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Solar Tracking System with Auto Cut-Off Battery Charging and Inverter Circuit

Prof. M. B. Bhilawade [1], Abhishek Narendra Pawar [2], Chaitanya Arvind Kore [3], Kajal S Patil [4]

[1,,3] Dept. Of Electronics & Tele-communication, Engineering, [2,4] Dept. Of Electronics Engineering.
Dr. J. J. Magdum College of Engineering, Jaysingpur, Maharashtra, India

ABSTRACT:

Sun is a very abundant source of power. Even so, only a fraction of the entire energy is harnessed and that too not efficiently. The main cause of this is the high cost of installation of solar cells. Also solar cells are mostly kept fixed, so they do not obtain the optimum amount of sunlight throughout the day.A micro-controller based solar-tracking system is proposed in this project. The system checks the position of the sun and controls the movement of a solar panel so that radiation of the sun comes normally to the surface of the solar panel. The developed-tracking system tracks the sun in the single plane.

Simply tracking the sun's position is of no use if we cannot efficiently store the converted solar energy to electrical energy, in such a way that it is readily available whenever it is needed.Hence we are also designing an auto cut-off charging circuit which charges a battery up to the specified voltage of the battery and stores the electricity and stops the charging of the battery immediately. This prevents overcharging of the battery which is dangerous as well as it reduces the life of the battery.

Along with storing the energy we need to make sure that the required appliances should work properly on the power that is provided by the battery itself, so for that purpose we are also including an inverter circuit which will convert the low voltage DC supply into a standard 230V/50Hz AC supply.This will ensure that majority of the home appliances that we use in our day to day life are capable of working without any additional power supply.This being a small scale project certain parameters like the output voltage, No. of appliances that are connected and working will be limited because of the small solar panel used and the capacity of the battery used which produces low output. This can be varied according to our need and the desired result can be easily obtained.

INTRODUCTION

This project aims to produce energy by maximizing the amount of solar energy that is absorbed, store it in a battery which has auto cut-off circuit to charge the battery, only to its required potential and stop the charging process and further convert the low voltage DC supply provided by the battery to a standard power supply i.e 230V/50 Hz AC supply. This is to make sure that most of the home appliances are able to work on the provided output power supply. This being a small scale project certain parameters like the output voltage, No. of appliances that are connected and working will be limited because of the small solar panel and the capacity of the battery used which produces low output. This can be varied according to our need and the desired result can be easily obtained.

Conventional solar panels, fixed with a certain angle, limit their area of exposure from the sun during the course of the day There- fore, the average solar energy is not always maximized. Solar Tracking systems are essential for many applications such as thermal energy storage systems and solar energy based power generation systems in order to improve system performance. The change in the sun's position is monitored, and the system always keeps that the plane of the panel is normal to the direction of the sun. The solar tracker designed and constructed in this paper offers a reliable and affordable method of aligning a solar panel with the sun in order to maximize its energy output. The sun tracker system is a hybrid hardware and software prototype designed around ,which automatically provides best alignment of the solar panel with the sun. Two Cadmium Sulfide (CdS) photo resistors are used to sense the light intensity. The CdS photoresistors are light dependent resistor(LDR),it is basically a photocell that is sensitive to light .The sensors will be positioned in such a way, so that if one of the two comes under a shadow the microcontroller will be detect the difference in resistance and thus rotate the motor to move the solar panel into a position where the light upon both sensors is equal.

LITERATURE SURVEY

1. R. Suguna, M Shanmuga Priya, B Charuhasan, M Dhakshnamoorthy, R.Senthil Kumar, K Lithish Prabha, "Enhancement of Solar Output with Dual Axis Solar Tracker using Arduino", *2022 International Conference on Power, Energy, Control and Transmission Systems (ICPECTS)*, pp.1-5, 2022.

This paper aims to track the direction of the highest radiation angle of the sun's beam. This is done by fixing the panel with the geared motors embedded with sensors and controllers.

2. R. Abhinav, Adithya P. Rajeev, Anson M. Varghese, M. Harigovind, "Performance Analysis of Single Axis Tracking and Floating Solar Panel for Domestic Usage", *2021 13th IEEE PES Asia Pacific Power & Energy Engineering Conference (APPEEC)*, pp.1-7, 2021.

In this paper, the performance of a solar panel with single-axis tracking and a floating panel with a tracker is evaluated for domestic usage. The findings, effectiveness, and any defects that may exist are discussed.

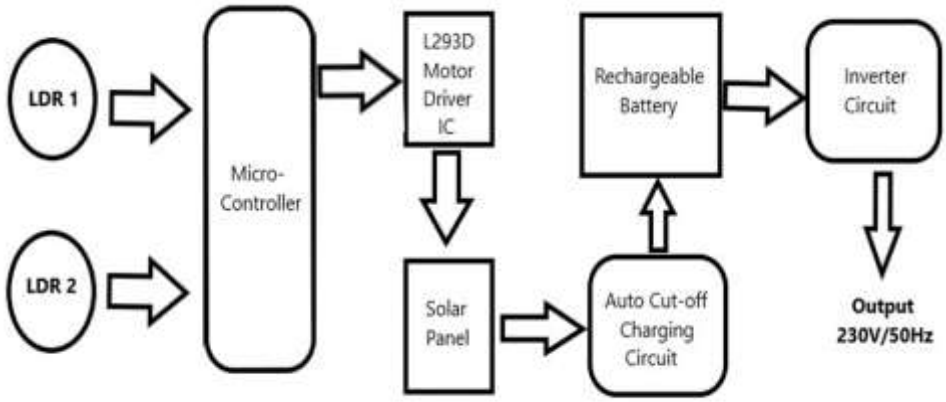
3. B. Jayalakshmi, V. Anjali, A.P. Karthik, K. Nibin, Sanoop Lal S., Akhil Rahm ath ulla h, "Microcontroller based Automatic Sun Tracking Solar Panel", 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), pp.1097-1099, 2020.

This paper describes an automatic sun tracking system, based on two stepper motors, and moving solar panels, to gain more energy from the sun.

4. M. Pushpavalli, P. Sivagami, P. Abirami, S. Sindhuja, Pathan Amzadkhan, "Solar Panel Tracking and Power Generation Using Automatic system", *2018 IEEE 4th International Symposium in Robotics and Manufacturing Automation (ROMA)*, pp.1-4, 2018.

This paper represents a dual axis programmed sun tracking system for keeping the fundamental sun oriented board around at right points by incident photons.

BLOCK DIAGRAM



RESULT AND CONCLUSION

Based on several studies, we can come to the conclusion that the conventional position of solar panels is not the most efficient in terms of the energy that is produced,To overcome this drawback the above mentioned solar tracking system using a microcontroller overcomes this drawback by tracking the light intensity of the sun and positioning the solar panel to almost perpendicular to the sun rays so that the energy that is produced is maximum throughout the daytime.Along with this to store the electrical energy, there is a battery charging circuit with auto cut-off circuit to protect the battery from overcharging which is dangerous and also impacts the life of the battery.Also there was a need for an inverter circuit to make sure that not only the low voltage DC appliances work with this system but also some appliances that require a 230 volts 50/60Hz AC power supply will be able to work with the system, these are the household appliances that we use in our day to day life.

The primary aim of this project was to implement the proposed solar tracking system with a auto cut-off battery and inverter circuit and get the desired results, which were successfully achieved.Also as an Electronics engineer to implement the academic knowledge that we gained during the course, into practical usage for the betterment of the existing technology.

FUTURE SCOPE

1. The solar tracking system can be calibrated to achieve maximum output by interfacing it to certain software that provide data about weather, so that the tracking of the sun rays is precise,
2. The whole system can be calibrated for a particular geographical area depending upon the weather of that respective area.
3. The output of the inverter circuit can be improved by interfacing a microcontroller in the circuit.

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3. R. Abhinav, Adithya P. Rajeev, Anson M. Varghese, M. Harigovind, "Performance Analysis of Single Axis Tracking and Floating Solar Panel for Domestic Usage", 2019 13th IEEE PES Asia Pacific Power & Energy Engineering Conference (APPEEC), pp.1-7, 2019.
4. Sheetal Sharma, Yogesh Rohilla, "A Study-Level Dual-Axis Active Solar Tracker", 2021 International Conference on System, Computation, Automation and Networking (ICSCAN), pp.1-6, 2021