Journal of Science, Computing and Engineering Research (JSCER)
Volume-7, Issue-6, June 2024.
DOI: *https://doi.org/10.46379/jscer.2023.070609*
ISSN: 2708-1079

Design and I Implementation of Solar Tracking Techniques to Enhance the Performance of Air Cooller System

Gopi Chand, Murali Boosa

Assistant Professor,Sri Venkateswara University, Tirupati, India

Article Information

Received : 02 June 2024
Revised : 06 June 2024
Accepted : 18 June 2024
Published : 22 June 2024

Corresponding Author:
Gopi Chand

Abstract— This paper deals with a brief article about a solar tracking mechanism & it's working explained along with Air Cooler. A solar tracker is a device that orients a payload toward the sun. Payloads can be photovoltaic panels, reflectors, lenses or other optical devices. In this system we will use photo voltaic method to absorb the solar energy usually with photovoltaic panels. The solar panel was tilted according to the sun movement. So this mechanism is called "Solar Tracking Mechanism". The above figs will give the brief idea about photo voltaic effect & conversion of light to electricity

Keywords: ***Solar Tracking, Solar Panel, Solar Tracking Mechanism***

Citation: Gopi Chand, Murali Boosa, "Design and Implementation of Solar Tracking Techniques to Enhance the Performance of Air Cooller System", Journal of Science, Computing and Engineering Research, 7(6), June 2024.

I. INTRODUCTION

The solar panel is converting sun rays to the Electricity by "Photo-Voltaic Effect". This electrical power is stored in a 12-Volt battery. Battery D.C power is used to run the D.C motor and D.C water pump. The D.C motor is coupled with impeller blades. The D.C motor runs during the air cooler button ON, the impeller blades starts rotating. The water pump is used to circulate the water to the blower unit. The forced air is flow through the water which is sprayed by water pump, so that the cold air produced. The switch control is used to ON/OFF solar air cooler circuit. To understand this Paper, we will take an example of air cooler with auto tracking mechanism

Fig. 1: Physical Setup of Solar Air Cooler with Auto Tracker

II. COMPONENTS

Components – Solar Panel, Battery, Blower, Water pump, and auto tracker. Solar Panel A solar Panel works on the principle of photo-voltaic principle, the photo-voltaic solar energy conversion is one of the most attractive non-conventional energy sources of proven reliability from the micro to the Megawatt level.

Fig. 2: Solar Panel

Battery In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo-voltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern. To be

economically attractive the storage of solar electricity requires a battery with a particular combination of properties

Fig. 3: Battery

Auto Tracker A solar tracker is a device that orients a payload toward the sun. Payloads can be photovoltaic panels, reflectors, lenses or other optical devices. In flat-panel photovoltaic (PV) applications, trackers are used to minimize the angle of incidence between the incoming sunlight and a photovoltaic panel. This increases the amount of energy produced from a fixed amount of installed power generating capacity. In concentrated photovoltaic (CPV) and concentrated solar thermal (CSP) applications, trackers are used to enable the optical components in the CPV and CSP systems. The optics in concentrated solar applications accept the direct component of sunlight light and therefore must be oriented appropriately to collect energy. Tracking systems are found in all concentrator applications because such systems do not produce energy unless pointed at the sun.

Fig. 4: Auto Tracker

The Solar Tracker which we are showing in this paper is single axis solar tracker. This is as shown in fig. We may consider this though X-axis or Y-axis. But the rotation of the PV panel should be from the East to West. Advantage 1) Compare to solar panel in fixed form, single axis solar tracker has better efficiency. The efficiency of single axis solar tracker over fixed mount panel is 32.17%. Disadvantage 1) Single axis solar tracker tracks sun only from east to west direction. 2) Its efficiency is less compare to dual axis solar tracker Direct power lost (%) due to misalignment (angle I): Because of not imposing the solar panel to sun rays we may lost the power production capacity. The below chart is representing the % of lost due to misalignment.

Table – 1

I	*Hrs.*	*Lost = 1 – Cos(I)*
15°	*1*	*3%*
30°	*2*	*13%*
45°	*3*	*30%*
60°	*4*	*>50 %*
75°	*5*	*>75%*

Here I = Incident Angle, Hrs. = No of hours imposed to sun rays.

III. BACKGROUND OF STUDY EFFICIENCY OF SINGLE-AXIS TRACKING SYSTEM OVER FIXED MOUNT

The power output for the single-axis and fixed mount panel are tabulated for a single day. The average power values prove that the single-axis panel produces more power than that of the fixed mount. The power efficiency calculated for the singe-axis solar tracker is said to be 13% more than that of the fixed mount. The tabulated values are simulated & obtained using MATLAB. Disadvantages This kind of tracker is most effective at equatorial latitudes where the sun is more or less overhead at noon. Due to the annual motion of the earth the sun also moves in the north and south direction depending on the season and due to this the efficiency of single-axis is reduced since the single-axis tracker only tracks the movement of sun from east to west. During cloudy days the efficiency of the single axis tracker is almost close to the fixed panel.

Table – 2
Power Output for the Fixed Mount and Single-Axis Panel

HOUR	*POWER FOR FIXED MOUNT (mW)*	*POWER FOR SINGLE-AXIS (mW)*
08.00	*20.664*	*62.403*
09.00	*39.780*	*67.473*
10.00	*44.176*	*77.212*
11.00	*70.616*	*93.772*
12.00	*88.110*	*110.430*
13.00	*104.960*	*137.160*
14.00	*125.334*	*130.754*
15.00	*105.342*	*120.335*
16.00	*86.172*	*103.096*
17.00	*70.620*	*89.910*
18.00	*46.494*	*65.625*

The below graph will show the difference between fixed

solar system & solar tracking system. This will show clear idea of the solar tracking system while in day times

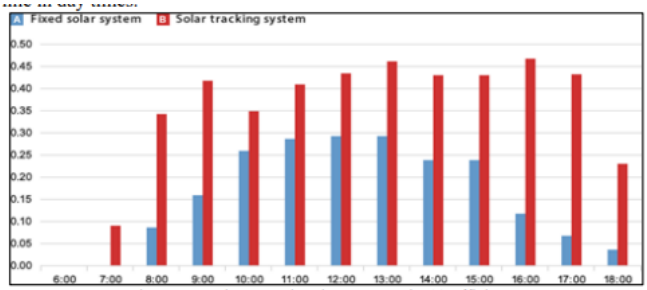

Fig. 5: X- Axis: Day Time in Hrs. Y-axis: % Efficiency

The circuit diagram of the single tail comparator shown in Fig 3. The single tail comparator circuit operation is given below. When CLK=0 the circuit works in reset phase so the Mtail NMOS transistor is in off position and the reset transistors M7 and M8 PMOS transistors are in on position now the output at OUTN and OUTP will be VDD. When CLK= VDD , Mtail NMOS transistor is in ON position and M7 and M8 PMOS transistors are in OFF position now the OUTN and OUTP urrent to keep the differential amplifiers in weak condition so a large current required enabling fast regeneration in the circuit.

IV. CONCLUSION

In this paper we have achieved a clear knowledge of comfort cooling system for human by using non-conventional energy and heating system by power supply. This study would be fruitful in both domestic & industrial backgrounds. We also know about non-conventional energy sources and utilization. This paper although fulfilling our requirement has further scope for improvements. Some of the improvements that could be made in this solar air cooler unit are listed below. 1) By adding solar panel auto tracking system 2) By adding some components to make solar heater cum cooler

REFERENCES

[1]. P. Nirmala, T. Manimegalai, J. R. Arunkumar, S. Vimala, G. Vinoth Rajkumar, Raja Raju, "A Mechanism for Detecting the Intruder in the Network through a Stacking Dilated CNN Model", Wireless Communications and Mobile Computing, vol. 2022, Article ID 1955009, 13 pages, 2022. https://doi.org/10.1155/2022/1955009.

[2]. D. Sathyanarayanan, T. S. Reddy, A. Sathish, P. Geetha, J. R. Arunkumar and S. P. K. Deepak, "American Sign Language Recognition System for Numerical and Alphabets," 2023 International Conference on Research Methodologies in Knowledge Management, Artificial Intelligence and Telecommunication Engineering (RMKMATE), Chennai, India, 2023, pp. 1-6, doi: 10.1109/RMKMATE59243.2023.10369455.

[3]. J. R. Arunkumar, Tagele berihun Mengist, 2020" Developing Ethiopian Yirgacheffe Coffee Grading Model using a Deep Learning Classifier" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-4, February 2020. DOI: 10.35940/ijitee.D1823.029420.

[4]. Ashwini, S., Arunkumar, J.R., Prabu, R.T. et al. Diagnosis and multi-classification of lung diseases in CXR images using optimized deep convolutional neural network. Soft Comput (2023). https://doi.org/10.1007/s00500-023-09480-3

[5]. J.R.Arunkumar, Dr.E.Muthukumar," A Novel Method to Improve AODV Protocol for WSN" in Journal of Engineering Sciences" ISSN NO: 0377-9254Volume 3, Issue 1, Jul 2012.

[6]. R. K, A. Shameem, P. Biswas, B. T. Geetha, J. R. Arunkumar and P. K. Lakineni, "Supply Chain Management Using Blockchain: Opportunities, Challenges, and Future Directions," 2023 Second International Conference on Informatics (ICI), Noida, India, 2023, pp. 1-6, doi: 10.1109/ICI60088.2023.10421633.

[7]. Arunkumar, J. R. "Study Analysis of Cloud Security Chanllenges and Issues in Cloud Computing Technologies." Journal of Science, Computing and Engineering Research 6.8 (2023): 06-10.

[8]. J. R. Arunkumar, R. Raman, S. Sivakumar and R. Pavithra, "Wearable Devices for Patient Monitoring System using IoT," 2023 8th International Conference on Communication and Electronics Systems (ICCES), Coimbatore, India, 2023, pp. 381-385, doi: 10.1109/ICCES57224.2023.10192741.

[9]. S. Sugumaran, C. Geetha, S. S, P. C. Bharath Kumar, T. D. Subha and J. R. Arunkumar, "Energy Efficient Routing Algorithm with Mobile Sink Assistance in Wireless Sensor Networks," 2023 International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI), Chennai, India, 2023, pp. 1-7, doi: 10.1109/ACCAI58221.2023.10201142.

[10]. R. S. Vignesh, V. Chinnammal, Gururaj.D, A. K. Kumar, K. V. Karthikeyan and J. R. Arunkumar, "Secured Data Access and Control Abilities Management over Cloud Environment using Novel Cryptographic Principles," 2023 International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI), Chennai, India, 2023, pp. 1-8, doi: 10.1109/ACCAI58221.2023.10199616.

[11]. Syamala, M., Anusuya, R., Sonkar, S.K. et al. Big data analytics for dynamic network slicing in 5G and beyond with dynamic user preferences. Opt Quant Electron 56, 61 (2024). https://doi.org/10.1007/s11082-023-05663-2

[12]. Krishna Veni, S. R., and R. Anusuya. "Design and Study Analysis Automated Recognition system of Fake Currency Notes." Journal of Science, Computing and Engineering Research 6.6 (2023): 16-20.

[13]. V. RamKumar, S. Shanthi, K. S. Kumar, S. Kanageswari, S. Mahalakshmi and R. Anusuya, "Internet of Things Assisted Remote Health and Safety Monitoring Scheme Using Intelligent Sensors," 2023 International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI), Chennai, India, 2023, pp. 1-8, doi: 10.1109/ACCAI58221.2023.10199766.

[14]. R. S. Vignesh, R. Sankar, A. Balaji, K. S. Kumar, V. Sharmila Bhargavi and R. Anusuya, "IoT Assisted Drunk and Drive People Identification to Avoid Accidents and Ensure Road Safety Measures," 2023 International Conference on

Advances in Computing, Communication and Applied Informatics (ACCAI), Chennai, India, 2023, pp. 1-7, doi: 10.1109/ACCAI58221.2023.10200809.

[15]. I. Chandra, G. Sowmiya, G. Charulatha, S. D, S. Gomathi and R. Anusuya, "An efficient Intelligent Systems for Low-Power Consumption Zigbee-Based Wearable Device for Voice Data Transmission," 2023 International Conference on Artificial Intelligence and Knowledge Discovery in Concurrent Engineering (ICECONF), Chennai, India, 2023, pp. 1-7, doi: 10.1109/ICECONF57129.2023.10083856.

[16]. G. Karthikeyan, D. T. G, R. Anusuya, K. K. G, J. T and R. T. Prabu, "Real-Time Sidewalk Crack Identification and Classification based on Convolutional Neural Network using Thermal Images," 2022 International Conference on Automation, Computing and Renewable Systems (ICACRS), Pudukkottai, India, 2022, pp. 1266-1274, doi: 10.1109/ICACRS55517.2022.10029202.

[17]. R. Meena, T. Kavitha, A. K. S, D. M. Mathew, R. Anusuya and G. Karthik, "Extracting Behavioral Characteristics of College Students Using Data Mining on Big Data," 2023 International Conference on Artificial Intelligence and Knowledge Discovery in Concurrent Engineering (ICECONF), Chennai, India, 2023, pp. 1-7, doi: 10.1109/ICECONF57129.2023.10084276.

[18]. S. Bharathi, A. Balaji, D. Irene. J, C. Kalaivanan and R. Anusuya, "An Efficient Liver Disease Prediction based on Deep Convolutional Neural Network using Biopsy Images," 2022 3rd International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 2022, pp. 1141-1147, doi: 10.1109/ICOSEC54921.2022.9951870.

[19]. I. Chandra, G. Sowmiya, G. Charulatha, S. D, S. Gomathi and R. Anusuya, "An efficient Intelligent Systems for Low-Power Consumption Zigbee-Based Wearable Device for Voice Data Transmission," 2023 International Conference on Artificial Intelligence and Knowledge Discovery in Concurrent Engineering (ICECONF), Chennai, India, 2023, pp. 1-7, doi: 10.1109/ICECONF57129.2023.10083856.

[20]. Revathi, S., et al. "Developing an Infant Monitoring System using IoT (INMOS)." International Scientific Journal of Contemporary Research in Engineering Science and Management 6.1 (2021): 111-115.