Threshold Voltage Maintain Solar Tracker

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Abstract

Solar energy represents a clean and sustainable energy resource for many countries around the world. A solar tracking system (STS) can significantly improve the collection of solar energy by reducing the solar incidence angle. The present research presents the design and modelling of a two-axis STS with a hybrid controlled tracking system which operates depending on voltage level of MPPT (Maximum Power Point Tracker). The maximum of solar plants in India using the MPPT method to conserve the electricity from PV panels. The prototype model which can be interface with existed systems. This system was composed with Solar, Light sensors, Stepper motor, Arduino controller, Real time clock, Boost converter or voltage booster. The main objective of the system is stabilization of voltage level at MPPT for continuous power drawn by tracking solar light intensity.

Keywords - *Zenith, MPPT, Dual-axis STS, Voltage booster, Real Time Clock.*

I. INTRODUCTION

The increasing awareness of renewable energy around the world, the demand for clean energy is on the rise and as a result there is a continuous shift towards the solar, wind, tidal, etc., and hybrid electric generation system. The solar energy is currently among the most important clean and sustainable energy resources. Therefore, many investigations have been attempted to improve the sun trackers‟ performance using effective mechanical drives and efficient control systems. The sun tracking mechanisms can be classified into active and passive trackers. Open-loop controlled solar tracking systems (STS) are based on a fixed control algorithm that depends only on a date, time, and geographical location. Closed loop controlled STSs have a dynamic tracking control algorithm. They depend on a feedback signal from MPPT voltage readings and light sensors. The triggering parameter is fixed voltage value at MPPT. The operating parameter is output of light sensors. The total setup changing the angle with the help of stepper motors. The prototype model operated with dual axis. designed and constructed dual-axis STSs with optimal mechanical structure based on a microprocessor controller. They concluded that the most efficient and cost-effective solar tracking system.

II. OBJECTIVE

1. To design a dual axis solar tracker system.
2. To initiate the tracking when intensity of light becomes minimum.
3. Also display and monitor the current voltage value on MPPT.

III. LITERATURE SURVEY

It survey is conducted to understand the process of development of a dual axis solar tracking.Nader Barsoum [1], 2018 AutoCAD software is being used to design the draft in 2-dimension (2D) for the hardware dual axis solar tracker. Sketch Up software is being used to sketch the drawing to be more real in 3-dimension (3D).Krishna Kumar. a, Venkat Subramaniam [2],2018 Real Time Clock based solar tracking system and asymmetric solar dish concentrator.Masoumeh Abdollahpoura [3], 2018 the power output of the solar tracker is directly dependent upon the amount of solar radiation received

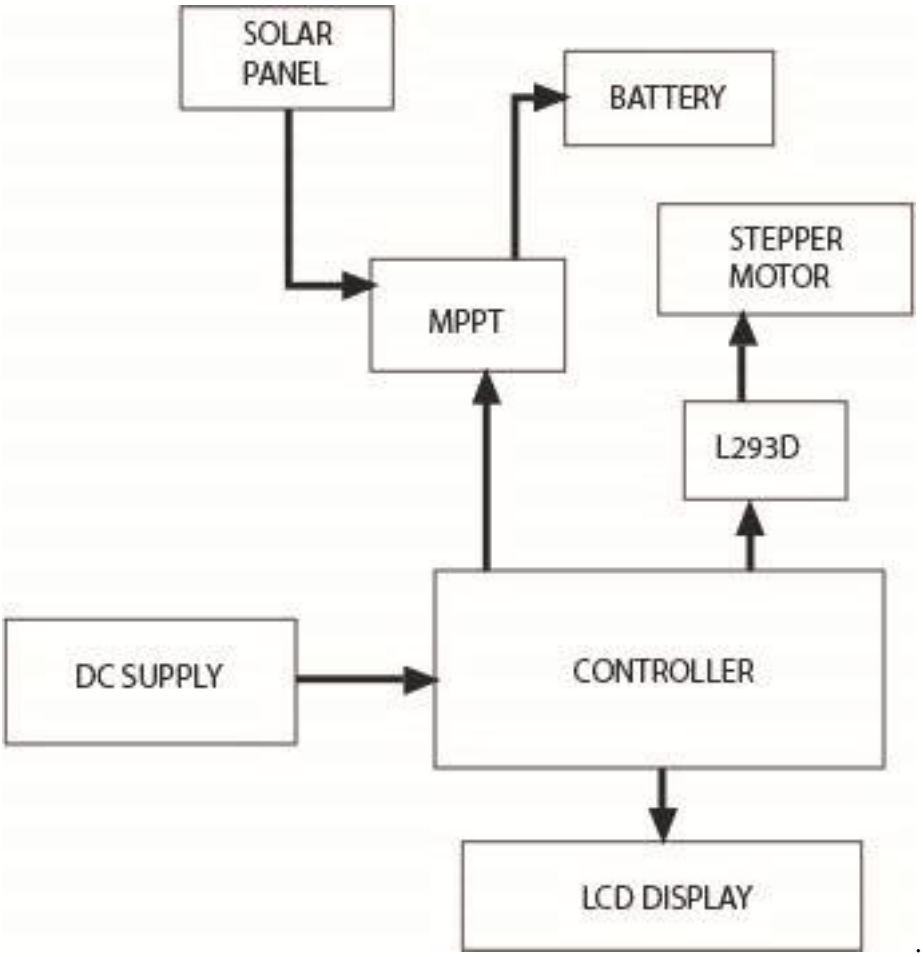

Fig : Block Diagram

IV.HARDWARE DESIGN

A. Power supply module

Assemblies of solar cells are used to make solar modules which are used to capture energy from sunlight. Here we have used 3W solar panel. The buck–boost converter is a type of DC-to-DC converter that has an output voltage magnitude that is either greater than or less than the input voltage magnitude.

B. Step-down transformer

Step down Transformer is a type of transformer, which converts a high voltage at the primary side to a low voltage at the secondary side. Fig: 3.3 show the step-down transformer. If we speak in terms of the coil windings, the primary winding of a Step down Transformer has more turns than the secondary winding. The following image shows a typical step down transformer

C. Bridge rectifier

ABridge rectifier is an Alternating Current (AC) to Direct Current (DC)converter that rectifies mains AC input to DC output. Bridge Rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components or devices. Depending upon the load current requirements, a proper bridgerectifier is selected. A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full wave rectification.

D. Voltage Regulator

A regulated power supply is very much essential for several electronic devices due to the semiconductor material employed in them have a fixed rate of current as well as voltage. The device may get damaged if there is any deviation from the fixed rate. The AC power supply gets converted into constant DC by this circuit. By the help of a voltage regulator DC, unregulated output will be fixed to a constant voltage. The circuit is made up of linear voltage regulator 7805 along with capacitors and resistors with bridge rectifier made up from diodes.

E. Arduino

Arduino is a open source platform used for building electronic projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino

does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable.

V. WORKING

The proposal system which working to maintain and stabilize the voltage on solar PV system or MPPT for continuous power drawing. The system divided into powering unit, tracking unit, boosting unit.

A. Power unit

This section is providing the total power for whole setup working. This unit can work on AC and also battery.If the system connected to AC supply the voltage will be stepped down to 19V. The system equipment requires two set of different voltage that 5V and 12V. 5V give to RTC, display devices 12V is give to arduino controller and backup battery unit.From step-down transformer supply feed into rectifying unit and convert AC to DC by bridge rectifier circuit and the voltage give to IC7805 for 5V constant output and IC7812 for 12V constant output supply and these are distributed to components for working.

B. Tracking unit

The tracking unit is the heart of the system. Stationary panel's energy conversion is 40-50% from over all irradiation. But the tracking panel can convert or use 70-80% of total irradiation level. In the proposed system the tracking unit consist light sensors, solar panel, geared motor, motor driver circuits which powered with 12V supply and signals given by microcontroller. The LDR is using as light sensor, totally the 4 LDR is used for analysing the light intensity that give to controller as input data from solar panel location for determining the light intensity. By processing with conditional loops were program on microcontroller and the motor adjustment signal gives to motor driver circuit. The motor driver circuit consist L293D IC it also called as H-Bridge IC. The driver circuit get the signal and energize the motor terminals as per the controlling signal. These results the panel can align to better intensity levels. This causes the solar panel gets maximum voltage level and working with higher efficiency

C. Control unit

Control unit which controls the flow of parameters and analyse the sensed data and gives the motor control signals.In this control unit the microcontroller LCD display interfacing unit, light sensor and motor drivers. The fetched program has done the all process as per the input and feedback data and give control signals and output display signals. Additionally the RTC also interfaced with that for Time/date determination.

D. Booster unit

Booster unit is a set-up to boosting the output of the panel. This used instead of boost converter in prototype system. This model is denoted as MT3608 which use for boost up the voltage to constant level.The regulation of voltage is the simple but boosting the voltage is done by voltage booster module. The proposed system is threshold maintenance system. The regulation and boosting will do by the booster unit. It will give the constant DC output whatever the solar panel output. These boosting mechanisms will operate or boost the limited level of variations and that's enough for the systems optimal operation. These units will gives the optimal operation, cost effective, reliable and also minimized designing complexity. This prototype can bed develop as an operating device and it can interface with existing solar plants.

VI. CONCLUSION

In this presented work, the design, implementation and performance of a RTC based dual axis automatic solar tracking system with I2C protocol (Bi-directional Bus) is presented. The performance of the developed system was tested and compared with fixed solar tracking system. This presented work reveal that the RTC based dual axis solar tracking system can assure higher solar thermal generation compared to fixed solar concentrator. The result shows that the real time clock based solar tracking system has 75 % more average thermal gain when compared to fixed solar tracking system. In this RTC based dual axis solar tracking method one motor rotates the solar concentrator in azimuth angle and as well as adjust the initial position of the solar concentrator and another motor adjusts the concentrator in zenith angle. The RTC based solar tracking system can rotate the concentrator in both clock and anti-clock wise direction as per the seasonal climatic program which is programmed into the microcontroller chip. Thus the presented solar tracking system is producing solar thermal power generation which is 3 times more than the fixed solar concentrator. The main objective of this present work is to attain maximum temperature by using RTC based solar tracking. The temperature output of the tracking device is deeply compared with fixed solar concentrator system. From the observed results, it is clearly proves that the RTC based solar tracking system output is more than the fixed system. While tracking, the mechanical errors are arrested by correction factor in software. Absence of sensors may not introduce environmental and physical errors. Automatic power failure detection and switching circuit is added advantage in RTC device

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