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Solar Power Bank with Wireless Charging

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ABSTRACT

This paper contains the information about the project named "Wireless Power Transmission". It is the system for transmitting the electrical power from a transmitting source to load wirelessly using coils. In this project two coils are used, one on the transmitter side called as primary coil and another at the receiver side called as secondary coil. This project is not similar to the wireless signal transmission which is used in cell phones. In this method of transmission, power from electrical source is transmitted in the form of magnetic flux. In this project, the AC power is supplied to the transmitting circuit which converts the AC Power into magnetic flux using primary coil. When secondary coil interacts with this flux, an E.M.F. will be induced in the secondary coil. In this way, electrical power will be transmitted without using wires.

KEYWORDS: *Wireless Power Transmission, coils, primary coil, secondary coil, magnetic flux, electrical source, AC power, transmitting circuit, E.M.F., electrical power.*

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1. INTRODUCTION

A technique for transferring electricity without the use of cables or conductors is known as wireless power transfer (WPT). It is most beneficial in situations when conductor-based electricity transfer is impossible. The electromagnetic induction theory underlies the majority of this technology. The basic idea behind electromagnetic induction is that a primary coil creates a magnetic field that creates an attracting field, and that when an optional loop is inside that field, a current is generated inside the coils of that loop. Due of the power needed to create an electromagnetic field, this leads to the relatively short range. According to Tesla, "Power can be delivered without wires and will be at no distant time, for all commercial needs, including the lighting of homes and the operation of aero planes. I have figured out the fundamental ideas; now I only need to commercialise them. Once you've finished, you'll be able to set up a little piece of equipment that will provide you with heat for cooking and light for reading almost anywhere in the world, whether it's on a mountaintop overlooking your farm, in the arctic, or in the desert. This equipment will be transported in a smaller satchel than a typical suit case. In the future, wireless lighting will be as prevalent on farms as standard electric lighting is today in our cities. Inductive or resonant wireless power systems are primarily used for near field energy transfer. The primary coil and secondary coil of the system are not in direct contact with one another in an inductive wireless charging system.

2. LITERATURE SURVEY

When it comes to meeting human energy needs, solar energy is the way of the future. Only 47% of the energy that the sun sends towards the planet actually makes it to the surface. The atmosphere reflects about a third of it back into space. Daytime, when solar energy is most abundant, is also the period when we least need it. We need to transform the sun's energy into a form that can be stored because it cannot be used at a later time. The solar panels produce low

grade heat, or low temperatures for the amount of heat required during the day. Solar panels can be used to generate energy. In terms of energy density (power/area), this energy is incredibly inefficient. Therefore, we require a procedure to guarantee that the energy being harvested is used effectively. The Earth continues to revolve around the star known as the Sun. The Sun rotates 360 degrees around the Earth because of its relative position to it. As a result, it becomes necessary to continuously face solar energy harvesting equipment towards the Sun. By automatically altering the alignment of the Solar Panel with regard to the Sun, the project seeks to achieve this. The components of trackers include motors, light-detection materials, solar panels, connecting wires, and microcontrollers. Additionally, we require an algorithm to control how the tracker operates

3. HARDWARE DESCRIPTION

The components used in the solar power bank with wireless charging are:

A. Solar Panel :

Fig 1: Solar Panel

A solar cell, also known as a photovoltaic cell, is an electronic device that converts sunlight into electrical energy. It is a semiconductor device that is made of a layer of silicon, which is doped with impurities to create a p-n junction. When light photons from the sun hit the p-n junction, they create an electron-hole pair that generates an electric current. Solar cells are typically made of silicon, but other materials such as gallium arsenide, cadmium telluride, and copper indium gallium selenide can also be used. Solar cells can be used to power a wide range of devices, including calculators, watches, and remote sensors. To generate enough power for larger applications such as homes, businesses, and solar farms, solar cells are connected together in arrays to create a solar panel. The amount of electrical energy that a solar cell or panel can produce is determined by its efficiency, which is measured by its conversion efficiency or the percentage of sunlight that is converted into electrical energy.

B. Solar Charge Controller:

Fig 2; Solar Charge Controller

A solar charge controller is a piece of machinery that controls the amount of electricity transmitted from the solar array to the battery bank. Neither the solar panels nor the deep cycle batteries are overloaded throughout the day. Although certain charge controllers may manage loads and provide lights, their main function is to manage power. PWM and MPPT are the two available methods for solar charge controllers. It is generally preferred to spend more money on an MPPT charge controller since it is more costly and significantly more efficient than a PWM charge controller.

C. Switch:

Fig 3: Switch

An electrical switch is a device that can connect or disconnect an electrical circuit, either allowing current to flow through or blocking it. Electromechanical switches are the most common type of switch and consist of movable electrical contacts that connect external circuits. When the contacts are in proximity, current flows, but when they are apart, it does not. Switches can have multiple

sets of contacts, which can be controlled by the same knob or actuator and operate in parallel, series, or alternating configurations. For example, a thermostat can act as a sensor to detect the position of a machine part, liquid level, pressure, or temperature, and manually activate a switch such as a light switch or a keyboard button. Specialized types of switches include relays, circuit breakers, mercury switches, push-button switches, reversing switches, and toggle switches. Lighting control is a common application of using multiple switches in a single circuit for practical control of lighting fixtures. Switches used in high-powered circuits must be designed to prevent damaging arcing when they are opened.

D. Tx/Rx Module:

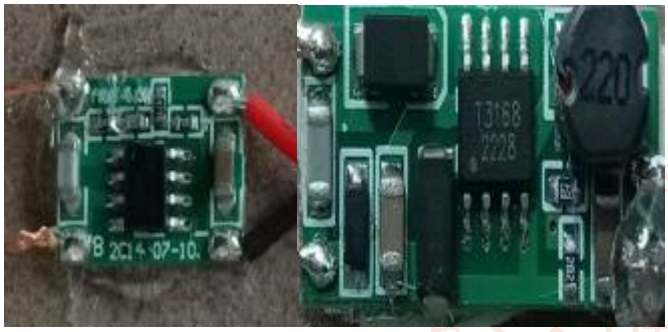

Fig 4: Transmitting Module Fig 5: Receiving Module

Wireless systems must be able to function within a certain range and transfer a certain quantity of data at a certain data rate. These are the two basic criteria for wireless system designers in general. The RF modules are quite tiny and operate across a wide voltage range, from 3V to 12V.

The RF modules are made up of straightforward RF transmitter and receiver modules that operate at 433 MHz When powered by batteries, the transmitter uses almost no power, and when broadcasting logic 0 while totally muting the carrier frequency, it uses zero power. About 4.5mA from a 3 volt power supply is needed to completely activate the carrier during the transmission of logic 1. The tuned receiver receives data in serial format from the transmitter. Two microcontrollers are suitably interfaced with the transmitter and receiver for data transfer.

E. Tx/Rx Coils:

Fig 6: Tx/Rx coils

An electric current will start to flow through the battery the moment copper wire is connected to it. Obviously no. Use magnetism to connect anything magnetic that is around, such as a paperclip, to your wire. Better still, you may create the second coil of wire, place it will be next to the first, and measure the voltage there using a voltmeter.

Wireless charging is based on electromagnetism, which is the fundamental interaction of electricity and magnetism.

Similar to the straightforward experiment we just reviewed, wireless charging transfers energy between devices like your smart phone and a wireless charging station via an electromagnetic field. This is a brief explanation of how wireless charging functions:

1. Alternating current is converted from the input voltage in order to energise a coil inside a wireless charging pad. It is known as the transmitter coil.
2. A magnetic field is created when you place a compatible device such as a smart phone next to this pad with another coil inside of it. This is because both devices' magnetic fields are produced by the electric current that flows through this coil.
3. The receiving coil on your smart phone can now take in an electric current. Then, using this current, your smart phone's battery gets charged without the need for any cables!

F. Battery:

Fig 7: Battery

A battery typically consists of one or more cells, and operates by chemical processes that create a flow of electrons. The three primary components of a cell are the anode (the negative side of a battery), the cathode (the positive side), and an electrolyte, which is a substance that reacts chemically with the anode and cathode. Rechargeable batteries are referred to as secondary batteries. When the cathode and anode are connected to a circuit, an electrochemical reaction occurs between the anode and the electrolyte. The

electrons then flow back to the cathode and undergo another chemical transformation. When the anode or cathode material is depleted and can no longer participate in the reaction, the battery is no longer able to generate electricity and is considered "dead." Primary batteries, after use, must be discarded.

G. Arduino:

Fig 8: Arduino UNO

The Arduino Uno is a widely used microcontroller board that is used in building interactive and programmable projects. It is powered by the ATmega328P microcontroller and provides several input/output pins, communication interfaces, and sensors. The flexibility of the Arduino Uno is one of its key advantages, as it can be utilized for a range of projects, including home automation systems and robots. It is designed to be user-friendly, making it accessible to people with little or no programming or electronics experience. The programming language used by the Arduino Uno is based on C/C++, which is relatively easy to learn. The Arduino IDE, which comes with a code editor, compiler, and programming language, is the recommended software platform for uploading code to the board.

The Arduino Uno is an excellent option for people who are new to electronics and programming since it provides a low-cost and user-friendly way to start building projects. The Arduino Uno is also a popular choice among makers and hobbyists because of its expandability and versatility.

H. 16*2 LCD :

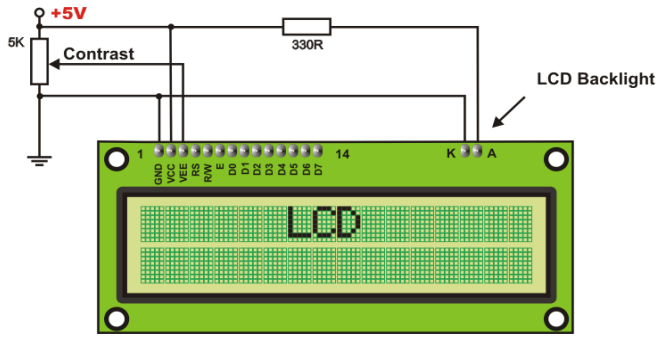

Fig 9: LCD

LCD (Liquid Crystal Display) is a widely used flat panel display technology in various electronic devices due to its numerous benefits. It is made up of several layers, including polarizing filters, liquid crystal molecules, and a backlight, that work together to produce images.

LCD displays are used in devices such as smartphones, televisions, digital cameras, and computer monitors. They offer several advantages, such as low power consumption, high resolution, and a thin and lightweight design.

The low power consumption of LCD displays makes them suitable for battery-powered devices, while their high resolution provides clear and sharp images. They are also thin and lightweight, which is ideal for portable devices with limited space.

LCD displays function by manipulating liquid crystal molecules to control the backlight's passage through the display. By applying an electric charge, the crystals twist and modify the light's movement, creating an image on the screen. With advancements in technology, LCD displays have improved in image quality, response times, and viewing angles.

LCD displays are a versatile and popular display technology that offers numerous benefits over other display technologies. Their low power consumption, high resolution, and lightweight design make them a go-to choice for electronic devices.

4. Block Diagram

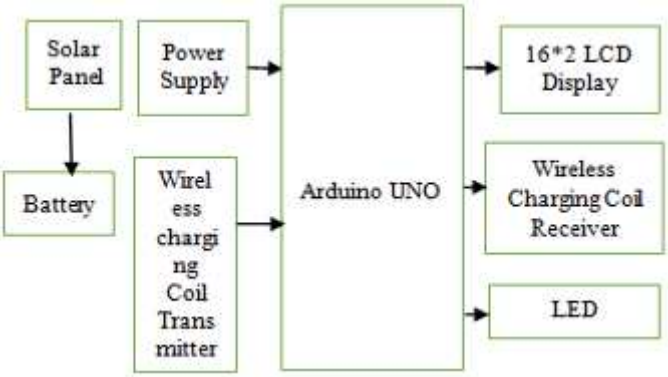

Fig No: 10 Block Diagram

5. Working Principle:

Fig No: 11 Final Project Model

The working principle of a solar power bank with wireless charging involves several steps. Firstly, the solar panel on the power bank collects solar energy and converts it into electrical energy. This electrical energy is then stored in the battery for later use. When a compatible device is placed on the power bank for wireless charging, the wireless charging circuit is activated. This circuit generates an electromagnetic field that induces an electrical current in the device being charged. This electrical current is used to boost the device's battery power until it is fully charged. The wireless charging process continues until the power bank's battery dies or the device's battery is fully charged. This means that the solar power bank with wireless charging functions by using a solar panel to collect sunlight and convert it into electrical energy, which is stored in a battery for later use. When a compatible device is placed on the power bank for wireless charging, energy is transferred from the power bank to the device's battery using electromagnetic induction

6. Result:

The transmitter and receiver components of our project make up its basic structure. Main and Secondary coils are required for wireless power transmission. A transformer, rectifier, and filter are used to process a 230 V, 50 Hz, AC supply before the coil receives 24 V, DC, from the filter. The Power MOSFET IRZ44 is now provided a PWM pulse with a frequency of 1 K Hz that is produced with the aid of the PIC microcontroller. In order to continuously change the voltage in the coil, a MOSFET is linked to it. As a result, we know that any change in the magnetic field of the coil will generate an EMF. This is in accordance with Faraday's Law of Mutual Inductance. In addition, current will flow through the circuit even if the conductor circuit is closed. Air will serve as the core of the transformer action at this location.

7. Conclusion:

Electricity can be sent wirelessly via wireless power transfer. With this concept, there would be no need for wires or charging for any electronic devices. With its successful construction, the suggested wireless power transfer system offers a comprehensive remedy for low power gadgets. The gadget is made up of circuits that interface voltage and current sensor units with a microcontroller unit. By utilising inductive power transfer, it is possible to construct a fairly straightforward design in the recommended system at a reasonable cost. A cell phone, a microcontroller unit, and a DC fan have all been combined effectively in one case.

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