Solar Tracking System Using Arduino

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ABSTRACT

Solar energy is clean, cheap, renewable, and abundantly available source of energy and hence many researchers focus on the techniques of increasing absorption of solar power for different practical applications. Solar tracking system plays a major role in this field because of the importance of tracking the sun and increasing absorption of solar energy during the day light timing. This project presents a new design, simulation as well as results of dual axis solar tracking system that is able to make the solar panel produce maximum power during its function. The design takes into account that all related electronic (transducers, controlling, and drive circuits) are supplied by an efficient designed and simulated DC power supply which is fed from the connected solar panel. The simulation results show that the dual axis tracker has better capability of tracking the sun light in two planes instead of single plane tracking of single axis tracker. The design of the proposed system depends on general use discrete electronic components that make the practical implementation to be easily constructed.

Keyword: - *Solar energy, renewable, absorption, Solar tracking, dual axis solar tracking system, maximum power, DC power, two planes.*

1. INTRODUCTION

Solar energy uses radiant light and heat from which are mainly used in technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis is. It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones are available, based on thin-film cells. The cells must be connected electrically in series, one to another. Externally, most of photovoltaic modules use MC4 connectors type to facilitate easy weatherproof connections to the rest of the system. Modules electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive transition metals. Bypass diodes may be incorporated or used externally, in case of partial module shading, to maximize the output of module sections still illuminated.

Some special solar PV modules include concentrators in which light is focused by lenses or mirrors onto smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way.

1.1 LITERATURE SURVEY

This solar tracker is system is used to monitor the moisture content of the soil using soil moisture sensor. The data collected from the sensor are sent the user's mobile using the Bluetooth connection between the Arduino board and the mobile. The Bluetooth connection is made possible using the Bluetooth module.

Ram Prasad et al., [1] proposed work on AI development. In this system the sensors are places in the top of device. The data from the sensors are analyzed by the given set of instruction.

Stephon P.et.al., [2] described the light sensitive device. Its resistance decrease when the light falls on it and that's why it is frequently used in Dark or Light Detector Circuit. The two LDR's placed at the two sides of the solar panel and Servo Motor is used to rotate the solar panel.

Taniya Shetty et al., [3] this project concentrates efficient of Solar panel and more mobility to the user to use and it makes a base for the future enhancement in Solar Devices.

Suresh JP et al., [4] this paper concentrates on simplicity and efficient implementation of solar tracker using the microcontrollers. The microcontroller examples are Arduino board.

Aditi Rao et al., [5] this paper proposed that how the Solar Tracker technique can be used in more efficient manner as compare to previous existing System.

2. PROPOSED SYSTEM

A solar tracker is a device that orients a payload toward the Sun. Payloads are usually solar panels, parabolic troughs, Fresnel reflectors, lenses or the mirrors of a heliostat. For flat-panel photovoltaic systems, trackers are used to minimize the angle of incidence between the incoming sunlight and a photovoltaic panel. This increases the amount of energy produced from a fixed amount of installed power generating capacity. In concentrator photovoltaic (CPV) and concentrated solar power (CSP) applications, trackers are used to enable the optical components in the CPV and CSP systems. The optics in concentrated solar applications accept the direct component of sunlight light and therefore must be oriented appropriately to collect energy. Tracking systems are found in all concentrator applications because such systems collect the sun's energy with maximum efficiency when the optical axis is aligned with incident solar radiation.

3. IMPLEMENTATION

In this circuit constant current is given across LDR and constant voltage is given across 555 timers. 555 timer are used for monostable circuit. In monostable circuit a triggering pulse is needed; this pulse is given by LDR arrangement. LDR is negative temperature coefficient device, so when the circuit is kept under light, resistance across the LDR decreases. As current across the LDR is constant and resistance decrease with light intensity, voltage starts to change its state, this voltage is working as triggering pulse in monostable circuit. From monostable multi vibrator circuit we get voltage waveform, which remains in high state at first, then changes its state with varying light intensity.

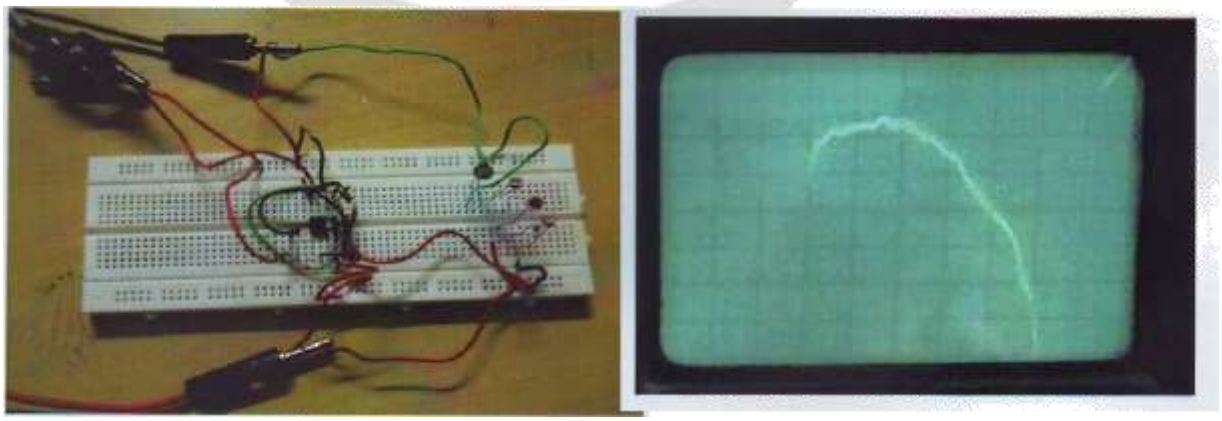

Fig.:1 Light sensing outputs

Here Cd4017 is a decade counter, this counter gives medium speed operation and hazards-free counting sequence, output pulse from light sensing circuit act as clock pulse in decade counter (i.e. at pin no. 14). Here output is taken from (00, 01, 02, 03) pins which are connected through resistance to Darlington pair. Darlington pair is used to obtain high current gain because current obtained from decade counter is amplified by Darlington pair (which is an arrangement of bipolar transistor). This high current gain is needed for driving more load. Diode is connected across the Darlington pair to remove spike in case of inductive load. Resistance is connected in the base of Darlington pair to control the leakage current across CE. Output pulse of Darlington pair is connected across (1,2,3,4) pins of ULN2003 (which acts as motor driver IC). This gives more current gain as it is a Darlington pair IC to drive the load. Stepper motor is connected with it, which moves in a step. As output of decade counter changes sequentially, speed increases motor torque decreases which gives movement to load (i.e. solar panel)

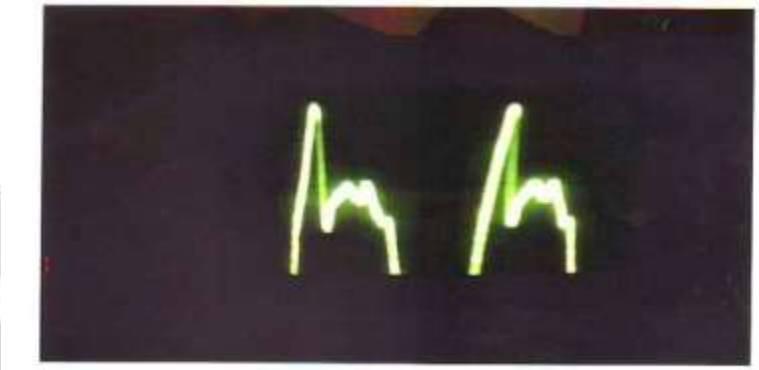

Fig.:2 Circuit output

This circuit consists of four resisters (1K) each. One of its terminals is shorted with the terminal of the one terminal of LDR which is then connecting to the analog pin of the Arduino board. The pins include A0, A1, A2, and A3. The terminal of the resistor is give to power source from which the wire will be connecting to the 5v power source of the Arduino. One wire is used to interconnect the ground from the Arduino to the free terminal of the resistor. Then the signal wires of the two servomotors are connected to the digital pins of the Arduino. The power and ground of the servomotor is connected to the power and ground terminals of the Arduino.

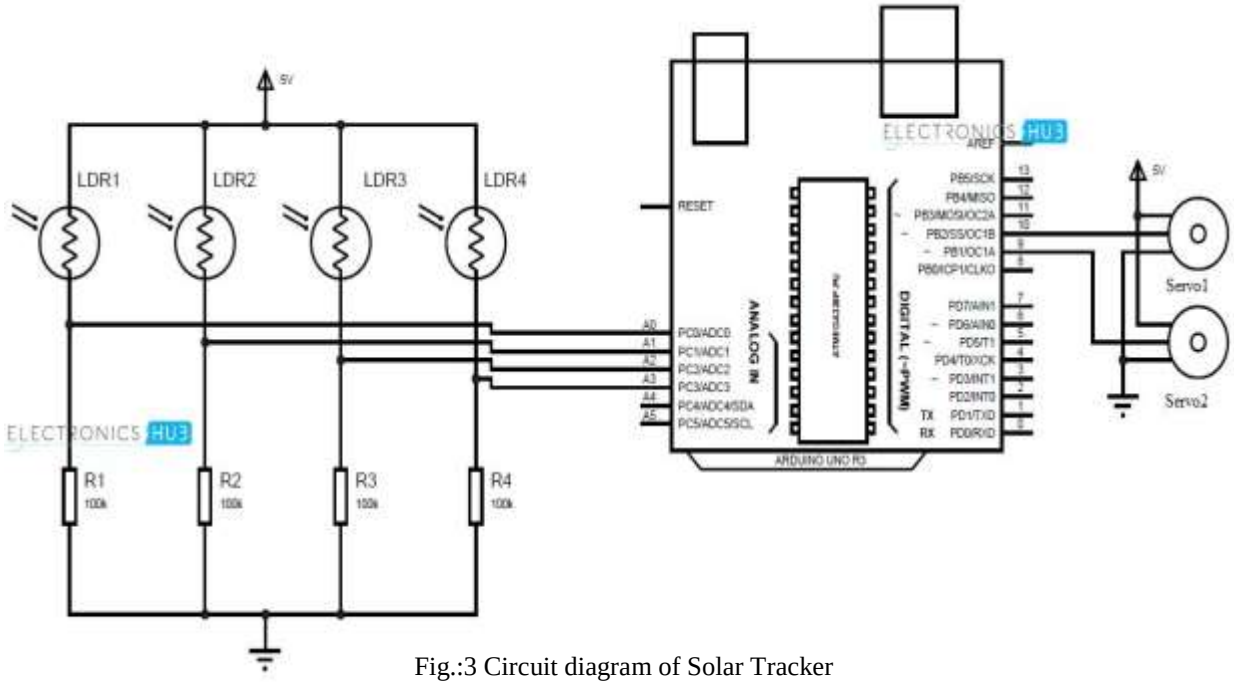

Fig.:3 Circuit diagram of Solar Tracker

4. CONCLUSIONS

In this project a solar tracker has been developed to increase the amount of power generated by the solar panel as the sun traverses across the sky. An Arduino Uno was used to control the movement of the solar panel. The system is designed to be automatic, such that energy generated by the solar panel would be used for power supply in houses. Solar Energy is one of the most popular renewable sources nowadays. It is being widely used also, and within some more years it will be very popular that it will be used for many purposes, in industries and household as well. So, it is most important fact to utilize the maximum energy of the sun so that maximum power can be generated. In many places experiment is being done on this fact how it is possible to make full use of the day light.

This project has got a bright future scope further. Accuracy of this solar panel can be increased further and number of steps can be increased as well to get more accurate desired output. Timer circuit is also being integrated with this so that this system responses more accurately. Even in a cloudy day when intensity of sunlight may vary at different time of a day, the timer circuit can be more that handy to drive the solar panel correctly in that low light. As per energy concerned solar energy is one of the most promising energy which is going to be a main source of energy in near future. A cost effective intelligent sun tracking system to extract maximum solar energy possible has been designed.

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