AUTOMATIC SOLAR TRACKER

Megha Singh
DEECE
Galgotias University
Greater Noida, India.
rajputmeghasolanki16@gmail.com,

Natasha Zulu
DEECE
Galgotias University
Greater Noida, India.
kamwenjenatasha@gmail.com,

Vishesh Kumar Mishra
DEECE
Galgotias University
Greater Noida, India.
mishravishesh95@gmail.com

Ms. Tarannum Bahar
DEECE
Galgotias University
Greater Noida, India.
tarannum.bahar@galgotiasuniversity.edu.in

***Abstract*— Energy emergency is one of the most urgent points in this day and age. Customary energy assets are restricted and expensive, yet additionally the excellent reason for natural contamination. The natural contamination and increasing expense of the petroleum products certainly stand out to sustainable power sources. Sun based energy, being the cleanest and most dependable sustainable power source, is generally used in warm frameworks to warm water and air. It offers a tremendous chance for public and private associations to decrease fossil fuel byproducts and cut power costs. A suitable way to deal with boosting the sunlight based charger proficiency is sun oriented following. This paper, thusly, proposes a programmed microcontroller-based sun powered tracker with a crossover calculation for finding the sun's situation. The proposed crossover sun powered following calculation consolidates the two sensors and numerical models to decide the exact sun's situation, along these lines bridling ideal sunlight based energy for every atmospheric condition. Exploratory outcomes reliably demonstrate the way that the cross breed sun oriented following calculation can yield higher sun based power that the conventional dynamic and sequential calculations. A website page was likewise evolved to work with constant checking of sun oriented information. As such the sun powered following cycle is completely programmed, augmenting the assortment and the executives of sunlight based energy for nuclear power.**

KEYWORDS: **Solar Power, PV panels, solar tracker, Azimuth, Passive actuators, latitudes.**

I. INTRODUCTION

Everyone knows that "energy is neither been made nor been annihilated " this is a general regulation said by newton which has been demonstrated by science. this is appropriate for everything in energy area the different types of energy is changed over into electrical energy during the time spent change of different energy into electrical energy nonrenewable assets, after some time these assets are expired or recharged in human existence we want to zeroed in on sustainable power which are given essentially and don't' make mischief to a similar nature so many energy have been recognized ,from that sun based energy is one of the most amazing energy from environmentally friendly power this energy isn't renewed until the sun exists[1].

II. METHODOLOGY

In this section, authors have described all the perspective and terms that have been used during the project. A detailed view has been given to all the elements of this project.

A. SOLAR RADIATION

Sun oriented radiation are become expanding appreciated happened to their impact on living matter and the achievability of its application for valuable reason. It is ceaseless wellspring of normal energy that alongside different types of environmentally friendly power has an incredible potential for a wide assortment of use since it is plentiful and available. Sun oriented radiation is quickly making progress as an enhancement to the non-inexhaustible wellspring of energy which has limited supply. The electromagnetic radiation transmitted by the sun cover an extremely huge scope of frequency from radio wave through the infrared apparent and bright to X-beam and gamma beams**.**

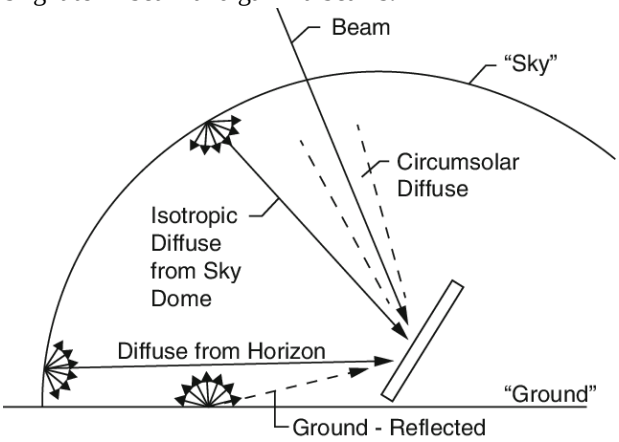


Fig. [1] Isotropic and anisotropic diffuse solar radiation

B. SOLAR ALTITUDE ANGLE (ΘZ)

The sun powered height point is the point between the sun is beams and a level plane. It is connected with the sun powered peak point ϕ which is the point between the sun's beams and the upward the sun and level at nightfall/dawn the height is zero (0^0) and nighty degrees (90^0) the elevation connected with

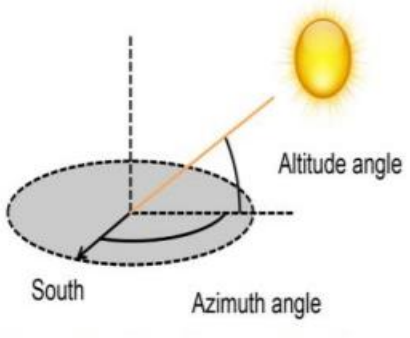


Fig.[2] Altitude and Azimuth Angle [1]

C. SOLAR AZIMUTH ANGLE

The Solar azimuth point z is the point of sun beams estimated in the even plane structure because of south for the Northern half of the globe or because of north for the southern side of the equator toward the west is assigned as sure. The numerical articulation for the sun powered azimuth point is

$$\sin(z) = \frac{\cos(\delta)\sin(h)}{\cos(\alpha)}$$

The condition is right give that cos (h) > tan(s)/tan (L). If not, it imply that the sun is behind the E-W line and the azimuth plot for the moving hours is - pi+|z| and for the midday hours is pi-z At sunlight based early afternoon, the sun is by definition precisely on the meridian which contain the north south line and thusly the sun powered azimuth is 0 degree[12]. Their front the early afternoon elevation an is

$$\alpha_n = 90^\circ - L + \delta$$

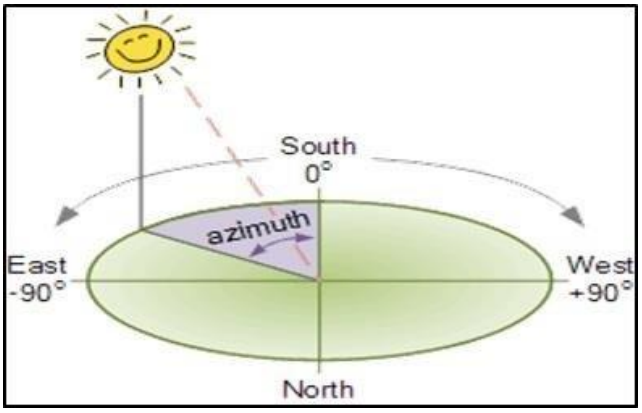


Fig. [3] Solar panel orientation-Azimuth angle

D. LDR (LIGHT DEPENDENT RESISTOR)

An electronic part like LDR or light-subordinate resistor is receptive to light. When light beams drop on it, then promptly the opposition will be changed. The opposition upsides of a LDR might change north of a few significant degrees. The obstruction worth will be dropped when the light level increments. The resistance values of LDR in darkness are several megaohms whereas in bright light it will be dropped to hundred ohms. So due to this change in resistance, these resistors are extremely used in different applications. The LDR sensitivity also changes through the incident light's wavelength. The designing of LDRs can be done by using semiconductor materials to allow their light-sensitive properties. The famous material used in this resistor is CDs (cadmium sulphide), even though the utilization of this material is currently restricted in European countries due to some environmental issues while using this material. Likewise, CDs (cadmium selenide) is also restricted and additional materials that can be employed mainly include Pubs (lead sulphide), Ins (indium antimonide) [10].

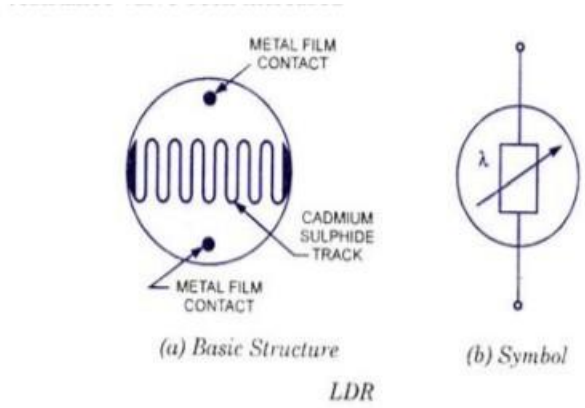


Fig. [4] Light Dependent Resistor -LDR

E. STEPPER MOTOR

A stepper engine is an electromechanical gadget it changes over electrical power into mechanical power. Likewise, it is a brushless, simultaneous electric engine that can partition a full revolution into a far reaching number of steps. The engine's position can be controlled precisely with practically no input system, as long as the engine is painstakingly estimated to the application. Stepper engines are like exchanged hesitance engines. The stepper engine involves the hypothesis of activity for magnets to make the engine shaft turn an exact distance when a beat of power is given. The stator has eight posts, and the rotor has six shafts. The rotor will require 24 beats of power to move the 24 stages to make one complete unrest [3]. One more method for saying this is that the rotor will move exactly 15° for each beat of power that the engine gets.

Fig. [4] Stepper Motor

F. ARDUINO UNO

Due to the ATmega328P microcontroller, the Arduino Uno is a microcontroller board (datasheet). There are 14 automated input/yield pins (six of which can be used as PWM yields), six simple data sources, a 16MHz fired resonator (CSTCE16M0V53-R0), a USB connection, a power connector, an ICSP header, and a reset button [4] [5]. To begin, connect it to a PC by USB or power it with an AC-to-DC converter or battery.

G. MPPT(MAXIMUM POWER POINT TRACKER)

A MPPT, or most prominent power point tracker is an electronic DC-to-DC converter that improves the match between the sun situated show (PV sheets), and the battery bank or utility organization. To spread it out clearly, they convert a higher voltage DC yield from daylight fueled chargers (and two or three breeze generators) down to the lower voltage expected to charge batteries.

The Power Point Tracker is a high-repeat DC to DC converter. They take the DC input from the daylight controlled chargers, change it to high-repeat AC, and convert it back down to other DC voltage and current to definitively match the sheets to the batteries. MPPT's work at incredibly high sound frequencies, generally speaking, in the 20kHz-80kHz range. The advantage of high-repeat circuits is that they can be arranged with especially high-efficiency transformers and little parts [2]. The plan of high-recurrence circuits can be exceptionally precarious in light of the issues with segments of the circuit "broadcasting" very much like a radio transmitter causing radio and TV obstruction. Commotion disconnection and concealment turns out to be vital [6].

There are a couple non-computerized (that is, direct) MPPT's charge controls around. These are a lot simpler and less expensive to fabricate and plan than the computerized ones. They truly do further develop productivity to some degree, yet generally the effectiveness can change a ton - and we have seen a couple lose their "following point" and really deteriorate. That can happen sometimes assuming a cloud disregarded the board - the direct circuit looks for the following best point however at that point gets excessively far out on the profound finish to find it again when the sun emerges. Fortunately, relatively few of these around any longer.

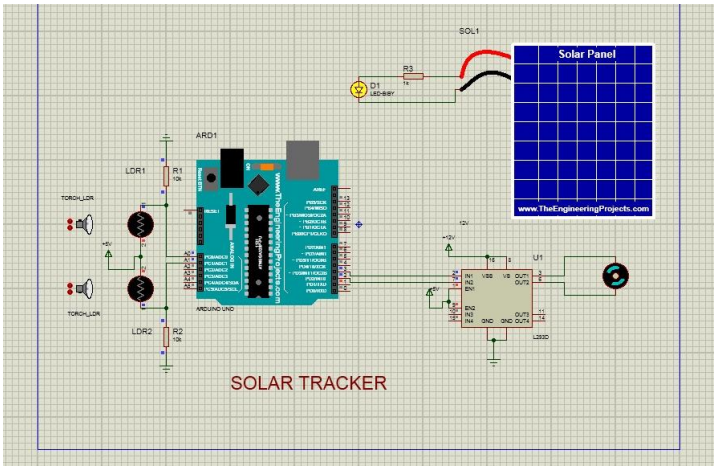
H. MPPT TRACKING SYSTEM (OR) DUAL AXIS SOLAR TRACKING SYSTEM

This is perhaps the best strategy which are been acquainted until right presently contrast and other method this is a novel one

- The actual name legitimizes about it self it is a two-pivot global positioning framework.
- It was superior to one way global positioning framework.
- It can utilize for shut/open circle control framework.
- The movement of sun is determined occasionally by its situation and its point with the assistance of LDR sensor the place of sun is been followed.
- With the assistance of sensors, it ensures that the board ought to be set in MPPT-highlight get more productivity.
- MPPT-(greatest power point following) in this point will most extreme measure of energy or to notice greatest measure of light from sun, how much energy age was more at this point[1].
- At beginning the expense of introducing was all the more however the rebound time of profits significantly quicker should be visible in this technique.
- There is 2 point like slant point and azimuth point which are most significant things in this technique.
- 20-30% of effectiveness expansions in this technique [7].

• In this strategy the levels of opportunity were two.

III. RESULT



Fig[5] Proteus Module for circuit verification [1]

Parts when light or lux (units of light)was builds it is contrarily corresponding to obstruction assuming the light force expands the opposition valve diminishes on the off chance that lux was diminishes the obstruction valve builds this is a fundamental guideline behind LDR (light ward resistor) which gives input to the Arduino no board.

The above figure shows the screen captures about the equipment valves of LDR and how they are bean answering light when the light force or lux expands the LDR-light ward obstruction where been diminishes[1].

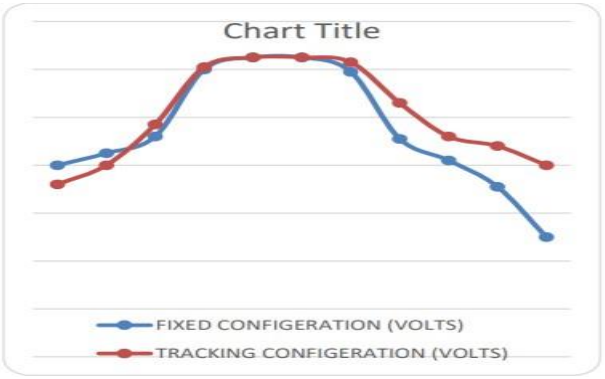
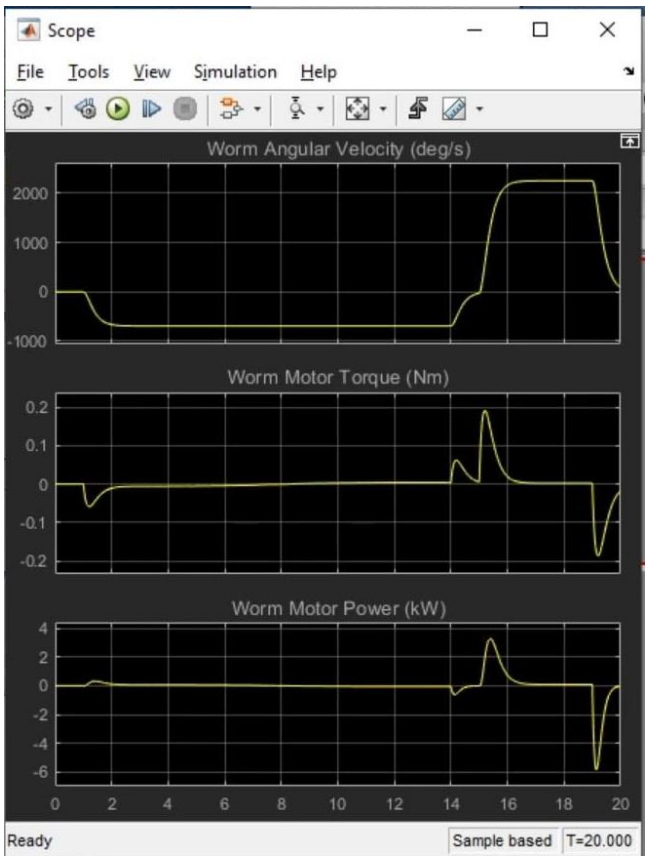


Fig. [7] Graphical portrayal from the consequences of fixed and duel following arrangement.



Above figure about contest among fixed and following design in different sorts. With the assistance of graphical portrayal, we can see the unmistakable investigations wile contrasting the valves of the both fixed and following arrangement.

IV. CONCLUSION

From the outcomes we can say that the double pivot sun oriented tracker is more compelling analyzed than the proper sunlight based charger, it is 12% more powerful than the decent sunlight powered charger. Contrasted with their conventional fixed-position partners, nearby planet groups which track the shifts in the sun's direction throughout the span of the day gather a far more noteworthy measure of sun oriented energy and thusly produce a fundamentally higher result power.

REFERENCES

[1] Bonamsetti Madhu, Karri Vinay Sudheer, S. Rajasekhar. "A Fully Automated Solar Tracking System", International Journal of Engineering and Advanced Technology, 2019.

[2] Deepti, Kakarla, P. Srihari, and Manjunadh Achari. "Simulation and analysis of an intelligent fuzzy logic controller model for low power photovoltaic energy utilization system", 2014 International Conference on Electronics Communication and Computational Engineering (ICECCE), 2014.

[3] P Rajendra Prasad, Nidhi Narayan, S Gayathri, Shefali Ganna. "An Efficient E-Health Monitoring with Smart Dispensing System for Remote Areas", 2018 3rd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2018.

[4] Alice James, Avishkar Seth, Subhas Chandra Mukhopadhyay. "Chapter 5 Programming Arduino for IoT System", Springer Science and Business Media LLC, 2022.

[5] A.K. Saxena and V. Dutta, “A versatile microprocessor based controller for solar tracking,” in Proc. IEEE, 1990, pp. 1105 – 1109.

[6] Muhammad Faheem Khan and Rana Liaqat Ali “Automatic Sun Tracking System (ASTS)”, Faculty of Electronics Engineering, Air University.

[7] T, Esram and P.L. Chapman, “Comparison of Photovoltaic Array Maximum Power Point Tracking Techniques,” IEEE Transactions

[8] Chong, K.K.; Wong, C.W. General formula for one-axis sun tracking system and its application in improving tracking accuracy of solar collector “Solar Energy. 2009, 83, pp.298-305.

[9] Al-Mohamad, A.” Efficiency improvements of photo-voltaic panels using a sun tracking system”. Applied Energy 2004, 79, pp.345-354.

[10] Roth, P., Georgieg, A., Boudinov, H. “Design and construction of a system for sun-tracking”, Renewable Energy. 2004, 29, pp.393- 402.

[11] Saxena,A.K.; Dutta, V.“A versatile microprocessor based controller for solar tracking,” Photovoltaic Specialists Conference, 1990. Conference Record of the Twenty First IEEE, 21-25 May 1990, Page(s):1105 -1109 vol.2