International Journal For Technological Research In Engineering
Volume 10, Issue 10, June-2023 *ISSN (Online): 2347 - 4718*

A REVIEW ON SOLAR TRACKING SYSTEM

[1]ANKUR JAIN, [2]SAHIL SRIVASTAVA, [3]MANTHAN DOGRA
DEPARTMENT OF ECE
MVSIT, SONIPAT, INDIA

Abstract— solar energy is an efficient energy source. Based on this, the solar panel was created for electricity generation. Sunlight falling directly on the solar panel generates electric its Most solar panels are fixed. The position of the sun changes due to the rotation of the earth, so the solar panel is not always with the sun and therefore produces less electricity.

This problem can be solved with a system called solar tracker. Solar trackers automatically change the position of the solar pan el and follow the sun according to its maxi mum energy output. The research of this article is a review of different types of tracking mechanisms for solar tracking systems

. Basically, sun tracking includes two types

- Single axis trackers and dual axis trackers.

-Uniaxial trackers are centered around the equator without significant changes in the various positions of the sun. Dual-Axis trackers are useful where solar energy is tracked from east to west during the d ay and east to north or south during the season

1. INTRODUCTION

Major applications such as transportation, industry, agricultural use, home and office needs all require energy. It can do many things like thermal energy, electrical energy, chemical energy, nuclear energy, light energy. The relationship between social development and energy consumption is clear; Countries that use more energy are more developed. Since electricity has become a n integral part of our lives, electronic products must be safe and durable. The sun is the most powerful and one day it will be th e greatest source of radiance.

Fossil fuels such as oil, natural gas and co al are frequently used to meet the electricity demand. However, the use of fossil fuels to generate energy provides benefits such as acid rain pollution and global warming, which harms many animals, plants and people around them. This is why solar energy is considered the best of all energy sources as it is renewable and plentiful. It provides endless resources as well as time. Sol ar energy is also called green energy because it does not pollute the environment.

Shifting from traditional fossil-based to more solar sources such as geothermal, wind, biomass and solar. Solar energy is one of the most important ways to solve the problem of global warming and is also a new energy. It can also help provide cost- effective energy as well as providing an alternative to fossil energy. Actual electricity consumption is recorded with photovoltaic and thermal energy using solar panels an d solar panels, respectively. Consider photovoltaic thermal sports equipment, there will be many applications.

At low temperature, the cooling and domestic hot water from the product appear to be used continuously.

A solar tracking system is a device that directs the solar panel according to the movement of the sun to maximize solar energy. It will automatically change position when solar power is weak. The solar tracker is designed so that the angle between the sun and the solar panel is always around 90 degrees. By using solar tracking devices, energy production can be increased by 40 % compared to fixed modules. This part can move and rotate 180 degrees.

Therefore, solar trackers are best for fixed modules. With all the necessities, the solar power (S PV) experience is very much donated, with the incredible budget of its global potential and the diversity of so little time devoted to earth energy. Therefore, in the next few years, SPV technology will be involved in electricity generation from all sources. In addition, an SPV module is a true DC power source and usually generates DC power, the size of which is dependent on availability, including sunlight during the day and th e temperature of the Standard Test Conditions (STC) of 25°C and sunlight. 1 kW/ m2 continuously [2]. Basically, the SPV module exhibits all the unidirectional characteristics. Therefore, the power output of the SPV module usually expands with atmosphere temperature and room temperature.

2. SOLAR ENERGY

All the energy used by the sun is called so lar energy. Radiant light and heat from the sun are used in many technologies such a s solar heating, solar cells, solar thermoelectricity, solar buildings and electrical appliances. It is estimated that the world receives about 1kW/m2 at noon, but direct conversion from photon energy to electricity has also been achieved and solar power plants consist of these few parameters. However, the solar power generation capacity is not at a satisfactory level. Therefore, it is best to obtain as much energy as possible by reducing losses.

Solar power seems to have more advantages than any other energy source. The most important fact is that besides huge installation costs and zero maintenance costs, i t is completely free and has no energy restrictions. Besides heat and carbon dioxide or electricity, it does not accept solar energy and makes no more noise. Therefore, it is the most environmentally friendly of all. Solar power is a reliable source of energy in the mountainous regions of the world, and there are rural areas where the transmission of electricity is often too costly or im possible.

Photovoltaic panels can be used for electricity in remote areas. In addition, the use of electricity in the city with the help of photovoltaic panels street lamps is also gaining popularity. Today's electrical appliances also have facilities that work

with solar energy. Today's electric cars, solar homes and smart grids are starting to use a lot of so lar energy. Spacecraft and satellites sent into space have no other energy source than solar energy.

3. SOLAR PHOTOVOLTAIC SYSTEM STRUCTURE

The PV generator is the essential component in a PV system, but it needs to affiliate with many other ones to provide a total solution that functions properly and reliably. A PV system consists of a number of different components and subsystems, which are carefully designed and all- together connected to provide the desired power production.

A photovoltaic generator is actually a photovoltaic system. It is made by connecting several photovoltaic modules to a solar panel that can be continuously expanded to form a Solar array for more energy. Electric al machines are supported by mechanical devices that are fixed in position or tracked for rotation. Photovoltaic generators convert solar energy into DC output, which can be used in a variety of ways depending on the application. In small photovoltaic sy stems, the DC output is often used as a direct load or charged into a battery for extended use.

For heavier applications, larger PV systems include inverters to provide single-phase or three-phase AC output for commercial use or home grids. For the reliability of photovoltaic systems, it is important to protect individual photovoltaic cells in the shade. Due to the series connection of the batteries, the shadow can act as a load due to the forward direction. Therefore, the current produced by other cells can heat and burn the cell, causing the body to malfunction. This problem can be avoided by using bypass diodes to provide a path for PV current when some cells are shaded.

Also, in applications that use a PV generator to charge a battery, blocking diodes are used to prevent the PV cell from charging the battery when it is not operating (shading conditions). The energy transferred from the sun is constantly changing, so it is often necessary to store this energy. Chemical batteries are a popular choice for energy storage. To charge batteries, photovoltaic systems use a charge controller for efficient operation and battery protection. Control modules such as solar panels, charging systems and lighting are all managed and controlled by the control room to keep the hull working.

All components or subsystems in a photovoltaic system are supported and physically connected by different mechanical components. It is specially designed to meet the application and working environment. A particular technology, such as monitoring, can affect the performance and performance of the system as it affects the photovoltaic system's ability to absorb solar energy. The importance of this generator for solar panel operation is discussed in more detail in the next section.

4. FUNDAMENTALS OF SOLAR TRACKING

A sun tracker is a device used to aim a heliostat, solar photovoltaic panel, or sunglasses or lens at the sun. The position of the sun in the sky changes with the season (altitude) and even with time as the sun moves across the sky. Solar devices perform best each time they are pointed at the sun, so a solar tracker will make the device work well anywhere, but at the expense of multiple system complexity. There are many different types of solar trackers that differ in price, quality, and functionality. Some of the best-known types of sun trackers are heliostats, which are movable mirrors that reflect the sun's motion into a fixed position, but a few other technologies can also be us ed.

The efficiency of the solar tracker depends on the application. Concentrators must be used with precision, especially in the solar system, to ensure that the saturated sunlight is displayed exactly on the device, i.e. a t (or near) the focal point of the reflector. I n general, the concentrator process will no t run without a trace, so there must be at least one trace. Large power plants or temperature detectors that use a lot of frosted glass with suction elements should be the same height as sunglasses.

5. SUN PATH, AZIMUTH & ALTITUDE ANGLE

The change of position of moving sun varies at different time and season to season due to earth’s continuous and periodic rotation and revolution. As a result it has become necessary to locate the orientation of sun for a particular moment. The locations are placed on a special type of chart named Sun Path Diagram. A Sun Path Diagram shows the azimuth angle, elevation angle, sun paths throughout the years, sunrise and sunset time etc.

Due to the constant and constant rotation and change of the earth, the position of th e sun moves differently from time to time and from season to season. Therefore, it is necessary to find the direction of the sun a t a given time. These positions are on a special type of paper called a solar calendar. Shows sunbeam azimuth, altitude, the sun 's path throughout the year, sunrise and sunset, and more.

Solar azimuth, ψ, is the direction of the sun from the observer, expressed because of the hour angle from the north point of the line to the point at which a vertical circle passing through the sun intersects the horizon.

Solar altitude, α, is the angular height of the sun measured from the horizon. Above the horizon is positive, below is negative. The sun directly in the centre of the sky has a Solar Altitude of 90 degrees.

DIFFERENT TYPES OF SOLAR TRACKING SYSTEM

There are two types of solar trackers - single axis trackers and dual axis trackers. Single Axis Tracker - A single axis tracker means it has a single axis of rotation. The axis of rotation is usually along the true north meridian. They usually follow the movement of the sun from east to west every d ay. Increases power level by 25 to 30%.

The rotation axes for single axis trackers are: -

Horizontal single axis tracker (HSAT):

This is the most common type of single axis tracker designed and suitable for small attitudes. The axis of rotation is located horizontally with respect to the ground. They are very flexible and can rotate from east t o west on a fixed axis to the ground. Proper removal can increase the energy-to- cost ratio depending on the area and shad e climate and daily energy costs. Horizontal trackers are usually face modules aligned with the rotation axis.

It brushes the cylinder-like approach module, which is symmetrical by rotation about the axis of rotation. These

audiences are often used for the biggest and most effective campaigns.

Vertical Uniaxial Trackers (VSAT):
These trackers have an axis of rotation perpendicular to the ground. They usually tur n from east to west every day. These trackers are more effective at higher latitudes t han horizontal axis trackers.
The installation site must be respected to avoid unnecessary energy and improve land use. It has been found that the packaging quality is limited by the shading condition for more than one year. Vertical uniaxial trackers usually have a face module angled relative to the rotational axis. It passes through the cone like a path module that is rotationally symmetrical about its axis of rotation.

Polar Axis Aligned Single Axis Trackers:
These trackers are well-known technique s used to better align the camera image. An inclination axis aligns with the star's axis of rotation.
Therefore, it is called pole-aligned uniaxial tracker.
Dual-Axis tracker: The Dual-Axis tracker has two degrees of freedom. It tracks the movement of the sun from east to west during the day and from east to north or south during the seasons. Movement from east to west is also called zenith, and other movements that occur throughout the year from east to north or south are also called azimuth. As the trackers move vertically and horizontally in the direction of the sun, the y help capture the maximum amount of sunlight. Increases solar energy by 40-45%. They are classified according to the direction of their main axes relative to the ground.
This tracker has two types. These are -

Tilted Dual-Axis Tracker (TTDAT):
The principal axis of the tilt Dual-Axis track er is adjusted with respect to the ground. The second axis is often referred to as the first axis. In this viewer, a series of panels rise to the top of a tall pole.

Movement from east to west can occur by rotating the array around the end of the rod. To reduce the installation cost, the spindle rotating end frame can be split between the followers. They are very flexible and rotational balances are required to properly orient the audience relative to each other. They can be packed without shadows at any speed with backtracking. The axis of rotation is usually oriented along the true north meridian or east-west combination.
Using advanced tracking algorithms, they can point in the main direction.

Azimuth Altitude Dual Axis Trackers (AAD AT):
The main axes of these trackers are fixed to the ground. The secondary axis is also called the secondary axis and is the same as the primary axis. It works exactly the same as the tilt system, but they differ in the rotation of the array for daily viewing. Instead of rotating the array around the top of a pole, they use a large ring mounted on the ground with the array mounted on a set of cylinders.
The main advantage of this tracker is that i t allows to support many major series. However, it can reduce system speed compared to TTDAT, especially considering shadow interaction when the system is placed closer than the ring diameter. According to their data, they are only used in research, unlike tracking technology.

METHODS OF SOLAR TRACKING
There are three methods of solar tracking:

- Active Tracking -
  The position of the sun is continuously determined by sensors throughout the day. Sensors activate motors or actuators so the solar panel faces the sun during the day. Active monitoring is accurate with the help of sensors. However, serious problems arise when the meter cannot distinguish the measurement and gives an incorrect result on the day of the weather or fails to display it in the first place.
- Passive Tracking -
  Passive tracking does not use sensors like active tracking. Passive trackers do not us e sensors, it depends on the complaints from the two points at the end of the tracking. This dissatisfaction is caused by heat from the sun, which compresses the structure to create high-pressure gas. This approach does not rely on electronics and requires negligible power. However, technology is essential to maintain accuracy.
- Chronological Tracking -
  Chronological Tracker is a timer based tracking system. Because the sun moves across the sky at a constant speed of about 1 5 degrees per hour, the pattern moves continuously throughout the day. This method is suitable for measuring the absence of uniaxial tracking. A modified version is available for dual-axis tracking. The position of the sun during the day can be calculated and adjusted by the program executed in the controller module.

ADVANTAGES OF SOLAR TRACKER:
The main advantage of using a solar tracker is that it increases the amount of solar energy in the field. Before the solar tracker was made, feasibility studies were carried out and an increase in power was observed [15]. A 10 watt solar panel will be used f or the test. Open circuit voltage, closed circuit current, voltages of different loads have been measured and the maximum power point for a typical sunny day has been determined and these figures can be prepare d for comparison.

6. CONCLUSION

It is clear from the above studies that the u se of solar trackers will increase the efficiency of SPV systems, but proper care must be taken when installing solar trackers for these machines. Issues such as solar tracker failure should also be considered during installation. Whether to develop active or passive solar trackers is also an issue that needs further research. This study also tries to examine all the important factors necessary to make a better sun tracker. A solar tracker is a tool that can be used to increase the amount of solar energy from a photovoltaic system by monitoring the sun's position in the sky every day.

This system is as beautiful, environmentally friendly and cost-effective as previous computer and control technology. The combined features make the technology suitable as a green and large building and power generation process. In this article, the design, thermal and electrical performance of different STS types and factors affecting heat loss during operation are noted.

REFERENCES

[1] N. Gupta, N. Patel, R. Ladha, and D. P. Saini, "A novel autoscaling variable perturbation size maximum power point tracker applied to photovoltaic (PV) system," Int. Trans. Electr. Energy Syst., no. June 2019, pp. 1–17, 2020.

[2] P. A. C. Rocha, S. P. Mendonça, T. T.G. Watanabe, M. E. V. da Silva, and R. J. P. Lima, "Analysis of different tracking intervals for Parabolic Trough Collectors for water disinfestation in agricultural applications," Semin. Ciências Agrárias, vol. 41, no. 1, p. 7, 2020.

[3] K. Aygül, M. Cikan, T. Demirdelen, and M. Tumay, "Butterfly optimization algorithm based maximum power point tracking of photovoltaic systems under partial shading condition," Energy Sources, Part A Recover. Util. Environ. Eff., vol. 00, no. 00, pp. 1–19, 2019.

[4] N. Kumar, B. Singh, and B. K. Panigrahi, "LLMLF-Based Control Approach and LPO MPPT Technique for Improving Performance of a Multifunctional Three-Phase Two-Stage Grid Integrated PV System," IEEE Trans. Sustain. Energy, vol. 11, no. 1, pp. 371–380, 2020.

[5] A. A. A. Radwan and Y. A. R. I. Mohamed, "Grid-Connected WindSolar Cogeneration Using Back-to-Back Voltage-Source Converters," IEEE Trans. Sustain. Energy, vol. 11, no. 1, pp. 315– 325, 2020.

[6] Ashwin R , JoshuaraI Immanuel K , Lalith Sharavn C, Ravi Prasad P.S, Varun A.K (2014). "Design and Fabrication of Single Axis Solar Tracking System" Journal of Mechanical and Production Engineering.

[7] Gama M Dousoky, Abou-Hashema, M ELSAYED, Masahito Shoyama (2011)."Maximizing Energy Efficiency In Single Axis Solar Tracker Photovoltaic Panels". 8th International Conference on Power Electronic-ECCE Asia.

[8] Anusha, K., S. Chandra, and Mohan Reddy (2013). "Design and Development of Real Time Clock Based Efficient Solar Tracking System".

[9] Tudorache, Tiberiu, Constantin Daniel Oancea, and Lliviu Kreindler (2012). "Performance Evaluation of a Solar Tracking PV Panel". Bucharest Scientific Bulletin, Series C: Electrical Engineering.

[10] Hussian S. Akbar, Muayyad N. Fathallah, Ozlim O. Raoof (2017). "Efficient Single Axis Tracker Design for Photovoltaic System Applications". Physics Department, College of Science, Kirkuk University and Electronic Department, Kirkuk Technical College.

[11] Asmarashid Ponniran, Ammar Hashim, Handy Ali Munir (2011). "A Design of Single Axis Sun Tracking System". Faculty of Electrical and Electronic Engineering, University Tun Hussein Onn Malaysia, School of Mechanical Engineering, University Malaysia Perlis.

[12] V Sundara Siva Kumar and S Suryanarayana (2014). "Automatic Dual Axis Sun Tracking System using LDR Sensor". Department of EIE, RGMCET Nandyal and ECE, Ace Engineering College, Hyderabad A.P, India.

[13] Dhanalakshmi. V, Lakshmi Prasanna.H.N, Priyanka. V, Rani. K.J (2016). "Dual Axis Solar Tracker Using Arduino Uno". Department of EEE, Dr.T.T.I.T, KGF. 14. M. Kacira, M. Simsek, Y. Babur, S. Demirkol (2004). "Determining Optimum Tilt Angles and Orientations of Photovoltaic Panels". Renewable Energy , Volume-29.

