Single Axis Solar Tracking System

A

Project Exhibition -II

Submitted in partial fulfilment for the award of the degree of

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In
ELECTRICAL AND ELECTRONICS ENGINEERING

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CANDIDATE'S DECLARATION

I hereby declare that the Dissertation entitled **"Single Axis Solar Tracking System"** is my own work conducted under the supervision of Dr. V Sivasankaran, Assistant Professor, Electrical and Electronics department at VIT University, Bhopal.

I further declare that to the best of my knowledge this report does not contain any part of work that has been submitted for the award of any degree either in this university or in other university / Deemed University without proper citation.

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

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CERTIFICATE

This is to certify that the work embodied in this Project Exhibition -2 report entitled **" Single Axis Solar Tracking System "** has been satisfactorily completed by **Ms. Anuradha Tiwari** Registration no: **19BEE10030** in the School of Electrical & Electronics Engineering VIT University, Bhopal. This work is a bonafide piece of work, carried out under our guidance in the School of Electrical and Electronics Engineering for the partial fulfilment of the degree of Bachelor of Technology.

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Acknowledgement

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Executive Summery

Single Axis SolarTracking System tracks the sun path East-west directions & provides the maximum electricity as output. PV cell material with their better execution can improve the electricity problems and cost is also reduced.

This type of system can be installed on the rooftop and other places for efficient energy generation.In the project hardware development, two light-dependent resistors (LDR) will use for capturing maximum light source. Servo motor will be used to move the solar panel at maximum light source location sensing by LDR.

The light sensors consist of two LDRs placed on either side of the panel separated by an opaque plate. Depending on the intensity of the sun rays one of the two LDR is shadowed and the other is illuminated. The LDR present on the side, in which the intensity of the sun rays is higher, will generate a stronger signal and the other will generate a weaker signal.

The difference in the output voltage between the two LDRs will help in the movement of the PV panel in the direction in which the intensity of the sun rays is maximum. In this 555IC is used to command the DC motor by giving pulse signal to it. Relay controls the rotation of the motor either to rotate clockwise or anticlockwise.

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List of the abbreviations

LDR	**Light Dependent Resistor**
PV	**Photo - Voltaic**
SASTS	**Single Axis Solar Tracking System**
LED	**Light-Emitting Diode**
rpm	**Revolutions per minute**

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CHAPTER – I

INTRODUCTION

Solar Tracking System- The conversion of solar light into electrical energy represents one of the most promising and challenging energetic technologies, in continuous development, being clean, silent and reliable, with very low maintenance costs and minimal ecological impact. A photovoltaic panel is a device used to capture the suns radiation. These panels consist of an array of solar cells. The solar cells are made up of silicon (sand). They are then connected to complete a photovoltaic (solar) panel.

a solar tracking system which can be used as a power generating method from sunlight. This method of power generation is simple and is taken from natural resource. This needs only maximum sunlight to generate power.

This helps for power generation by setting the equipment to get maximum sunlight automatically. it is tracking for maximum intensity of light. When there is decrease in intensity of light, this system automatically changes its direction to get maximum intensity of light.

Single Axis Solar Tracking System

The single-axis solar tracking system analyzed in this paper consist of a PV panel rotating around a tilted shaft under the action of a Bidirectional Motor that is controlled according to the real sun position, estimated by means of two light intensity sensors.

The light sensors consist of two LDRs placed on either side of the panel separated by an opaque plate. Depending on the intensity of the sun rays one of the two LDR is shadowed and the other is illuminated.

The LDR present on the side, in which the intensity of the sun rays is higher, will generate a stronger signal and the other will generate a weaker signal. The difference in the output voltage between the two LDRs will help in the movement of the PV panel in the direction in which the intensity of the sun rays is maximum. In this 555IC is used to command the DC motor by giving pulse signal to it. Relay controls the rotation of the motor either to rotate clockwise or anticlockwise.

OBJECTIVE

- Study of different type of solar tracking system.
- Simulate the charging station using PROTEUS.

PROPOSED METHODOLOGY

Single-axis tracking has three kinds of layout methods :

- Inclined shaft installation, east-west direction for tracking
- South-north axis horizontal installation, east-west direction for tracking
- East-west axishorizontalinstallation, south-north direction for tracking

These three methods are all single-axis rotation tracking, and the work principles are similar. According to the results of the calculation of the rotation angle of the sun, the collectors rotate around the axis of rotation to track the sun. At high noon, the angle between the incident direction of the sun and the normal direction of the collector's aperture is the smallest; collectors can then obtain the maximum heat flux. In the morning or afternoon the sunlight is oblique.

CHAPTER -II

LITERATURE REVIEW

This chapter focuses on existing literature related to key concepts of this report's research and addresses the following research objectives:

S. No.	Author	Title	Summery	Journals/conferences
I	Prakash Kumar Sen, Krishna Awtar and Shailendra Kumar Bohidar	A Review of Major Non-Conventional Energy Sources.	Non-Conventional Energy Sources are widely used	International Journal of Science, Technology & Management, vol. 4(01), 2015
II	S. Gupta and A. Sharma	Global Scenario of Solar Photovoltaic (SPV) Materials	How the Energy Demanding are changing. And impact of SPV.	Advanced Computational and Communication Paradigms Springer, Singapore, 2018
III	Bansal, Ramesh	Handbook of Distributed Generation	Distributed Renewable Energy Technologies	Springer International Publishing, 2017
IV	Samantha, A., R. Varma, and S. Bhatt,	Chronological Single Axis Solar Tracker	The different methods of SAST system for reliable energy.	International Journal of Engineering Trends and Technology (IJETT), vol. 21(4), 2013
V	Pounirap, Asmarashid, Ammar Hashim, and Ariffuddin Joret.	A design of low power single axis solar tracking system regardless of motor speed	Changing the Motor Speed is necessary for designing the solar tracking system.	International Journal of Integrated Engineering, vol. 3.2, 2011
VI	Chang, Tian Pau	Output energy of a photovoltaic module mounted on a single-axis tracking system	The basic design of the tracking system modifications	Applied energy, vol. 86, no. 10, 2009,
VII	Mousazadeh, Hossein, et al.	A review of principle and sun-tracking methods for maximizing solar systems output	Maximum output getting methods are useful with Sun tracking	Renewable and sustainable energy reviews, vol. 13.8, 2009
VIII	Faranda, and Moris Gualdoni	Performance analysis of a single-axis tracking PV system,	The basics of the performance of tracker which is show reliable o/p	IEEE Journal of Photovoltaics, vol. 2, no. 4, 2012
IX	Sandeep Gupta	An Evolution Review in Solar Photovoltaic Materials	Different materials of the SPV changes the o/p in the tracker	Journal of Communications Technology, Electronics and Computer Science, vol. 20, 2018
X	Kassem, A., and M. Hamad	A microcontroller-based multi-function solar tracking system	Useful in the fundamentals of the programming for Tracking System	Systems Conference (SysCon), 2011 IEEE International. 2011.

CHAPTER -III

LIST OF COMPONENTS FOR SIMULATION

- Arduino UNO
- Solar PV
- Light Dependent Resistor (LDR)
- Light Emitting Diode (LED)
- Driver IC L293D
- Voltage Regulator
- Basic Resistor ,Capacitor, and 555 IC

Solar Panel :

Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers.

Light Dependent Resistors:

A photoresistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity.

Light Emitting Diode (LED):

LED is a semiconductor light source that emits light when current flows through it. When a current flows through the diode, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

L293D IC :

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC that can control a set of two DC motors simultaneously in any direction.

555 Timer IC：

It is an integrated circuit chip used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element.

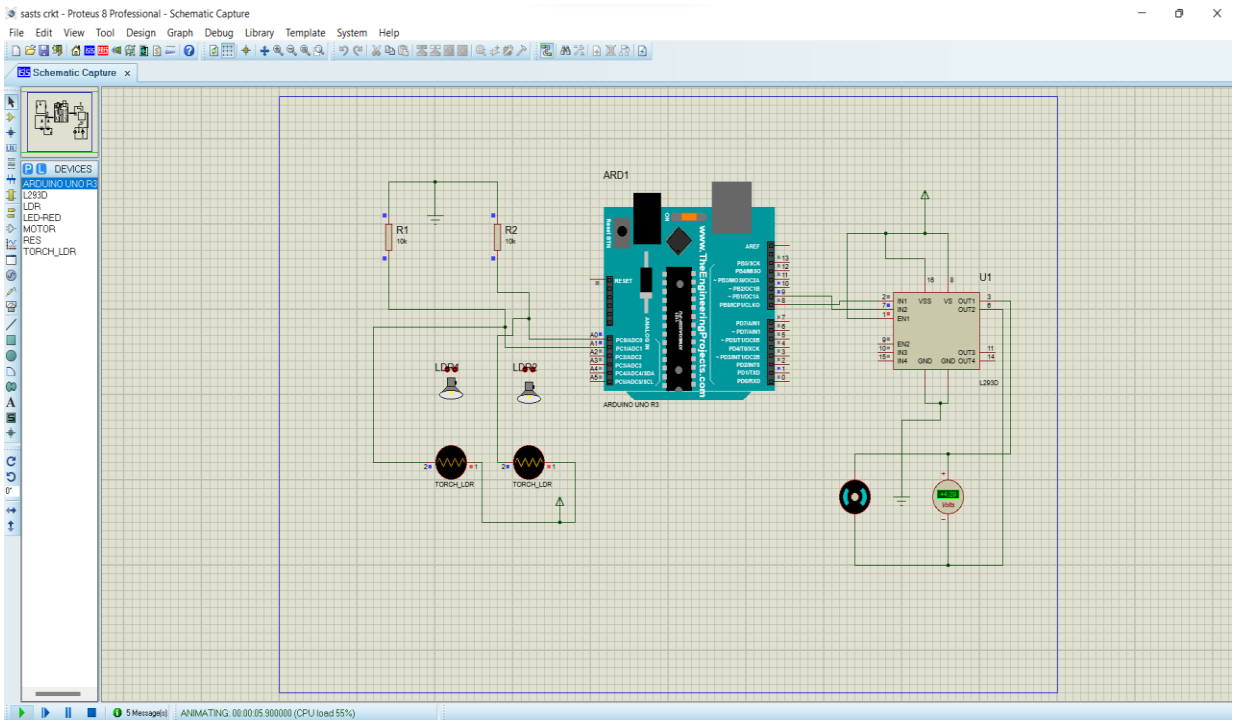
DC Gear motor :

Gear motor is an all-in-one combination of a motor and gearbox. The additionof gear head to a motor reduces the speed while increasing the torque output themost important parameters in regards to gear motors are speed (rpm) , torque and efficiency (%).

CHAPTER - IV

SIMULATION DIAGRAM

The output of the solar panel is maximum, when the panel surface is perpendicular to the incident sunlight. In such case the intensity of the sunlight is same on both the LDRs. The rating of the prototype solar panel used is 6V. To demonstrate the use of the solar energy generated an additional charger circuit is designed and connected to the output of the solar panel. The charger circuit contains two electrolytic capacitors for the stable DC output and one 7805 voltage controller IC. The output of the capacitor 2 is connected to USB port terminals. A mobile can be charged using a USB cable connecting the mobile with the USB port.

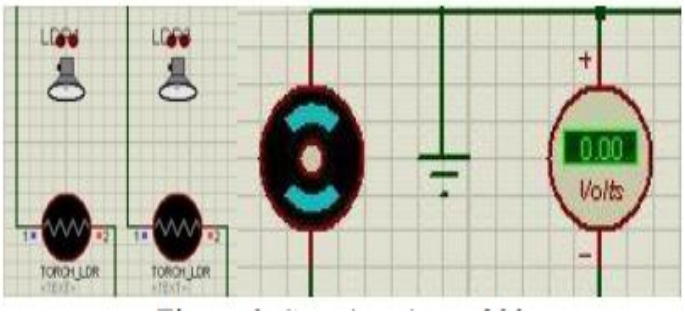


CHAPTER – V

RESULT AND DISCUSSION

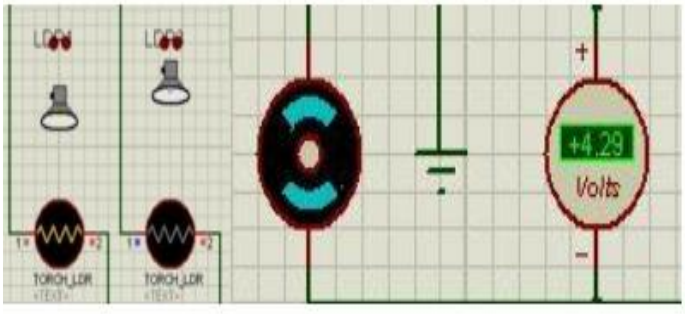
Depending upon different values from the LDRs the direction of motor rotation will be determined. Let analog values by LDR1 and LDR2 are x and y respectively.

Case 1: x and y both are less than the predefined intensity 200. In this case the voltage shows zero reading and hence the motor is static as shown.



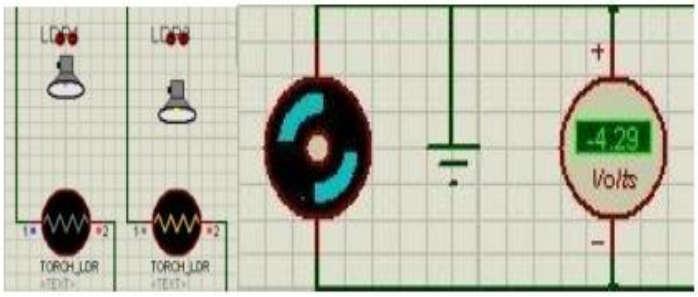
Case 1: x & y < 200

Case 2: x > 200 and y < 200 In this case the voltage shows positive reading (+4.29V) and hence the motor rotates clockwise as shown in Figure.



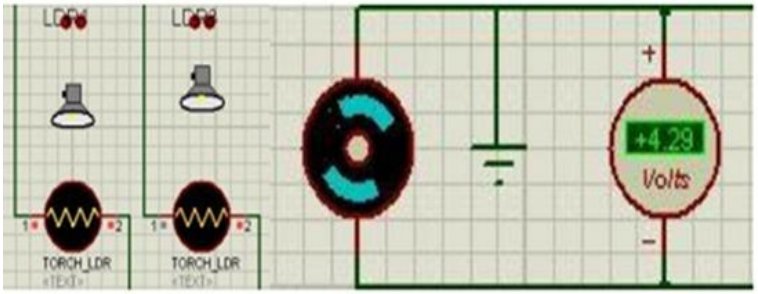
Case 2: x > 200 and y < 200

Case 3: x < 200 & y > 200 In this case the voltage shows negative reading (- 4.29V) and hence the motor rotates anti-clockwise as shown in Figure below.



Case 3: x < 200 & y > 200

Case 4: x > 200 & y > 200 & x > y In this case the voltage shows positive reading (+ 4.29V) and hence the motor rotates clockwise as shown.



Case 4: when x > 200 & y > 200 & x > y

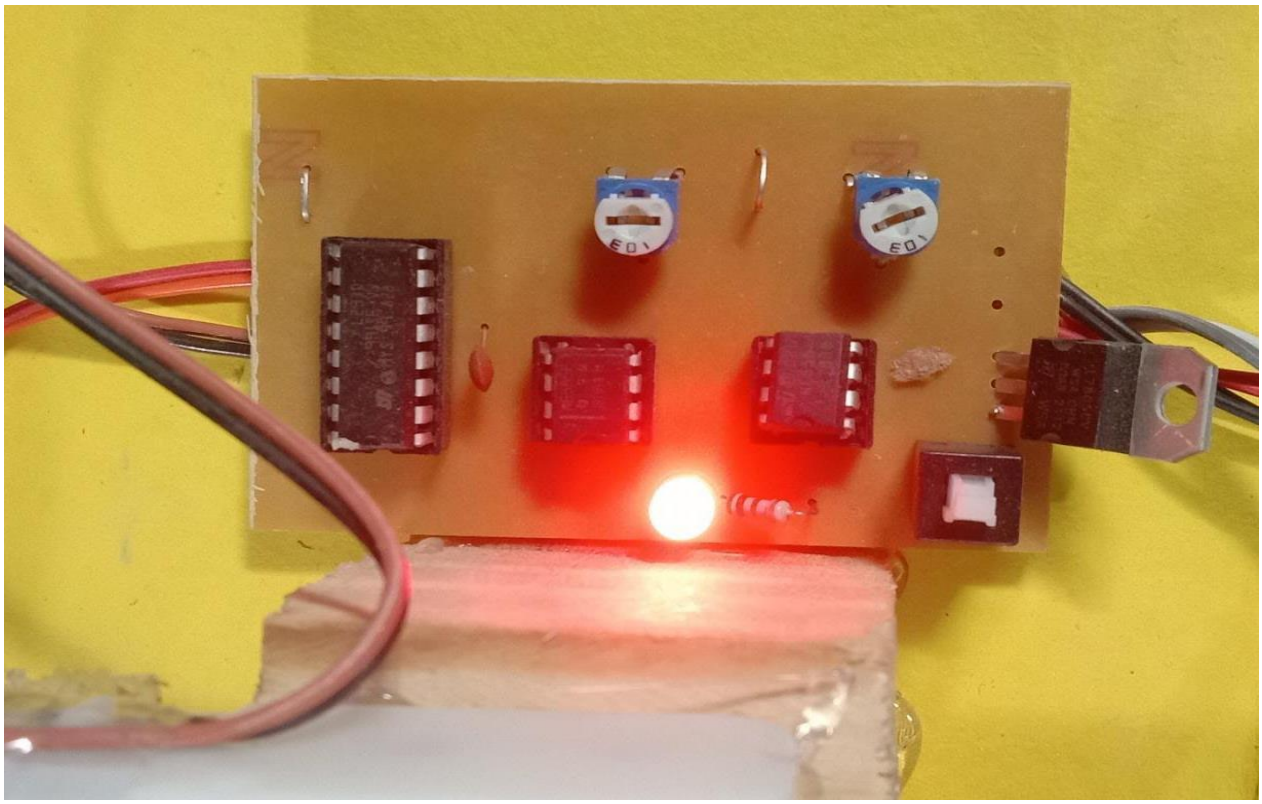
PRESENT AND FUTURE SCOPE OF PROJECT

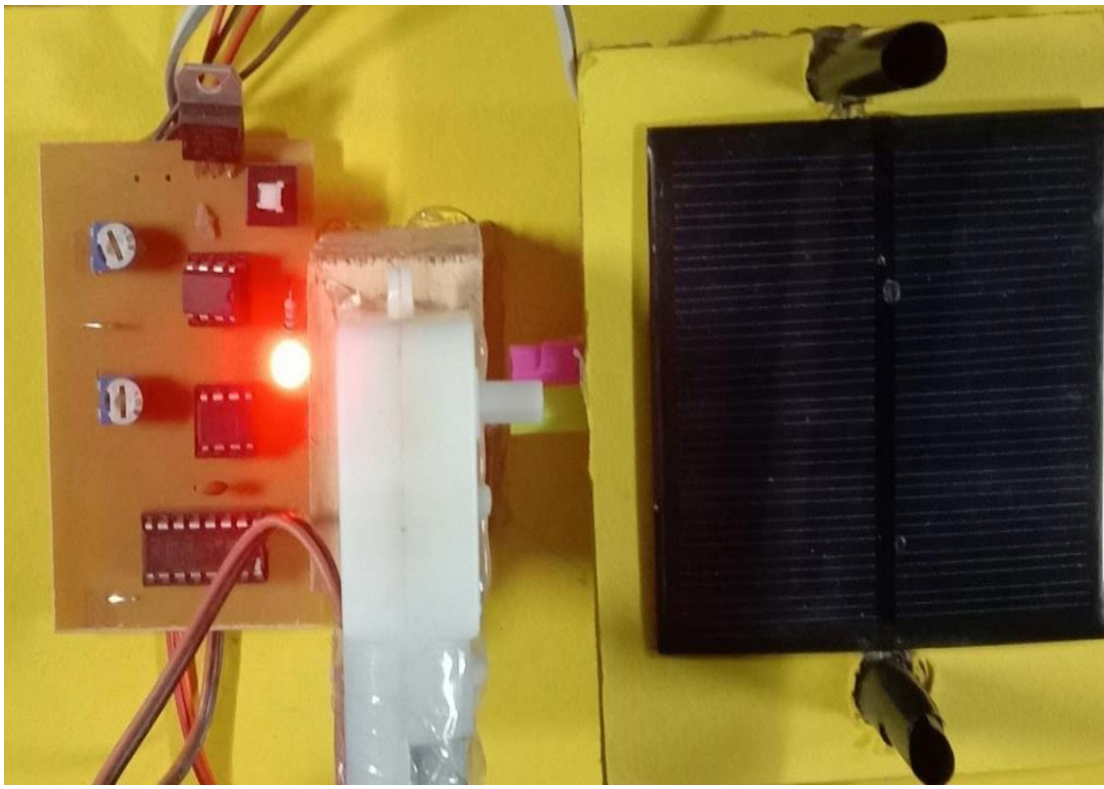
- It can be used for small and medium scale power generations.
- It can be used for power generation at remote places where power lines are not accessible.
- It can be used for domestic and industrial power backup system

HARDWARE PART

Solar tracker works by using a 555IC which compares light intensity illuminated onto the LDRs. The logic that works on the LDR to detect the signal is based on a resistance capacitor timing circuit, (RC constant), Once the signal is fed into the input for RB2 and RB3, the program compares the two inputs and then the differences are detected and send an output signal from port RB0 and RB1 to let the motor move clockwise and counter clock wise respectively.

The signal that is sent from output port RB0 and RB1 is logic level of 1 and 0, logic 1 is high level and 0 is for low level, when logic high is sent to the base of the transistor, it energizes and makes a closed circuit, thus a current flows through the motor, only two transistors can be switched on and off at a time The materials used in the construction of this prototype include Polyvinyl Chloride (PVC), one and a half inch pipes, wooden base of Medium-density fiberboard (MDF), stool which can rotate 360 degrees, automotive motor and bicycle gear mechanism.





Finally the motor and the gear are mounted on the side and linked using a chain for the horizontal axis and all the LDR‟s are mounted and wired.

CONCLUSION

The solar tracking system with **single-axis** freedom can increase energy output by approximately 20%, whereas the tracking system with double axis freedom can increase the output by more than 40%.

Therefore this work in this paper is to develop and implement a solar tracking system with both degree of freedom and the detection of the sunlight using sensors. The control circuit for the solar tracker is based on a microcontroller. This PIC is the brain of the entire tracking system, and it is programmed to detect the sunlight through sensors and then actuate the motor to position where maximum sunlight could be illuminated onto the surface of the solar panel.

After many setbacks in testing of the solar tracker, a lot of time is needed to be set aside for verification and testing due to the unpredictability of the weather and debugging of errors. This tracking implementation is successfully achieved with complete design of two degree of freedom using the PIC microcontroller. Suitable components and gear dc motors are used for the prototype model, which exhibit a clear, stable and precise movement to face the sun.

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