IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 4, April 2023

DOI: 10.17148/IARJSET.2023.10455

AERIAL TECHNOLOGY FOR LOW POWER TRANSMISSION USING ARRAY OF RF ANTENNA

Bhavana S[1], Davino Joseph[1],Rajshekar[1], B.Y Harshitha[1], Dr.Christo Jain[2]

Dept. of Electronics & Communication Engg.K S Institute of Technology Bangalore, India[1]

Associate Prof, Dept. of Electronics & Communication Engg.K S Institute of Technology Bangalore, India[2]

Abstract: The suggested study places particular emphasis on the difficulty of power transfer. Because wireless power transfer eliminates the requirement for a line for the transmission of electricity, this technique allows us to reduce complexity. Comparing this process to other systems can increase proficiency, reduce energy crisis, and lessen power loss. Wires are never used in wireless power transmission, therefore mishaps and electric shocks in the home are reduced. Instead than using cables to transmit power, this technology makes use of RF antenna.

Keywords: Microstrip antenna, Dc source, impedance matching, voltage converter

I. INTRODUCTION

Wireless power transfer is the physical link-free delivery of electrical energy. In a wireless power transmission system, an electrically powered transmitter device creates a time-varying electromagnetic field that transfers power across space to an electrical load through a reception device. By doing away with wires and batteries, wireless power transfer technology can improve an electronic device's portability, use, and safety for all users. Electrical devices can be powered wirelessly in situations where running wires would be difficult, dangerous, or impossible.

"transmitter" device attached to a power source, like a mains power line, that transforms the power into a time-varying electromagnetic field, and one or more "receiver" devices that take in the power and transform it back into DC or AC electric current utilised by an electrical load. A type of "antenna" device is used at the transmitter to transform the input power into an oscillating electromagnetic field. The term "antenna" is used broadly here; examples include wire coils that produce magnetic fields, metal plates that produce electric fields, antennas that emit radio waves, and lasers that produce light. The oscillating fields are converted to an electric current at the receiver using a comparable antenna or coupling device. The frequency, which determines the wavelength, is a crucial factor.
in determining the kind of waves.

Wireless power uses the same electromagnetic fields and waves as wireless communication devices like radio, a well-known technology that involves electrical energy transmitted without wires by electromagnetic fields. This technology is used in WiFi, radio and television broadcasting, and cellphones, among other things. The purpose of radio communication is the transfer of information; therefore, the quantity of power that reaches the receiver is not as crucial as long as it is sufficient for the information to be understood. In wireless communication technology, the receiver only receives very little power. The efficiency (the proportion of sent energy that is received) is a more relevant factor in wireless power transfer since the amount of energy received is what matters.

II. LITERATURE SURVEY

[1] wireless Electricity Transfer (WPT) enables the supply of power across an air gap without the usage of wires that convey current. the absence of physical connectors or WPT may use cables to connect compatible batteries or devices to an AC power source. Mobile devices, tablets, drones, cars, and even equipment used in transportation can all be refuel by WPT. The groupings for near-field and far-field WPT systems are separated. According to the method, power can be wirelessly transmitted using resonant inductive coupling, magnetic resonance coupling, and microwave power transfer. The proposed method takes use of an aerial various half-wave Dipoles. The dipole aeria is the least priced and most popular form. A dipole aerial is made up of two parts, which are commonly metal wires or rods. loss caused by power converters, controllers, and nodes.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 4, April 2023

DOI: 10.17148/IARJSET.2023.10455

[2] In the present day, electricity is a fundamental necessity and the fuel for technological advancement. Traditionally, electricity has been used through cables. We currently use wire systems to transmit power, however everyone requires wireless systems in today's modern world if they want flexibility or mobility. This study work's main objective is to provide a succinct outline of the most recent advancements and research in the field of wireless transfer of electrical power. We can somewhat boost efficiency and reduce transmission and distribution losses by implementing delivery of power wirelessly. Electrostatic induction, radio, microwave, electrodyamic induction, electromagnetic transmission, and induction, laser, etc. are the techniques used for wireless power transmission. Economic aspects, restrictions, advantages, disadvantages, biological effects, and applications of WPT systems are also discussed.

[3] The time is now for radio frequency (RF) energy harvesting. Everything uses RF energy. We are showcasing a mobile wireless charging system prototype. All the inconveniences associated with current battery technology should be gone thanks to this wireless battery charger. It would be convenient to use a device without having to bother about charging it or replacing the batteries. The ability of this device to wirelessly recharge the batteries is a benefit that, over time, can help the general public save time and money.

[4] A number of businesses and the scientific community have recently become interested in the potential technology known as Wireless Charging (WC). Energy conservation and energy harvesting are essential for increasing network lifetime in the Internet of Things (IoT) and Wireless Sensor Networks (WSNs)., are only two areas where WC offers a wide range of benefits and applications. WC products and solutions have been released by a number of businesses and are now accessible to end customers.

[5] For manufacturers, a mobile phone's battery life has always been a challenge. People frequently complain that the batteries in their mobile devices don't last very long and require frequent recharging. These days, portable electronics are extremely popular. The need for more battery life is growing along with the usage of these portable electronic devices. Periodically, these batteries need to be recharged or changed. After a while, charging or replacing the battery can be a problem, especially if there isn't a power outlet nearby. All the inconveniences associated with current battery technology should be gone thanks to this wireless battery charger.

[6] The energy harvesting circuit was introduced in this research to enable wireless charging. Public spaces have extensive and powerful wireless RF spectrum that can be exploited for energy harvesting. The fact that RF waves are widespread and do not require any kind of propagation material supports this. The charge pump circuit, matching circuit, and ideal antenna are used in the system's development. Using the High Frequency Simulator, the 2x2 array type patch antenna operating at 924 MHz is built. The antenna functions as a transducer to gather and measure the RF signals from a source of energy that is readily available.

[7] In this paper, a Franklin array antenna is suggested for use in wireless charging applications. The concept of using radio waves as a power source for portable gadgets is intriguing. However, because of its relatively long wavelength, microwave radiation loses some of its power density as it travels. According to power budget analysis, a one watt transmitter is only capable of producing a few milliwatts at a distance of one meter when using transmitting and receiving antennas with moderate gains.

[8] With the ultimate goal of reviving energy, wireless charging is an advancement in power transfer through an air hole to loads. A viable alternative strategy to relieve the energy bottleneck of generally useful battery-powered devices has been made possible by the current improvement of wireless charging technology and the upgrading of commercial items. However, there are a number of testing difficulties with regard to execution, planning, and force organization brought on by the integration of the current Wireless correspondence system into the Wireless racing circuit. In this article, improvements to certain security protocols, numerous system applications, and a full graph of wireless charging procedures are all included. When everything is considered, these systems frequently have a place with clinical implantation and flexible chargers for all electrical and electronic obligations.

[9] For the purpose of powering a few circuits in wirelessly communicating electronics devices, RF energy harvesting offers a promising future. One of the many fields with active study is RF power harvesting. Devices that utilize RF waves can harvest that energy and use it to operate more effectively and efficiently. This study illustrates how effectively energy harvesting performs when a straightforward voltage double is used. With a few minor adjustments, we were able to

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 4, April 2023

DOI: 10.17148/IARJSET.2023.10455

generate a high output voltage using RF radiation. The current schottky diode-based voltage double circuit is improved in order to achieve high output.

[10] This study describes a wireless tab charging system that uses Radio Frequency (RF) energy harvesting. The size of the battery and the lengthening of the charge time present significant challenges for mobile devices, as does the requirement for constant mains connection for charging. The project aims to recharge mobile end devices using the RF received by its antenna. The appropriate frequency for power transmission was found by this investigation, and an effective microstip patch antenna with a increase of 3.762dB, directivity of 5.906dB, and a power density of 7.358dBW/m2 was selected.

[11] The world would be unimaginable without electricity. Typically, cables are used to transmit power. This essay outlines a novel idea for getting rid of dangerous electrical wire usage, which causes a lot of difficulty when it comes to organizing them specifically. Imagine a world in which it is possible to transfer power wirelessly. Cell phones, robots for the home, mp3 players, laptops, and other portable electronics would be able to charge themselves without being plugged in, freeing us from the last, , most common power wire. Some of these gadgets might even run without the need for their large batteries. This article describes non-radiative power transmission systems systems that have an efficiency of about 95% without utilizing wires. As a result, it has no impact on the environment.

[12] The possibility of feeding a system without making physical touch by employing microwave radiation is known as Microwave Power Transmission (MPT). The difficulty with such a system is improving the efficiency of energy transmission from the emitter to the load. This can be done by rectifying the microwave radiation using a rectifier system made up of an antenna with a significant gain coupled to an input impedance-matched rectifier. This study develops a new multiband antenna employing fractal geometry and microstrip technology.

[13] Antenna arrays are one of many techniques that have been suggested to regulate electro rmagnetic fields in the near- or far-field region. The method of maximum power transmission efficiency (MMPTE), which is used to build This paper reviews antenna arrays and wireless power transfer (WPT) technologies. The power transmission efficiency (PTE) between the transmitter and receiver is the goal of all wireless systems, and as a result, the PTE can be used as a performance metric when designing WPT systems and antennas. The method's inspiration is given by this.

[14] Modern society's fundamental need for electricity serves as the fuel for technological advancement. Wires are the traditional method for utilizing energy. Currently, we transmit power utilizing wire systems, however in today's modern world, everyone requires wireless systems for flexibility or mobility. The main objective of this research project is to provide a concise summary of the most recent advancements and research in the field of wireless transfer of electrical power. We can somewhat boost efficiency by implementing wireless power transmission while reducing transmission and distribution losses. Wireless power transfer methods include induction, electromagnetic transmission, evanescent wave coupling, electrodynamic induction, radio, microwave electrostatic induction, laser, etc.

[15] Increasing the lifespan of wireless nodes and hence reducing the energy bottleneck in energy-constrained wireless networks are two goals of simultaneous wireless information and power transfer, or SWIPT. Instead of using traditional energy collecting methods, SWIPT makes use of It is anticipated that this development will fundamentally alter how wireless communication networks are designed. radio frequency signals. The use of modern smart antenna technologies, such as multiple-input multiple-output and relaying methods, to SWIPT is the main topic of this article. The energy and spectrum efficiency of SWIPT could both be considerably increased by these smart antenna technologies. In order to establish a fair trade-off between system performance and reliability, various network topologies with single and multiple users are examined, along with some interesting alternatives

[16] Future wireless energy distribution may be made possible by two developing alternative energy technologies: radio frequency energy harvesting (RFEH) and wireless power transfer (WPT). The receiving antenna is one of the most important parts of an RFEH or WPT system. The power delivery capacity of an RFEH or WPT system is significantly impacted by the performance of the receiving antenna. An extensive overview of current developments in receiving antennas for RFEH and WPT is given in this study. Low-profile, multi-band, circularly polarized, and array antennas are the categories of antennas covered in this study.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 4, April 2023

DOI: 10.17148/IARJSET.2023.10455

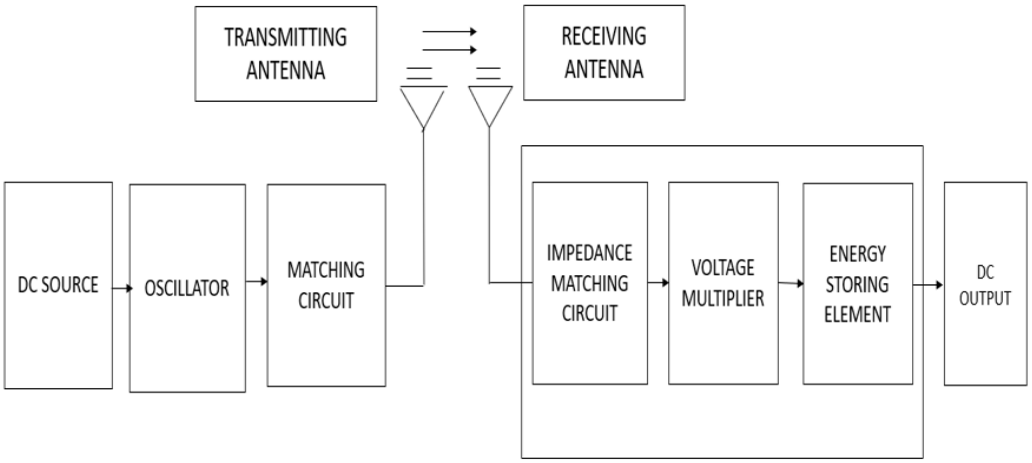
[17] The primary goal is to extract energy from the RF signal round, thus an effective antenna with a small profile and an appropriate RF power converter are required to recharge the mobile phone battery at the receiving stage. When there is a mismatch, some of the power will be wasted as heat and system damage as it is reflected back from the antenna to the source. A voltage multiplier circuit is needed to transform the RF signal captured by the antenna into DC power adequate for charging a mobile phone.

[18] As mobile technology develops, products like wearables, tablets, and smartphones are utilized for extended periods of time. With this advancement, it is important to always keep the gadgets fully charged. The majority of these devices don't need cords for Internet connectivity, but charging still necessitates connecting them to a wire The purpose of wireless power is to do away with these cords and send electricity wirelessly so that these gadgets can be charged.

[19] The use of modern smart antenna technologies, such as multiple-input multiple-output and relaying methods, to SWIPT is the main topic of this article. The energy and spectrum efficiency of SWIPT could both be considerably increased by these smart antenna technologies. In order to establish a fair trade-off between system performance and complexity, various network topologies with single and many users are examined, along with some interesting solutions.

[20] In order to further the development of this technology, much study has been done on the technical indices and test procedures for microwave wireless energy transfer systems. In this study, the topology of these systems was examined, technical performance indices for important system components were created, and related test and assessment procedures were created.

III.BLOCK DIAGRAM



The power transmission takes place between transmitter and receiver antenna. Transmitter part has a DC source which is the power supply. Oscillator is used to convert DC signal to AC. Impedance matching circuit is used to match the impedance of the antenna at both transmitter and receiver side. Then the power is transmitter from transmitting antenna to receiving antenna through air medium. Again the AC signal is converted back to DC signal. Voltage multiplier is used to amplify the voltage or to increase the voltage. Finally the DC signal obtained is stored in a storage element like capacitor and given as output. The DC output can be used to charge the mobile phone, glow an LED etc wirelessly.

IV.METHODOLOGY

The design consists of transmitter, receiver, oscilloscope, rectifier, dc storage element, power supply.

The system consists of TWO stages:

Transmitter part -array of dipole antenna

Receiver part -array of dipole antenna

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

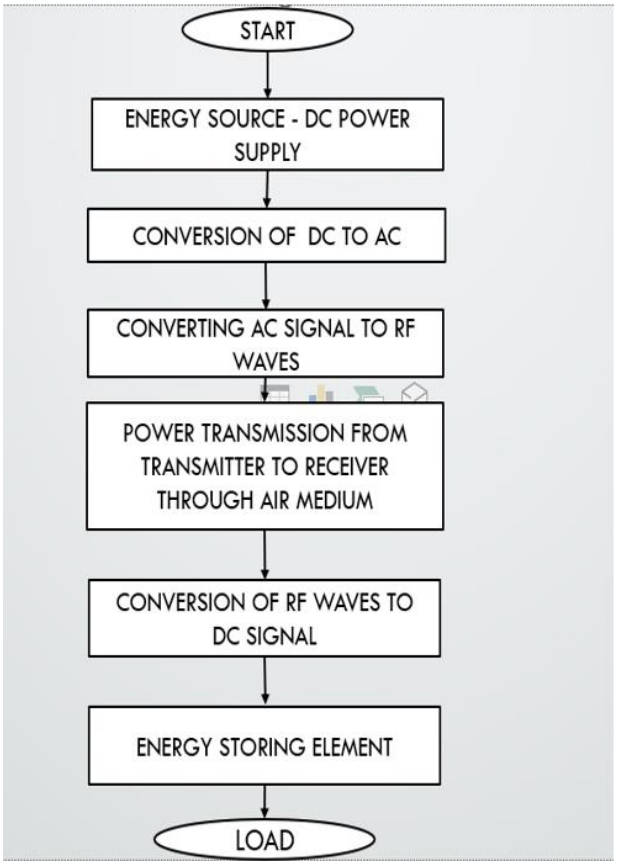
ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 4, April 2023

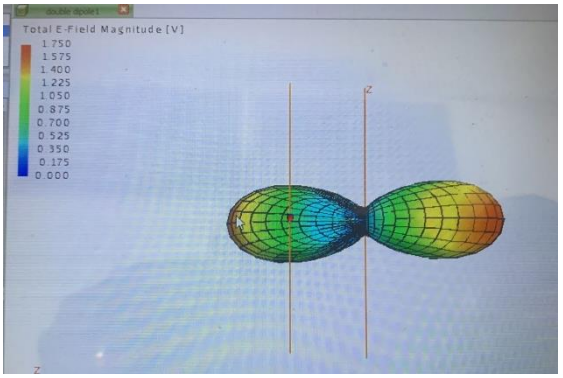
DOI: 10.17148/IARJSET.2023.10455

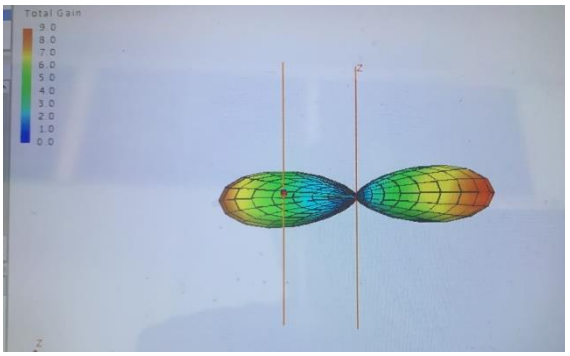
A. Transmitter part: It consists of power supply of 5-10v will be given and which will be connected to the voltage multiplier also called as a oscilloscope which will convert DC power supply to ac signals then it is given to the transmitter part where array of dipole antenna is used for the effective signals which will be travel through free space and will reach to the receiver side.

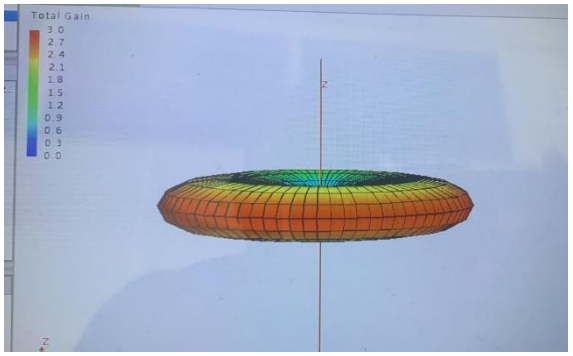
B. Receiver part: It consists of rectifier which will convert ac signals to dc and voltage booster circuit which will double the voltage of dc to dc signals also called as a step up transformer which is given to the dc storage element where the power is stored and phone can be charged.

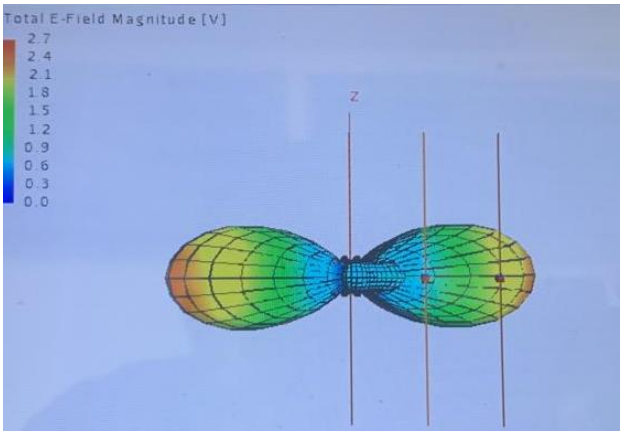
I. FLOWCHART











IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 4, April 2023

DOI: 10.17148/IARJSET.2023.10455

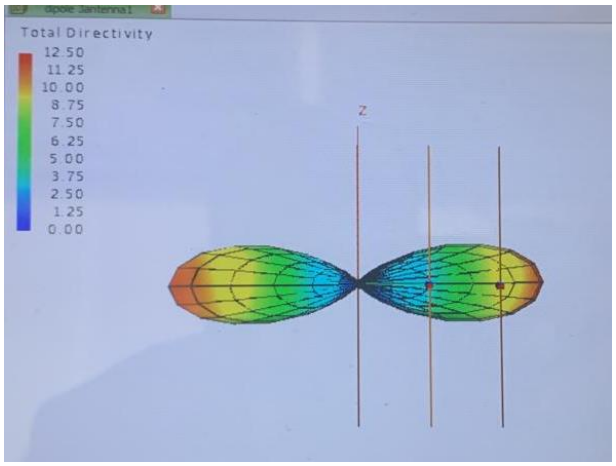


Figure: shows the array of 3 dipole antenna, comparison of electric magnitude and total gain and directivity.

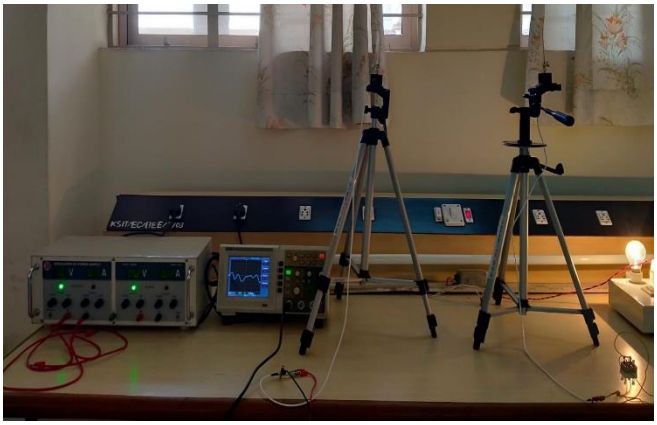
As observed on the oscilloscope, the final output i.e., the RMS value that we have achieved is in milli-volts which is approximately equal to the values obtained from simulation. the output that we get here is not constant as it completely depends on RF energy. You may get in millivolts or sometimes in volts depending on the intensity of RF energy waves. The output DC voltage can be amplified by adding more number of voltage double circuit stages to the RF to DC converter

The below images shows the array of 2 dipole antenna placed beside each other and comparison of the total electric magnitude and total gain of antenna

V.CONCLUSION

The conclusion is using wireless technology for low power transmission using Rf antenna where the phone can be charged wirelessly without the use of electric wires by transmitting low power dc voltage from the transmitter to reciver through free space

VI.RESULTS



REFERENCES

[1] H. Shoki, "Issues and Initiatives for Practical Deployment of Wireless Power Transfer Technologies in Japan," in Proceedings of the IEEE, vol. 101, no. 6, pp. 1312-1320, June 2013, doi: 10.1109/JPROC.2013.2248051.

[2] Wang C, Xu W, Zhang C, Wang M, Wang X. Microwave wireless power transmission technology index system and test evaluation methods. EURASIP Journal on Advances in Signal Processing. 2022 Dec;2022(1):1-

[3] P. Eekshita, N. S. V. Narayana and R. Jayaraman, "Wireless Power Transmission System," 2021 International Conference on Computer Communication and Informatics (ICCCI), 2021, pp. 1-4, doi: 10.1109/ICCCI50826.2021.9402575.

DOI: 10.17148/IARJSET.2023.10455

[4] M. Z. Chaari and S. Al-maadeed, "Wireless Power Transmission for the Internet of Things (IoT)," 2020 IEEE International Conference on Informatics, IoT, and Enabling Technologies (ICIoT), 2020, pp. 549-554, doi: 10.1109/ICIoT48696.2020.9089547.

[5] Khan H, Ali SA, Wajid M, Alam MS. Antenna array design on flexible substrate for wireless power transfer. Frontiers in Engineering and Built Environment. 2021 May 3;1(1):55-67.

[6] Z. Ding et al., "Application of smart antenna technologies in simultaneous wireless information and power transfer," in IEEE Communications Magazine, vol. 53, no. 4, pp. 86-93, April 2015, doi: 10.1109/MCOM.2015.7081080.

[7] Chaurasia D, Ahirwar S. An Optimal Parameter Estimation Technique for Wireless Electricity Transmission.

[8] S. M, E. R. G, B. G. Reddy, S. L. Reddy and V. Chennareddy, "Wireless Power Transmission Science Model," 2021 Second International Conference on Electronics and Sustainable Communication Systems (ICESC), 2021, pp. 1-5, doi: 10.1109/ICESC51422.2021.9532606.

[9] C. H. Lee, G. Jung, K. A. Hosani, B. Song, D. -k. Seo and D. Cho, "Wireless Power Transfer System for an Autonomous Electric Vehicle," 2020 IEEE Wireless Power Transfer Conference (WPTC), 2020, pp. 467-470, doi: 10.1109/WPTC48563.2020.9295631.

[10] S. Guo, P. Zhang, J. Guo, L. Wang and G. Sun, "Design of Wireless Power Transmission System based on magnetic coupling resonant for the capsule endoscopy," 2017 IEEE International Conference on Mechatronics and Automation (ICMA), 2017, pp. 23-28, doi: 10.1109/ICMA.2017.8015782.

[11] M. A. Ullah, R. Keshavarz, M. Abolhasan, J. Lipman, K. P. Esselle and N. Shariati, "A Review on Antenna Technologies for Ambient RF Energy Harvesting and Wireless Power Transfer: Designs, Challenges and Applications," in IEEE Access, vol. 10, pp. 17231-17267, 2022, doi: 10.1109/ACCESS.2022.3149276.

[12] M. Shidujaman, H. Samani and M. Arif, "Wireless power transmission trends," 2014 International Conference on Informatics, Electronics & Vision (ICIEV), 2014, pp. 1-6, doi: 10.1109/ICIEV.2014.6850770.

[13] R. Saha, B. Roy Joy and S. A. Mirbozorgi, "Wireless Power Transmission with Uniform Power Delivery in the 3D Space of the Human Body using Resonators in Parallel," 2021 43rd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), 2021, pp. 7268-7271, doi: 10.1109/EMBC46164.2021.9629929.

[14] Bakolia, P., 2017. Wireless Power Transmission–The Future of Power Transmission System. By. Journal of Advanced Computing and Communication Technologies, (5), pp.48-54.

[15] Q. Wang and H. Li, "Research on the wireless power transmission system based on coupled magnetic resonances," 2011 International Conference on Electronics, Communications and Control (ICECC), 2011, pp. 2255-2258, doi: 10.1109/ICECC.2011.6067744.

[16] S. R. A. Bolonne, A. K. K. Chanaka, G. C. Jayawardhana, I. H. T. D. Lionel and D. P. Chandima, "Wireless power transmission for multiple devices," 2016 Moratuwa Engineering Research Conference (MERCon), 2016, pp. 242-247, doi: 10.1109/MERCon.2016.7480147.

[17 M. Hassan and A. E. Zawawi, "Wireless power transfer (Wireless lighting)," 2015 5th International Conference on Information & Communication Technology and Accessibility (ICTA), 2015, pp. 1-4, doi: 10.1109/ICTA.2015.7426916.

[18] Vikash, C., Satendar, P.S., Vikash, K. and Deepak, P., 2011. Wireless Power Transmission: An Innovative Idea. International Journal of Educational Planning & Administration, 1(3), pp.203-210.

[19] M. Andrei, B. Claudiu and I. Vadan, "Wireless Power Transmission — State of the Art and Applications," 2019 8th International Conference on Modern Power Systems (MPS), 2019, pp. 1-6, doi: 10.1109/MPS.2019.8759759.

[20] Harrist DW. Wireless battery charging system using radio frequency energy harvesting (Doctoral dissertation, University of Pittsburgh).