UPS SYSTEM USING SOLAR AUTO TRACKING

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Abstract: This paper focuses on building a standalone UPS system using solar energy with a solar tracking system. Solar energy and UPS system are two rapidly growing technologies due to the demand for electricity and to reduce the carbon footprint in the atmosphere. The main reason for this system to be chosen is UPS system can invert and rectify the electricity that's the solar power can be delivered to DC part of the system instead of an AC grid which may avoid the installation of excessive inverters in the system. The solar tracker is used to improve the energy gained by the panel or payload so that the system produces more power at high efficiency.

Keyword:

UPS system,Inverter, Sun positioning, solar tracker; dual axis; light depending resistor (LDR), servo motor, Arduino, altitude, charge controller, Grid.

Introduction:

Due to the environmental pollution, global warming and climatic changes, many researches have been carried out in the field of renewable energy sources (RESs) to provide a eco-friendly method of energy production. Solar and wind energy are the two most abundant useful sources of renewable energy that are available on the Earth. The inconsistent availability of solar power, however has a negative impact on the efficiency and reliability of the power system. To eliminate such a problem, a power electronic converter and a solar tracking system is installed and can be used to interface the photovoltaic (PV) module and integrate energy storage with the loads. Traditionally, a single DC-DC power converter with two ports is used to interface one source of renewable energy with the loadIn order to harvest theenergy from twodifferent renewable energy sources or to use a storage battery, a multiport power converter (MPC) is the best due to the potential of lower component count and single power processing between any two port.

Discovery of the photoelectric effect made the possibility of extracting energy from the Sun suing a panel made of silicone. As the potential need for solar energy increases, similarly the materials requirement and amount of energy required also increases. There are numerous factorsthat affect the efficiency of the collection process. Major factors that influence the overall efficiency include solar panel efficiency, intensity of the solar radiation and energy storage. The materials used in solar panel manufacturing limit the efficiency of asolar panel. This makes itpractically difficult to make considerable amount of increase in the performance of the cell,and hence restricts the efficiency of the overall collectionprocess. Therefore, the most achievable method of improving the efficiency of solarpower collection is to increase the net intensity of radiation received from the Sun. There are three major possibilities for maximizing powerextraction,they are sun tracking, maximum power point (MPP) tracking and both methods are also commonly used to improve the efficiency of the tracker.

In this paper, a new high step-up UPS using solar tracking system is proposed. The principle used is described in Section I. Modes of operations are explained in Section II, Components used in this system are explained in the section V The experimental results are presented in Section IV,Section V concludes this paper and section VI explains the future works.

I.SOLAR TRACKER:

A Solar tracker is a device for positioning or aligning a payload such as a solar photovoltaic panel or concentratingsolar reflector or lens toward the source that is the Sun. The position of the sun in the sky varies both with the seasons that is during the summer as well as in winter and also due to change in time of day as the sun keeps moving due to the rotation and revolution of the Earth. Solar based equipment works best when pointed towards or near the sun, so a solar tracker can increase the generation output of such equipment over any fixed position, at the cost of additional system complexity. There are many types of solar

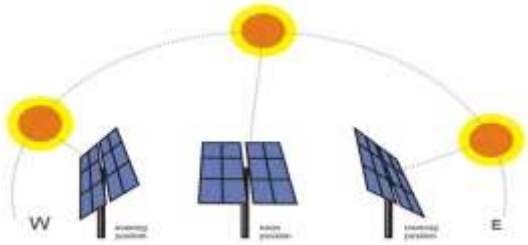

Fig 1

trackers, of varying costs, sophistication, and performance. One well-known type of solar tracker is the heliostat, a movable mirror that reflects the moving sun to a fixed location, but manyother approaches are used as well.

Fig 2

II.WORKING:

The proposed tracking system can be used to track a lot of solar energy during the daytime with the help of PV panel rotation in different direction. In dual axis system we can track the sun in four different directions as the sensors are placed on either of the corners of the panelas a, result we can achieve more amount of energy from the solar panel.. During this period, we are able to absorb additional sun rays. The dual-axis system is as effective as the single axis however the former rotates in both axes and captures more energy when compared to the latter,the former captures the solar energy more productively by rotating in both horizontal as well as vertical direction as the name itself suggest that they are dual axis tracker. The sensors placed on the corner transfer a signal to the controller which then starts the motor and orients the panel in the precise position where the intensity of the radiation is maximum, the actuator is used to position the panel. Since the position of the Sun keeps changing due to the movement of the Earth ,solar energy produced by the fixed panel will not be much effective as the position of the Sun varies by an angle of 22 degrees from north to south.

Fig 3

The servo motor isoperating to follow the path of the sun. This servo motor and LDR sensors areinterfaced with a microcontroller where servo motor is operated on the base of sensor reading. Sun light sensed by LDR sensors and send a signal to microcontroller. The microcontroller receives signals from LDR sensor and based on the received input signal it decides the rotation direction of servo motor and positions the panel towards the sun to get a maximum output.This energy can be stored in a battery for future use or fed directly to the grid or can be used for domestic appliances like TV, Fridge and washing machines etc. They consist of an inverter and converter set-up to convert the DC to AC and vice versa

Fig 4

III.COMPONENTS:

I ARDUINO

The **Arduino Uno** is an opensource microcontrollerbased on the Microchip ATMega328P microcontroller and developed by Arduino. The board is provided with a sets of Digital and Analog (I/O) pins that may be interconnected to various expansion boards and other devices. The board has 14 digital I/O pins, 6 Analog I/O pins, and is programmable with the ArduinoIntegrated Development Environment, through a type-B USB cable. They can be powered by the USB cable or by the externalbatteries, though it accepts voltages between 7 and 20 volts. It is same as that of the Arduino Nano and Leonardo. They provide the control signal to the servo motor to align the panel towards the sun.

Fig 5

IILDR

A LDR is a light dependent resistor also known as photoresistor is an electronic component that is sensitive to the intensity of light. When light falls upon the LDR, then the resistance keeps changing. Values of the resistance of the LDR may vary over many orders of magnitude, the value of the resistance decreases as the level of light increases.It is not uncommon for the values of resistance of an LDR or photoresistor to be several megohms in darkness and then to fall to a few hundred ohms during bright light. With such a wide range of resistance, LDRs are easy to handle and there are many LDR circuits available. The sensitivity of the LDR also varies with the wavelength and intensity of the incident light.

Fig 6

IIISOLAR PANEL

The term solar panel is used to describe for photo voltaic (PV) module. A PV module is an assembly of photo-voltaic cells made of silicone mounted in a framework for installation purpose. Photo-voltaic cells uses light from the sun as a source of energy and generate direct current. A collection of solar cells is called a PV module and a system of Panels is an Array. Arrays of a PVsystem supply power to electrical equipment using photovoltaic principle that converts solar energy to electrical energy.

Fig 7

IVSERVO MOTOR

The servo motor is a type of motor that has closed loop mechanism which allows for accurate control of linear or angular position velocity and acceleration.The servos are controlled with the help of either digital or Analog electrical signal through control wire. They allow a precise control of angular or linear velocity, velocity and acceleration. In this project they are used to align the solar panel to get maximum efficiency.

Fig 8

RESULTS:

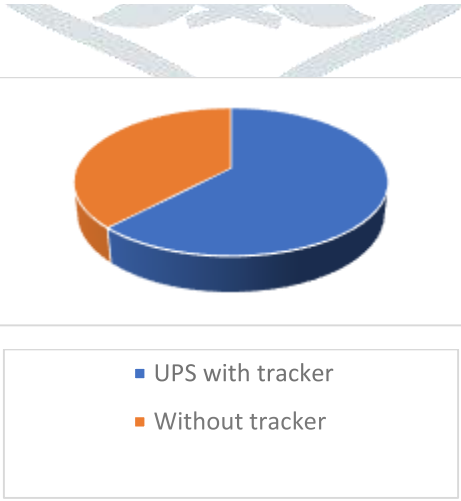

Fig 9

Components rating:

Servo motor	Motor 5v, 0.6 A, 9gr Servo,HXT900 Controller
PV Panel Dimension	16×16 inches square
Rating	35 Watts
PV Panel Material	Mono crystalline

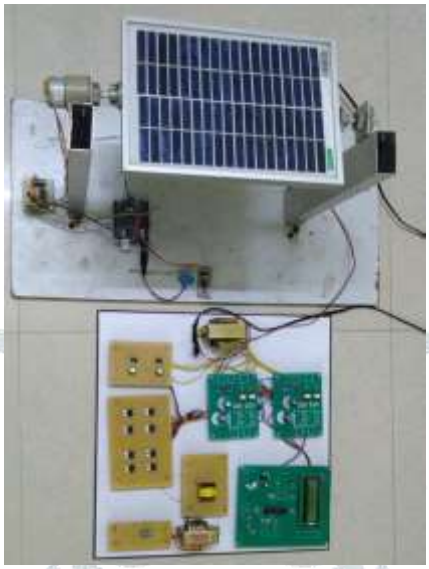

Fig 10

Output of fixed panel:

Time	Voltage (V)	Current (A)	Power (W)
8:00	7.55	0.03	0.22
10:00	8.70	0.10	0.87
12:00	17.22	1.12	19.28
14:00	17.79	0.92	16.36

Output of moving panel:

Time	Voltage (V)	Current (A)	Power (W)
8:00	4.57	0.03	0.13
10:00	8.97	0.16	1.43
12:00	17.31	1.30	22.5
14:00	17.50	0.95	16.65

The outputs obtained are shown in the above tabulations for both fixed panel and flexible panel and the components ratings are also mentioned

IV.CONCLUSION:

They can used to generate power in rural,remote and hilly areas where the erection of transmission pole is difficult.They can be used for a wide range application such as domestic purpose or standalone system.They can be used to replace the conventional way of producing electricity by fossil fuel and non -renewable sources. There are many methods to improve the efficiency of the solar power generator but the effective way to improve the output obtained is solar tracking based on the intensity of the sensor.

V.FUTURE WORKS:

This idea could be expanded in the future by combining other sources of renewable energy such as wind and hydro-power for generating and storing electricity to meet the future demands due to the increasing population of the world and to reduce the carbon footprint in the atmosphere.

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