SUN TRACKING SOLAR HYBRID CHARGERS

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ABSTRACT

Solar Panel has been used increasingly in recent years to convert solar energy to electrical energy. The solar panel can be used either as a stand-alone system or as a large solar system or as a large solar system that is connected to the electricity grids. The earth receives 84 Terawatts of power and our world consumes about 12 terawatts of power per day. We are trying to consume more energy from the sun using solar panel. In order to maximize the conversion from solar to electrical energy, the solar panels have to be positioned perpendicular to the sun. Thus the tracking of sun's location and positioning of the solar panel are important. The goal of this topic is to design an automatic tracking system, which can locate position of the sun and will move the solar panel so that it is positioned perpendicular to the sun for maximum energy conversion at all time. Efficiency also depends on weather conditions. Usually the solar panel gets four to five hours of bright sunlight in a day. If weather is cloudy or rainy, it affects the charging process and the battery does not attain full charge. This simple hybrid technology can solve the problem as it can charge the battery using both solar power as well as AC main supply.

1. INTRODUCTION

In recent days, the process of generating electricity from sunlight has more popularity than other alternative sources and the Photovoltaic panels are absolutely pollution free and they don't require high maintenance. The conversion efficiency of a solar cell is the percentage of the solar energy shining on a photo voltaic cell that is converted into usable electricity. Sunlight has two components, the "direct beam" that carries about 90% of the solar energy, and the "diffuse sunlight" that carries the remainder – the diffuse portion is the blue sky on a clear day, and is a larger proportion of the total on cloudy days. As the majority of the energy is in the direct beam, maximizing collection requires the Sun to be visible to the panels for as long as possible. Solar trackers move the solar panel in the direction of sun throughout the day thus maximizing the utilization of solar energy. For continuous access of the power even during the absence of sun can be achieved by using this method. The efficient utilization of available solar energy and to full fill the continuous requirement of the power sun tracking hybrid system can be used.Concentrated solar photovoltaic and concentrated solar thermal have optics that directly accepts sunlight, so solar trackers must be angled correctly to collect energy. Hybrid solar charge can charge the battery using both solar power as well as AC mains supply. When the output from the solar panel is above 12 volts, the battery charges using the solar power and when the output drops below 12 volts, the battery charges through AC mains supply. Solar power can restrict climate change as it produces no carbon emissions. Solar energy is the best alternative, which can replace the fossil fuels like coal and gas for electricity generation that create air, water, and land pollution. The solar power (i.e. DC form of energy) can be stored in a battery for future use.

2. LITERATURE REVIEW

The US Patent by Robert H. Dold describes a two- axis solar tracker capableofwithstanding the extreme weather conditions. The solar tracker includes a solar array, a frame, a base, a pivot frame, and a first andsecond actuator. The solar array is mounted to the frame and captures sunlight. The baseis pivotally connected to the frame and defines a pivot axis for elevational movement ofthe solar array. The pivot frame is also pivotally connected to the frame and defines apivot axis for azimuthal movement of the solar array. The base is pivotally connected tothe frame and defines a pivot axis for elevational movement of the solar array. The pivotframe is also pivotally connected to the frame and defines a pivot axis for azimuthalmovement of the solar array.

The first actuator controls elevational movement of the solar array and the second actuator controls azimuthal movement of the solar array. The solar tracker is pivotable between a raised position and a stowed position. Another US patent by Ronald P Corioclaimsas an object of thehis invention to mechanically link multiple solar trackers in a large array configurationso that they may operate in unison, driven by a single motor and tracker controller,whereby the mechanical linkage system is designed such that it must only be capable ofwithstanding the relatively low forces required to effect movement of thetrackers withoutthe requirement to resist larger wind forces acting on the array of trackers.Anotherobjectof his invention is to apply the drive principles to various solar single-axis trackinggeometries to maximize the economic performance for each solar tracking application.Multiple gearboxes can be mechanically linked by drive shafts and driven by a singlemotor. The drive shafts may incorporate universal joints for uneven terrain or staggeredconfigurations. Harmonic dampers can be affixed to the solar panels to decouple windforces which allow the use of larger solar panels.

3. METHODOLOGY OF SYSTEM

This system is designed with solar panels, LDR, ADC, Microcontroller, Stepper Motor and its driving circuit. In this project two LDRs are fixed on the solar panel at two distinct points. LDR varies the resistance depending upon the light fall. The varied resistance is converted into an analog voltage signal. The analog voltage signal is then fed to an ADC. ADC is nothing but analog to digital converter which receives the two LDR voltage signals and converts them to corresponding digital signal. Then converted digital signal is given as the input of the microcontroller. Microcontroller receives the two signals from the ADC and compares them. The LDR signal are not equal except for normal incidence of light . When there is a difference between LDR voltage levels the microcontroller program drives the stepper motor toward normal incidence of sunlight. When output from the solar panel is 12 volts or more, zener diode conducts and provides 11 volts to the inverting terminal of IC. Since its non-inverting input gets a higher voltage at this time, the output of the comparator turns high and the transistors conducts and relay RL energizes. Thus the battery gets charging current from the solar panel through the normally-open (N/O) and common contacts of relay When the output from the solar panel gets down below 12 volts, the output of the comparator turns low and the relay de-energizes. Now the battery gets charged current from the transformer based power supply through the normally closed (N/C) and common contacts of the relay. This power supplyincludes step-down transformer, rectifyingdiodes.

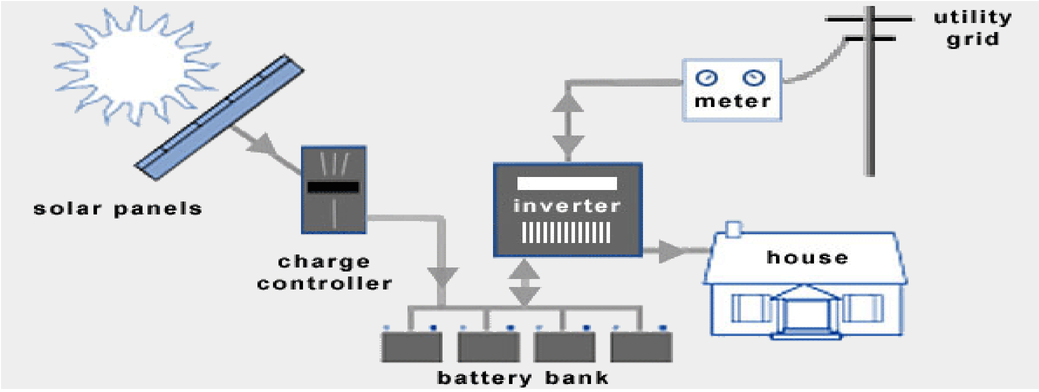

Fig 3.1.Block diagram of sun tracking panel.

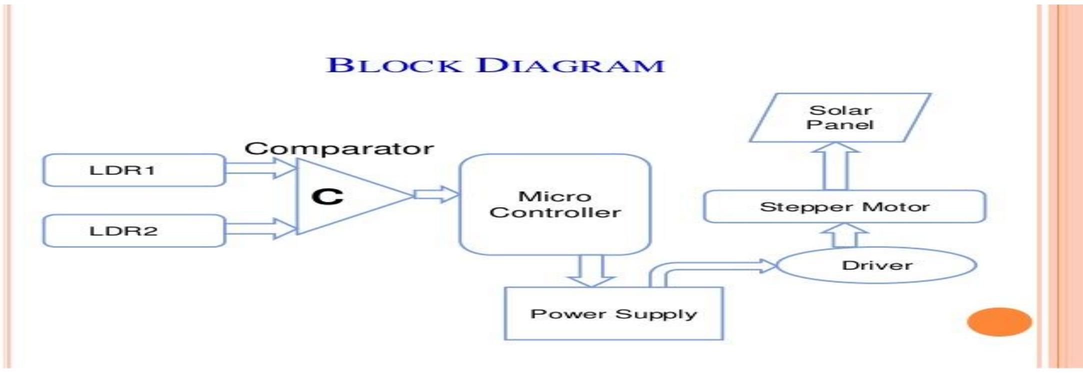

Fig.3.2Block diagram of solar hybrid chargers.

4.HARDWARE REQUIREMENTS

Hardware requirements
1.Diode gen purp 75v 150ma SOD523 2.IC MCU 8bit 64KB FLASH 40DIP 3.Opamp 4.I289 motor driver moidule 5.Solar panel 6.BNC547 Transistor 7.Diode schottky 8.Electrolithic capacitor 9.5v relay

Table 4.1 Hardware requirements

4.1.HARDWARE WORKING OF SYSTEM

In this circuit, we used a 10 Watt, 12 Volt Solar Panel. It will provide enough power to charge a 12V battery.10 Watt, 12 Volt Solar Panel.This 10w-12v module is an array of 36 multi-crystalline silicon solar cells of similar performance, interconnected in series to obtain the 12-volt output. These solar cells are mounted on a heavy duty anodized aluminium frame provides strength. For each 18 cells series strings, one bypass diode is installed. These cells are laminated between high transmissivity, low-iron, 3 mm tempered glasses and sheet of a Tedlar Polyester Tedlar (TPT) material by two sheets of ethylene Vinyl acetate (EVA). This setup protects against moisture penetrating into the module. In sunny sunlight, the 12V, 10W solar panel delivers up to 17 volts DC with the 0.6-ampere current.

The diode D1 provides reverse polarity protection and capacitor C1 buffers voltage from the solar panel. Op-amp IC1 is used as a simple voltage comparator. Zener Diode ZD1 provides a reference voltage of 11 volts to the inverting input of IC1. The non-inverting input of e op-amp gets voltage from the solar panel through R1.The working of the circuit is simple. When the output from the solar panel is greater than or equal to 12 volts, Zener diode ZD1 conducts and provides 11 volts to the inverting terminal of IC1.Since non-inverting input of the op-amp gets a higher voltage at this time, the output of the comparator turns high. Green LED1 glows when the comparator's output is high.The transistor T1 then conducts and relay RL1 energized. Thus the battery gets charged current from the solar panel through the normally-open (N/O) and common contacts of relay RL1.LED2 indicates charging of the battery. Capacitor C3 is provided for clean switching of transistor T1.Diode D2 protects transistor T1 and diode D3 prevents the discharge of the battery current into the circuit. When the output from the solar panel gets down below 12 volts, the output of the comparator turns low and the relay de-energizes. Now the battery gets charged current from the transformer based power supply through the normally closed (N/C) and common contacts of the relay. This power supply includes step-down transformer X1, rectifying diodes D4 and D5, and smoothing capacitor C4.

Light Dependent Resistors are the resistors whose resistance values depend on intensity of the light. As the intensity of light falling on the LDR increases, resistance value decreases. In dark, LDR will have maximum resistance. LDR will output an analog value which should be converted to digital. This can be done using analog to digital converter. ATmega8 has analog to digital converter internally. It has six ADC channels from ADC0 to ADC5.The two LDRs are connected to ADC pins i.e. PC0 and PC1. ADC conversion is done using successive approximation method. Stepper motor rotates the panel in a stepwise angle. To drive this motor a driver IC is used. Driver IC amplifies the input voltage and protects the microcontroller from back EMF. Generally, motors generate back EMF. This may damage the controller. The driver IC used is L293D. It has H Bridge internally made up of transistors. This IC has 16 pins. Output pins are connected to the stepper motor pins. Input pins are connected to of the stepper motor. The stepper motor had enough torque to drive the panel stepper motor are noise free and are affordable, making them the best choice for the project.

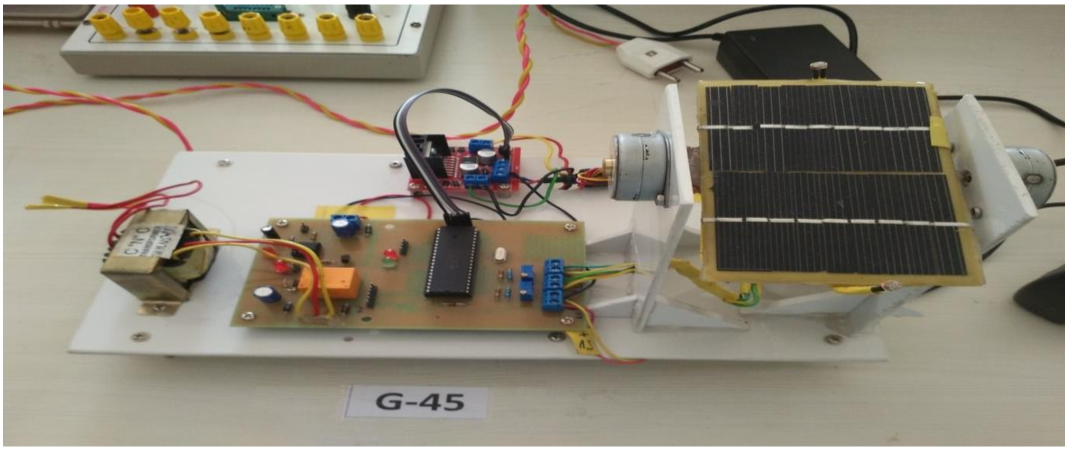

Fig 4.1. Working model of the sun tracking solar hybrid charger.

CONCLUSION

Solar energy is a clean energy source and it is high time we understand its importance and embrace it in our daily lives. In the circuit for this project, solar panels were used as a power supply and fed into a voltage regulator so as to have constant voltage charging for the battery. In this project we have successfully implemented a tracking solar power system. As the intensity of the light falling on, the LDR increases, resistance value decreases. In dark, LDR will have maximum resistance. LDR will output an analog value which should be converted to digital. This can be done by using analog to digital converter. Stepper motor rotates the panel in a stepwise angle. To drive this motor a driver IC is used. A solar panel that tracks the sun was designed and implemented. The required program was written that specified the various actions required for the project to work. To fulfil the continuous requirement of power a hybrid circuit of this project was helpful.The system designed was a single axis tracker. While dual axis trackers are more efficient in tracking the sun, the additional circuitry and complexity was not required in this case. This project was implemented with minimum resources. The circuitry was kept simple, while ensuring efficiency is not affected.

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