REVIEW OF PROGRAMMABLE SOLAR TRACKING SYSTEM FOR FINEST POWER SUPPLY

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Abstract

The modern trend is deployment of latest technologies in every field of life and the implementation of microcontroller programming in electrical domain is very hot area to address the electricity shortage. Solar power is one of the main sources of power supply in our life. Solar energy resolves the shortage of electricity to a great extent hence the need is deployment of intelligent solar tracking for maximum power input.

Keywords- *PV, AC, LED, LDR, IOT.*

I.INTRODUCTION

In our daily life solar energy play a very important role as an alternative of electricity and address the electricity shortage that consumers face to a great extent. Solar energy is a clean and reliable with low maintenance and the important thing is eco friendly. The Rural areas are more affected as compared to urban areas and the power supply is very much unscheduled by the providers. In Hiamchal Pradesh solar based energy performs great role particularly in rural areas like Chamba District during the winter season. The Government of India is working with a positive approach towards the development of solar based Power Plants to make supply smooth to consumers and also launched number of schemes in collaboration with different banks to make consumers more and more aware regarding Solar Power and offers home based Solar Power Systems to them. After deployment of solar systems it is very important to acquire optimum power supply that can be obtained through proper tracking of solar plants. The work is based on an intelligent solar tracking system based on modern technologies. The four parameters viz temperature, light intensity, voltage and current have been used and measured by temperature sensor, light dependent resistor sensor, voltage divider and current sensor module respectively. All these parameters have been used as input to Arduino and the output of the same has been generated and displayed on the LCD screen. The purpose of Arduino is to convert the analog input of the said parameters to the digital output and display via LCD screen [1].

There is a need to improve the energy efficiency of PV solar panel using Arduino mechanism in controlling the movement of solar panel [2]. The solar is an alternate lighting system and need a solution to the gap between energy

demand and energy availability [3]. We have solar tracking system in which PV panels are used to convert sun energy to DC electric current. Traditional solar panels are less efficient than these particular automated solar trackers. Also LDR's are also used to sense the intensity of light [5]. The solar tracking systems are based on microcontrollers and very cost efficient [6].

Researchers also introduces a methodology of an automatic solar tracker by means of both sensors and image processing simultaneously and in this approach a solar tracking has been implemented by the use of image processing software that combines the effect of sensors and processed image of sun and controls the solar panel accordingly and has been proved in the paper [7]. The solar tracking system collects free energy from the sun, store it using batteries and convert this energy to AC [8]. A single axis tracker device is designed and then analyzed for its efficiency. The proposed model operates by the orientation of PV panel according to the real position of the sun. The proposed model also eliminates the unnecessary movements, at too small intensities of the light signals received from any two LEDs [10].

II.LITERATURE REVIEW

Jumaat and Othman (2018) the research paper entitled "Solar Energy Measurement Using Arduino" has used Arduino Board Technology for developing a measurement of solar energy. For the same purpose, four parameters viz temperature, light intensity, voltage and current have been used and measured by temperature sensor, light dependent resistor sensor, voltage divider and current sensor module respectively. All these parameters have been used as input to Arduino and the output of the same has been generated and displayed on the LCD screen. The purpose of Arduino is to convert the analog input of the said parameters to the digital output and display via LCD screen.

Aigboviosa et al (2018) the research paper entitled "Arduino Based Solar Tracking System For Energy Improvement Of PV Solar Panel" defines the need to improve the energy efficiency of PV solar panel using Arduino mechanism in controlling the movement of solar panel. This paper has concluded that tracking solar panel is far better as compared to a fixed panel. It has put on the future work for researchers to consider the use of more sensitive and efficient sensors which consumes less power and also cost effective.

Jain et al (2017) the research paper entitled "Solar Home Lighting System with AC and DC loads" presents solar energy over alternate lightning system. It provides a solution to the gap between energy demand and energy availability. Also this study analysis the solar powered home lightning system practically and verifies its design of the system for reliable and optimal performance.

Williams and Qouneh (2017) the research paper entitled "Internet of Things: Solar Array Tracker" describes the IOT technology and IOT based solar tracker. The solar tracker predicts the sun position for maximum power output, controls servos that move the cell, monitors the output of the solar cell, collects and processes raw data to infer information that can be sent to a remote station for further analysis.

Racharla and Rajan (2016) the research paper entitled "Solar Tracking System—A review" actually reviews the various different solar tracking systems, checks for their efficiency and also gives detailed description of the advantages and disadvantages of the same. This paper also shows a comparison between a single and dual tracking system in terms of cost, efficiency and flexibility.

N.V and A.P (2016) the research paper entitled "Automatic Solar Tracking System" has designed a solar tracking system in which PV panels are used which convert sun energy to DC electric current. Traditional solar panels are less efficient than these particular automated solar trackers. Also LDR's are also used to sense the intensity of light.

Deekshith K et al (2015) the research paper entitled "Solar Tracking System" gives a brief overview of solar tracking system based on microcontroller. This solar tracker is cost efficient. These solar trackers enable the accurate tracking of the sun.

Sohag et al (2015) the research paper entitled "An Accurate and Efficient Solar Tracking System Using Image Processing and LDR Sensor" introduces a methodology of an automatic solar tracker by means of both sensors and image processing simultaneously. In this mechanism a solar tracking has been implemented by the use of image processing software that combines the effect of sensors and processed image of sun and controls the solar panel accordingly and has been proved in the paper.

Juang and Radharamanan (2014) the research paper entitled "Design of a Solar Tracking System for Renewable Energy" has discussed the design of a solar tracking system to collect the free energy from the sun, store it in a battery and convert this energy into alternating current(AC). The system is then tested for its responsiveness, reliability, stability and safety, resistance to weather, temperature and minor mechanical stresses. The system is designed as such that it can be easily recovered after a failure.

Fengtao Zhang (2014) the research paper entitled "Research of Solar Tracking Controller based on the STC12C5A32S2" defines the biaxial memory tracking controller and is carried out thorough research. Also a memory tracking system is designed based on four quadrant location to improve the conversion efficiency. In this case, a four way photosensitive resistance circuit AD conversion device of STC12C5A32S2 MCU itself.

Tudorache and Kreindler (2010) the research paper entitled "Design of a Solar Tracker System for PV Power Plants" discusses the design and the working efficiency dedicated to the PV conversion panels. In this paper a single axis tracker device is designed and then analyzed for its efficiency. The proposed model operates by the orientation of PV panel according to the real position of the sun. The proposed model also eliminates the unnecessary movements, at too small intensities of the light signals received from any two LEDs.

III. EXISTING SYSTEM

Solar energy is considered the best alternative for power supply across the world and there is lot of research work done on this concept but stills

areas needs to be improved in future like monitoring. Remote monitoring at the solar power plants, keeping up the health of the solar PV system is of paramount importance, and continuous monitoring is required. There are number of monitoring and solar tracking systems available but not furnishing the optimum power supply means we need an intelligent solar tracking system based on intensity of sun light.

IV. PROPOSED SYSTEM

This paper presents a dynamic and programmable tracking system based on intensity of the light. The deployment of technological implications improves the solar plant performance like remote monitoring using IOT technology and rotation of solar panels as per the intensity of light. The work also offers other feasibilities like use of solar panels for voltage status etc.

V. ADVANTAGES OF PROPOSED METHOD

The proposed work supports number of dynamic features based on solar plants like manual rotation of solar panels in case there is any technical failure present in the system. Full automatic rotation of solar panels as per the intensity of light and the best feature is on LCD screen we can check the voltage status generated by solar panels.

VI. COMPARATIVE ANALYSIS OF LITERATURE REVIEW

Reference	Title	Technique	Research Findings
Jumaat and Othman	Solar Energy Measurement Using Arduino	Arduino	Arduino based technology for solar energy measurement
Aigboviosa, et al	Arduino Based Solar Tracking System For Energy Improvement Of PV Solar Panel	Ardauino	To improve the energy efficiency of PV solar panel using Arduino mechanism in controlling the movement of solar panel
Williams and Qouneh	Internet of Things: Solar Array Tracker	IOT	Presents an IOT based solar tracker system with the capability of tracking the sun for optimum power generation
Jain et al	Solar Home Lighting System with AC and DC loads	Microcontroller	Presents solar energy over alternate lightning system
N.V and A.P	Automatic Solar	Microcontroller	Presents a solar

	Tracking System	AT89S52	tracking system in which PV panels are used which convert sun energy to DC electric current
Deekshith K et al	Solar Tracking System	Arduino	Presents a cost efficient solar tracker with accurate of the sun.

VII. RESULTS

The comparative results of programmable based solar tracking literature are given below:

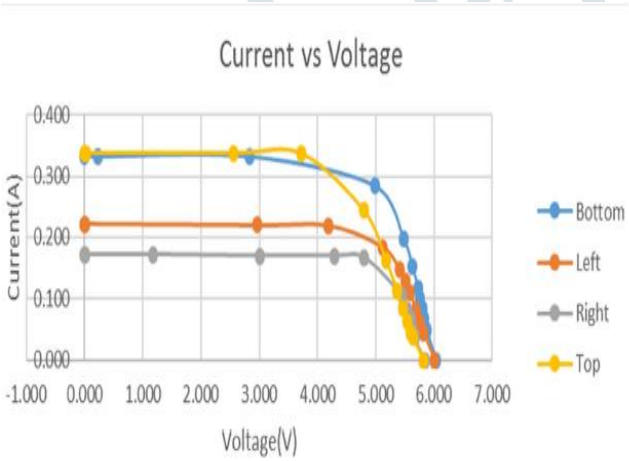

Figure 1: Solar cell current/voltage curve based on orientation

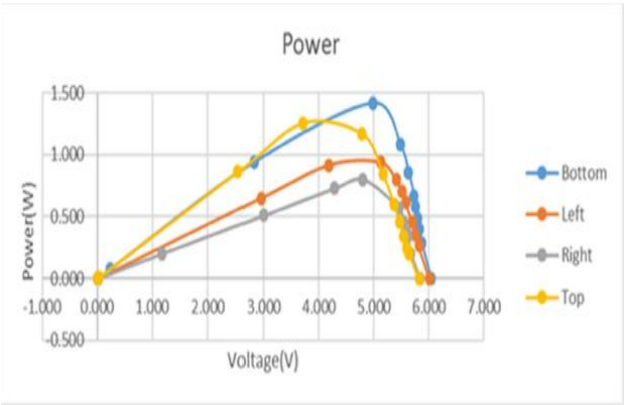

Figure 2: Solar cell's power generation curve based on orientation

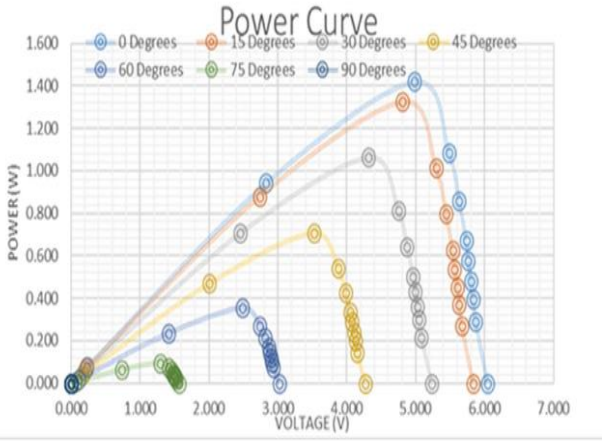

Figure 3: Solar cell's power curve based on angle of the cell

Time	LDR1 (Ω)	LDR2 (Ω)	LDR3 (Ω)	LDR4 (Ω)	Temperature (°C)	Fixed Panel O/P (W)	Duel Axis O/P (W)
7:00 AM	49	75	159	77	25	2.22	6
8:00 AM	47	77	165	78	26	3.67	7.84
9:00 AM	46	72	171	69	28	6.27	8.34
10:00 AM	47	68	164	68	29	7.35	8.76
11:00 AM	45	55	166	52	29	7.92	8.45
12:00 AM	41	50	42	54	30	8.84	9.58
1:00 PM	48	46	52	48	31	8.87	9.32
2:00 PM	168	161	55	162	32	8.64	9.08
3:00 PM	172	163	57	161	32	8.38	8.86
4:00 PM	170	174	68	176	29	7.33	8.78
5:00 PM	171	168	67	165	28	5.69	8.37
				Average	29	6.8754545 45	8.489090 909

Table I: Experimental Results of Automatic Solar Tracking System on a Clear and Sunny Day

Time	LDR1 (Ω)	LDR2 (Ω)	LDR3 (Ω)	LDR4 (Ω)	Temperature (°C)	Fixed Panel O/P (W)	Duel Axis O/P (W)
9:00 AM	55	75	182	77	27	1.57	6.6
10:00 AM	43	77	181	78	27	2.59	6.6
11:00 AM	48	72	179	69	28	5.62	6.7
12:00 AM	48	68	179	68	30	6.24	6.8
1:00 PM	47	55	179	52	32	6.27	6.8
2:00 PM	165	50	57	54	32	6.18	6.9
3:00 PM	168	46	57	48	32	5.92	6.4
4:00 PM	171	161	56	162	28	5.21	6
5:00 PM	175	163	55	161	28	4.04	6
6:00 PM	183	174	56	176	27	3.81	5.7
				Average	2.91	4.745	6.45

Table II: Experimental Results of Automatic Solar Tracking System on a Partly Cloudy Day

Time	LDR1 (Ω)	LDR2 (Ω)	LDR3 (Ω)	LDR4 (Ω)	Temperature (°C)	Fixed Panel O/P (W)	Duel Axis O/P (W)
7:00 AM	210	218	214	221	21	0.726	2.215
8:00 AM	203	198	199	197	22	1.197	2.898
9:00 AM	48	72	179	69	21	2.193	3.073
10:00 AM	48	68	179	85	21	2.397	3.2
11:00 AM	47	78	179	89	23	2.598	3.087
12:00 AM	182	133	112	132	23	2.883	3.47
1:00 PM	187	67	147	115	22	2.898	3.38
2:00 PM	171	161	56	162	24	2.8206	3.297
3:00 PM	175	163	55	161	23	2.733	3.22
4:00 PM	183	174	56	176	23	2.4087	3.199
5:00 PM	237	241	238	227	21	1.848	3.052
6:00 PM	242	239	224	235	21	1.386	3.072
				Average	22.08	2.17403	3.09692

Table III: Experimental Results of Automatic Solar Tracking System on a Cloudy and Overcast Day

CONCLUSION

The paper presents the deployment of programmable instructions in solar plants for better power supply. The paper reviews solar plants and its sub topics with monitoring and rotation of solar panels based on microcontroller programming.

REFRENCES

[1] Siti Amely Jummat, Mohamad Hilmi Othman, "Solar Energy Measurement Using Arduino", MATEC Web of Conferences 150, 2018.

[2] Peter Amaize, Stanley Uzairue, Timilehin Fiyin Sanni, "Arduino Based Solar Tracking System For Energy Improvement Of PV Solar Panel", Proceedings of the International Conference on Industrial Engineering and Operations Management Washington DC, USA, 2018.

[3] Aaditya Jain, Mrs. Kusum Tharani, Himanshu Dhall, Nikhil Kumar Singh , Saarthi Bhatia, "Solar Home Lighting System with AC and DC loads", IOSR Journal of Electrical and Electronics Engineering(IOSR-JEEE), Vol 12, Issue 3, 2017.

[4] Kyle Williams, Amer Qouneh, "Internet of Things: Solar Array Tracker", IEEE, 2017.

[5] Suneetha Racharla, K Rajan, "Solar Tracking System—A review", International Journal of Sustainable Engineering, 2016.

[6] Parasnis N.V.,Tadamalle A.P,AUTOMATIC SOLAR TRACKING SYSTEM, International Journal Of Innovations In Engineering Research And Technology[IJIERT], 2016.

[7] Md. Hanif Ali Sohag, Md. Mahmudul Hasan, Mst. Mahmuda Khatun, Mohiuddin Ahmad "An Accurate and Efficient Solar Tracking System Using Image Processing and LDR Sensor",

Proceedings of International Conference on Electrical Information and Communication Technology (EICT), 2015

[8] Deekshith K , Dhruva Aravind , Nagaraju H , Bhaskar Reddy, "Solar Tracking System", International Journal of Scientific & Engineering Research, Volume 6, Issue 9, 2015.

[9] Jeng-Nan Juang, R. Radharamanan "Design of a Solar Tracking System for Renewable Energy", Conference of the American Society for Engineering Education (ASEE Zone), 2014.

[10] Fengtao ZHANG, "Research of Solar Tracking Controller based on the STC12C5A32S2", IEEE Workshop on Electronics, Computer and Applications, 2014.

[11] Tiberiu Tudorache, Liviu Kreindler, "Design of a Solar Tracker System for PV Power Plants ", Acta Polytechnica Hungarica, Vol 7, 2010.