Wireless power Transfer of Electric Power via Solar Energy

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Abstract - With the rising need for electricity, governments are increasingly turning to renewable energy sources such as solar, wind, tidal, and geothermal. Pollution, global warming, and other natural calamities may also be avoided by utilising these renewable energy sources. Solar panels are employed as a primary source of renewable energy in this disclosure, rather than other non-renewable energy sources. The panels convert solar energy into electrical energy, which may then be stored in batteries. The inverter then converts the stored energy in the battery into an AC supply. The inverter provides energy to the transmitter, which is then sent to the receiver coil in the form of electromagnetic waves. In addition, the receiver transforms electromagnetic waves into a voltage form that is identical to that used at the transmitting end. This entire setup is linked to the solar system. Furthermore, if the efficiency of wireless power transmission is slightly improved, wireless power transmission could become a standard means of charging an electronic device, and if this power transmission is done using a renewable and clean power source like solar energy, it would be the icing on the cake.

Key Words: Wireless, Power, Transfer, Solar Panel, PWM Charge Controller

1.INTRODUCTION

We live in a world where new technology advancements arise every day to make our lives easier. Despite this, we continue to utilised the traditional wire system to charge our low-power gadgets, such as cell phones and digital cameras, as well as mid-power equipment, such as pcs. When it comes to charging many gadgets at the same time, the traditional power infrastructure is a disaster. It also necessitates a large number of electrical outlets, not to mention the fact that each device's charging connector is unique[2]. The effective transfer of electric power from one place to another through vacuum or environment without the need of cables or any other substance is known as wireless power transmission. This can be used in situations when an instantaneous or continuous transmission of energy is required, but traditional cables are prohibitively expensive, cumbersome, harmful, undesired, or impractical. Inductive pairing can be used for short-range transmission, resonating induction for mid-range transmission, and electromagnetic wave power transmit for long-range transmission. WPT is a technique that allows electricity to be sent to places that would otherwise be impossible or impractical to reach[4]. The goal of this project is to develop and build a technique for wirelessly transmitting electric power over space and charging low-power gadgets. The system will function by sending electricity from an AC line to a resistive load through resonant coils. In order to enhance coupling across transmitter and receiver, different geometrical and physical form variables were evaluated[3].

If this is accomplished, the use of wires in the charging process will be eliminated, making charging low-power gadgets simpler and easier. It would also assure the device's safety by eliminating the danger of a short circuit[1].

1) 1.1 Solar PWM Charge Controller

The PWM Charge Controller is an electrical circuit that signals and controls the flow of charge from the solar panel to the battery, limiting overcharging of the battery. The gadget separates the battery from the charging period after it is fully charged, preventing it from overcharging.

A voltage regulator is included in the charge controller to regulate the input charging voltage from the solar panel to the battery, resulting in a steady, consistent output voltage.

2) 1.2 Inductive Coupling

Inductive or magnetic coupling is based on the electromagnetism concept. When a conductor is in close proximity to a magnetic field, it creates a magnetic field on that conductor, allowing energy to be transferred between conductors via magnetic fields.

If a portion of the magnetic flux created by one circuit interlinks with the magnetic flux created by the series coil, the two circuits are magnetically linked, and energy may be transmitted from one circuit to the other.

This energy transfer is accomplished by the transmission of a magnetic field that is shared by both circuits. When two conductors are arranged so that a change in current flow through one wire generates a voltage across the end of the other wire by electromagnetic induction, they are referred to be mutually inductively coupled or magnetically linked in electrical engineering.

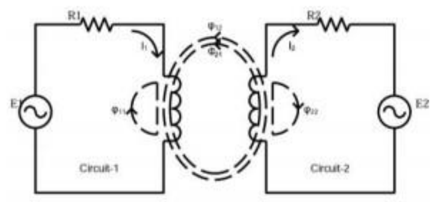

Figure 1- Inductive coupling with four Component Fluxes

The amount of inductive coupling between two conductors is measured by their mutual inductance. Power transfer efficiency of inductive coupling can be increased by increasing the number of turns in the coil, the strength of the current, the area of cross-section of the coil and the strength of the radial magnetic field. Magnetic fields decay quickly, making inductive coupling effective at very short range.

2. BLOCK DIAGRAM OF WIRELESS POWER TRANSFER VIA SOLAR ENERGY

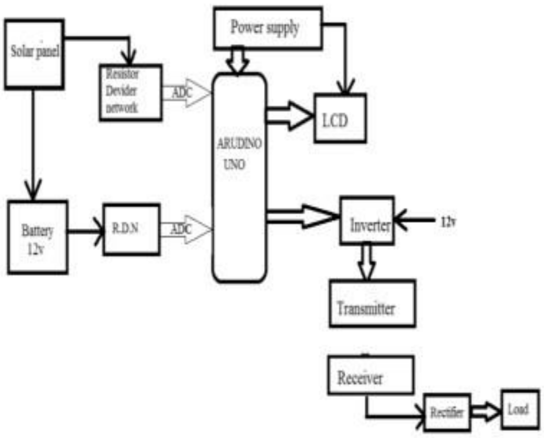

Figure 2- Block diagram for wireless power transmission via solar energy

The solar panel generates electricity, which is stored in a 12 volt rechargeable battery through a charge controller. The solar panel and battery status are displayed on the LCD. By utilising a resistor divider network, the 12 volt supply is divided into 3 to 5 volts for the Arduino controller.

Inductive coupling is used to transmit energy from electromagnetic induction to the receivers. The inductive coupling is utilised as an antenna to convey wireless power from the transmitter to the receiver's input. The bridge rectifier is utilised in the receiver unit to change ac voltage to dc voltage and create dc output. A capacitor is used as a filter in a circuit to minimise ripple voltage.

The transfer of electrical energy from a power source to an electrical load without the need of man-made conductors is known as wireless power or wireless energy transmission. Wireless transmission utilising solar energy is a practical, non-hazardous, and environmentally friendly technique. With the aid of a coil, a wireless power transmitter generates a magnetic field with the same frequency as a wireless power receiver. In order for optimal impedance, cable reels used on both sides.

3. CIRCUIT DIAGAM

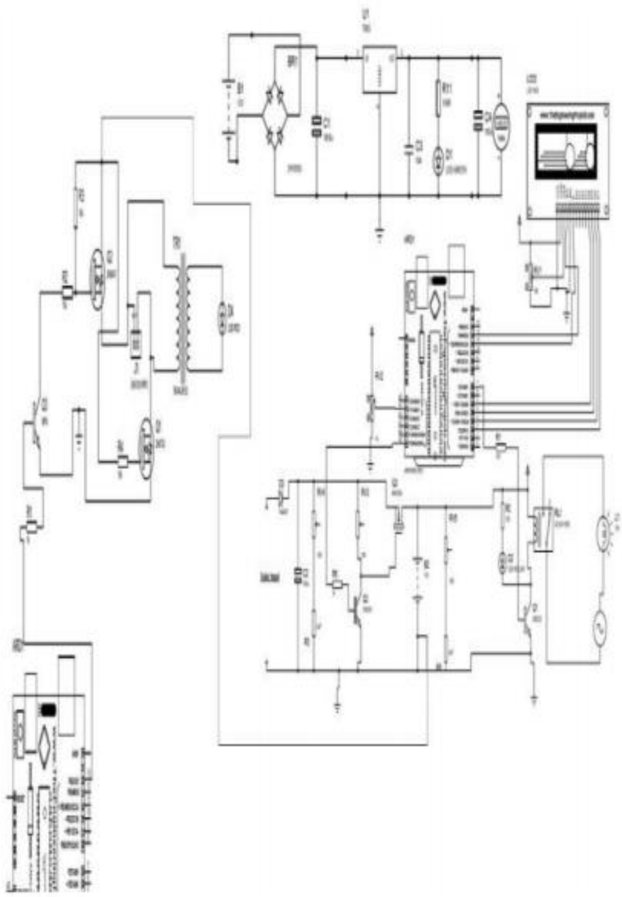

Figure 3- Circuit Diagram

The circuit schematic of a solar PWM charge controller and inverter circuit with inductive coils is shown above.

For ease of understanding, the charge controller circuit has been split into six parts.

1. Voltage sensing
2. PWM signal generation
3. MOSFET switching and driver
4. Filter and protection
5. Display and indication
6. Load On/OFF

The charge controller's principal sensors are voltage indicators, which may be readily constructed using a voltage divider circuit. We must perceive the voltage from the solar panel as well as the voltage from the battery. We constructed the voltage divider such that the output voltage is less than 5V, because the ARDUINO analogue pin input voltage is limited to 5V. For power storage, we utilised a 5W (Voc=12v) solar panel and a 12v and 1.3Ah SLA battery. As a result, we must reduce both the voltage and the current to less than 5V. In order to sense both voltages, we chose R1=10k and R2=4.7K. (solar panel voltage and battery voltage). R1 and R2 can have lower values, but the difficulty is that when resistance is low, more current flows through it, resulting in a considerable quantity of power (P = I2R) being wasted as heat. As a result, different resistance values can be used, but care must be given to reduce power loss through the resistance. We've utilised a PWM controller in this case. PWM (pulse width modulation) is a technique for controlling a digital output signal by rapidly switching it on and off. Varying the width of the on/off period gives the effect of changing the output voltage. We utilised two MOSFETs in our charge controller, one to regulate the power flow from the solar panel to the battery and the other to control the power flow from the battery to the solar panel.

The capacitor (C1) following the solar panel on the input side acts as a filter, removing any unwanted ripple or noise signal. The solar panel and battery voltages are monitored using a 16X2 char LCD. It also displays the charge percentage. The charge controller's output is sent into the inverter circuit, which converts D.C to A.C.

Two MOSFETs, IRF630 and IRF9630, were utilised in the inverter circuit. Transistor 2N2222 was used to switch the IRF630. The Arduino controller is utilised to give the MOSFET with a gate signal through a transistor. The inverter's output, which is in the form of an alternating signal, is sent to the transmitter coil. Inductive coupling receives the signal at the receiving coil.

4. CONCLUSIONS

Our study has primarily concentrated on combining the technologies of solar power generation and wireless power transfer, since this would be a significant technological development in the field of combining renewable and wireless technologies. If we can overcome these obstacles, we may be able to use this technology in a variety of applications, including airports, household appliances, and the workplace.

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