

Dual Axis Sun Tracking System with Weather Monitoring System

Dr. Harish Harsurkar¹, Girija Lohar², Pooja Fulwade³, Vikas Ishte⁴, Jadhav Jayant⁵

¹HOD Mechanical Engineering Vidya Prasarini Sabha's College of
Engineering and Technology, Lonavala, India

²³⁴⁵Student Mechanical Engineering Vidya Prasarini Sabha's College of
Engineering and Technology, Lonavala, India

hodmech@vpset.in, lohargirija12345@gmail.com, fulpooja@gmail.com, ishtevikas@gmail.com, jjadhav383@gmail.com

Abstract : A world is now move towards renewable energy source due to various factors like pollution and cost of non-renewable energy sources. One of the main renewable energy sources is Sun. In this project Arduino based Dual-axis solar tracking system proposed in order to get maximum solar energy. The Arduino is used to give command to rotate the solar panel. Solar trackers are used to improve the power gain from solar energy. Solar power is changes due to the seasonal variation and tilting of earth which change the position of the sun in the sky. In this regard dual axis solar tracking is practically implemented and performance is compared with fixed mount and single axis solar tracking system. Finally, project result that proposed method gives better efficiency compared to fixed mount and single axis solar tracking system

Keywords: Dual-axis vitality, Dynamic sensors, Arduino, Robotized framework, regulators, photo-voltaic

I. INTRODUCTION

The expanding interest for vitality, the persistent diminishment in existing wellsprings of petroleum derivatives and the developing concern with respect to condition contamination, have pushed humanity to investigate new innovations to deliver electrical vitality utilizing perfect, inexhaustible sources, for example, sunlight based vitality, wind vitality, and so on. Among the non-traditional, sustainable power sources, sun based vitality manages incredible potential for change into electric power, ready to guarantee an essential piece of the electrical vitality needs of the planet.

The transformation of sun based light into electrical vitality speaks to a standout amongst the most encouraging and testing vivacious innovations, in ceaseless improvement, being perfect, quiet and solid, with low support costs and negligible biological effect.

Sunlight based vitality is free, for all intents and purposes limitless, and includes no contaminating residues or ozone harming substances emanations. Distinctive investigates evaluate that covering 0.16% of the arrive on earth with 10% proficient sun oriented transformation frameworks would give 20 TW of energy, about double the world's utilization rate of fossil vitality.

This demonstrates the capability of sun powered vitality which thusly brings up the need of following component in universes. Daylight has two parts, the immediate pillar that conveys around 90% of the sun based vitality, and the diffuse daylight that conveys the remaining. The diffused bit is the blue sky on a crisp morning and it increments proportionately on shady days. As most of the vitality is in

the immediate bar, expanding accumulation requires the sun to be unmistakable to the boards to the extent that this would be possible. A run of the mill sun powered board changes over just 30 to 40 percent of the episode sunlight based illumination into electrical vitality.

In this manner, to get a steady yield, a robotized framework is required which ought to be proficient to always turn the sun powered board. The Sun Tracking System (STS) was made as a model to take care of the issue, specified previously. It is totally programmed and keeps the board before sun until the point that that is unmistakable. "The remarkable element of this framework is that as opposed to taking the earth as its reference, it takes the sun as a managing source. Its dynamic sensors continually screen the daylight and turn the board towards the bearing where the power of daylight is greatest

II. PROBLRM STATEMENT

Solar energy is a renewable source of energy. Its sources are divided into two types they are passive solar source and active solar source. These sources are completely depending upon how the solar energy is captured and it is distributed and also on how it is converted to the solar power. As we know the solar energy is free energy and it can be utilized easily

III. .LITERATURE REVIEW

The US Patent no. 0215199 A1 [2007] by Robert H. Dold describes a two- axis solar tracker capable of with standing the extreme weather conditions. The solar tracker includes a solar array, a frame, a base, a pivot frame, and a first and second actuator. The solar array is mounted to the frame and captures sunlight. The base is pivotally connected to the frame and defines a pivot axis for elevational movement of the solar array. The pivot frame is also pivotally connected to the frame and defines a pivot axis for azimuthal movement of the solar array. The base is pivotally connected to the frame and defines a pivot axis for elevational movement of the solar array. The pivot frame is also pivotally connected to the frame and defines a pivot axis for azimuthal movement of the solar array. The first actuator controls elevational movement of the solar array and the second actuator controls azimuthal movement of the solar array. The solar tracker is pivotable between a raised position and a stowed position

The US patent No. 0308091 [2008] by Ronald P Corioclaimsas an object of the his invention to mechanically link multiple solar trackers in a large array configuration so that they may operate in unison, driven by a single motor and



tracker controller, whereby the mechanical linkage system is designed such that it must only be capable of withstanding the relatively low forces required to effect movement of the trackers without the requirement to resist larger wind forces acting on the array of trackers. Another object of his invention is to apply the drive principles to various solar single-axis tracking geometries to maximize the economic performance for each solar tracking application. Multiple gearboxes can be mechanically linked by drive shafts and driven by a single motor. The drive shafts may incorporate universal joints for uneven terrain or staggered configurations. Harmonic dampers can be affixed to the solar panels to decouple wind forces which allow the use of larger solar panels Qiang Xie's US Patent No.0051017 A1 [2010] refers to a solar collector which may receive and direct solar radiation onto a photovoltaic (or, solar) cell. A concentrating solar collector may also convert the received solar radiation into a concentrated radiation beam prior to directing the radiation onto the solar cell. In some aspects, determination of the target tracker position in the second coordinate system includes subtracting 360° from an azimuth angle in the first coordinate system if the azimuth angle in the first coordinate system is between $+180^\circ$ and $+360^\circ$, wherein the azimuth angle in the second coordinate system is determined to be equal to the azimuth angle in the first coordinate system if the azimuth angle in the first coordinate system is between 0 and 180° .

IV. OBJECTIVE

- i. In this project we will monitor the solar panel using rain sensor.
- ii. Propose dual axis solar tracker is cost effective
- iii. Average power gain of solar panel with dual axis tracking system over normal stationary arrangement is upto 40-50%.
- iv. Less power consumption by internal circuit and motors.
- v. Ability of tracking sun light at any weather
- v. Installation is easy and operates automatically.

V. SYSTEM DESIGN

The renewable energy source due to various factors like pollution and cost of non-renewable energy sources. One of the major renewable energy sources is Sun. In this project Arduino based Dual-axis solar tracking system proposed in order to get maximum solar energy. The Arduino is used to give command to rotate the solar panel. Solar trackers are used to improve the power gain from solar energy. Solar power is changes due to the seasonal variation and tilting of earth which changes the position of the sun in the sky. In this regard dual axis solar tracking is practically implemented and performance is compared with fixed mount and single axis solar tracking system. Finally, project result clearly evident that proposed method gives better efficiency compared to fixed mount and single axis solar tracking system

A. Working

The LM78XX/LM78XXA series of three-terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a Wide range of applications. Each type employs

internal current limiting, thermal shutdown and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output Current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

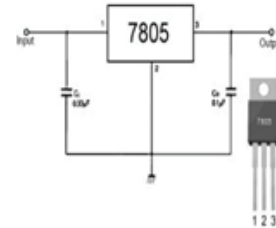


Fig. 1.



Fig. 2.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible

B. LCD display



Fig. 3.

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command

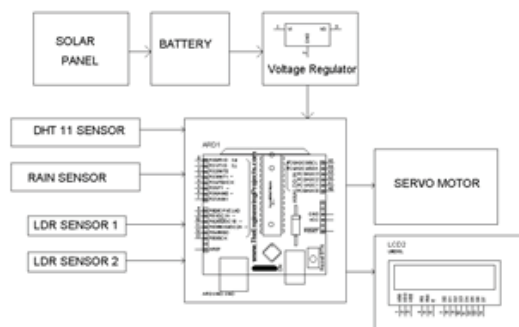


Fig. 4.

C. Block diagram

SOLAR PANEL Photovoltaic principles

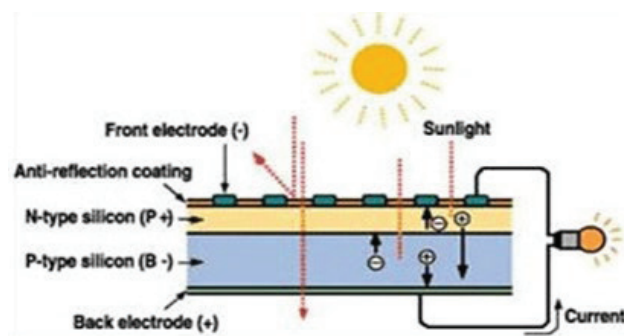


Fig. 5. SOLAR PANEL Photovoltaic principles

Field in most solar cells for the photon interaction in a semiconductor. A solar cell consists of Semi-conductor in which electron hole pairs are created by the absorption of incident solar radiation.

- Region containing a drift field for charge separation.
- Charge collecting front and back electrodes.

VI. DHT11 HUMIDITY SENSOR

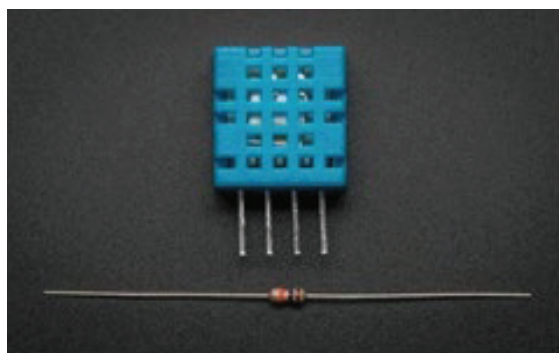


Fig. 6. DHT11 HUMIDITY SENSOR

The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and

a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old.

LDRs are utilized as the basic light sensors. The working of the endeavour is as indicated by the running with. LDRs sense the measure of light falling on them. Four LDRs are confined into top, base, left and right. For east – west after, the key respects from two best LDRs and two base LDRs are inspected and if the best strategy of LDRs get all the more light, the vertical motor will move in that direction. If the base LDRs get all the more light, the motor moves in that direction. For spruce redirection of the sun based board, the sensible respects from two holding up LDRs and two right LDRs are looked. On the off chance that the left procedure of LDRs get more light than the correct set, the level MOTOR will move in that direction. If the correct methodology of LDRs get all the more light, the servo advances toward that way

VII. ADVANTAGES

- i. Solar trackers are highly efficient installations. The operating costs are extremely low once the initial investment of building a solar power plant has been spent.
- ii. As solar tracker is directly exposed to solar rays, they can generate more electricity compared to their stationary counterparts.
- iii. Solar trackers continuously direct photovoltaic panels towards the sun, maximizing the investment on photovoltaic systems.
- iv. Roughly, in the same amount of space needed for fixed tilt systems if solar trackers are installed, solar trackers can generate more electricity making way for ideal usage of land.
- v. Solar trackers can be utilized most efficiently in areas with low horizons and locations which are shade free from daybreak to dusk every day.

VIII. DISADVANTAGES

- i. Solar trackers are slightly more expensive than their stationary counterparts, as they are regarded as complex systems with moving parts.
- ii. Trackers require more maintenance than fixed systems.
- iii. All tracking systems need a great deal of site preparation.

IX. APPLICATIONS

- i. Solar tracker, a system that positions an object at an angle relative to the Sun.
- ii. The most-common applications for solar trackers are positioning photovoltaic (PV) panels (solar panels) so that they remain perpendicular to the Sun's rays and positioning space telescopes so that they can determine the Sun's direction

Experimental setup

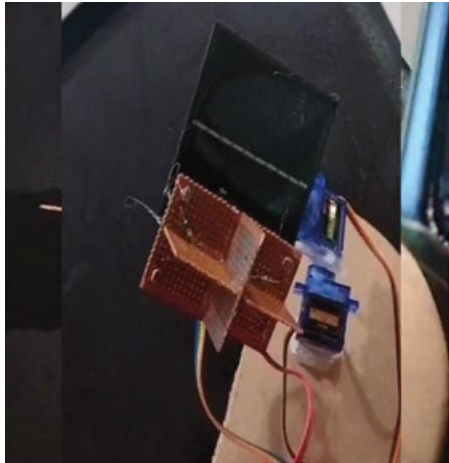


Fig. 7. Experimental setup

X. EXPERIMENTAL RESULT AND DISCUSSION

The Arduino based dual axis solar tracking based solar panel is designed and successfully implemented to increase the efficiency of solar panel. The dual axis solar tracker is more effective than the existing single axis solar tracker and fixed mount. The solar tracker which automatically tracks the sun to grab maximum solar power with the help of Arduino board was effectively achieved. The implementation cost of Arduino board for tracking solar power is low and its implementation is simple. Finally, experimental system clearly reveals that proposed system effectively tracks the sun in both good and bad weather conditions. During different time periods in a day compared with the existing system and efficiency of solar panel is effectively improved.

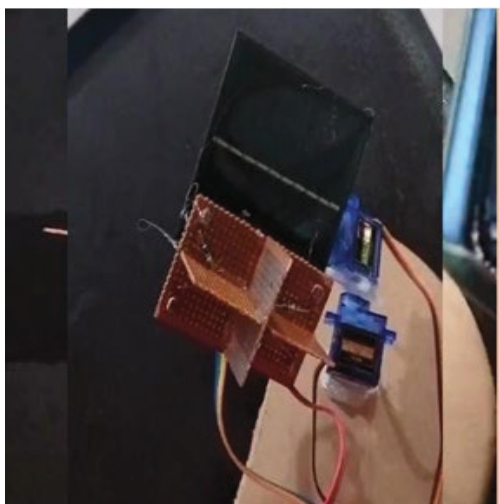


Fig. 8.

XI. FUTURE WORK

The solar tracking system provides more effective method to track the solar insolation and provide economic consistency for generation of electric power. Solar power technology is constantly advancing and improvements will intensify in future.

In Future the conventional energy is not sufficient for use so there is need of use non- conventional energy sources. This Project is very useful for power supply in rural areas where use of high sensitive solar panels which can work in mild sun light also and by connecting number of solar tracker assemblies will be able to produce sufficient large quantity of power which will be able to supply power to medium size village. We can make use of solar panels in our day to day life for street lighting, in mobile phone chargers, water heaters, etc.

In the future, in order to decrease the cost further, the design of the device can be improved. Some safety switches can also be employed which will act as a guard for the device in case of failure. Some techniques like genetic algorithm can be implemented.

REFERENCES

- [1] M.D.Singh and Khanchandani: "Power Electronics
- [2] Electrical Machines "AshfaqHussain <http://www.solar-tracking.com/>
- [3] International Journal of Advanced Research Computer Science and Software Engineering
research paper www.ijarcsse.com
- [4] International Journal of Engineering and Science at www.researchinventy.com
- [5] American Journal of Engineering Research (AJER) 2013.
- [6] International Journal of ChemTech Research
<http://sphinxesai.com/2013/conf>
- [7] American Journal of Engineering Research (AJER) 2013.