IJIREEICE

ISSN (Online) 2321-2004
ISSN (Print) 2321-5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering

Vol. 9, Issue 5, May 2021

DOI 10.17148/IJIREEICE.2021.9551

Wireless Power Transfer Using Solar Energy

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Abstract: This paper describes about the utilization of solar energy and the wireless transmission of the generated power. First the solar power is stored in a battery which is then transferred through wireless medium based on inductive coupling. There is a high thrust for renewable energy to mitigate the effect of global warming. The inductive power transfer has wide applications along with renewable energy. To demonstrate this solar based wireless power transfer system for home appliances has been developed. The advantage of this project is to increase the usage of renewable energy resources in order to reduce the CO emissions. And also the wireless power transfer system is a new way to transfer the power to the load rather than the conventional method of transferring power through livewires.

Keywords: wireless power, solar energy, inductive coupling

I. INTRODUCTION

Traditional wired power transmission systems usually require lying of transmission wires between the distributed units and the consumer units. This produces a lot of constraints as the cost of the system- the cost of the cables, the losses incurred in the transmission as well as in distribution. Just imagine, only the resistance of the transmission line results in loss of about 20-30% of the generated energy.

One of the most advanced wireless power transfer systems is based on transferring solar power using a microwave or LASER beam. The satellite is stationed in the geostationary orbit and consists of photovoltaic cells that convert sunlight into an electric current which is used to power a Microwave generator and accordingly generate microwave power. This Microwave power is transmitted using RF communication and received at the based station using a Rectenna, which is a combination of an antenna and a rectifier and is converted back to electricity or required AC or DC power. The satellite can transmit up to 10MW of RF power

. Previously we already know the network connection data wirelessly or more often called a wireless or wifi, well at the moment scientists are developing a Wireless Electricity network (Wireless Electricity). The basic principle of how electrical energy can be transferred without wires is related to the phenomenon of resonance. Resonance is an object pulsate process because there are other objects that vibrate, this happens because an object vibrating at the same frequency with the frequency of affected objects. Inductive coupling is the resonant coupling between the coils
of two LC circuits with the same resonant frequency, transferring energy from one coil to the other [1]. However, resonance coupling wireless power transfer is still in its infancy, whose theoretics and experimental analysis are in lacks, especially for efficiency analysis. During the
wireless power transfer process, resonant frequency maybe change because resonant inductance changes with obstacles (such as magnetic objects,etc.), parasitical parameters, impacts of receiving loop, temperature rising in circuit and so on 2.

II. RESEARCH METHOD

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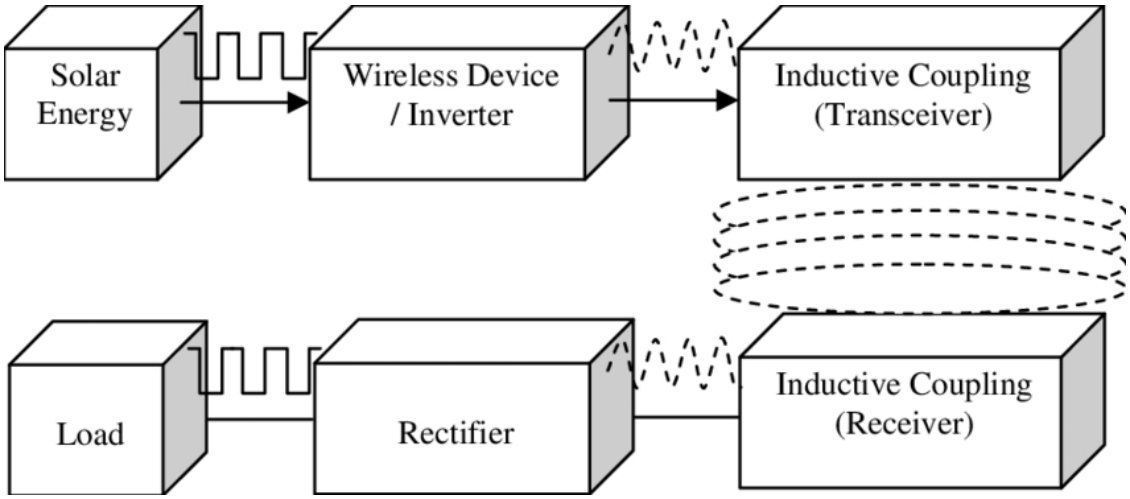

Figure 1. Block diagram wireless power transfer by using solar energy

The experimental setup of transceiver unit has been conducted. Energy transfer by electromagnetic induction to the receiver is via inductive coupling. The voltage sources to the transceiver were provided by solar cells. The inductive coupling is used as the antenna to wireless power delivered from the transmitting to the input of a receiver. Receiver unit, the bridge rectifier is used convert AC voltage to produces DC voltage and produce DC output. A capacitor is included in the circuit to act as a filter to reduce ripple voltage [3]. Wireless power or wireless energy transmission is the transmission of electrical energy from a power source to an electrical load without man made conductors. Wireless transmission
using solar energy is wireless are inconvenient, no hazardous, and green technology [4].

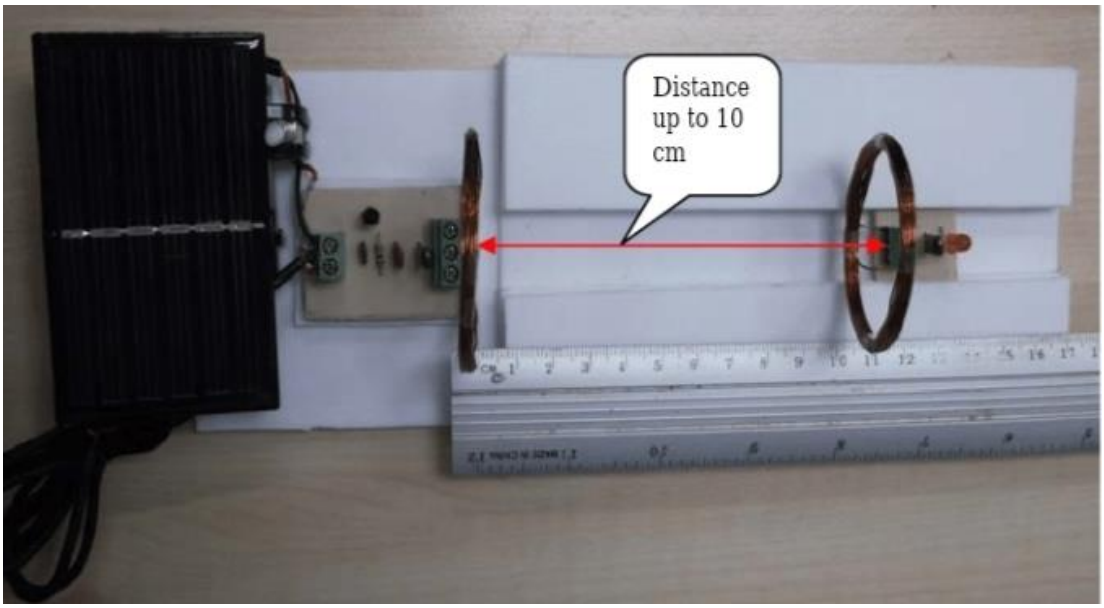

Figure.2. Experimental setup and collect data

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Figure. 3. Inductive Coupling in this case , as the antenna of Wireless Power Transfer

A wireless power transmitter emits a magnetic field with the help of the coil with the same frequency emitted by wireless power receiver. In order for optimal impedance, cable reels used on both sides.Cable reels also serves as the transmission gear bike. When the transmission gear uphill lowered in order to get more energy efficient, and vice versa. Wireless power receiver also determines its own voltage required to fit. Thus, the function of the adapter is not required. In addition, the wireless power transmitter also only emits as much energy as is required by the receiver. These equations apply for when the length of the wire is much longer than the wire diameter [5], use this formula:

Where :L=inductance (μH)
l = length (mm)
d = wire diameter (mm)

$$L = 0.21\left(\ln\frac{4l}{d} - \frac{3}{4}\right)$$

III. RESULTS AND ANALYSIS

An experiment has been conducted to get the WPT efficiency. The inductive coupling was supply from direct current dc source. The difference in the distancebetween transmitter and receiver are varied to obtain the optimum distance for wireless power transmission.

Distance (cm)	Solar Source Volt	DC output Voltage (Volt)	Frequency (MHz)	Efficiency %
0	9	8.89	3.34	98.78
1	9	8.36	3.20	92.89
2	9	8.01	3.13	89.00
3	9	7.86	3.05	87.33
4	9	6.93	2.90	77.00
5	9	6.01	2.82	66.78
6	9	5.79	2.73	64.33
7	9	4.88	2.61	54.22
8	9	4.16	2.53	46.22
9	9	3.88	2.41	43.11
10	9	3.60	2.30	40.00

Table 1 shows the result of different distances with the voltage varied when the distanceis different. The DC input source was used and the LED used as a Load.

Figure 4 and 5 shows the graph that has been created. The DC output voltage and

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frequency getting lower as the distance are higher. From this graph we can conclude that the wireless power transmission is higher when the distance is nearer.

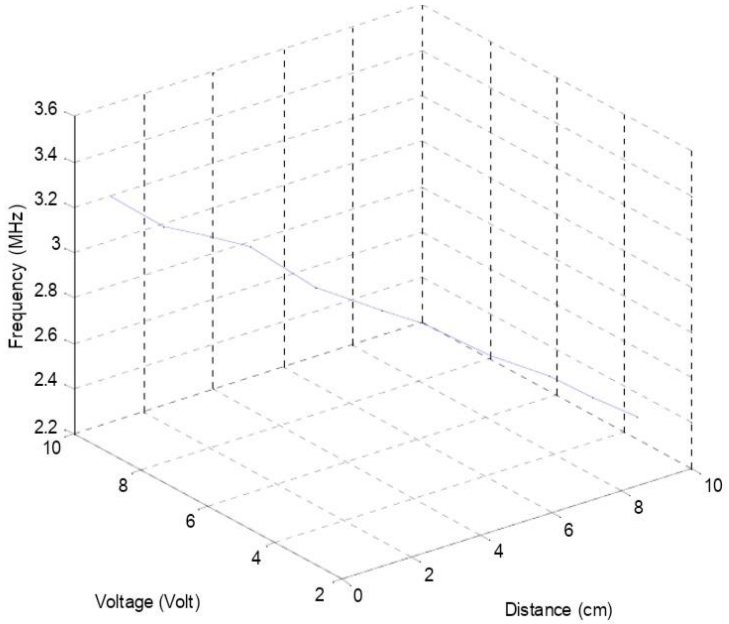

FIGURE 4. GRAPH OF VARIED DISTANCE VS DC OUTPUT VOLTAGE AND FREQUENCY

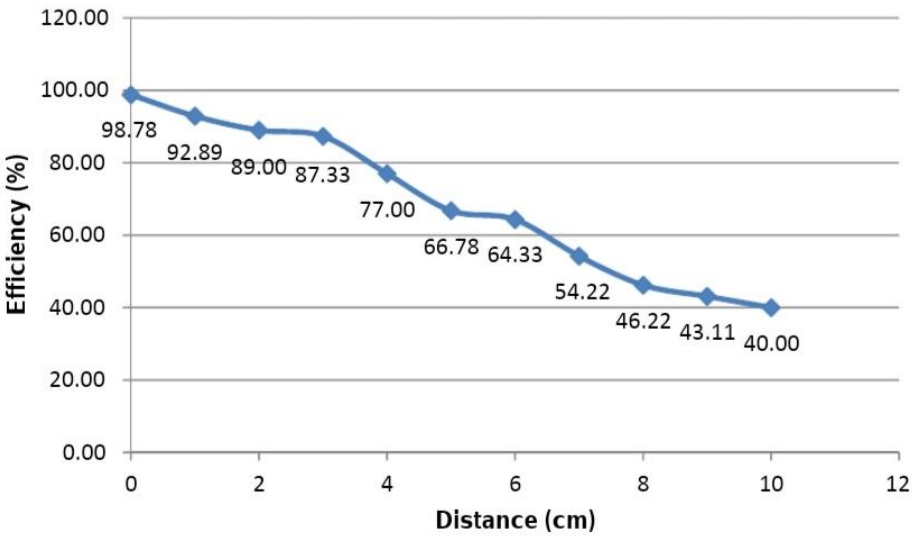

Figure 5. Graph of wireless power transfer efficiency and varied distance

To observe the exact waveform of an electrical signal in this study used oscilloscope. Oscilloscopes are electronic measuring instrument that serves to project the form of an electrical signal that can be seen and studied.

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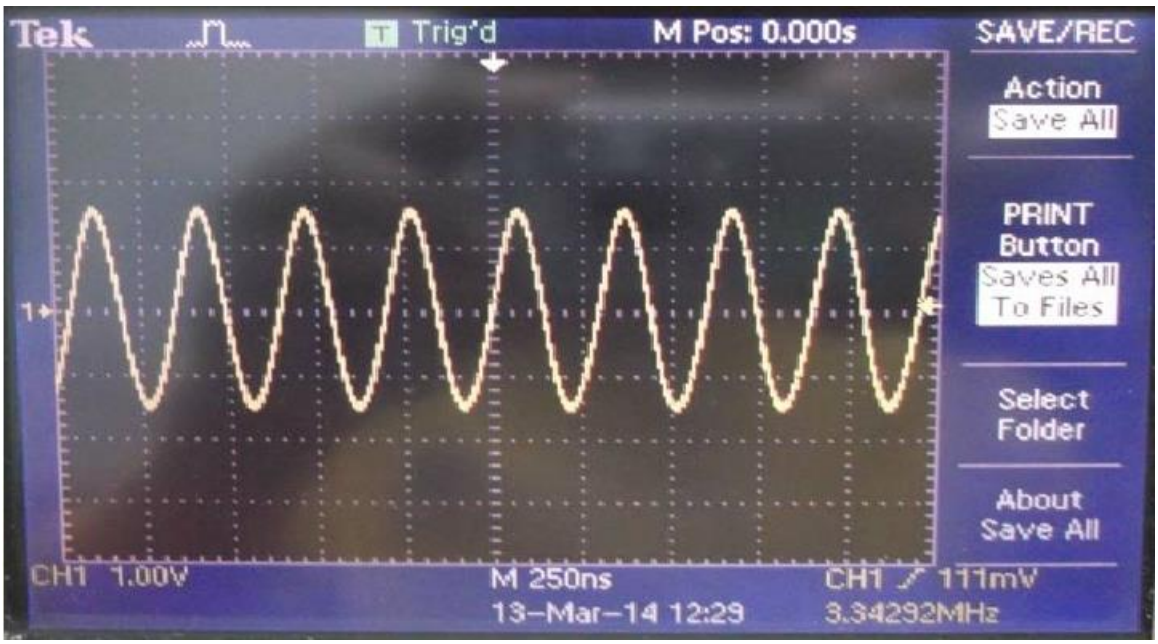

Figure 5. Waveform at Transceiver

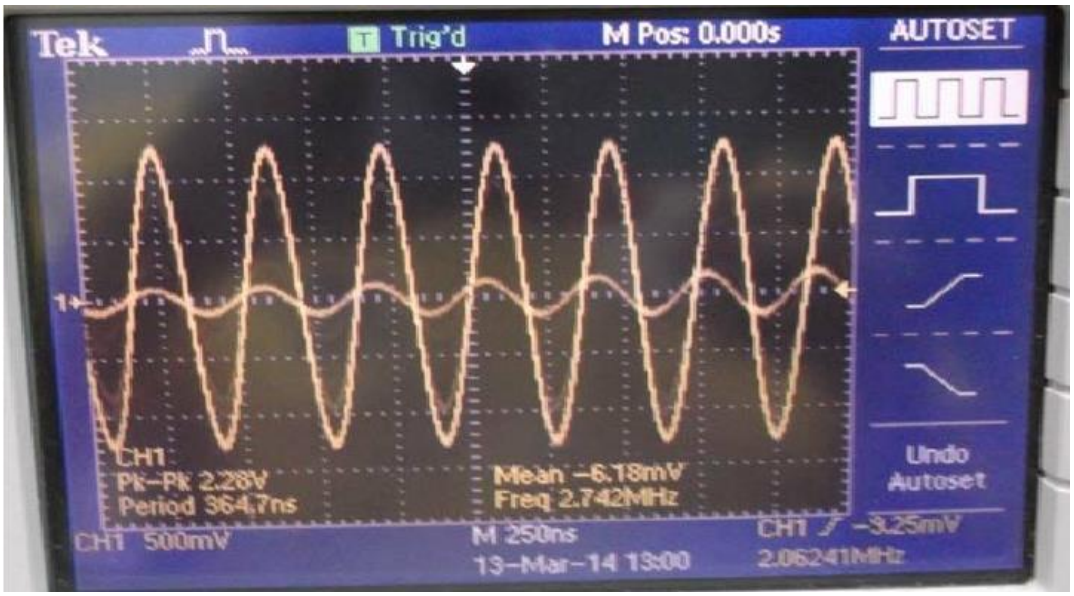

Figure 6. Waveform at Receiver

From Figure 5 and 6 waveform has measured from the point of inductive coupling which is the waveform is transmitted and received as well as sinewave. And then the sinewave is converted to DC waveform for DC load by using rectifier.

IV. ADVANTAGES

- Simple design
- Low frequency operation
- Low Cost
- Practical for short distance

V. APPLICATION

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- Consumer electronics
- Transport
- Heating and ventilation
- Industrial engineering
- Model engineering

VI. CONCLUSION

From the overall experiment conducted from wireless power transfer by using solar energy below conclusions are deduce. Base on experimental result, the study on wireless power transfer has much aspect in terms distance, range of frequency and result show the closer the distance, the voltage transferred is higher. From the experimental result in Table 1, distance of the nearest is the most efficient wireless power transfer, and wireless power transfer by using solar energy can be reach is up to 10 cm with 3.60 Volt. The high efficiency is at 0 cm with 98.78% and the lower efficiency is at 10 cm with 40%

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