



## SINGLE AXIS SOLAR TRACKING SYSTEM WITH WEATHER SENSOR

KRISHNA R TELRANDHE<sup>\*1</sup>, HARSH RANGARI<sup>\*2</sup>, HARSH KATULWAR<sup>\*3</sup>,  
RITIK HUMANE<sup>\*</sup>, KOMALE DONGRE<sup>\*5</sup>, Prof. RITESH HARODE<sup>\*6</sup>

Mechanical Engineering, NIT POLYTECHNIC, NAGPUR, INDIA

### ABSTRACT

Solar energy is quickly gaining ground as a vital mean of increasing renewable energy use. star pursuit is utilized so as to maximise collected radiation by a electrical phenomenon panel. The planned single axis star hunter device functions to make sure the optimisation of the electrical phenomenon panel in accordance with the important position of the sun. The operation of experimental model of the device relies on a DC motor that is showing intelligence controlled by a fervent drive unit that moves a mini PV panel consistent with the signals received by a PLC (Programmable Logic Controller) from 2 straightforward however economical lightweight sensors. The performance and characteristics of the star hunter device area unit by experimentation analyzed. Improving the potency of star panels is that the main task of alternative energy generation. One amongst the strategies may be a star pursuit system. one amongst the foremost necessary parameters of pursuit systems may be a precise orientation to the Sun. during this paper, the performance of single- axis star trackers supported schedule and light weight dependent electrical device (LDR) photosensors, likewise as a stationary electrical phenomenon installation in varied weather,were compared. In the star pursuit system mechanical switches used and PLC used PLC system additionally known as in terms of microcontroller. By victimisation that mechanically star move once sun radiation direction changes by victimisation hunter and find the most output in terms of Energy. The battery used for storing and used the storing energy for mechanical switches and for motor drive.

**Keywords:** single-axis solar tracker; exact orientation to the Sun; schedule- and LDR-based solar trackers; efficiency of solar panels; encoder; electronic control unit. etc..

### I. INTRODUCTION

In last 10 years, several of residentials round the world used electrical scheme as a sub power at their homes. this is often as a result of solar power is a vast energy resource, set to become progressively vital within the long term, for providing electricity and warmth energy to the user. solar power additionally has the potential to be the main energy provide within the future. star huntsman is an automatic solar array that truly follows the Sun to extend the ability. The sun's position within the sky varies each with instrumentality over any fastened position. One well-known variety of star huntsman is that the heliostat, a movable mirror that reflects the moving sun to a set location, however several different approaches square measure used also. Active huntsmans use motors and equipment trains to direct the tracker as commanded by a controller responding to the star direction.



Fig.1 Solar cell PV system

The star huntsman will be used for many application like star cells, star day-lighting system and star thermal arrays. The star huntsman is incredibly helpful for device that desires additional daylight for higher potency like photovoltaic cell. Manufacturers square measure perpetually creating progressive enhancements to their star panels to form a better energy yield per unit than previous and competitory models. Another established thanks to increase system output is by victimization star trackers, which, not like fixed-tilt ground-mount systems, build star panels follow the sun's path throughout the day. Single-axis star trackers track the sun east to west, rotating on one purpose, moving either in unison, by panel row or by section. Among the renewable energy sources is electrical solar power from the Sun will be controlled victimization star panels or star cells to convert star irradiation into electrical current. Most electrical phenomenon cells use physical phenomenon impact. this is often a method by that electrons square measure emitted from some materials, like a metal, as a results of being stricken by photons. Some substances, like Se, square measure significantly vulnerable to this impact and if utilized in star cells, they will generate some voltage through emission. Sun rays are available sort of UV-light, a sort of radiation and once they fall of solar array surface made from materials like atomic number 14, the irradiation is absorbed and born-again into electricity through image emission. most absorption happens once the star panels and star cells directly face the Sun, in order that the sun's rays fall sheer on the absorption surface. This absorption and conversion might not be best providing the star panels and star cells square measure mounted in fastened positions sometimes on rooftops with slants. For viable solar power generation victimization single installation, its potency should be improved and so numerous star pursuit strategies square measure devised to closely track sun movement throughout the day. Types of star Trackers and star pursuit Techniques fashionable star pursuit strategies will be classified into the subsequent categories: Single Axis star pursuit System this is often technique is sometimes used for star trackers aimed to be utilized in the tropics wherever the main target is to trace the angle of altitude (angle of tilt) of the sun on one axis. one linear mechanism is employed, like a motor to drive the panel in step with sun movements. a collection of 2 LDRs on opposite sides of the solar array is also wont to live the intensity of the star irradiation by activity the fall across them that is then compared by a drive circuit till the 2 LDR voltages square measure equal and also the motion of the panel is stopped. This way, the solar array is usually homeward-bound, unremarkably to sun irradiation.

## II. OBJECTIVE

The main objective for this project is :-

- 1)To develop the sun tracking solar system model which is a device that follow the movement of the Sun regardless of motor speed.
- 2)It is to improve the overall electricity generation using single axis sun tracking system and also to provide the design for residential use.
- 3)Solar power is pollution free during use
- 4)Design a system to track solar for UV light for solar panel
- 5)Commonly called green city under sun

## III. LITERATURE OF REVIEW

### 1.1 Optimized Single-Axis Schedule Solar Tracker in Different Weather Conditions Article in Energies · October 2020, Nurzhigit Kuttybay 1 , Ahmet Saymbetov 1,\*, Saad Mekhilef 2,3,4 , Madiyar Nurgaliyev 1 , Didar Tukymbekov 1 , Gulbakhar Dosymbetova 1 , Aibolat Meir Khanov 1 and Yeldos Svanbayev 1

In this paper, up the potency of star panels is that the main task of alternative energy generation. one in every of the strategies could be a star following system. one in every of the foremost necessary parameters of following systems could be a precise orientation to the Sun. during this paper, the performance of single-axis star trackers supported schedule and lightweight dependent resistance (LDR) photosensors, additionally as a stationary electrical phenomenon installation in numerous climatic conditions, were compared. A comparative associate analysis of the operation of a factory-made schedule star hunter and an LDR star hunter in several climatic conditions was performed; additionally, a straightforward technique for crucial the rotation angle of a star hunter supported the encoder was projected. Finally, the performance of the factory-made star trackers was calculated, taking under consideration numerous climatic conditions for one year. The projected single-axis star hunter supported schedule showed higher leads to cloudy and rainy climatic conditions. The obtained results are often used for planning star trackers in areas with a variable climate. The paper concludes was found that the schedule-based star following system is four.2% additional economical than LDR star trackers in several climatic conditions. The projected hunter showed fifty seven.4% additional potency compared with a set solar battery set to optimum angle. Wrong determination of the Sun's position by the LDR hunter in cloudy or rainy weather results in a decrease within the power of the solar battery. additionally, as a results of this work, a mechanism was developed victimisation associate encoder for correct determination of the AZ angle of the Sun. This mechanism could be a trade-off between accuracy and ease and also the price of necessary instrumentation. supported the experimental knowledge, the output power of star trackers was calculated throughout the year. The obtained results are often utilized in the planning of star trackers in areas with a variable climate.

1.2. SOLAR TRACKER FOR SOLAR PANEL Submitted By Mukesh Choudhary[T120223066] Neeraj Bani [T120223067] Prashant Kumar [T120223077] A Seminar report submitted as a partial fulfilment towards term VI of T.E (Electronics & Telecommunication) Savitribai Phule Pune University Guide Mrs. Sushma Wadar Department of E&TC Engineering Army Institute of Technology, Dighi , Pune – 411015 2014-2015

In the paper presents, the project involves style associate degreed implementation of an automatic microcontroller based mostly star hunter system expected to be utilized in electrical phenomenon conversion panels. The planned single axis star hunter device functions to confirm the improvement of the electrical phenomenon panel in accordance with the important position of the sun. The operation of experimental model of the device relies on a DC motor that is showing intelligence controlled by an ardent drive unit that moves a mini PV panel consistent with the signals received by a microcontroller from 2 easy however economical lightweight sensors. The performance and characteristics of the star hunter device ar by experimentation analyzed.

### **1.3 A Design of Single Axis Sun Tracking System, 1 Asmarashid Ponniran, 2 Ammar Hashim, 3 Handy Ali Munir 1,2Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia 3 School of Mechatronic Engineering, Universiti Malaysia Perlis**

The paper abstract, solar energy generation had been used as a renewable energy since years past. Residential that uses solar energy as their various power provide can bring advantages to them. the most objective of this project is to develop AN automatic star following system which can keep the star panels aligned with the Sun so as to maximise in harvest solar energy. The system tracks the most intensity of sunshine. once the intensity of sunshine is decreasing, this method mechanically changes its direction to induce most intensity of sunshine. LDR lightweight detector is employed to trace the coordinate of the Sun. whereas to rotate the acceptable position of the panel, a DC meshed motor is employed. The system is controlled by 2 relays as a driver and a microcontroller as a main processor. This project is roofed for one axis and is intended for residential usage. Finally, the project is ready to trace and follow the Sun intensity so as to induce most power at the output regardless motor speed.

### **1.4 Design and Construction of an Automatic Solar Tracking System**

**Md. Tanvir Arafat Khan, S.M. Shahrear Tanzil, Rifat Rahman, S M Shafiu Alam\*, Member, IEEE, Department of Electrical and Electronic Engineering, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh**

In the paper mentioned, Energy crisis is that the most significant issue in today's world. typical energy resources aren't solely restricted however additionally the prime offender for environmental pollution. Renewable energy resources are becoming priorities within the whole world to reduce the dependency on typical resources. solar power is speedily gaining the main target as a vital suggests that of increasing renewable energy uses. star cells those convert sun's energy into current square measure expensive and inefficient. completely different mechanisms square measure applied to extend the potency of the photovoltaic cell to cut back the price. star trailing system is that the most acceptable technology to reinforce the potency of the star cells by trailing the sun. A microcontroller based mostly style methodology of Associate in Nursinging automatic star huntsman is given during this paper. lightweight dependent resistors square measure used because the sensors of the star huntsman. The designed huntsman has precise management mechanism which is able to give 3 ways of dominant system. alittle example of star trailing system is additionally created to implement the look methodology given here.

## **IV. COMPONENTS**

The components are used in the solar tracker system for weather conditions are below:-

- 1) Solar panel
- 2) 10volt zener diode
- 3) 100 k ohm resistor
- 4) 1k resistor 10k resistor
- 5) 220 ohm resistor
- 6) Ic 741 op amp ic
- 7) Diode 4007
- 8) Bd 140 transistor
- 9) Exhaust fan
- 10) 9 volt battery
- 11) Sensor 4148
- 12) Gear motors

## **V. WORKING**

In the come used, solar battery • 10volt zener diode • a hundred k ohm resistance • 1k resistance • 10k resistance • 220 ohm resistance • Ic 741 op amp ic • Diode 4007 • Bachelor of Divinity a hundred and forty junction transistor • fan • nine V battery • device 4148 • Gear motors, the full parts assemble along and as per the merchandise functioning work and given the ability output. The star panel:- star panels ar those devices that ar wont to absorb the sun's rays and convert them into electricity or heat. Description: A solar battery is really a group of star (or photovoltaic) cells, which may be wont to generate electricity through electrical phenomenon impact. 10volt zener diode- Zener diodes ar used for voltage regulation, as reference components 100k ohm resistance:- The input voltage can drop across every resistance by associate degree quantity that's proportionate to the values of the resistor. If the first resistor is 1ok and another is 100k, primarily the perform of a resistance is often to oppose the flow of current through it.

Fig. Experimental diagram for solar tracker system for weather condition



The electrical device, diode, motor, sensor, ic, transistor, mounted on the PLC given the electrical affiliation through wire, and build microcontroller. The rechargeable battery have some energy additionally the battery charged by victimization our project, so , the reversible battery did jazz group work. The motor mounted with the rod and on rod electrical device mounted thereupon LDR detector used the LDR detector used for the pursuit , once sun rays i.e. actinic radiation rays reflection on the electrical device. The rays taken by victimization electrical device and absorbed and hold on the energy. When the sun rays moves as per the rays the system or our project track the rays by victimization LDR hunter and therefore the by victimization mechanical switches and therefore the gear motor revolved as per the hunter indicator and set the system per the rays, and electrical device once more absorb the rays and storing the energy by victimization rechargeable battery. once more identical method following incessantly.

This star pursuit system can have 3 salient components; Associate in Nursing input stage with light-weight sensors and potentiometer, a program in embedded computer code in microcontroller and a driving circuit in sort of H-bridge. The input stage is 2 LDRs that ar a part of resistance circuit. L293D chip forms the driving force circuit and a C-program loaded into MSP430 forms the embedded computer code. All the elements ar designed severally then assembled into a star pursuit system. Finally a picket frame is employed to deal with the parts needed to execute the hunter. 5.1: style and Results Analysis Hardware and computer code parts of the project were separated into stages whereas developing the general system. The parts consisted of sunshine detection, motor driving, computer code pursuit, and computer code enhancements. Building and testing smaller Chapters of the system created the project additional manageable and multiplied potency by decreasing debugging time. The project performs the desired functions visualised at the proposal section. However, whereas glad with computer code operation and simulation, less satisfaction was obtained from 2 hardware areas. First, there's a possible for issues with motor/photocell movement thanks to the detector wires making binding problems. There ar 2 wires hooked up to the detector then connected to manage circuit. Once the hunter has stirred or so thirty to forty five degrees, the wires place a counter force on the motor and therefore the motor slips. This creates positioning error. this workaround for this is often to carry the detector wires in an exceedingly approach on keep them about to the picket frame that holds the detector because the hunter moves. This drawback are mentioned additional in Chapter five. The second issue deals with the detector. it had been discovered that the detector must be secure specified light-weight will be directed narrowly to its surface. This was done by putting a black vinyl tube round the detector to make a tunnel and facilitate defend it from light-weight that's ultimately in its direct path.

## VI. ADVANTAGES AND DISADVANTAGES

### Advantages

- 1) Production finish wastes and emissions square measure manageable mistreatment existing pollution controls and end-of-use utilisation technologies are beneath development.
- 2) Once the initial opportunity cost of building a solar energy plant has been spent, operative prices square measure very low compared to existing power technologies
- 3) Grid-connected star electricity will be used regionally therefore reducing transmission/distribution losses (transmission losses square measure or so seven.2% in mostsystems).
- 4) Facilities will operate with very little maintenance or intervention once initial setup. star electrical generation is economically superior wherever grid affiliation or fuel transport is troublesome, a lot of expensive or not possible. Examples embrace satellites, island communities, remotely locations like ocean vessels.

### Disadvantages

1. Solar electricity is almost always more expensive than electricity generated by other sources.
2. Solar electricity is not available at night and is less available in cloudy weather conditions and therefore, a storage or complementary power system is required.
3. Limited power density: Average daily isolation in the contiguous Kenya is 3- 7kW•h/m<sup>2</sup> and on average lower in Europe where isolation is lower annually.
4. Solar cells produce DC which must be converted to AC (using a grid tie inverter) when used in currently existing distribution grids. This incurs an energy loss of 4-12%.

## VII. RESULT

The result as per the project objecting taking reading below:-

Weather	Number of Days	$E_{\text{cloudless}}$ kWh	$E_{\text{avg}}$ kWh
Rainy/cloudy	142	194.8	136.6
Partly cloudy weather	99	175.13	173.12
Clear	164	925.86	925.86

## VIII. CONCLUSION

Single Axis Sun trailing system with weather model is developed by considering given specification. The system is in a position to trace and follow the Sun intensity so as to urge most power at the output regardless motor speed. Besides, low speed DC geared motor has been used for neglecting motor speed parameter and so the system solely focuses in trailing of Sun intensity. The system are often applied within the district for various electricity generation particularly for non-critical and low power appliances.

The obtained results are often employed in the planning of star trackers in areas with a variable climate

## IX. FUTURE SCOPE

- 1) Increase the sensitivity and accuracy of tracking by using a different light sensor
- 2) Future solar project should use a microcontroller which can be used as a standalone unit in the fabricated circuit without the use of the programmer kit.
- 3) Compact the size and increase the efficiency

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