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AUTOMATIC SOLAR TRACKING SYSTEM

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Abstract *: Of the multitude of sustainable power sources, sun based energy is the main energy acquired its prominence and significance rapidly. Through the sun based global positioning framework, we can deliver a bountiful measure of energy which makes the sun powered charger's usefulness substantially more proficient. Opposite proportionality of the sun powered charger with the sun beams is the explanation lying behind its proficiency. Financial, its establishment charge and development component of the model for the sun oriented global positioning framework having a solitary hub of opportunity. The principle control circuit depends on NodeMcu microcontroller. Programming of this gadget is done in the way that the LDR sensor, as per the identification of the sun beams, will give guidance to the DC Motor that in what direction the sunlight powered charger is heading to rotate. Through this, the sunlight powered charger is situated in such a way that the greatest measure of sun beams could be gotten. In correlation with different engines, DC engine is the least complex and the smooth one, the force of which is high and speed of which is adequately slow. We can program it for adjusting the course despite the way that it turns just in one bearing subject to exemption, taking everything into account. 1985, very first time it was seen for creation of the silicon sunlight based cells with an effectiveness of 20%. However a climb in the proficiency of the sunlight powered charger had an attractive increment still flawlessness was a fantastical objective for it. Underneath 40%, the vast majority of the boards actually float to work. Therefore, people groups are constrained to buy various boards to satisfy their energy needs or buy single frameworks with huge results*

Keyword – *Renewable energies, Solar panel, Microcontroller, LDR, DC motor, Single, Axis Tracker etc.*

I. INTRODUCTION

Clamoring civilization is the vein through which current development is worked. Energy step by step is put to use at satisfying the cravings and aspiration of the people groups at large best. Every single corner of our life is confined with different layers of obstruction and in this reaction, energy is turning into a vital element. Accordingly, the wellspring of energy should be interminable/unending to convey this gigantic populace ahead. Individuals being developmental in nature are maybe the best ever production of nature is generally in the race of visualizing the likely and accessible solaces and advantages in each conceivable point in this dangerous world.

The evidential framework shows that in a division of different assessments what choices best speed up the shortage of energy in a hugely heterogeneous society like our own. Our proverb is to attempt in sending such honorable objective of energy conservation.In the universe of contamination, this framework is an eco-accommodating other option, henceforth a significant resource. Whenever the expanse of contamination is hindering each edge of life, this framework would have the option to make waves of trust amidst this clamoring human progress. The survivability of this framework lies upon its functionality. In the pattern of correlation with other staggering frameworks, it very well may be a pioneer

II. LETRUTRE REVIEW

The scarcity of accessible assets has constrained contemporary society to search for measures to perfect the requests of the last option. With the supporting progress, the exhaustion of customary fills, because of human practices has been a caution to reasonable advancement issues. The shortage of energy and its source directed us towards the hopeful methodology of utilizing the elective assets presented to humanity Solar, flowing etc.The Sun has been viewed as a basic wellspring of energy.

Sun oriented energy is an eco-accommodating asset when contrasted with its partners. The progression of innovation has out-transform encourage strategies to use this energy into its own great use.

Be it as nuclear power, power, fuel creation and some more. Photovoltaic or concentrated sunlight based power (CSP) frameworks are worked to change the sun oriented power confiscated by the earth into power. Sun based GPS beacon uses this seized sun based power through the channel of photovoltaic exhibits, an arranged platform of photovoltaic/sun based cells.[1]

Sun based cells, otherwise called photovoltaic cells are utilized to change over light energy into power. Photovoltaic cells work on the standard of the photovoltaic impact, which is like the photoelectric impact. Contrasts being that the electrons in photovoltaic are not transmitted rather contained in the material around the surface, making a voltage distinction. Sun powered cells are produced with translucent silicon. It is the most ordinarily involved material in a sunlight based cell. The utilization of silicon in the sun oriented cell has been exceptionally effective and minimal expense. Two types of translucent silicon can be utilized to make sunlight based cells. Other than silicon, sun based cells can be manufactured with cadmium telluride (CdTe), Copper indium gallium (di)selenide (CIGS) and so on the manufacture of sun powered cells with materials other silicon is marginally costly, consequently making silicon the best material to be utilized in sun based following systems.[2]

One of the best and broadly utilized material, monocrystalline silicon has an effectiveness of around 15-20%. While under high temperature the presentation of the cell material drops by 10-15% of the initial.Polycrystalline silicon is another structure, less expensive than the last option however has a similar band hole as that of monocrystalline silicon. However it has a similar band hole energy, it slacks in effectiveness, henceforth this material is utilized in minimal expense items.

Solar panels are a cumulative orientation of photovoltaic cells. The PV cells are arranged in a solar panel or a PV array such that is serves the purpose of exciting the electron of the material consisting inside the solar cells using photons. The average amount of sunlight received by solar panels particular depends on the position of the sun. [6]

Being a repository of energies, Sun witnessed to be the eminent and ever continuing source of emitting radiation from it. A part of this source of natural energy is received by the solar panel. Certain ways have been developed to utilize this energy source as an alternative to other nonrenewable sources.

Considering its multitudinous flourishing ways in which it can be applied to bring about the change in conserving other resources, the manipulation of the energy source is encouraged. [7]

Nebulous silicon cells can work under very high temperatures, yet the productivity of these cells is relatively lower than the other silicon structures. [3] The innovations which use CdTe, CIGS, Amorphous Thin-Film Silicon (a-Si, TF-Si) in the creation of sun oriented cells are known as slender film photovoltaic modules. These dainty film sunlight based cells are somewhat financially savvy than the sun powered cells of glasslike silicon. [4]

Cell Technology	Crystalline Silicon
Types	• Mono-crystalline silicon (c-Si) • Poly-crystalline silicon (pc-Si/ mc-Si)
Temperature resistivity	Lower
Module Efficiency	13-19%

Table 2.1: Types of Solar cell based upon the material

There are several other factors on which the efficiency of a solar cell depends.

- Cell temperature
- Energy Conversion Efficiency
- Maximum power point tracking [5]

Solar panels are hence used to utilize solar power in electrical means. They are aligned different arenas to collect maximum solar power. Though, solar panels can be used to absorb or collect solar power, there work is bounded to certain hours of the day and the sunlight pouring directly on them, i.e. the angle between the sunrays and the panel is orthogonal. While at other hours of the day, the angle of the sunrays is different, hence the amount of the solar power captured is very less. To overcome such pitfalls, and encapsulate the maximum available of solar energy the solar tracking systems were introduced. A solar tracking system is designed with the intention of keeping the angle between the sunrays and the solar array 90°. The solar tracking system have three different modules-

- The mechanism
- Driving motors
- The tracking controller.

The mechanism is accountable to furnish with accurate movements, in the sake of following the footsteps of the sun throughout the day. The prototype of the device is made durable enough to withstand unfavorable weather condition. This mechanism of the solar tracking systems classifies themselves into two segments single axis tracker, dual axis tracker.[8] Single axis tracking can be considered as one of the handy systems or prime solution in terms of small- scale photovoltaic power plants. Single axis tracking can be done using three different arrangements, which are based on the different axesof tracking-

- Inclined shaft installation
- South-North axis horizontal installation
- East-West axis horizontal installation.

Single axis tracker tracks in a single cardinal direction. The tracker has a single row tracking On the basis of the **driving mechanism** solar trackers can again be of two kinds active solar trackers and passive solar trackers. The mechanism which makes use of electric motors such as DC motor, can be termed as active driving mechanism. The passive ones are simply controlled by the movement of the earth that is the gravitational forces.

configuration. The above maintained methods are the different arrangements in which single axis tracker can be implemented. The working mechanism of all the maintained methods is at par with each other. The angle of the sun with the surface of the collector is computed and examined, the collectors are thus charged to track down the movement of the sun to meet the expectations of captivating a greater percentage of solar radiance.[9]

There are numerable other imposition of single axis tracking tracker, including-

- Horizontal Single Axis Tracker (HSAT)
- Horizontal Single Axis Tracker with Tilted Module (HTSAT)
- Vertical Single Axis Tracker (VSAT)
- Tilted Single Axis Tracker (TSAT)
- Polar Aligned Single Axis Tracker (PSAT)

The rotational axis in the dual axis tracker are orthogonal to each other. One of the axes is fixed in accordance with the ground level. This axis is known as the primary axis and the other axis is hence called the secondary axis. Dual axis trackers moved along two cardinal directions, horizontal and vertical. There are many applications of the dual axis tracker, the two most common being-

- Tip-Tilt Dual Axis Tracker
- Azimuthal Altitude Dual Axis Tracker. [10]

The efficiency of these tracker is much more than any single axis tracker. It conventionally follows the movement of the un and hence captivates maximum solar energy.

Solar **tracking controller** can also categories solar trackers into two different module-

1. Open loop control- The approach followed requires microprocessor. This method has a inbuild prototype which is based upon the records of the movement

of sun throughout the day. Hence, the microcontroller computes the time and determines the position of the sun at that particular hour. The control system is not affected by any geographical conditions.

2. Closed loop control/Feedback controllers- This control system utilizes photosensor to compare the light intensity. These sensors are fixtures at the side of panel and helps in detection of the position of the sun.

The prototype used in this research, is that of a horizontal single axis tracker. The tracking system The instrument is responsible to outfit with precise developments, in the purpose of following the strides of the sun over the course of the day. The model of the gadget is made sufficiently strong to endure troublesome atmospheric condition. This instrument of the sun based global positioning frameworks arranges themselves into two sections single hub tracker, double hub tracker.[8]

Single hub following can be considered as one of the convenient frameworks or prime arrangement as far as limited scale photovoltaic power plants. Single hub following should be possible utilizing three unique game plans, which depend on the various tomahawks of following

- Slanted shaft establishment
- South-North hub level establishment
- East-West pivot level establishment.

Single pivot tracker tracks in a solitary cardinal bearing. The tracker has a solitary column following arrangement. The above kept up with strategies are the various plans where single pivot tracker can be executed. The functioning component of the relative multitude of kept up with strategies is at standard with one another. The point of the sun with the outer layer of the authority is processed and inspected, the

The effectiveness of these tracker is significantly more than any single pivot tracker. It ordinarily follows the development of the un and henceforth spellbinds most extreme sunlight based energy.

III. IMPLEMENTATION

The task called "Programmed Solar Tracking System" is created through establishment of the different bare essential, for example, sunlight based charger which gives 12 volts as result, a NodeMcu as MCU, an engine driver - with IC L293D, two utilizes photosensitive sensors to track down the movement or the path of the sun. This type of tracking technique is classified as active solar tracking. It is based on feedback control system or closed loop controlling. The intensities of light in our system are compared and the solar panel is charged to move in the direction of maximum available intensity. Thus, the system works on the feedback of the weather condition. gatherers are in this manner pursued to follow the development of the sun to live up to the assumptions of charming a more prominent level of sun oriented radiance.[9]

There are numerable other burden of single hub following tracker, including-

- Level Single Axis Tracker (HSAT)
- Flat Single Axis Tracker with Tilted Module (HTSAT)
- Vertical Single Axis Tracker (VSAT)
- Shifted Single Axis Tracker (TSAT)
- Polar Aligned Single Axis Tracker (PSAT)

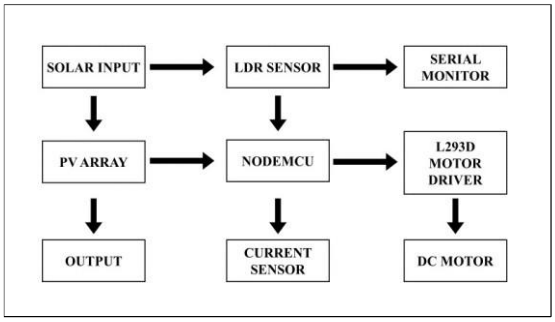
The rotational hub in the double pivot tracker are symmetrical to one another. One of the tomahawks is fixed as per the ground level. This pivot is known as the essential hub and the other hub is consequently called the auxiliary hub. Double hub trackers moved along two cardinal headings, flat and vertical. There are numerous uses of the double pivot tracker, the two most normal being-

- Tip-Tilt Dual Axis Tracker
- Azimuthal Altitude Dual Axis Tracker. [10]

LDR sensor module, a 10 r.p.m. basic DC engine, a current sensor and a 9 V battery.

Development of the said project is being worked out of the wooden base introduced at its ground, attached with the iron poles on both the sides in a cross-formed way associated with an empty tube shaped bar from both the sides and the DC engine is sticking at one edge of the empty bar. Three-crease segments into which the circuit of the sunlight based it is isolated to follow framework. The info stage has

two LDR module that is so organized to frame a voltage divider circuit, the microcontroller is modified through the product named Arduino ide being decked up in the framework and ultimately the driving circuit that has the DC engine helps in turning the sunlight powered charger. The engine driver is embraced with three terminals-two for engine input/yield sepa rately and the third one for power input. The terminal for engine input is associated with 2 of the 14digital info/yield pins of Arduino UNO and therefore, the engine yield terminal is associated with the DC engine. The two LDR sensor modules are added to the framework with NodeMcu simple sources of info. The light reliant resistors are then attached along the length, on one or the other side of the sunlight based charger.



.1(a): Block Diagram of Automatic Solar Tracking System

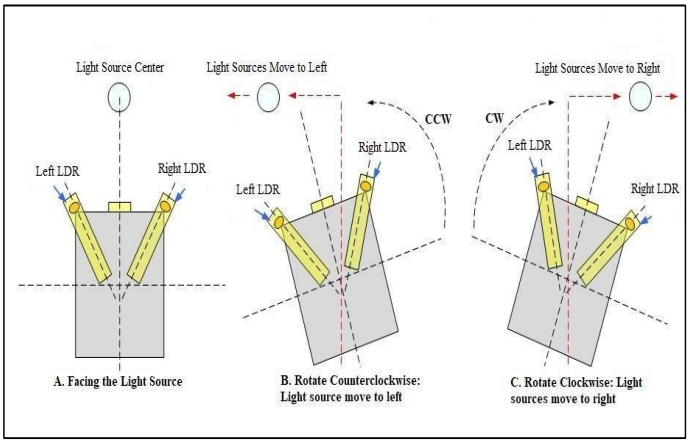


Figure 3.2: Concept of using Two LDR

IV. CONCLUSION

Today in the realm of uncontrolled efficiency, energy is the major source whereupon the entire civilization depends on. As it is said that energy can nor be made nor be obliterated and, in that reaction, it tends to be connoted that it can some way or another be put away. The endeavor towards making such objective validated, this undertaking has been attempted towards unwinding the way of such objectivity. It is very regular that steady usage of energies some way or another opens the entryway of shortage according to as natural sources are concerned. Sun, in the stand of which, the tallest source, spiked over for age's right from the beginning of the entire universe, through which life has been considered, is the essential and the mother wellspring of the relative multitude of energies. Considering the exceptionally major from the perspective of putting away such energy, the venture has been unwound. Energies other than from the Sun, are the interaction from which such are been created through the consuming of different materials, including discharge of a lot of

contamination, causing the climate and the air day off by day. Speed and sagacity of the world's present conduct perceivability, where simple access of each circle of life needs the intense ease, consistently is another test of incubating something new and remarkable which makes an energy to be the final proposal source behind all the difficult work exists. In that respects it would be worthier to uncover that commercialisation has blast its wings so much in the need of cash and power that we are some way or another present in the pool of intense obliviousness of the world's assets shortage, in outcome of which the entire world is injured. Mending the world is the premise development with which the hour clock is calling and this undertaking presents the eye, consequently, to open the passages of diminishing how much contamination in putting away of energy winnowed out from the Sun and furthermore to make the speed of headway fired up around.

I. FUTURE SCOPE

The very epitome through which the advanced problem be saved, is the venture called "Programmed Solar Tracking System". A pioneer by its soul, this framework works in its most extreme proficiency, whether that be concerning its financial capacity or regarding its openness. In the smoke of the haziness where contamination overwhelming each circle of progression as a result of producibility, this gadget in its very effectiveness run after just headway and advancement by flushing out the contamination overall.

II. REFERENCE

1. Ying-Tung Hsiao, China-Hong Chen, “Maximum Power Tracking for Photovoltaic Power System,” Conference Record of the 2002 IEEE Industry Applications Conference. 37th IAS Annual Meeting, ISBN-0-7803-7420-7, 13-18 Oct, 2002, pp 1035-1039.

2. Mayank Kumar Lokhande, “Automatic Solar Tracking System,” International Journel of Core Engineering & Management, October, 2014.

3. Scott J Hamilton, “Sun-Tracking Solar Cell Array System,” University of Queensland, Department of Electrical Engineering, 1999

4. Furkan Dincer, Mehmet Emin Meral, “Critical Factors that Affecting Efficiency of Solar Cell,” University of Yuzuncu Yil, Department of Electrical and Electronics Engineering, Van, Turkey, 2010.

5. R.Z. Wang, T.S. Ge, “Advances in Solar Heating and Cooling,” Woodhead Publis hing, 2016, Pages 81-93, ISBN 9780081003015, Levent Bas, “Thin Film vs. Crystalline Silicon PV Modules,” December, 2011.

6. M. A. Panait, T. Tudorache, “A Simple Neural Network Solar Tracker for Optimizing Conversion Efficiency in Off- Grid Solar Generators”, International Conference on Renewable energies and Power quality (ICREPQ), march 12-14, Santander, 2008.

7. Juan Reca-Cardeña, Rafael López-Luque, Chapter 9- Design Principles of Photovoltaic Irrigation Systems, “Advances in Renewable Energies and Power Technologies”, Elsevier Science, 2018

8. C. Chang, Chapter 5 Tracking solar collection technologies for solar heating and cooling systems, “Advances in Solar Heating and Cooling”, Woodhead Publishing, 2016

9. Kamrul Islam Chowdhury, Md.Iftekhar-ul-Alam, Promit Shams Bakshi, “Performance Comparison Between Fixed Panel, Single-axis and Dual-axis Sun Tracking Solar Panel System,” BRAC University, Department of Electrical and Electronic Engineering, 2017.

10. Oloka Reagan Otieno, “SOLAR TRACKER FOR SOLAR PANEL”,University of

Nairobi, Dept. of Electrical and Electronic Engineering, 24th August 2015.