DESIGN AND IMPLEMENTATION OF SOLAR PV BASED MOBILE CHARGING SYSTEM USING RESONANT INDUCTIVE WIRELESS POWER TRANSMISSION TECHNOLOGY

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Abstract : Nowadays wireless communication plays a vital role in the wide range of applications like electric vehicle charging and charging of electronic based devices like mobile phones, batteries, laptops etc. Generally, transfer of wireless power has been achieved through AC source. But in this paper Solar PV panel is used as an input source to charge mobile phones and drive small fan using wireless technology. DC-DC Boost converter have been used since the solar panels output is very small it has to be stepped up to appropriate values. Then the stepped up dc voltage is stored in rechargeable batteries and it is given to the microcontroller and MOSFET setup. The inverted voltage from MOSFET driver circuit is given to the primary of the copper coil set up arranged for short range transmission. According to the resonant principle, the power from primary copper coil which is in transmission section is transferred to receiver section through secondary copper coil. Later the bridge rectifier circuit converts AC signal which is received from secondary of copper coil into DC signal for the utilisation of DC loads such as mobile charging and driving fans.

Index Terms **- wireless power transmission; DC-DC Boost converter; PV system; mobile phone charging**

I.INTRODUCTION

The need of wireless electric power transmission is to increase the reliability in power system for small scale applications. Usually the electrical energy is transferred to the load through the wire. It may be copper, aluminum or any other conductive material for effective power transfer. Since the losses are more when transferring electrical power using wires then the wireless power transferring is taking much advantageous in charging electronic gadgets. Thus the power losses during power transmission could be reduced eventually. According to the distance of power transmission, there are various technologies have been adopted in the wireless power transmission. Therefore it can be minimized 20 to 30 per cent loss of power while transferring power from one source to destination.

Fareq M (2014) et al, proposed the wireless power transfer using Solar Energy through an inductive coupling as an antenna. It has been made wireless power transfer energy up to 10 cm with higher efficiencies. It has been proposed that the wireless powered communication network is a new networking paradigm technology where the battery of wireless communication devices can be remotely replenished by the way of microwave wireless power transfer (Suzhi Bi, 2016 et al). Papageorgas et al (2013), proposed the design methodology for an in-situ solar panel monitoring system which is based on wired and wireless sensor network technologies.

II. PV SYSTEM AND WIRELESS TECHNOLOGIES

A. Rating of Photovoltaic panel

A solar cell, or photovoltaic cell, is an electrical device that converts directly the light energy into electrical energy. It is a form of photoelectric cell which changes their electrical characteristics such as current, voltage or resistance when it is exposed to sunlight or normal day light atmospheric conditions (Thulasiyammal et al 2016). Table 1 shows the rating of PV panel which has been used for transferring electric power to the DC loads.

Table 1 Rating of PV Panel

Panel parameter	Rating
Panel Capacity	2.5Wp, 8.73V
Max.Peak Current	286mA
Short circuit Current	309mA
Open circuit Voltage	10.5V
Max. System Voltage	11V
Temperature	1000W/m^2 at 25^{o}C

B. Method adopted for Wireless Technology

In a wireless power transmission system, a transmitter transmits power to the receiver section in different ranges of signal frequencies in order to reduce the power loss and reduce the cost of the total system while using wired transmission system. Also it ensures the convenience, and safety of an electronic device for all users. There are three methods are being used to transfer electrical energy through wireless technology such as long range, medium range and short range.

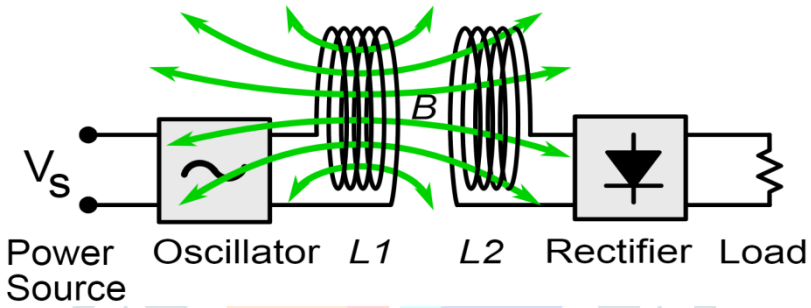

Fig-1 Power transfer through Inductive coupling

In this paper short range technology has been used to drive DC loads and charging electronic gadgets using solar PV panel. Actually, transformer is a good enough to understand a short range wireless electrical power transfer based on inductive coupling method as shown in figure 1 This short range power transmission is used to transfer energy for the distance of some centimeter to meter ranges.

III. PROPOSED SYSTEM

A. Block Diagram Description

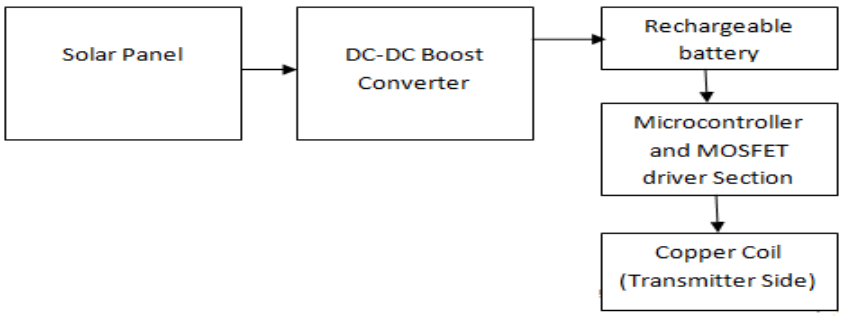

Fig-2 Block diagram of Transmitter Section

Figure 2 shows the block diagram of transmitter section of proposed method of this work. It consists of Solar panel, DC-DC boost converter, batteries, CD4047 micro controller unit and Copper coil. The working principle of inductive coupling is based on magnetic field production between primary and secondary coils of transformer. When the electricity flows through the copper coil then there is some magnetic flux occurs are highly induced in the resonant circuit which is used for increasing the inductance of electric power transmission for effective power transmission. Here solar panel is used as an input source from through which solar energy is captured. The solar panel input voltage is boosted using a high step-up DC-DC power booster. This high dc voltage obtained is then stored in

the rechargeable batteries. The stored dc voltage from the batteries is given to the CMOS oscillator CD4047.The output from this is transmitted through the copper coil.

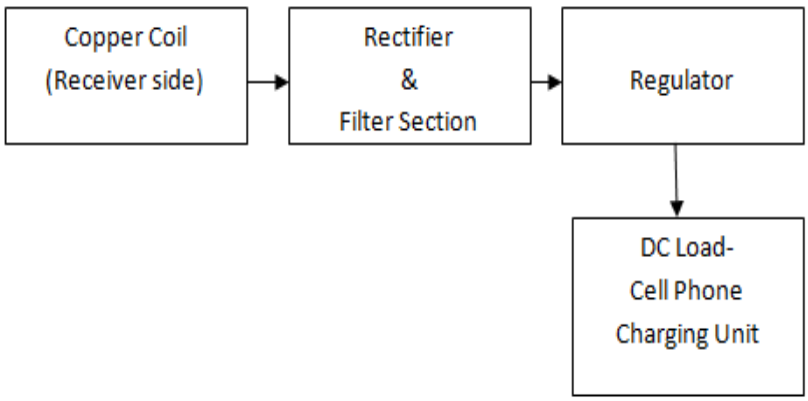

Fig-3 Block diagram of Receiver Section

The block diagram of receiver section is shown in figure 3 which consists of copper coil, rectifier, filter, regulator and DC load. Due to the working principle of inductive coupling the copper coil in the receiver section receives magnetic fluxes from primary coil and produces an induced voltage as secondary of transformer which is directly connected to rectifier unit. The output voltage is then rectified using the rectifier and then given to the filter regulator and finally given to the dc load like mobile charger or the dc fan. The output from this is transmitted through the copper coil and is received through the secondary of the power copper coil.

IV. THE DESIGN OF HARDWARE DRIVER SECTION

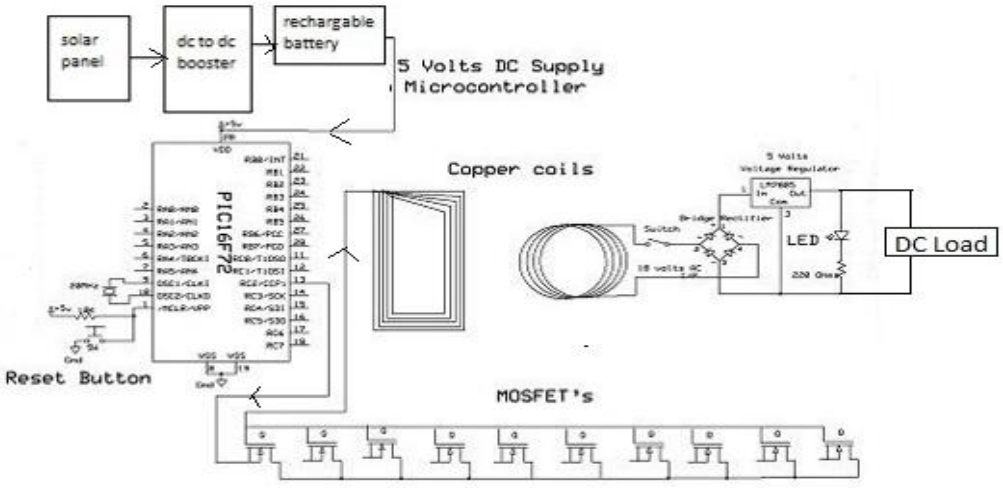

Fig.4 Detailed Circuit Diagram of proposed system

Figure 4 shows the detailed circuit diagram of the proposed technique in this paper. Initially solar energy is captured through the solar panel where sunlight is converted into electrical energy in the form of DC. Then it is boosted up using the dc to dc voltage booster circuit into 12volts and the output dc voltage is stored in the rechargeable batteries. Rechargeable battery which is connected to the kit via diode to ensure the unidirectional current will get charged. Here CD4047 microcontroller is also been used as a controlling device for MOSFET driver circuit. For that, 12 Volts DC voltages from researchable section is divided into 5volts using resister divider circuit. So the microcontroller gives switching pulses to the IRF540 –MOSFET driver circuit where DC is converted into 12V AC and feeding it to primary power copper coil. Then the voltage is transmitted through the power coil primary to power coil secondary and is given to the dc load through the rectifier circuit which helps dc load to work efficiently.

V. RESULT AND DISCUSSION

Actually the working model here designed is to run only two types of DC loads such as fan type load and Electronic Gadgets charging.

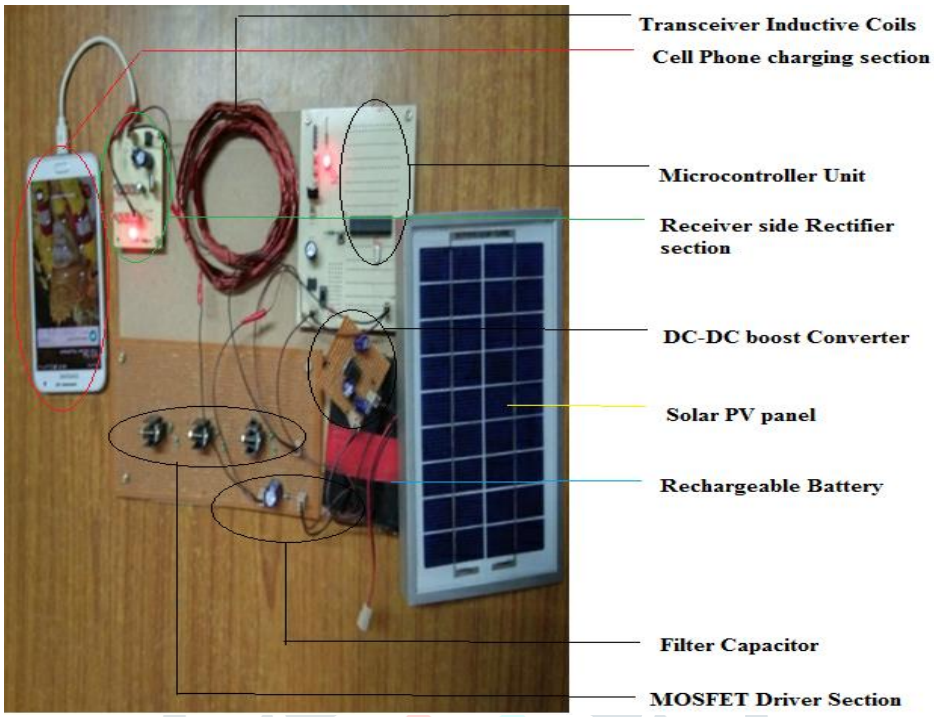

Fig 5 Working module of hard ware kit

Here the working module shows the cell phone charging using solar PV Panel through inductive coils as shown in the figure 5.In this module LEDs are placed to indicate the power transfer from transmitter section to receiver section. There is one toggle switch is provided in the module to get change over from fan type load and charging cell phones.

VI. CONCLUSION

In this paper solar PV panel based wireless power transfer for driving Fan type load and Charging of cell phone is tested successfully. The idea which has been implemented here will be most suitable for electronic gadgets charging like mobile phones, tablets and some military surveillance systems. Hence the power losses through wired transmission system could be replaced by wireless and lossless power transmission to meet out the day to day power demand increment.

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