Annals of R.S.C.B., ISSN: 1583-6258, Vol. 25, Issue 6, 2021, Pages. 994-998
Received 25 April 2021; Accepted 08 May 2021.

Single Axis Solar Tracking

Balamurugan C.R., Vijayakumar P., Raghul Narayanaswamy S., Sakthi Nithish M., Shoheal Basha H., Gokul M.

Department of EEE, Karpagam College of Engineering, Coimbatore, Tamilnadu.

Abstract: *The aim is to design a system that will automatically track the solar energy from the sun and changes the panel direction according to the sun's direction. a solar tracking system is mainly used to track the direction of the sun and consume its energy efficiently. The absorption of energy will be maximum when the sun rays are high solar cells constantly monitor the energy from the sun. Solar energy is renewable energy thus we can consume energy frequently. The energy extracted from solar photovoltaic depends on solar isolation to consume maximum energy from the sun. the plane of the solar collector should away to be normal radiation. solar tracker moves both grid-tie and off-grid have current and voltage sensor in a battery charger or inverter units. Voltage can be accessed by using IOT based automatic system. In this work, we are using RTC to generate the time signal. Single acid solar Tracking has been implemented through microcontroller-based control logic*
Keywords— Atmega 328 controller, solar panel, internet of things, motors, RTC, ESP8266

1. Introduction

Nowadays solar energy is one of the most used renewable energy sources in the world. Nearly the sun produces about 12,000 TW of the solar radiation on the earth's surface. It covers almost 0.16percentage of the earth's surface with a 10 percent efficient percentage conversion of about 20 TW of power we can generate.

The above comparison shows the solar energy has impressive magnitude. It provides more energy than any other human provides energy source. The first solar cell was developed in 1954 by Bell laboratory. In satellites, this solar cell is used as a power source. The solar energy of the sun when it reaches earth in form of radiation is distributed over the colour spectrum. This energy is in the form of an excited electron-hole so it must be captured as an electron-hole.

Nowadays photovoltaic are a popular source of renewable energy. Maximizing it system’s output power to increasing its efficiency. To increase the maximum output power from panels, the solar panel must be aligned from the sun. The energy which is extracted from the solar panel can be increased up to 30 percent by using a tracking system instead of using a fixed array solar panel system. there are different methods were proposed, among them astronomical or time-based systems are the most popular one and optical methods which uses different types of sensors are quite popular.

In the present day scenario, India has a huge potential for the production of solar energy. Most of our country’s land is located perfectly for maximum radiation. Nearly 629GW of solar panels were installed all over the world in 2019. India has become the third-largest producer of solar energy.

Huge solar farms are being constructed all over India with a capacity of 5 megawatts to 15 megawatts. Standstill photovoltaic is one type of solar panel system which is used in most of this farm. This system will face a single direction throughout the day. As a result, it will give a lesser efficiency than the solar tracker system.

A slower transition is being made from a standstill photovoltaic system to a single-axis solar tracking system and dual-axis solar tracking system. A major problem is the cost of these

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 25, Issue 6, 2021, Pages. 994-998
Received 25 April 2021; Accepted 08 May 2021.

products. In the future, it will be a less expensive solar tracker with good efficiency and quality.

2. System Implementation

Existing System

- In Existence, Horizontally Fixed PV panels are used.
- Naturally Sun rays position is varied with respect to time.
- But these panels are not changing its position.
- So these methods could generate lesser voltage than our proposed method.

Proposed System

- To propose an IOT based solar panel tracking system.
- To monitor the voltage and current from solar panel through internet.
- Solar panel direction is changed as per the time.
- When movement or adjustment of the surface happens by rotating around one axis, it is called single-axis tracking.
- Solar trackers have two axis horizontal axis or vertical axis.

Block Diagram

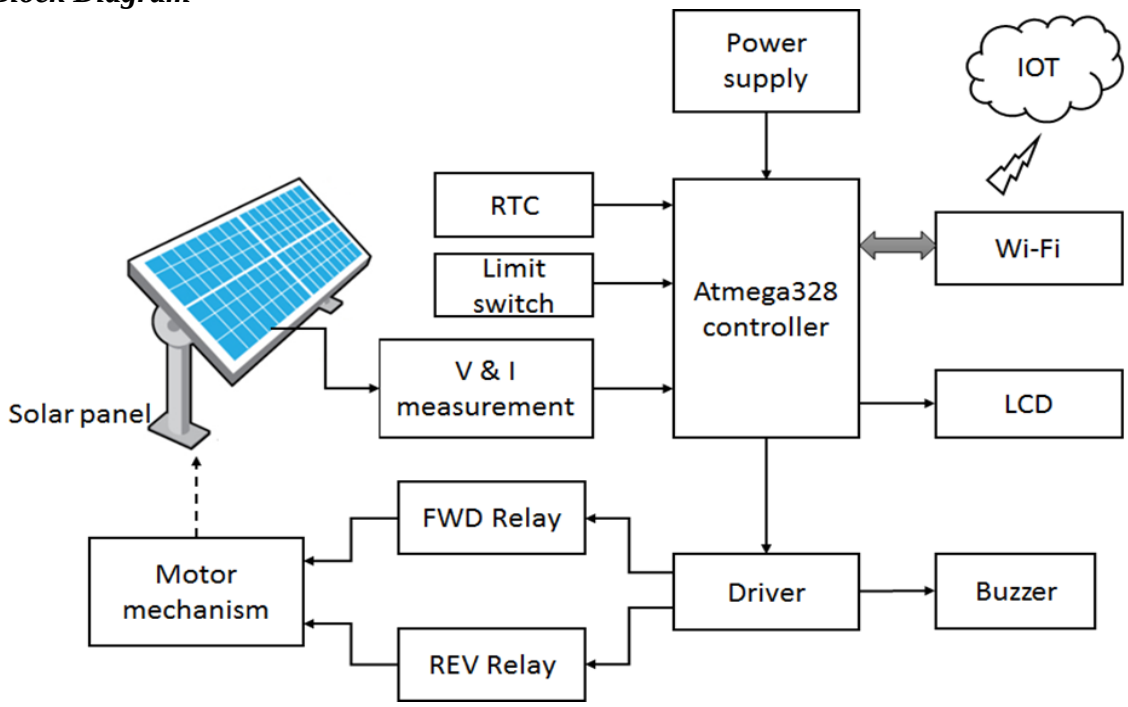

Fig.1 Block diagram of this system

Block Description

In this work the system is designed for monitoring a single axis solar tracking system using IOT. This system we use Atmega328 controller. This microcontroller is interfaced to RTC which is used for tracking time.

To monitor the solar panel voltage and current by using voltage and current measuring unit. This information is updated in webpage through IOT server via Wi-Fi module. A Driver is connected to the microcontroller which is used for controlling the solar panel mechanism motor. It is used to drive the motor for rotating the solar panel according to the sun ray direction location.

The driver is connected to relay to rotate the panel in forward and reverse direction. In this system one limit switch is placed in solar mechanism. It is used t detect the solar theft. If any theft is detected, this system to intimate the alert signal through buzzer unit.

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 25, Issue 6, 2021, Pages. 994-998
Received 25 April 2021; Accepted 08 May 2021.

Circuit Description

We use a transformer as a power supply. It will give supply to all components. Here we used a step-down transformer, which will convert 230 volts into 12 volt AC supply. This 12v ac supply is given to the diode.IN4007 is the diode that converts ac into a dc voltage. Alternating current capacitors are used to charge ac components and they will discharge through the ground.LM&7805 is a 7 series voltage regulator which is used to maintain voltage constant. Then the signal will pass through the next capacitors which will filter unwanted ac components. Load will be LED and resister. LED voltage is 1.75V.if voltage is above level beyond the limit, and then it will be dropped on resister. In this work we use arduino atmega328 controller. Solar voltage and current is measured by using voltage and current measuring unit. This output is connected to controller port A0, A1. In this system we use RTC for track the real time. It is connected to controller port A2. Solar theft is indicated by using limit switch. It is connected to controller port A3. Controller receive the input data and to control the motor through driver unit, Driver we use ULN2003 is connected to controller. Driver used to drive the motor through relay. Relay is act as a switch. Two relays are used to control the motor in forward and reverse direction. Motor is connected to relay. LCD is also interfaced to controller. It is used to display the short messages. Controller to update the information in webpage through IOT server via Wi-Fi/ W-Fi we use ESP8266. It is connected to controller port 23 & 25. Wi-Fi used as communication device between controller and IOT page.

Circuit Diagram

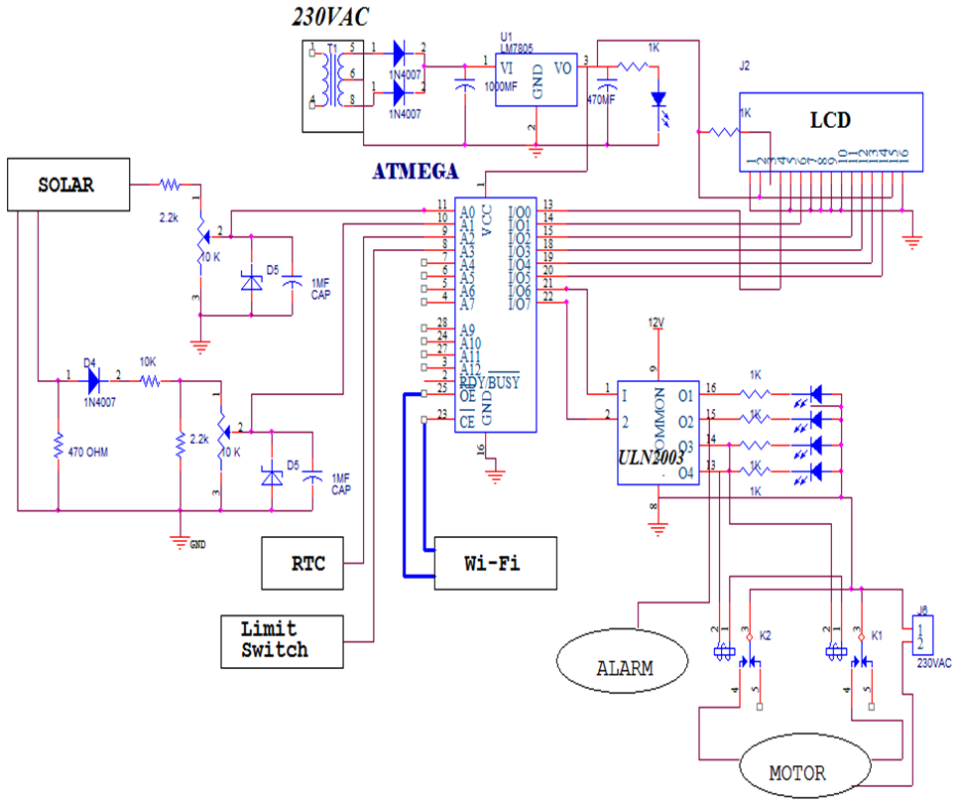

Fig.2 Circuit diagram

Before Panel Theft

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 25, Issue 6, 2021, Pages. 994-998
Received 25 April 2021; Accepted 08 May 2021.

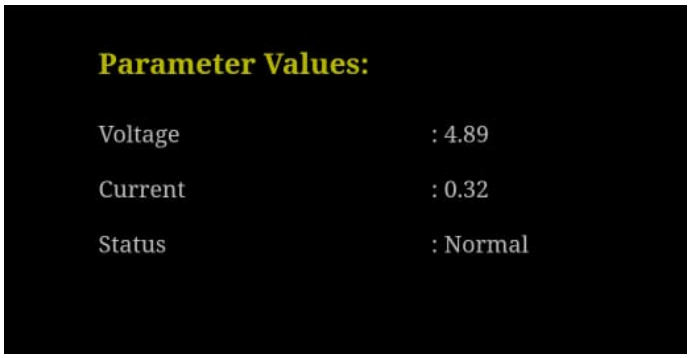

Fig.3 IOT output

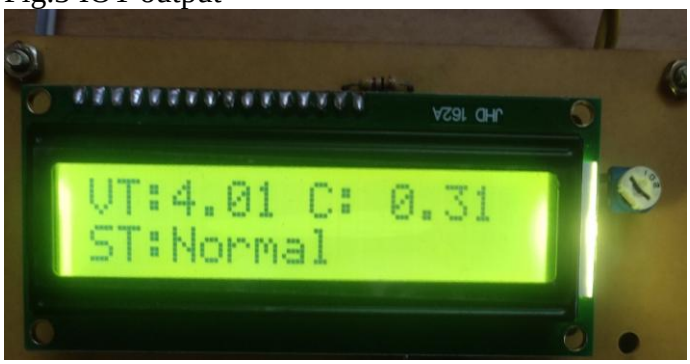

Fig.4 LCD output

After Panel Theft

Fig.5 LCD output

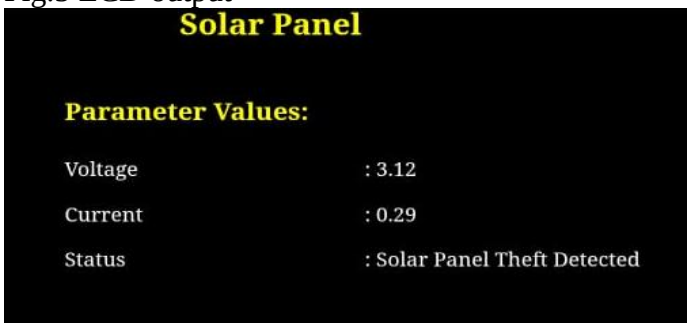

Fig.6 IOT output

3. Advantages and Applications

Advantages

- Low power consumption.
- Solar panel direction is changed as per the time.
- We can acquire efficient power from solar panel.

Applications

- This work is very useful to industry as well as domestic purpose for utilizing solar electric energy.
- Remote homes and emergency traffic applications.

Annals of R.S.C.B., ISSN: 1583-6258, Vol. 25, Issue 6, 2021, Pages. 994-998
Received 25 April 2021; Accepted 08 May 2021.

4. Conclusions

The invention of these kinds of solar tracking systems helps us to improve the efficiency and performance of the solar system. These kinds of solar tracker systems have comparatively low cost and maintenance. This system has both vertical axis and horizontal axis thus they can track sun's apparent motion anywhere. The theft of solar panel can be easily identified with this help of the proposed system.

References

[1] Prabodh Bajpai and Subhash Kumar, “Design, Development and Performance Test of an Automatic Two-Axis Solar Tracker System”, 2011
[2] Yiwang Wang and Jia Song, “Design of a Digital Solar Panel Automatic Tracking Controller for Photovoltaic Generation System”, 2012
[3] A. Kassem and M. Hamad, “A microcontroller-Based Multi-Function Solar Tracking System”, 2011
[4] A.B. Afarulrazi, W. M. Utomo, K.L. Liew and M. Zarafi, “Solar Tracker Robot using Microcontroller”, 2011
[5] Elham Ataei, RouhollahAfshari, Mohammad Ali Pourmina,Mohammad Reza Karimian,“Design and construction of a Fuzzy Logic Dual axis Solar tracker Based on DSP”, 2011
[6] Hung-Ching Lu and Te-Lung Shih, “Fuzzy System Control Design with Application to SolarPanel Active Dual-Axis Sun Tracker System”, 2010
[7] Ahmad Al Nabulsi, Ammar El Nosh, Abdulrahman Ahli, Mohamed Sulaiman, RachedDhaouadi, “Efficiency Optimization of a 150W PV System Using Dual Axis Tracking and MPPT”, 2010
[8] S. Pattanasethanon, “The Solar Tracking System by Using Digital Solar Position Sensor”, American j. of Engineering and applied sciences 3(4): 678-682, 2010.2nd ed., R. M. Osgood, Jr., Ed. Berlin, Germany: Springer-Verlag, 1998.
[9] Solar Energy: The Physics and Engineering of Photovoltaic Conversion Technologies and Systems Authors Arno Smets, Klaus Jäger, Olindo Isabella, Miro Zeman, René van Swaaij.