DUAL AXIX SOLAR TRACKING SYSTEM

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Abstract -Solar power is the fastest growing means of renewable energy. The paper is designed and implemented using simple dual axis solar tracker system. In order to maximize energy generation from sun, it is necessary to introduce solar tracking systems into solar power systems. A dual-axis tracker can increase energy by tracking sun rays from switching solar panel in various directions. This solar panel can rotate in all directions. This dual axis solar tracker can also be used to sense weather, and it will be displayed on LCD

Key Words:Solarcell, LDR, Arduino, light, Servomotor.

1.INTRODUCTION

Useable electricity from the sun was made possible by the discovery of the photoelectric mechanism and subsequent development of the solar cell – a semi conductive material that converts visible light into a direct current. There are two main ways to make solar cells more efficient, either by improving the actual energy conversion technique, or by installing the solar system on a tracking base that follows the sun, a two axis solar tracker system can increase the energy conversion by 40% by keeping the panels pointing towards the maximum sun radiation during the entire day, being a suitable solution to increase the electrical energy output.

The objective of the paper was to develop a dual axis tracking system, based on an opened-loop system where the tracker operates based on mathematical calculation according to the sun's geometry to predict the exact apparent position of the Sun. This system stands out when compared to sensor based trackers; as it does not require clear sky, and it is not affected by other shining light sources which may cause confusion when the wavelength is close to that of the sensor, it also has high accuracy; the algorithm used has uncertainty of .003 degrees.

2. Working Principle

Resistance of LDR depends on intensity of the light and it varies according to it. The higher is the intensity of light, lower will be the LDR resistance and due to this the output voltage lowers and when the light intensity is low, higher will be the LDR resistance and thus higher output voltage is obtained. A potential divider circuit is used to get the output voltage from the sensors (LDRs). The LDR senses the analog input in voltages between 0 to 5 volts.Now this will give feedback to the microcontroller using the arduino software(IDE).

The tracker finally adjusts its position sensing the maximum intensity of light falling perpendicular to it and stays there till it notices any further change. The sensitivity of the LDR depends on point source of light. It hardly shows any effect on diffuse lighting condition.

2.1 MATHEMATICAL EQUATIONS REQUIRED

Here in this model we considered two laws.

1.Inverse square law

2. Lamberts cosine law

1. INVERSE SQUARE LAW

The illumination upon a surface varies inversely as the square of the distance of the surface form the source. Thus, if the illumination at a surface 1 metre from the source is I units, then the illumination at 2 metres will be I/4, at 3 metres will be I/9 and so on. In fact inverse square law operates only when the light rays are from a point source and are incident normally upon the surface. Thus illumination in lamberts/m2 on a normal plane= Candle power/ (Distance in metres)^2

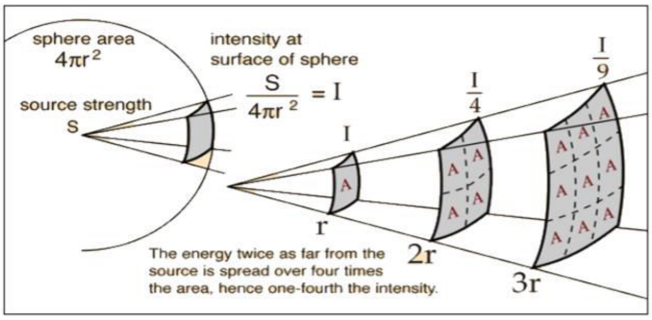

Fig - 1: Inverse Square law

2. LAMBERT'S COSINE LAW

The illumination received on a surface is proportional to the cosine of the angle between the direction of the incident light rays and normal to the surface at the point of incidence. This is mainly due to the reduction of the projected area as the angle of incidence increases.

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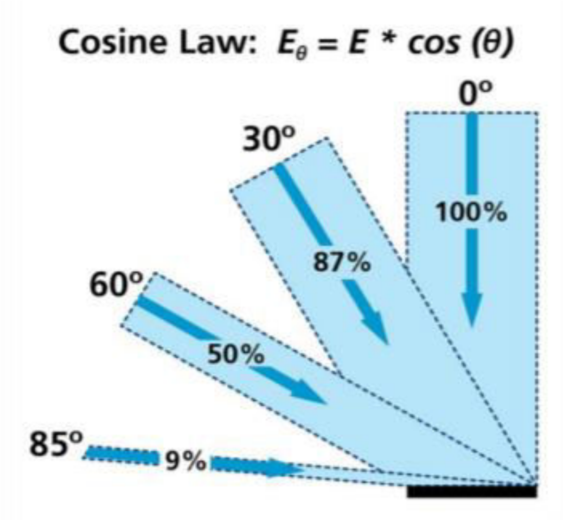

Fig- 2: Lamberts Cosine law

Thus, the equations are:

$$E_\theta = E\cos\theta = \frac{I\cos\theta}{D^2}$$

where,

E_θ= illumination on horizontal plane

E= illumination due to light normally incident

θ= the angle of incidence

D= distance from the surface

3. BlockDiagram

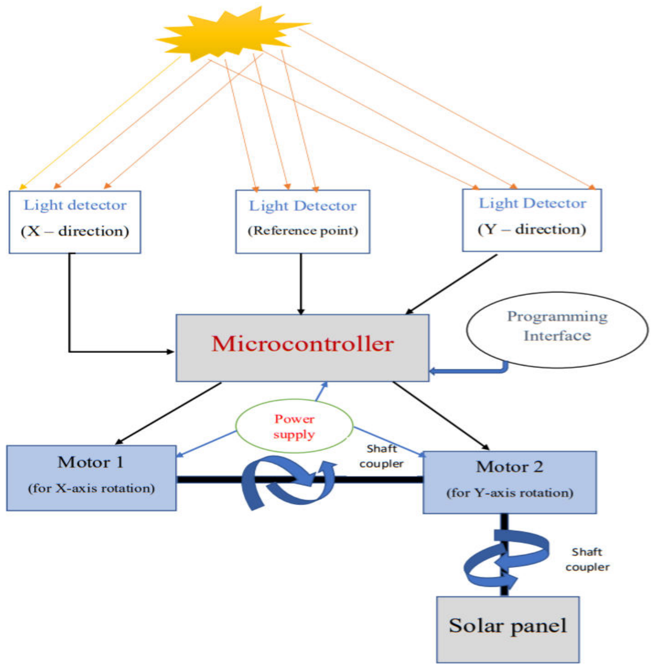

Fig- 3: Solar Trackig System

As we see in the block diagram, there are three Light Dependent Resistors (LDRs) which are placed on a common plate with solar panel. Light from a source strikes on them by different amounts. Due to their inherent property of decreasing resistance with increasing incident light intensity, i.e. photoconductivity, the value of resistances of all the LDRs is not always same. Each LDR sends equivalent signal of their respective resistance value to the Microcontroller which is configured by required programming logic. The values are compared with each other by considering a particular LDR value as reference. One of the two dc servo motors is mechanically attached with the driving axle of the other one so that the former will move with rotation of the axle of latter one. The axle of the former servo motor is used to drive a solar panel. These two-servo motors are arranged in such a way that the solar panel can move along X-axis as well as Y-axis. The microcontroller sends appropriate signals to the servo motors based on the input signals received from the LDRs. One servo motor is used for tracking along x-axis and the other is for y-axis tracking.In this way the solar tracking system is designed.

4. DUAL AXIS MOVEMENT OF SOLAR TRACKER

The dual axis solar tracker is device which senses the light and positions towards the maximum intensity of light. It is made in such a way to track the light coming from any direction.To simulate the general scenario of the Sun's movement, the total coverage of the movement of the tracker is considered as 120˚ in both the directions. The initial position of both the servo motors are chosen at 90˚i.e, for east-west servo motor as well as for north-south servo motor. The position of the tracker ascends or descends only when the threshold value is above the tolerance limit.

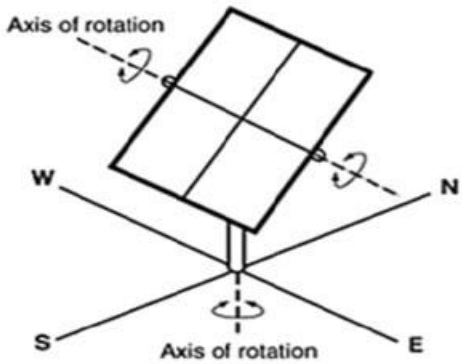

Fig - 4: Two axis Tracking sytem

5. HARDWARE KIT

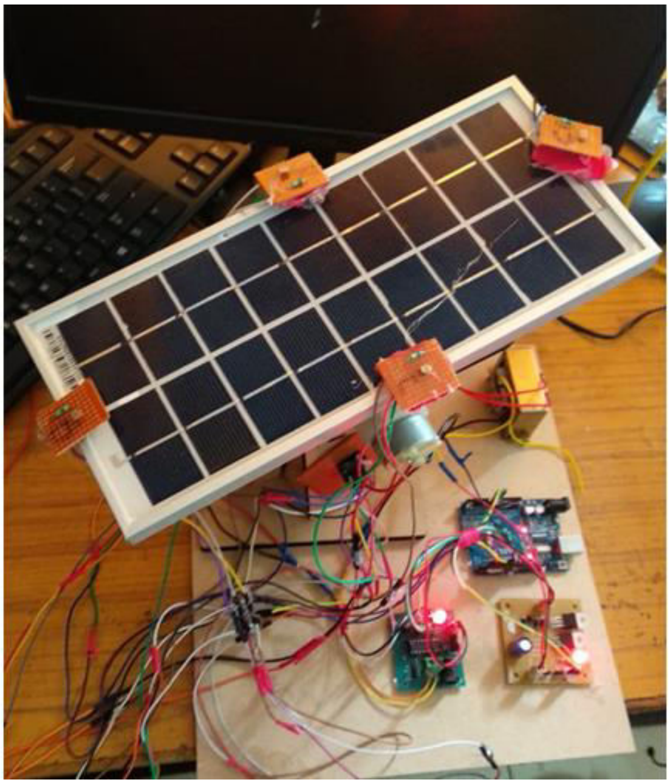

Fig -5: Hardware kit of Solar tracking System

6. CONCLUSION

This paper has presented a mean of controlling a sun tracking panel with an embedded microprocessor system. Specifically, it demonstrates working solution for maximizing solar cell output by positioning a solar panel at the point of maximum light intensity. The proposed solution for a solar tracking system offers several advantages concerning the dual axis movement of the solar panel: the high system stability; the control algorithm used has no searching phase; it calculates the position of the sun and moves the motors towards that sun immediately. No light sensors involved to determine the sun apparent position.

REFERENCES

1. L. Ranghetti, L. Busetto, A Crema, "Testing estimation of water surface in Italian rice district from MODIS satellite data". *International Journal of Applied Earth Observation & Geoinformation, vol. 52, no.7, pp.* 284-295, Oct. 2016

2.M. Campos-Taberner , F. J. García-Haro and R. Confalonieri, "Multitemporal Monitoring of Plant Area Index in the Valencia Rice District with PocketLAI". *Remote Sensing, vol. 8, no. 3, pp. 192-209,* Mar. 2016

3. EA Chiaradia, A. Facchi, D. Masseroni and D. Ferrari, "An integrated, multisensor system for the continuous monitoring of water dynamics in rice fields under different irrigation regimes". *Environmental Monitoring and Assessment, vol. 187, no. 9, pp. 586-603, Sep. 2015*

4.H. Luo, G. Li and W. Peng, "Real-time remote monitoring system for aquaculture water quality". *International Journal of Agricultural & Biological Engineering, vol. 8, no. 16, pp. 136-143, Dec. 2015*

5. I. Heimann, V. B. Bright and M. W. Mcleod, "Source attribution of air pollution by spatial scale separation using high spatial density networksof low cost air quality sensors". *Atmospheric Environment, vol. 113, no.* 11, pp. 10-19, Jul. 2015

6. Z. Can and M. Demirbas, "Smartphone-based data collection from wireless sensor networks in an urban environment". *Journal of Network& Computer Applications, vol. 58, no. 13, pp. 208-216, Dec. 2015*

7.C. H. Ngai and P. Gunningberg, "Quality-of-information-aware data collection for mobile sensor networks". *Pervasive & Mobile Computing,*vol. 11, no. 6, pp. 203-216, Apr. 2014

8.J. V. Capella, A. Bonastre and R. Ors, "A step forward in the in-line river monitoring of nitrate by means of a wireless sensor network". *Sensors & Actuators B Chemical, vol. 195, no. 5, pp. 396-403, May.* 2014

9. H. Navarro-Hellín, R. Torres-Sánchez and F. Soto-Valles, "A wireless sensors architecture for efficient irrigation water management". *Agricultural Water Management, vol. 151, no. 9, pp. 64-74, Mar. 2015*

10. J. W. Ji, H. Ding and Z. M. Li, "Paddy field irrigation monitoring system based on wireless transmission". *Journal of Agricultural Engineering, vol. S1, no. 15, pp. 52-59, Dec. 2013*