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DUAL AXIS AUTOMATIC SOLAR TRACKING SYSTEM

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ABSTRACT:

The paper mainly focuses on the automatic solar tracking system to maximize the utilization of solar energy. This is a closed loop system. This system makes the uniform distribution of solar radiation over the PV panel. A sensor unit that consists of photo sensor platform is designed and used to find the accurate position of the sun. This system uses two DC gear motors for driving the solar panel in north-south and east-west directions.

Key words: PV panel, dc gear motor.

I **INTRODUCTION:**

Now a day there has been an increasing interest in the renewable energy, the photovoltaic system as an alternative source of energy to generate electrical power. The maximum solar energy available on an average level is Gn 1 KW/m when it reaches the surface of the earth. To utilize the maximum solar energy the dual axis solar tracking system has been designed. This paper focuses on the controlling of solar panel using a microcontroller to track the maximum solar energy. The maximized utilization of the solar energy results in maximum power generation. The maximum power generation happens when the sun light falls perpendicularly on the solar panels that can be done by tracking the movement of the sun using this dual axis solar tracking system. The microcontroller is the heart of the system. The microcontroller compares the light intensity from all the four directions using the photo sensor unit that consists of photo sensor platform (Light Dependent Resistors). The intensity and spectral distribution of the solar radiation depend on environmental and positioning factors, the geographic position, climatic conditions, atmosphere, days in a year, altitude and other factors. The mobile PV panel driven by a solar tracker is always better than a fixed panel. This system may boost consistently the conversion efficiency of a PV panel.

II **NECESSITY OF DUAL AXIS AUTOMATIC SOLAR TRACKING SYSTEM:**

This system is necessary as the sun does not rise exactly at east direction every day, it has a slight deviations. If the solar panel is fixed for an angle based on the timing and sun movement which is not the same for all day. But the proposed system detects the maximum light intensity and helps to rotate the panel towards the direction where the sun light falls perpendicular to the panel. This increases the generation of electricity by utilizing the solar energy to the maximum level. The next advantage of this system is that there is no reference voltage fixed for comparison, the comparison is among the four LDRs where the intensity is high. In case of setting a reference value the problems faced are that if the light intensity is not above the reference value but higher than the value at the fixed direction the panel will not be rotated toward this higher value side. To avoid this problem the reference value should be fixed very low which is unnecessary. Thus these problems are avoided by using the proposed system.

III **Types of Solar Trackers**:-

The sun's position in the sky varies both with the seasons (elevation) and time of day as the sun moves across the sky. Hence there are also two types of Solar Trackers.

1. Single Axis Solar Tracker.
2. Dual Axis Solar Tracker.

1. Single Axis Solar Tracker:-

Single axis solar trackers can either have a horizontal or a vertical axle. The horizontal type is used in tropical regions where the sun gets very high at noon, but the days are short. The vertical type is used in high latitudes (such as in UK) where the sun does not get very high, but summer days can be very long.

2. Dual Axis Trackers: -

Double axis solar trackers have both a horizontal and a vertical axle and so can track the Sun's apparent motion exactly anywhere in the world this type of system is used to control astronomical telescopes, and so there is plenty of software available to automatically predict and track the motion of the sun across the sky. Dual axis trackers track the sun both East to West and North to South for added power output (approx. 40% gain) and convenience.

IV **BLOCK DIAGRAM:**

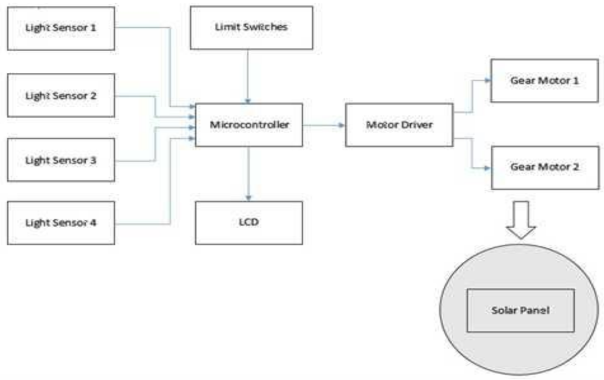

Fig.1Block diagram

The system consists of sensor unit, digital controller unit and position control unit. The power supply unit provides supply for the sensor unit, digital controller unit and position control unit. The sensor unit consists of four LDRs which sense the weather conditions through the light intensity and its output is fed to the digital controller unit. This unit consists of the AT mega 16 microcontroller that compares the output of the four LDR values and determines the weather condition and the direction with high light intensity. The output from digital controller is fed to the position control unit which consists of the motor drive circuit that determines the direction in which the DC gear motor should rotate. The azimuthal drive and the zenith drive are the two DC gear motors that turn east or west and north or south respectively. The rotation is based on the direction voltage supply from the driver circuit to the motor. Finally the solar panel moves both vertically and horizontally based on the light intensity.

IV **IMPLEMENTATION:**

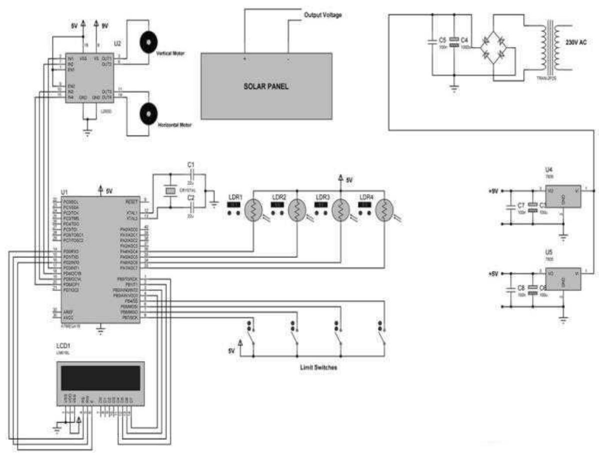

Fig.2 circuit diagram

The active solar tracking system consists of an external power supply or a backup battery, a digital controller, driver circuit for motors and a mechanical platform for the photovoltaic panel. The diagram illustrates the usage of two moors as mechanical derives that conduct a dual axes rotation for the solar panel to face the sun light perpendicularly. This rotation allows the system to track the sun and allows the PV panel to optimally harvest the solar energy.

The sensor unit consists of four light dependent resistors. This LDRs help to sense the direction of maximum light intensity. Light sensors (LDR) are connected to the pins 33, 34, 35 and 36 of the AT mega 16 microcontroller. They are the analog inputs to the A/D converter of port A. port A is an 8-bit bidirectional input output port. Here the four inputs are compared and the outputs are taken from the pins port D pins 17, 18, 19 and 20. This serves as input to driver L293D. The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. The L293D is the driver circuit used in the circuit. The input pins 2 and 7 are related the out pins 3 and 6. Thus the pins 2, 3, 6 and 7 control the vertical motion of the panel. Similarly pins 10, 11, 14 and 15 control the horizontal motion of the panel. The pins 3 and 6 are connected to a dc gear motor that is responsible for the vertical motion and similarly output pins 11 and 14 are connected to another dc gear motor which is responsible for the horizontal motion. Since the output supply from the microcontroller is not sufficient, the driver circuit is used.

The two dc gear motors are fixed in such a way that one motor is fixed at the base which helps in the right left motion of the pane and the other is placed below the panel that helps in up and down motion. The usage of DC gear motors have some advantages compared to the stepper motors. Since the rpm of dc gear motor is less the motion can be easily controlled. The DC gear motor provides a rigid support to the panel. It prevents the manual rotation of the panel. Since the gear motor has less rpm it is much easy to control its rotation than stepper motor and other motors. Three limit switches are used in this system. Two limit switches are used in the upper dc gear motor which is responsible for up and down motion of the panel and the third limit switch is used at the lower dc gear motor which is responsible for the right and left motion.

Fig. 3 solar panel with the solar tracking system.

V **CONCLUSION:**

In this paper the implementation of dual axis solar tracking system using a microcontroller has been done. In this design the maximum power from the sun is extracted as the sun light is made to fall perpendicular on solar panel by tracking the sunlight using the dual axis solar tracking system. Thus the efficiency of the solar panel has been improved. The improvement can be seen effectively at morning and evening than noon.

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