

Dual Axis Solar Tracker

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Abstract-

Solar energy is growing as an important means of renewable source of energy. There are many technologies of harnessing the solar energy such as photovoltaics (PV), solar heating and cooling systems, etc. Tracker is a Device which follows the movement of the sun as it rotates from the east to the west every day. Trackers are used to keep solar collectors/solar panels oriented directly towards the sun as it moves through the sky every day. The continuous utilization of non-renewable energy sources and the ozone depletion is a matter of worry for the people. So, the innovative methods of producing energy are must for cutting down the expenses of the sustainable power sources. In the recent years, Photovoltaic as a source of energy creation has proved to be one of the best method of energy production. The yield through the photovoltaic based energy production relies upon the sun based illumination and the orientation of the sun. Therefore, this paper outline the work, development (mechanical structure and electrical framework) of the Dual Axis Solar Tracker (DAST).

Date of Submission: 29-12-2020

Date of acceptance: 10-01-2021

I. INTRODUCTION

The exploitation of energy worldwide is expanding drastically in the recent years where the demand of power is growing rapidly. In Brazil, between 2006-2015 there was a 34% growth in energy consumption and 38.7% in the formation of electric energy. With the inescapable lack of fossil energy fields in the coming years, renewable energy are vital and have become the talk for the researchers.

Researchers are focussing on new energy fields like geothermal energy, bioenergy, hydro electricity, wind electricity etc. and because of their renewability, they are getting attention as approving substitution for fossil fuel sources. Among those sources of power, solar photovoltaic (PV) energy one of the most accessible energy. Due to sunlight based radiation and direction impulsion for eg.-impose deviation connected to power distribution, sun oriented photovoltaic energy has been expanding drastically.

This mechanism has been acquired more effectively for residential work in recent days, thanks to experimentation and growth project which lowers the cost solar PV power has largely anticipated to set off a vital source of energy in the future.

However, despite all those utility, solar PV power is still out of reach from succeeding conventional energy sources on the market. The area where there is a less reach of sunlight is still a confrontation to bump energy sources.

Improving the efficiency, design and other relevant factors is still the main variable for the researcher and development teams. Upgrading in technology and advertisements in machinery from manufacturer to refine the capabilities of PV materials. Aiming for that motive this assessment has been carried out to assist the development of such technology. Increasing the period of exposure to sun is one of the main practice of increasing efficiency.

II. PROBLEM IDENTIFICATION

Photovoltaic system help in capturing the radiations of sun in an easy and efficient manner. This problem has been effectively tackled by the use of photovoltaic system by capturing solar radiation of the sun. Since, position of the sun keeps changing due to the revolution and rotation, in order to extract maximum radiation the panel should be perpendicular to the angle of incidence. The usage of tracking system enables the increase of power output by about 35-50%.

III. WORKING

The working principle of the solar tracking system is done by Light Dependent Resistor (LDR). Arduino analog pin A0 to A4 are connected with four LDR's which act as the input for the system. The built-in analog to D convertor with digital capability will transform the analog value of LDR and transform it into digital signals.

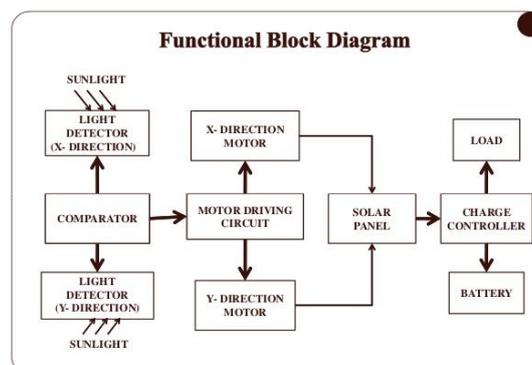
- LDR also known as photoresistor which works as a light detector. It senses the light and the flag to microcontroller.
- LDR having resistance which depends on the light's intensity and varies accordingly. The higher the intensity of light, lower the LDR resistance and by this the output voltage value lowers and when the intensity of light is low, LDR resistance becomes higher and thus a higher value of voltage is acquired.
- The LDR sight the input analog with voltage between 0 to 5V and gathers a digital value at the output which normally ranges from 0 to 1023.

Now, that gives the response to the microcontroller using the software having arduino in it. The tracker ultimately regulates its position by observing the light's maximum intensity collapsing perpendicular to it. The reactivity of the LDR depends upon the radiation of light (point source). It barely exhibits any result in diffuse light system condition.

IV. COMPONENTS REQUIRED

- Arduino UNO- The Arduino Uno is a microcontroller board based device. It consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains all the requires things to support the microcontroller; and can be simply connected to a laptop/desktop through USB or to an AC or DC supply or a battery to get started
- SG90 Micro-servo motor- It provides heavy power output despite of it's tiny size and lightweight. It can rotate 180 degrees (90 in each direction), and works like standard motors despite of small size.
- LDR, 5Mohm-It is an electronic components which detects the presence of light in a circuit and can change the operation of circuit.
- Resistor 330 ohm- Used to resist/regulate the flow of current.
- Rotary potentiometer(generic)-It acts as an adjustable voltage divider.It has three terminals.
- Pushbutton Switch,Pushbutton
- Mini Solar panel
- Relay- Used to control circuit by an independent power signal.
- LCD-uses liquid crystal as its form of operation.
- Crystal oscillator-Electronic oscillator that creates an electric signal with a constant frequency by using mechanical resonance of vibrating crystal of pizeoelectric material.
- H bridge-Used to allow DC motors to run forward and backward.

V. BLOCK DIAGRAM-



The conversion efficiency of a normal PV cell is low. One of the main reason for this is that the output of PV cell is dependent directly on the light intensity and with the position of sun in the sky changing continuously from time to time.

The absorption efficiency of an immobile solar panel would be significantly less at certain time day and year, for the solar photovoltaic cells are maximum productive when they are perpendicular to the sun and less productive otherwise. So to maximize the energy generation and improve the efficiency solar trackers are required. In photovoltaic systems, trackers help minimize the angle of incidence (the angle that a ray of light makes with a line perpendicular to the surface) between the incoming light and the panel, which increases the amount of energy the installation produces.

VI. SCOPE OF THE PROJECT

- Improvements in design may be released wherein only the rotation of tracker is there ,rest all the parts of the system are at rest.
- For more improvement of sun tracking,a stand alone tracker system can be designed by using 18 series PIC microcontroller.
- Some different algorithm can also be used for better tracking and it can be made more intelligent ,for eg- after tracking once,it could predict the line of sun's movement.
- Some configurations can be done so as to withstand adverse environmental conditions.

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