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Solar Based Wireless Power Transmission

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***Abstract*: Wireless power transmission is the delivery of electrical energy from a source to a load over a long distance without the need of any conducting wires or cables. An inductive coupling is used to transmit power. The entire setup is coupled to a solar system, which results in high frequency inductive coupling between the coils and power transmission to the load. Wireless power transmission is a novel method of transferring power to a load. Wireless power transfer has the potential to revolutions the area of electrical engineering by removing the need for traditional copper connections and current carrying wires. In 1890, Nikolas Tesla became the first person to invent wireless power transfer (WPT) technology. He intended to design a supply system that didn't require the usage of wire, thus he invented.**

***Keywords*: MOSFET, resistors, solar panel, LED, resonating coils.**

1. Introduction

The efficient transmission of electric power from one location to another through an atmosphere without the use of wires or other materials is known as wireless power transmission (WPT). This can be utilized in situations when an instantaneous or continuous flow of electricity is required, but traditional cables are prohibitively expensive, inconvenient, harmful, undesired, or impossible to employ. During the last two decades. This research focuses on using solar energy to charge a battery that can store multiple charges. Power transmission via cables lost 25-30% of its power, and there were several mishaps as a result of employing cables for power transmission. The essence of the phenomena of inductive coupling highlights that energy is transferred from the source to the load by altering the magnetic flux between two inductive coils, which is in accordance with Faraday's Law of electromagnetic induction. The operation of the system is similar to that of a resonant transformer. A LC tank circuit tunes a main and secondary coil to a certain frequency. The workings of these circuits remain unclear. This technique, which has just recently been developed, has piqued the interest of scientists and R&D firms all over the world. Mobile devices with rechargeable batteries, such as cell phones, PDAs, laptops, tablets, and other handheld devices, have become increasingly popular in recent years.

The transmission of electromagnetic waves is recognized to be connected with electromagnetic energy. All electromagnetic waves can theoretically be used for wireless power transmission (WPT). Only efficiency distinguishes the WPT from communication systems. In a communication system, the transmitted energy is distributed in all directions. Despite the fact that the received power is sufficient for data transfer, the efficiency from transmitter to receiver is quite low. By using the same technology to EVs, the vehicles may charge the battery while driving, extending the range of travel, reducing charging time, and so on. Two self-resonating copper coils with the same resonating frequency of roughly 100 kHz make up the project. A copper wire is joined to another.

Research resulted in a gadget that transmits energy wirelessly across a distance of around 10 cm using copper coils. At the transmitter circuit, the device uses solar energy and a 100 kHz pulse generator. As a result, current flows wirelessly from the transmitter side coil to the receiver side coil via a rectifier and regulator.

WPT is a fascinating and challenging field that draws researchers from a variety of disciplines, including material science and nanotechnology, power electronics, applied electromagnets, and RF and microwave electronics.

2. Wireless Power Transfer Types

Wireless power transmission can be divided into three categories. They really are.

- Coupling by induction
- Transmission of microwave energy
- Transfer of laser energy

For the transfer of electrical energy in this project, we use inductive coupling of the transmitter and receiver circuits. It works on the principle that as current flows through one coil, a voltage is produced across the other wire's ends.

3. Block Diagram of the Project

The circuit consists of five functional blocks. They are:

- Power supply block with solar energy and auxiliary supply
- Batteries for storing DC power
- IRFZ44N MOSFET operation
- Primary coil and secondary coil
- Rectifier section

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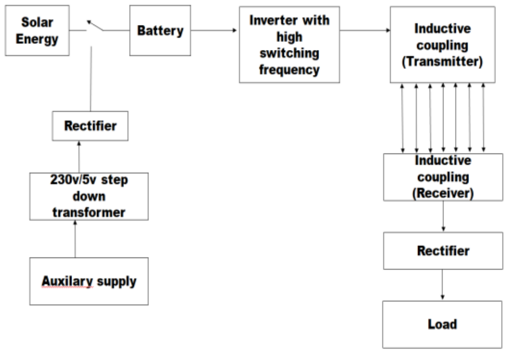

Fig. 1. Block diagram

4. Principle of Operation

The pulse generator, sending coil, receiving coil, rectifier, solar, and load are the six fundamental components of our experiment. These copper tube coils are manufactured to be identical so that they resonate at the same frequency. The resonance frequency of our coils, where we get the most power, is affected by the distance between the coils. The batteries are charged using a 12-volt, 5-watt solar panel. During the cloudy season, the sun's supply is usually unavailable, thus we rely on the auxiliary source. However, if both supply systems are accessible at the same time, we can store the power generated by the solar panels. We used four 12v batteries in this case, and the power from the batteries was fed to the computer.

The distance between the coils affects the resonance frequency of our coils, which is where we obtain the maximum power. As a result, we decided to employ a frequency generator, which allowed us to modify the frequency as needed. Several oscillators were developed to generate different frequencies, but due to the fluctuating nature of our resonance frequency, we used a frequency generator, similar to a pulse generator. The produced signal is sent into a 10-gauge wire driving loop. The loop is only a smidgeon smaller than our main coil (approximately 55.5 cm in diameter). The driving loop's AC current causes the wire loop to act like a dipole. The driving loop is as close as feasible parallel to the primary coil. The primary coil resonates as a result of the driving loop's generated current. It's vital to understand that the driving loop does not directly cause the secondary loop to resonate. Because the coils are the same form, size, and mass, the evanescent waves released by the main coil induce the secondary coil to resonate (or close to identical). Copper tubing with a 1/4-inch inner diameter (3/8-inch exterior diameter) is used for both the primary and secondary coils. Each coil has around 10 turns and is made up of 60 feet of tubing (57.5 cm in diameter). The two coils are now parallel and resonating, with only enough power to make the driving loop "drive" the coils.

The magnitude of power transmitted is determined by the distance between the primary and secondary coils. Solar cells provided the voltage sources for the transceiver. As the coils are pushed further apart, the power decreases exponentially. A stronger magnetic field is generated when the secondary coil vibrates at its resonance frequency. The receiving loop is made of 10-gauge wire and is placed as close to the secondary coil as possible. In the receiving loop, the magnetic flux from the secondary coil induces a current, which drives a resistive load (LED).

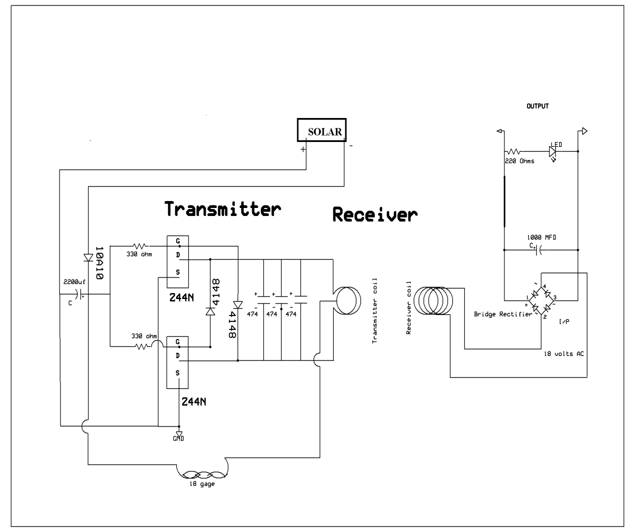

Fig. 2. Circuit diagram of the project

5. Applications

Industrial Applications: Wireless sensors on rotating shafts, wireless equipment charging and powering, and safe and watertight equipment by eliminating charging wires are among the most common uses.

Subsea applications: While subsea vehicles may self-navigate, power supply requires human help. Cabled conductors can be difficult to install due to the rugged terrain and the distance. In these situations, WPT comes in handy.

Charging and running medical implants: Wireless power transfer, particularly with high resonance, enables for convenient continuous charging of these implants without the need for frequent surgeries or external charging ports.

6. Advantages

- This system aids in the wireless transmission of power.
- Low power consumption, efficient and low-cost design.
- Simple to set up.
- Quick reaction time
- The benefit of this project is that it will increase the use of renewable energy resources, lowering CO emissions.

7. Result

- Figure 3 depicts the wireless power transmission transmitter coil, which is attached to the circuit.
- The model of a receiver coil for a wireless power transfer that is attached to the bulb is shown in Figure 4 and 5. The electricity is sent from the transmitter to the receiver via a 10cm air core, which illuminates the bulb.

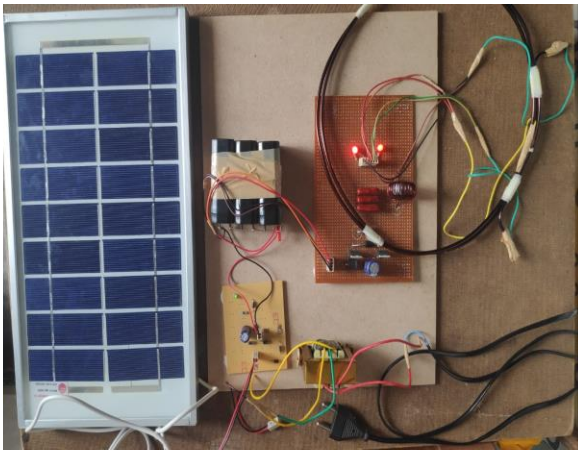

Fig. 3. Transmitter coil of WPT

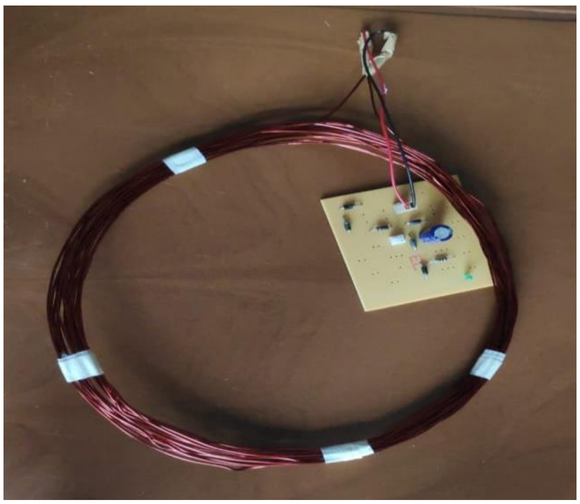

Fig. 4. Receiver coil of WPT

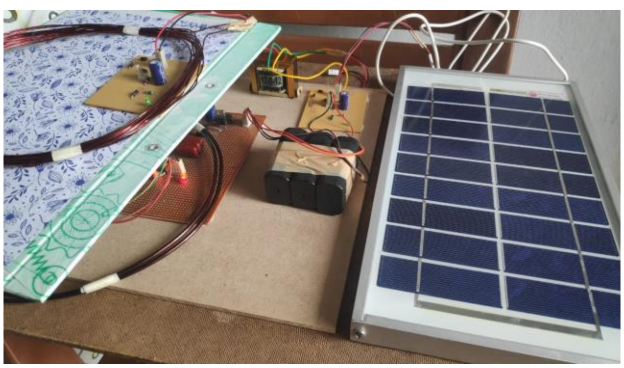

Fig. 5. LED glows in the receiver coil

8. Conclusion

The purpose of this project was to design and implement a resonant inductive coupling-based wireless power transfer and 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 significant gains in power transfer efficiency had been made. As a result, maintaining the spacing between the primary and secondary coils for smooth voltage characteristics is a trade-off for wireless charging.

9. Future Scope

Smart Charging Station: A back-end solution is used to power smart EV charging stations. If the charging stations are linked to the cloud, they can be managed depending on various signals like local energy use. We can simply identify available charging points, charge faster, charge safer, save money and the environment, and prevent arguments with neighbors by using smart charging stations.

Green Wireless Energy Provisioning: How to execute green wireless energy provisioning is currently an open problem that the majority of recent studies have disregarded.one interesting approach is to equip wireless chargers with sustainable energy sources, such as solar.

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