging Total Available Market (TAM) is very high because of large number of smartphones and is estimated to grow by more than forty times in terms of revenue by 2018 [5]. Pike Research has predicted that the number of wireless power systems in mobile phones will grow from 3.74 million in 2012, to 27.63 million in 2016 [6]. According to Markets & Markets consultancy company research the wireless power mobile phone manufacturers have already started incorporating wireless charging features in their flagship smartphones as early as 2013. Nokia (Lumia 830), Samsung (Galaxy S4), LG (Nexus 4) and HTC (Droid DNA) already incorporate wireless charging feature. Wireless charging in smartphones is estimated to become as abundant as Wi-Fi and Bluetooth [7].

Harvesting Energy using renewable sources has been in the main concern of the research society in recent years [2]. There are plentiful sources of renewable energy harvesting, and solar energy is one of the examples. However, solar cell has a drawback of that it can only produce power when sunlight is present. Solar energy harvesting module is used to power a sensor mote [8]. In [9], vibrational energy harvesting is presented and gathering energy from thermoelectric device attached to human is presented in [10]. In [16], Wireless battery charging system using RF energy harvesting is proposed. The energy of 60μW is collected from TV towers, 4.1 km away, and is able to control small electronic device [14]. Power can be transferred through free space by microwaves has been designed, developed and demonstrated by William C. [15]. In [11], Ambient RF energy harvesting with two systems has been studied. In the academia [13], [17], [18], prototypes for such RF harvesters have been developed and commercial products have also been introduced by the industry [12].

Photovoltaic cells (PV) to convert light into electricity which is used in solar energized devices [19]. Outdoor and indoor light sources can be used to produce energy by solar devices, even though indoor insolation electric levels produce around 2 to 3 orders of magnitude less electricity per unit area than outdoor sources [20,21]. Solar devices can attain high energy densities when used in direct sun compared to other sources, but it does not function without light (e.g., highly shaded areas, ducts) [3]. We have used photovoltaic cell as the source of electricity in our proposed device.

1.1 Wireless Power Transfer

wireless power transfer is one of the greatest and overgenerous achievement of mankind has always been.

Beginning stages of this idea was widely considered as an impracticality and thus

turned out to be a failure and never brought up to the knowledge of the society. American scientist, Nikola Tesla of the year 1856, used high electric fields to transfer energy by ionizing the air in the environs, which ultimately is a bad conductor, to plasma. Similarly, it can be detected in case of lightning, where enormous quantity of energy is transmitted at higher frequencies over a faraway distance by ionization of the surrounding the medium [1].

2. WORKING PRINCIPLE

The proposed device is mainly works on the principle of mutual inductance. Power is transferred from transmitter to receiver wirelessly based on the principle of "inductive coupling". Inductive coupling is nothing but phenomena of mutual inductance. Mutual inductance is the occurrences in which, when a current carrying conductor is positioned near another conductor, voltage is induced in that conductor. This is because, as the current is flowing in the conductor, a magnetic flux is induced in it. This induced magnetic flux links with another conductor and this flux induces voltage in the second conductor.

2.1 Inductive coupling

The phenomena of Inductive coupling are based on mutual inductance between two coil placed near to each other, it happens due to the varying magnetic flux between two inductive coils which transfer energy from the source to load. Accordance to Faraday's Law of electromagnetic induction which states that the varying magnetic flux formed by one coil will yield a varying magnetic flux in another induction coil when placed parallel to each other. The working of the system is similar to the working of a resonant transformer. It contains a primary coil and secondary coil. It is tuned to a specific frequency by a LC tank circuit. Being air core, these transformers have low coupling coefficient. Maximum energy is transferred through magnetic field. The electric fields are limited within the capacitor. The coupling coefficient being expressively low (i.e k<0.1) plentiful of the energy from the primary gets transferred to the secondary due to high frequencies (khz to Mhz)[1].

Table -1: Components used in the circuit

Transmitter Section
➢ Solar panel 12volt,300ma ,1 watt
➢ Chargeable battery 12volt,1.5Ah
➢ Capacitors, C: 6.8 nF
➢ Radio Frequency Choke, L1: 8.6 µH
➢ Radio Frequency Choke, L2: 8.6 µH
➢ Transmitter coil, L: 0.674 µH
➢ Resistors: ➢ R1: 1K ➢ R2: 10 K ➢ R3: 94 ohm ➢ R4: 94 ohm ➢ R5: 10 K
➢ Diodes: ➢ D1: D4148 ➢ D2: D4148
➢ Transistors: ➢ MOSFET, Q1: IRF540 ➢ MOSFET, Q2: IRF540

Circuit Diagram

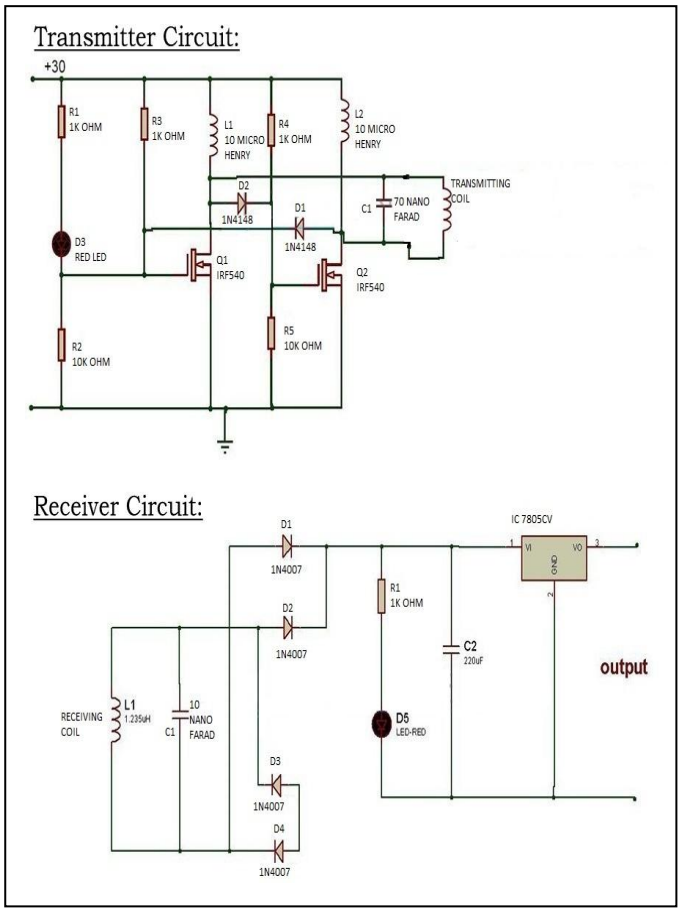

Fig -1: Circuit diagram of the proposed circuit

■ BATTERIES- Wireless charging is compatible with the different kind of batteries. (No problem here or difference to wired charging :)

■ DEVICE MAINTENANCE- With wireless charging there is no need for a USB port any longer.

- Furthermore, it'll allow manufacturers to make the device completely waterproof so it can be better maintained.
- COMPLETELY WIRELESS: Wireless charger present in market is not completely wireless but solar wireless charger is completely wireless.
- Any Smart phone can charge through solar wireless charger
- It can be charge smart phones any time at any place even at night.
- As an additional feature there is a Micro USB support in Solar wireless charger

3. Advantages

Usage of separate charger is eliminated (it works as a universal charger for smartphones). It can charge smartphone anywhere. It does not require wire for charging. There is no need of electricity. It saves electricity. There is no need of specific Smartphone for wireless charging.

3.1 Applications: It can be used in houses, offices, airport, upcoming modern railway station.

3.2 Impact on Environment: It is very much environment friendly because it works on non-conventional energy source (Solar Plate). It saves electricity.

3.3 Possible Innovation at later stage: Further modification can be done to charge the laptop through solar wireless charger. Electric vehicles can also be charged through solar wireless charger by making proper modification in the basic circuits [22-25].

4. CONCLUSIONS

This paper concludes that the proposed technique of wireless solar charging for smartphone is very efficient device. As we give input supply by solar panel so that we can use device anywhere. Normally wireless chargers are so much power consuming, but we use renewable source of energy so there is no such issue arises. We can also use this as normal wireless charger. In India, there are many towns and villages where electricity is a big concern, so here we can use wireless solar charger. We can make any smart phone compatible for wireless charging. This device is compatible with all smartphones, it has very less chance of mobile overcharging, less chance of mobile accident. It will be also providing safety from electric shock and it will be very much user and environment friendly.

REFERENCES

[1] Anand.M, Yogesh Kannan, "Wireless Power Transfer by Incorporation of Solar Energy", IJRDET,Volume 3, Issue 2, August 2014.

[2] Aakib J. Sayyad, N. P. Sarvade, "Wireless Power Transmission for Charging Mobiles", IJETT – Volume 12 Number 7 - Jun 2014.

[3] Talit Jumphoo, Peerapong Uthansakul, and Hoi-Shun Lui, "Implementation of Wireless Charger for Mobile Phone based on Solar Energy", Suranaree J. Sci. Technol. Vol. 21 No. 4; October - December 2014.

[4] Youngjin Park, Jinwook Kim and Kwan-Ho Kim (2012). Magnetically Coupled Resonance Wireless Power Transfer (MR-WPT) with Multiple Self-Resonators, Wireless Power Transfer - Principles and Engineering Explorations, Dr. Ki Young Kim (Ed.), ISBN: 978-953-307-874-8, InTech, Available from: http://bit.ly/25z9iE7

[5] Global Market Revenue for Wireless Charging to Rise by Nearly Factor of 40 by 2018,.IHS, March 13, 2014

[6] Wireless power for mobile devices market to reach $5 billion by 2020, Information Age, 16 November 2014

[7] Wireless Power Transmission: Patent Landscape Analysis, http://bit.ly/285aFMP

[8] K. Lin, J. Yu, J. Hsu, S. Zahedi, D. Lee, J. Friedman, A. Kansal, V. Raghunathan, and M. Srivastava, "Heliomote: Enabling long-lived sensor networks through solar energy harvesting," in 3rd Int. Conf.Embedded Networked Sensor Syst., Nov. 2–4, 2005, p. 309.

[9] J. A. Paradiso, "Systems for human-powered mobile computing," in Proc. 43rd Design Automation Conf. (DAC), Jul. 24–28, 2006, pp. 645–650.

[10] C. R. V. Leonov, T. Torfs, P. Fiorini, and C. Van Hoof, "Thermoelectric converters of human warmth for selfpowered wireless sensor nodes," IEEE Sensors J., vol. 7, no. 5, pp. 650–657, May 2007.

[11] D. Bouchouicha, F. Dupont, M. Latrach, and L. Ventura, "Ambient RF energy harvesting," in IEEE Int. Conf. Renewable Energies PowerQuality (ICREPQ'10), Mar. 2010, pp. 486–495.

[12] Nordic s Semiconductor,[online]. Available: https://www.nordicsemi.com/eng/nordic/download_resource/ 8066/3/45367956.

[13] PrusayonNintanavongsa, UfukMuncuk, Kaushik Roy Chowdhury "Design Optimization and Implementation for RF Energy Harvesting Circuits" IEEE JOURNAL ON EMERGING AND SELECTED TOPICS IN CIRCUITS AND SYSTEMS, VOL. 2, NO. 1, MARCH 2012 pg no 24- 33.

[14] W.C. Brown, J.R. Mims and N.I. Heenan, "An Experimental Microwave-Powered Helicopter", 965 IEEE International Convention Record, Vol. 13, Part 5, pp.225-235.

[15] A. Sample and J. R. Smith, "Experimental results with two wireless power transfer systems," in IEEE Radio Wireless Symp., Jan. 2009, pp. 16–18.

[16] D. W. Harrist, "Wireless battery charging system using radio frequency energy harvesting,"M.S. thesis, Univ. Pittsburgh, Pittsburgh, PA, 2004.

[17] J.J. Schelesak, A. Alden and T. Ohno, A microwave powered high altitude platform, IEEE MTT-S Int. Symp. Digest,pp - 283- 286, 1988.

[18] H. Yan, J. G. M. Montero, A. Akhnoukh, L. C. N. de Vreede, and J. N. Burghart, "An integration scheme for RF power harvesting," presented at the 8th Annu. Workshop SemiconductorAdvances Future Electron. Sensors, Veldhoven, Netherlands, 2005.

[19] Phungsripheng, S., Sanorpim, S., and Wasanapiarnpong, T. (2013). Effect of nitrogen doping on photovoltaic property of lead lanthanum zirconatetitanate

ferroelectric ceramics. Suranaree J. Sci. Technol., 20(2):109-116.

[20] Roundy, S. (2003). Energy scavenging for wireless sensor nodes with a focus on vibration-toelectricity conversion, [Ph.D. thesis]. Department of Mechanical Engineering, University of California, Berkeley, CA, USA, 287p.

[21] Paradiso, J.A. and Starner, T. (2007) Energy scavenging for mobile and wireless electronics. IEEE Pervas. Comput., 4(1):18-27.

[22] Ishu Agrawal, PN Kondekar, "Drain current improvement using spacer and charge plasma concept",Consumer Electronics (ISCE 2014), The 18th IEEE International Symposium on,1-2,2014,IEEE

[23] Ishu Agrawal, PN Kondekar, "Performance analysis of Tunnel Field Effect Transistor using charge plasma concept", Electron Devices and Solid-State Circuits (EDSSC), 2014 IEEE International Conference on,1-2, 2014, IEEE

[24] Ishu Agrawal, PN Kondekar,"Performance analysis of tunnel FET",IEEE STUDENT International Conference on Circuit Control and Communication (C-CUBE), December 2013, Bangalore, 2013.

[25] Pankaj Kumar, P. N. Kondekar, Sangeeta Singh, Ishu Agrawal, "Characteristics and sensitivity analysis of Gate Inside Junctionless Transistor (GI-JLT)", Electronics Circuits and Systems (ICECS), 2013 IEEE 20th International Conference on,56-59, 2013, IEEE.

[26] Seema Das, Hari Mohan Rai, RinkuSanghwa, "PID AND FUZZY-PID CONTROLLER FOR VARIOUS ELECTRICAL MACHINE APPLICATIONS: A COMPARATIVE STUDY", International Journal of Advanced and Innovative Research (2278-7844), Vol. 2, Issue 11, Nov-13.

[27] SEEMA DAS, Hari Mohan Rai, Shailey Gulati,RinkuSanghwan, "LOAD FREQUENCY ANALYSIS OF AUTOMATIC GENERATION CONTROL SINGLE AREA NETWORK USING ANN AND GA", International Journal of Advanced and Innovative Research (2278-7844), Volume 2, Issue 11, Nov-13.

[28] Hari Mohan Rai, Vishal Phaugat, Subham Gupta, RohitThakran, "EFFECT OF BINDER ON VISCOSITY WITH SHEAR RATE", International Journal of Emerging Trends in Electrical and Electronics (IJETEE) (ISSN 2320-9569), Volume 9, Issue 2, November 2013.

[29] Shivam Thakur, Hari Mohan Rai, Sidharth Kumar, SumanPawar, "FACTORS DETERMINING THE SPEED AND EFFICIENCY OF A MICRO-PROCESSOR IN A PC", International Journal of Emerging Trends in Electrical and Electronics (IJETEE – ISSN: 2320-9569) Vol. 9, Issue. 2, Nov-2013.

[30] Hari Mohan Rai, Chandra Shekhar Singh, Arun Kumar, Anish Kumar, Abhishek Sharma, "AUTOMATIC WIRELESS BATTERY CHARGER FOR PERMANENET PACEMAKER",International Journal of Advanced and Innovative Research (2278-7844) , Vol. 2, Issue 12, Dec-13.