

Dual Axis Solar Tracking System

Dhanushprakash M.¹, Giridaran A G.², Kaushikraja B.³, Sanjeevi Prasanth S.⁴, Dinesh K.⁵

1,2,3,4,5 B.E Mechanical Engineering, Bannari Amman Institute of Technology, Erode

Abstract : Energy crisis is one in every of the major problems in world developing countries like Republic of India. There's a huge gap between generation and demand of current. Nearly half of the population of the country cannot get the power supply. Renewable energy is one of the answer to solve this issue. Solar power is one in every of the foremost effective resources of the renewable energy that might play a big role to resolve this drawback. This analysis presents a performance analysis of the dual axis solar tracking system using Arduino and led & servo motors. The most objective of this research is whether the solar tracker is better than a solar panel. This work is split into 2 light dependent resistors (LDR) is employed to observe the almost source of illumination from the sun. Two servo motors put together accustomed move the electrical device to most source of illumination location perceived by the LDRs. In the other half, the software part is written by using C programming language which head towards to the Arduino UNO controller. The result of the solar tracking system has analyzed and compared with the mounted or static solar panel found higher performance in terms of current, power and voltage. Therefore, the solar tracking system is evidenced additional sensible for capturing the most daylight provide for star gathering applications. The result showed dual axis solar tracking system made further 10.53-watt power compared with mounted (fixed) and single axis solar tracking system. Components hardware and computer code. In hardware components, four

Keywords :

Solar tracking; single axis; dual axis; light depending resistor (LDR), servo motor, Arduino, altitude, charge controller.

INTRODUCTION :

Now a day's our socio-pecuniary growth depends on a great deal of electrical energy. However, in rising countries, this electrical energy is managed. thus we are able to solve this downside by using renewable energy. Solar, wind, gas, biomass, water etc... are sources of renewable energy. Among this solar power is being rife attributable to its non-contaminated assets. However solar tracker is best than the panel because it senses the twist of the world rotates by its axes following the format will need to create these components . Solar panels are utilized in incarcerate the solar irradiance solar energy is that the main furnish supply of all energy created by sunlight. The energy of the sun reaches on earth with entirely complete different rays. A large quantity of energy is transmitted from the sun each day; inside the world, we have a tendency to get a diminutive magnitude of it [20]. The larger part of the solar energy is lost inside the world. It absolute to the entire and that we can never face the insufficiency of solar energy like more than a few different energy. During this work dual axis, solar tracker is the main focus to talk about [20]. This paper also demonstrates the renewable energy state of dealings, entirely special light sensors, some expected value of solar tracker etc

SOLAR TRACKER:

A solar tracker is a perfect tool for track the path of the sun from east and west throughout daytime. Usually solar tracker is classify into 2 group i.e..

1. Single axis solar, and
2. dual axis tracker.

- For a conscientious line of longitude, each day sun moves from east to west on a fixed solar path. However, the sun moves through 460 degrees north and south throughout the seasonal revision. In our proposed model we've partiality to use micro controller based mostly dual axis solar tracking system. The angles of occurrence of sun beam are reaching to be 0°. we tend to use light-weight dependent resistors (LDR) for trace intensity of the sunshine of the sun.

- LDR unceasingly monitor the solar emission and this data is transferred to the servo motor via micro-controller. wherever the intensity of sunshine is highest the servo motor moves the panel that direction . Our planned model is to calm the power expenditure and build the very best use of solar energy generation. The most and purpose of our planned model is that we tend to use 2 servo motor. So as to manage two motor, system needs plenty of power. Inside the projected model we tend to tend to don't use 2 servo motor at constant time. At the preliminary stipulation two servo motor begins running. Since the sun amendment its location device detects the position of the sun and it takes four minute. When the sun moves from east to west, second servo motor will clean up that situated in vertically within the star hunter. The second servo motor can begin running if through the sun moves to the north or south position .The second servo motor won't run if there's no seasonal change. The movement of the solar pannel towards in vertical and horizontal on angle and altitude angle is taken as a reference. The solar elevation approach is distinct for the explanation that the angle situated stuck between the horizontal and as a result the line linking to the sun. At nightfall or break of day distance from the bottom approach is 0° and at one time the sun is at the top the height higher than water level angle relics 90° ."Fig. 1," shows the position of the sun over the year.

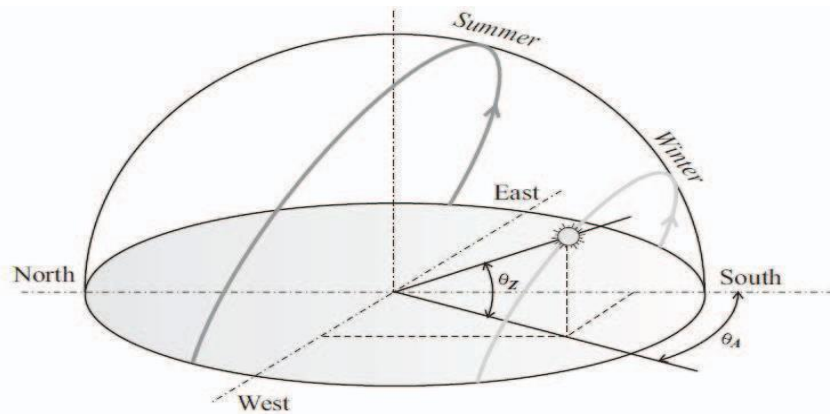


Fig. 1. The different position of the sun over the year

EXPERIMENTAL SETUP :

The tracking system can track loads of daylight in actual reality by PV panel rotation in several axis [15]. In dual axis system we can track the sun in four directions as a result we will succeed a lot of energy from the solar panel [15]. throughout this emerge, we have a tendency to square measure able to put behind bars further sun rays. Movement in two axes is explained with the assist of "Fig. 2," that's explaining basic arrange within the rear duel axis tracking [15].



Fig. 2. Dual axis tracker

- The dual-axis in service is pretty much as good on single axis but it captures the solar energy a lot of productively by rotating at intervals the horizontal moreover as a result of the vertical axis the doubtless anticipated for dual axis tracker is shown in "Fig 3," [12]. four LDR sensors, two servo motor and Arduino micro-controller consists our tracking system. One rest of sensors and one motor is employed to incline the tracker in sun's east - west route and the alternative rest of sensors and also the opposite motor that's mounted at the bottom of the tracker is employed to tilt the tracker at intervals the sun's north-south route [12].

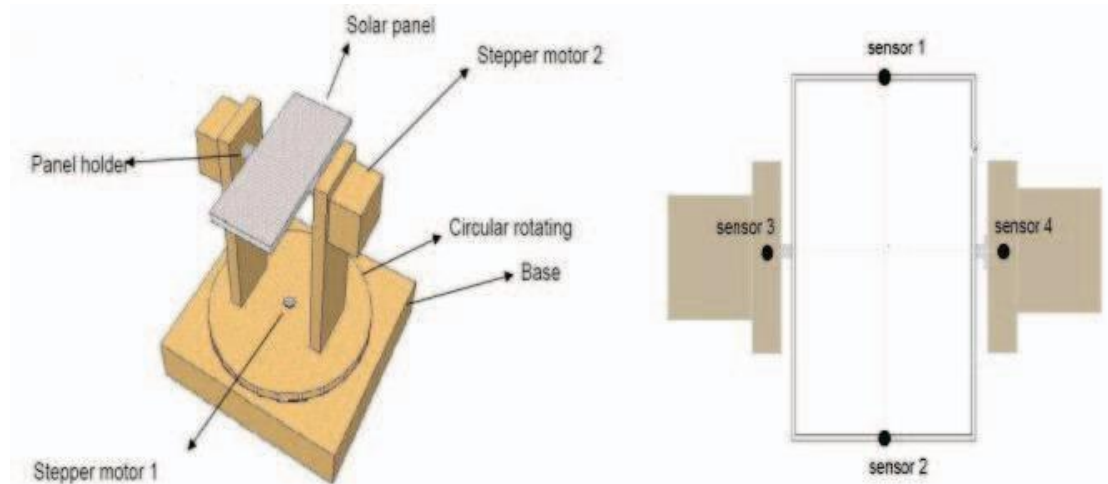
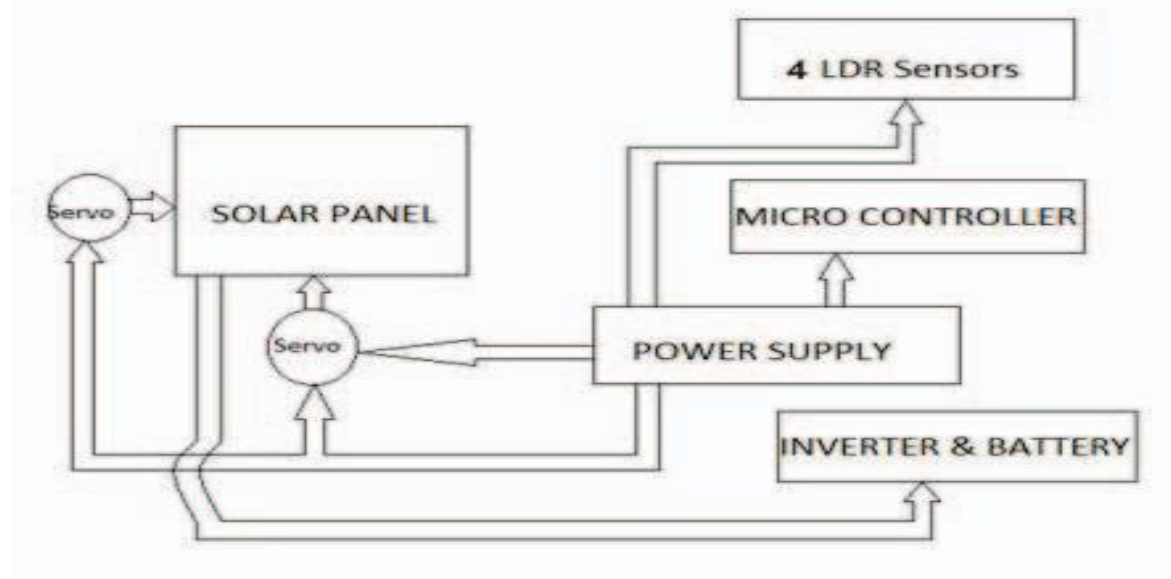


Fig. 3. Proposed model

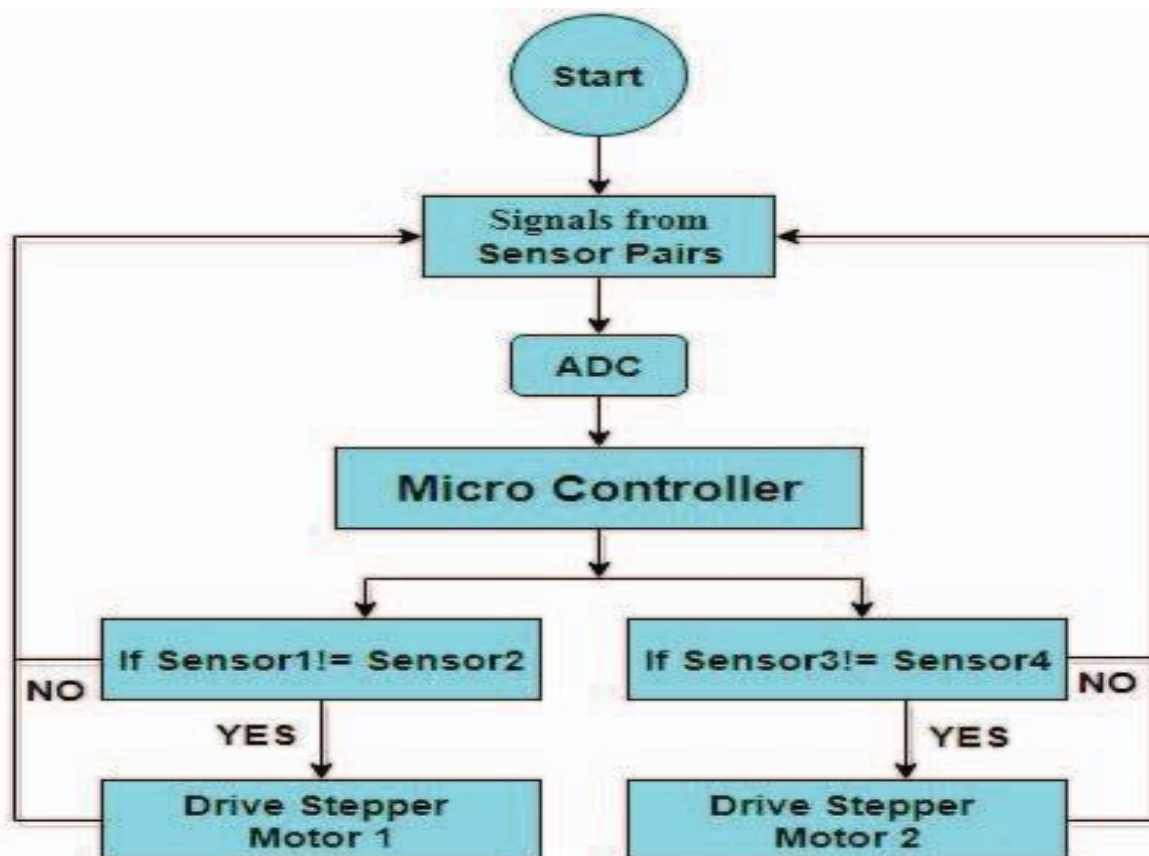
- The servo motor is performing operate to following path of the sun. The two servo motor and four LDR sensors are interfaced with a micro-controller that's scheming servo motor on the bottom of sensor's input [15]. Sun light sense by LDR sensors and give the signal to Arduino micro-controller [15]. The micro-controller received signals from LDR sensors and its deciding rotation direction of servo motors [15]. dual Axis tracking following system explained with the assistance of diagram shown in "Fig. 4," [15].



- The diagram is showing that LDR sensors once sensing the sunshine forward the signal to Micro-controller [15]. The micro-controller is a logical device that's attractive dealings on sensor place in and beginning the motor driver's track consequently [15]. Assume if the sun changes its individual locality and go from east to west, it'll

cause light absorption to vary on one device as associated with totally different one [15]. On the bottom of sun light intensity feature on sensors, the controller starts driver circuits and moves servo motor to new positions where light falling on device pairs is same [15]. Constant method will maintain it up with a modification in sun's locality enclosed by the sky [15]. As a result, this planned model is in a position to capture supplementary sun rays and system's solar energy conversion capability is greatly superior [15]. How management rule is activity gesture assessment and is that the key deciding constituent that shows it in "Fig. 5," [15]. once it collects information from LDR sensors then main algorithm is starts. Sensors productivity is analogue that's stimulated to digital signals. This serviceable task is performed analogue to digital convertor (ADC) [15]. Digitized signals are forwarded to Arduino micro-controller [15]. when aggregation digital signals, it decides with reference to the movement direction and steep angle of servo motors [15]. management algorithm is viewing that Arduino micro-controller drives servo motors as long as device light sensing is not even equal each other and if device signals are equal. It goes to begin of the algorithm. This technique is incessant till light falling on detector pairs is equal and PV panel is adjusted in an exceedingly position for optimum power [15]. The voltage generated by the electrical device is different and wishes to be synchronized [15]. A regulator is commonly used once the solar panel which can regulate the voltage coming from solar panel [15]. For this principle, energy is provided by generated solar energy [15]. There's not any would really like to administer exterior power Energy that produces our system economical and cost effective too [15].

- The purposed model also can use as Associate in impartial system by introducing battery storage and supervision of storage system [15]. Battery storage is controlled by the thought of generated voltage [15]. Charging and discharging events for storage are electing the concept of generated voltage [15].



HARDWARE IMPLEMENTATION:

In all earlier section details of management formula and block diagram of projected duel axis were pictured [15]. Currently, we have return to tend to the hardware implementation of the planned model [15]. we've enforced the planned system many and final hardware model is shown in "Fig. 6," For sustaining of the hardware we have a tendency to tend to plan a support model that's shown in "Fig 6" [15]. This support model is of two feet height. For higher management of hunter altitude of the panel is accumulated to increase and it ought to be placed in out-of-doors atmosphere



- PV panel used for hardware accomplishment is 36-watts and it's of mono crystalline sort [15]. Two servo motors of permanent magnet sorts are used. Servo motor moves in steps and is best fitted to correct position control [15]. PIC micro-controller is employed for controlling purpose that's easier to use as compared to micro-controller ATMEL family [15]. Details of PV Panel ratings, LDR sensors and servo motor ratings for our hardware design are enlisted in Table [15].

TABLE COMPONENT RATINGS

Component Name	Component Ratings
Servo Motor	5v, 0.6 A, 9gr Servo HXT900
Controller	LDR
LDR	GM 9516
PV Panel Dimension	16 × 16 inches square
PV Panel Rating	35 Watts
PV Panel Material	Mono crystalline

CONCLUSIONS :

Dual axis tracker totally aligns with the sun route and tracks the sun movement in a very a lot of cost-efficient loom and includes a fabulous performance upgrading. The investigation outcomes clearly show that dual axis tracking is good enough than single and fixed solar systems. The proposed system is price effective collectively as a stroke adjustment in single axis hunter provided notable power increase among the system. Through our experiments, we've got found that dual axis tracking can increase energy by concerning 40% of the fixed arrays. With heaps of works and better systems, we have a tendency to tend to believe that this figure will raise additional.

FUTURE WORK :

Commercially, dual axis solar tracking continues to be rare even in countries where a serious part of electricity is being created by solar power as they claim that single axis tracking is doing the work. But dual axis tracking can perceptibly increase the efficiency. For our research work we've enforced this procedure on a sporadic power PV panel. Cost effectiveness and planned system efficiency could also be discovered on a business level. This research used mono crystalline PV panel. However a poly crystalline material based mostly PV panel can also be used for this planned model. we tend to used LDR for this planned model however LDR isn't an honest alternative as a device because it littered with mud. So in future, we are able to additionally use the additional economical device. A reliable structure is extremely dearly-won compared to solar panel cost; thus, adding a further panel to the system rather than spending on tracking structure is way additional value effective.

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