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Use of Solar Energy for Charging Electric Gadgets

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Abstract-
Solar-powered device charging has the potential to be a convenient and sustainable way to power your devices. There are conventional and wireless methods for using solar energy as a great source of electricity for charging electronic devices. The energy production of solar panels can also be maximized by using a solar tracker. You can keep your devices charged while lowering your carbon footprint with solar-powered power banks, solar powered phone covers, and residential solar panels.

Keywords- Solar-powered, device charging, sustainable, conventional, wireless methods, solar energy, electricity, electronic devices, solar panels, solar tracker, carbon footprint, power banks, phone covers, residential solar panels.

1. INTRODUCTION

Solar energy is an exceptionally effective, environmentally friendly, and renewable energy source. Photo voltaic cells are the component of solar panels, which are used to transform solar energy into electrical energy. There are several locations where the solar system may be employed, including homes, schools, and institutions. This reduces the production of power from non-renewable sources of energy, as well as pollution and the usage of coal to produce electricity. In order to charge the mobile battery in this invention, solar power is employed as a source of electricity.

Today's emerging technology is wireless charging. It also goes by the name of wireless power transmission. In this, electricity is sent to the battery without a cable being connected. In the. galaxy S6 released in 2015, Samsung introduced wireless charging. Other names for this developing technology include inductive charging through. It takes the place of the necessity of a cable for charging. It lessens the deterioration of hardware ports.

Following is a comparison between wireless and cable charging: Reliable, tough, dust- and water-proofing technology. No radiation effects are present. Two important approaches for wireless charging advancement are radiation wireless charging (also Electromagnetic waves, primarily microwaves and RF waves, are used to transmit energy in a form of radiation that is covered by radiative wireless charging. According to the mutual induction theory, a magnetic field connects between two loops during inductive charging. Similar to how the electric field of an electromagnetic wave diminishes far more slowly than the magnetic field, the power transmission distance is often constrained.

Inductive charging is therefore employed in modern life for safety reasons.

Radiative wireless charging involves the use of electromagnetic waves, usually microwaves and radio frequency (RF) waves, to convey energy. The mutual induction hypothesis states that when an object is charged inductively, a magnetic field is connected between two loops. Power transmission distance is frequently restricted, much as how the electric field of an electromagnetic wave decays far more slowly than the magnetic field. Due of these concerns for safety, inductive charging is used in daily life.

2. LITERATURE REVIEW

Faraday was the one who first realised that electricity might be transmitted wirelessly. He was looking into the wire's ability to conduct current. Any nearby wires that are in close proximity to the current-flowing wire will also get part of the current. It should, however, be positioned close to the wire that carries the electricity. The MIT group made a shaky demonstration of inductive coupling in the 2007 issue of Journal Science.

Understanding their continued hypothetical expectation, the group was able to turn on a 60W light bulb from a power source that was 2.1 metres distant; there was no actual physical connection between the source and the light. The MIT researchers referred to their concept as "WiTricity.

The aforementioned experiment demonstrated that electricity may be wirelessly delivered for 2.1 metres. Efficiency was the worst, though. System effectiveness was just 40%.

The use of solar trackers for wirelessly charging electronic devices was investigated in a study by Karm Acharya et al. in 2021. Solar trackers, according to the study's findings, greatly raise the system's energy output and solar panels' effectiveness, making solar electricity a more efficient and environmentally friendly way to power electronic gadgets.

Similar to this, Tao et al.'s (2020) study assessed whether it would be practical to use a solar tracker for wirelessly charging electrical devices. In order to boost the production of solar panels, which may be used to wirelessly charge electrical gadgets, the researchers found that solar trackers are an effective technique to monitor the sun's position.

In a study published in 2018, Lee et al. looked into the use of solar trackers for wirelessly charging mobile devices. The study suggested a concept for a solar tracker that rotates the solar panel to maximise the quantity of sunlight captured and utilises a light sensor to determine the location of the sun. It was discovered that the solar tracker might boost solar panel efficiency by up to 38%. The study also showed how mobile devices might be wirelessly charged using power from a solar panel.

According to the assessment of the literature, various studies have looked into electronic devices. It has been discovered that solar trackers greatly improve solar panel efficiency and cut down on the time needed for electrical device charging. Solar energy can also be employed with wireless charging technologies like inductive charging and magnetic resonance coupling. Additional study can be conducted to examine how sun trackers can be used to charge different kinds of electronic devices and to improve the design of solar tracker systems for maximum effectiveness' solar trackers can wirelessly charge.

3. OBJECTIVE

PROJECT OBJECTIVES:-

1. 0ffset personal electricity consumption.
2. Manage future electrical costs.
3. Protect the environment.

4. BLOCK DIAGRAM

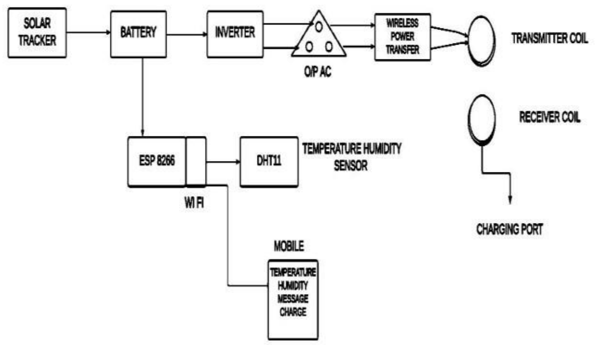

Fig 1.1 Block Diagram of the General System Configuration

The main structure of a solar tracker system that may be used to wired and wirelessly charge electrical devices is shown in the block diagram below:

Solar panels: The main energy source for a solar tracker system is provided by solar panels. They do this by converting solar energy into electrical energy, which is then utilised to power the electronic devices.

Solar Tracker: Solar tracker tracks the sun's movement and automatically moves the solar panels to follow it. As a result, more energy can be produced since the solar panels may get the most sunshine possible during the day.

Charge controller: The charge controller manages how much power is sent from solar panels to electronic devices. By preventing both overcharging and undercharging, it makes sure that the batteries in the devices are charged appropriately.

Batteries: The batteries store the energy for after use. They act as a backup power source when sunlight is not available.

Inverter: The inverter transforms the DC electricity generated by the solar panels and stored in the batteries into AC power, which is used to charge electrical devices. In addition, it gives forth a steady power source appropriate for delicate devices.

Charger with a wired connection: This charger is used to recharge electrical devices that need a wired connection. Through a cable, it is connected to the inverter and the devices.

Overall, this method makes it possible to use solar energy to efficiently and sustainably charge electronic devices. Maximum energy output is guaranteed by the solar tracker, which is also used to protect the devices and supply backup power. The chargers, both conventional and wireless, make it simple to charge a variety of electrical gadgets.

5. PROPOSED SYSTEM

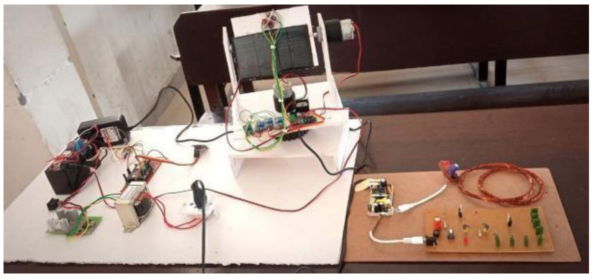

Fig 1.2 Project Model

5.1 Solar Tracker -

By orienting a solar panel or array to follow the course of the sun throughout the day, a solar tracker increases the quantity of sunlight that the panel receives. Solar trackers may boost the energy production of a solar panel or array by up to 40% in comparison to a fixed panel by following the sun.

Solar trackers come in two primary varieties: single-axis and dual-axis. A single-axis tracker spins the panel around one axis, often the vertical axis, whereas a dual-axis tracker rotates the panel around two axes, typically the vertical and horizontal axes. Dual-axis trackers are more costly than single-axis trackers, but they can produce more energy since they constantly change the panel's angle in relation to the sun's location.

5.2. Basic Principle of Solar Tracker

Keeping the solar panels or mirrors oriented directly at the sun all day long is the fundamental idea behind a solar tracker. By maximising the quantity of sunlight that the panels or mirrors can reflect, this raises their energy production.

In order for solar trackers to function, sensors must be used to determine where the sun is in the sky. Then, the solar panels or mirrors must be positioned or tilted in accordance with this information. Both the sun's location in the sky and its angle with respect to the horizon are normally measured by the sensors.

Based on these readings, a controller unit determines the best angle and placement for the solar panels or mirrors to maximise sunlight absorption. The panels or mirrors are then moved by the controller using motors or other devices to maintain their alignment with the sun.

Solar trackers can be either single-axis or dual-axis, among other variations. Dual axis trackers additionally modify the angle of the solar panels or mirrors to track the sun's varying elevation during the day, in contrast to single-axis trackers, which spin the solar panels or mirrors on a horizontal axis to follow the sun's east-to-west journey.

By ensuring that the solar panels or mirrors are constantly aimed squarely at the sun, maximising the quantity of sunlight they can catch, solar trackers are generally a good method to boost the efficiency and energy production of solar panel systems.

5.3. Dual Axis Solar Tracker –

The working of a dual-axis solar tracker involves several components and processes, including:

Sensors are used by dual-axis solar trackers to determine the sun's position in relation to the solar panels or mirrors. Photovoltaic cells, GPS, and other sensors that gauge the sun's location and angle in the sky may be among these sensors.

Control System: After receiving data from sensors, a control system determines the best location for solar panels or mirrors to face the sun. The motors that move the panels or mirrors are likewise under the direction of the control system.

Motors: To follow the path of the sun throughout the day, the motors move the solar panels or mirrors in both horizontal and vertical orientations.

Power supply: A power source is necessary to run the motors and control system. This might involve grid-connected electricity, solar energy, or batteries.

5.4. L298N Motor Driver

The L298N motor driver is a well-liked twin H-bridge motor driver integrated circuit (IC) that is frequently used to operate DC motors and stepper motors in robotics and automation projects. It can drive motors with voltage ratings between 5V and 35V and has a maximum continuous current handling capacity of 2A per channel (4A peak).

A number of microcontrollers, including Arduino, Raspberry Pi, and other microcontroller boards, can be used to operate the L298N motor driver. It contains four input pins, two of which are used to regulate the speed of each motor and the other two to control its direction. Additionally, the driver includes built-in safety measures including overcurrent and heat protection.

5.5. OLED Display

An OLED display might be used to indicate how well a solar powered item is charging. The OLED display might be linked to a microcontroller or other control circuit that is keeping track of the energy coming in from the solar panel and the battery level of the apparatus to do this.

The OLED display could show various pieces of information related to the charging process, such as the current voltage and current being generated fully charged.

5.6. Variable Resistor

In a solar energy charging system, the quantity of charge provided to the battery may be controlled using a variable resistor charging stimulator. The variable resistor serves as a current limiter, regulating how much current is sent to the battery. The variable resistor makes sure that the battery is charged safely and effectively by managing the current.

5.7. Node MCU

For the ESP8266 Wi-Fi chip, Node MCU is a well-liked open-source firmware and development kit. A low-cost microcontroller with Wi-Fi capabilities called the ESP8266 can be configured to connect to the internet and communicate with other devices.

6. WIRELESS CHARGER

6.1 Introduction

The basic idea behind wireless charging using solar energy is to use solar panels to convert the energy from the sun into electrical energy, which can then be used to charge electronic gadgets wirelessly. A wireless charging pad that transmits power from the solar panels to the electronic device can be used to accomplish this. The ability to wirelessly charge electronic devices using solar power has the potential to revolutionise the electronics industry.

6.2 Components Description

The key components of the wireless charger are:

a) IRFZ44N
b) 100uH inductor
c) Capacitor 68 nF 1000 V
d) Transformer
e) Coil

a. IRFZ44N

A power MOSFET is the IRFZ44N. An electromagnetic field is generally used to transmit electricity between two devices, such as a charging pad and a mobile phone, when harnessing solar energy for wireless charging of electronic devices. A controller or driver circuit that controls the power flow between the solar panel, battery, and charging pad would need to be attached in order to use the IRFZ44N in a wireless charging system. The needs of the charging system and the properties of the IRFZ44N would determine the precise circuit design.

b. Inductors

Inductive power transmission from the transmitter to the receiver is accomplished using inductors, which are a crucial part of wireless charging systems. An inductor is a component of a resonant circuit, which is utilised in a wireless charging system to wirelessly transmit energy between two coils.

c. Capacitors

The wireless system may use capacitors to store and control the energy generated by the solar panels.
A solar panel is used to transform sunlight into electrical energy while charging electronic devices wirelessly with solar power. However, the solar panel's output might fluctuate based on a number of variables, including the time of day and the weather. Consequently, the quantity of energy given to the electronic item may fluctuate, which has the potential to harm it.

d. Transformers

Transformers are frequently employed in power transmission applications, including solar-powered wireless charging of electronic devices. In wireless charging systems, a transformer is used to wirelessly transport energy from a power source, such a solar panel, to a receiving device.

e. Coil

In a conventional wireless charging configuration, a DC current is produced by the solar panel and then transformed into an AC current via an inverter. A coil is then used to conduct the AC current, creating an electromagnetic field. The electronic device gathers up this electromagnetic field and transforms it back into electrical energy, which is used to charge the battery. This device includes an integrated receiver coil.

7. Results and Discussion

The solar tracker was able to gather substantially more sunlight than a solar panel that was fixed, according to our findings. Mobile phones and other electrical devices might be charged using the wireless charging module. The battery management system worked well to store extra power produced by the solar panels, enabling us to utilise the stored energy during times of little sunlight.

As a result of being able to collect more sunlight throughout the day, solar trackers may considerably increase the effectiveness of solar panels. This is especially critical if there is a lack of sunshine or numerous obstacles that impede the sun's beams. By including a battery management system, it is ensured that extra energy produced by the solar panels will not be lost and will instead be put to use during times of diminished sunshine. By eliminating clutter and fostering a cleaner atmosphere, wireless charging technology provides a practical replacement for conventional cable charging.

8. Conclusion

The efficiency of energy collecting is increased, there is less dependence on fossil fuels, and wireless charging is more convenient using solar trackers for wirelessly charging electrical devices. With possible uses in streetlights, self-driving cars, and homes, solar-powered charging devices may become increasingly more useful as technology develops. Solar energy appears to have a promising future.

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