Wireless Power Transfer System

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Abstract: Wireless Power Delivery is the transmission of electrical energy from a source to a load over a long distance without the need of any conducting wires or cables. Nikola Tesla was the first to develop the notion of wireless power transfer. Wireless power transmission has the potential to revolutionize the field of electrical engineering by removing the need for traditional copper connections and current carrying wires. Every day, new technology makes our lives easier. Wireless charging by resonance might be one of the next technologies to help us get closer to the future. It was demonstrated in this experiment that low-power gadgets may be charged wirelessly via inductive coupling. It reduces the complexity that comes with using a traditional wire system. In addition, the project also opens up new possibilities of wireless systems in our other daily life uses.

KEYWORDS: Coil, Oscillator, power supply, Capacitor.

I. INTRODUCTION

For a long time, electricity was mostly transferred through the use of traditional wire systems. Traditional cable (wire) power transmission has issues with age, wear, and the generation of electric sparks. Due to the detrimental influence on the cable's safety and dependability, it is impossible to utilise it to transmit in specific terrains such as high mountains and seabeds [1]. By radically altering the manner of transmitting electricity, Wireless Power Transfer (WPT) has the potential to induce a paradigm change. WPT [2] is a massive approach for transmitting electric power over long distances across a vacuum or environment without the need of regular wires or any other material. Wireless charging has progressed from a concept to a feature in commercial items, particularly mobile phones and portable smart gadgets [3]. Mobile titans such as Huawei and Samsung produced modern high-end smartphones in 2014. Wireless charging capability was included into these gadgets. Several firms, including Qualcomm, Evatran, WiTricity, and others, have already created systems capable of delivering power via a 15-30 cm air gap with acceptable efficiency. The purpose of this study is to provide an overview of the wireless power transfer mechanism..

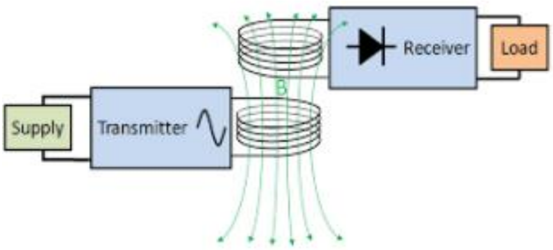

Fig1: Wireless Power Transfer

II. EXISTING SYSTEM

In [1], a 3D structured WPT that can transfer power wirelessly in a robotic application was achieved using simulation and experiments at a frequency of 500 kHz. For the winding method that was proposed, a joint made of dual spherical structures was utilized. The joint is made up of a rotating spherical structure inside a huge sphere using a 0°–85° mechanical stud. The transmitter coil (Tx) with a radius of 3.85cm was wounded on a spherical structure (with a slot). The mechanical stud can rotate the small sphere up to 45°. The receiver coils (Rx) with a radius of 2.85cm have been wounded onto a small sphere structure which produced a displacement angle α in degrees. The value of α was obtained taking measurements between the joint structure's vertical axes. Results showed that at a load (RL) of 20Ω, the hemispherical winding produced an efficiency of up to 96% at α = 0°.when it was at 85°, the efficiency reduced to less than 10%. For contrast, the optimized WPT under the same load conditions had an efficiency of 95.75% and 96% at α = 0° and 85° respectively. However, using this proposed method, the magnetic field density is concentrated in the close area around the coils which may be harmful if deployed close to the human body. In addition to this, the authors did not specify the optimization method used for finding the optimal dimensions of the core, coils, and detection circuit elements. In [2], a professor of Nuclear & Quantum Engineering at KAIST, and his team build off the ideas of the research team at MIT. Prof Park's team demonstrated great improvement in the distance that electric power can travel wirelessly. The authors developed the Dipole Coil Resonant System (DCRS) with a ferrite core wounded in middle for an extended range of inductive power transfer, to a distance of 3, 4 and 5 meters between transmitter and receiver coils with efficiencies of 29%, 16%, and 8% respectively. This team transferred energy based on the oscillating frequency of 20 kHz in the transmitting coil. Measurement for length, width, and height for this system are 3m, 10cm, and 20cm respectively with a low Q factor of 100. Several experiments were conducted using this system producing results that indicated that operating under 20 kHz produced a maximum power output of 1403W at a distance of 3m, 471W at 4m and 209W was obtained at 5 m. 100 W of electric power transfer gave an overall system power of 36.9%, 18.7%, and 9.2% for distances of 3m, 4m, and 5m respectively. The Dipole Coil Resonant System is capable of charging up to 40 smartphones once using maximum power output of 209v at 20 kHz. However, it was observed that the coupling was not considered for nonadjacent and adjacent cases [3]. Secondly, the complex structure and large size of the receiver coils make it difficult for them to be integrated into portable consumer devices. In [4], the authors conducted a study on relay effect via magnetic resonant coupling for wireless power transfer to extend the energy transfer distance. Modeling and numerical analysis were carried out using Computer Simulation Technology (CST) Microwave Studio simulation software. The authors explained that the power efficiency of a typical wireless power transfer system has the poor performance to transmit energy at a 1-meter distance which can only reach up to 4.6 % power efficiency. In other to overcome this shortcoming, a relay coil with a diameter of 24cm, operating at 41.586MHz frequency was inserted between the transmitter and receiver coils to extend the power transfer distance of the system. After placing the relay coil, the result showed an improvement of up to 50 % increment of power efficiency compared to the system without a relay coil. By adding two relay coils between the Transmitter and receiver, the power efficiency increased up to 75 % at a 1-meter distance of the WPT system. However, the relay coil can sometimes decrease the efficiency when the coupling distance is equal between Tx and Rx coils [5] .

III. WORKING OPERATION:

Working of transmitter circuit:

A D.C. power supply, an oscillator circuit (also known as an inverter), and a transmitter coil make up the transmitter module of our project. The oscillator circuit's input receives a steady D.C. voltage from the D.C. power source. This D.C. power is then transformed to a high-frequency A.C. power and sent into the transmitter coil. An alternating magnetic field is produced by the transmitter coil, which is generated by a high frequency A.C. current.

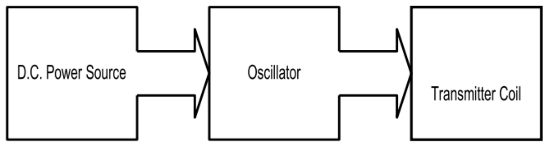

Fig2: Block Diagram Of transmitter

Working of Receiver:

Our project's receiver module consists of a reception coil, a rectifier circuit, and a voltage regulator IC. A second buck converter was added to generate extra current by lowering the output voltage to 5 volts. The receiver coil is induced with an A.C. voltage. The rectifier circuit transforms it to D.C., and the voltage regulator IC keeps the voltage at the load constant. The following block diagram depicts the receiver module in general:

IV. HARDWARE IMPLEMENTATION:

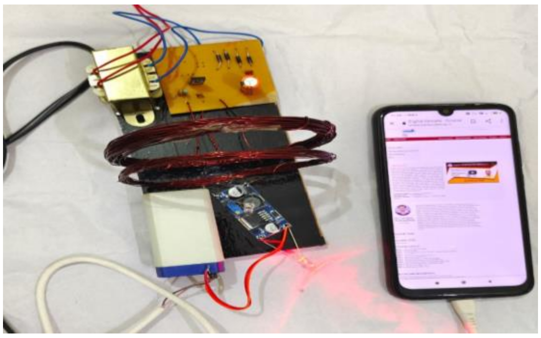

Fig1: Show hardware Implementation of hardware.

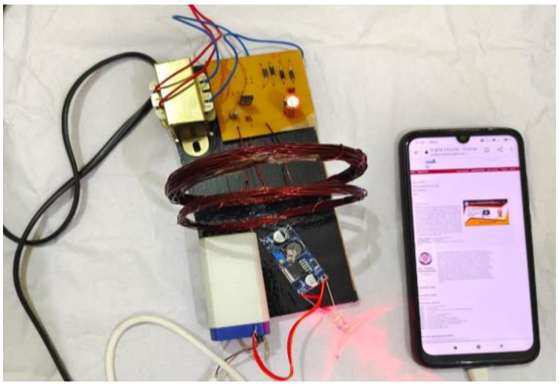

Fig 2: System Charge the mobile.

V. CONCLUSION:

The purpose of this project was to develop and build a resonant inductive coupling-based wireless charger for low-power devices. A circuit was devised and built after a step-by-step analysis of the entire system for optimization. The results of the experiments revealed that considerable gains in power-transfer efficiency had been made. The use of resonant inductive coupling to transport power wirelessly from a source coil to a load coil and charge a low-power device was described and demonstrated. Wireless charging, as previously said, might be the next big thing.

VI. REFERENCES:

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