An Effective Method of Solar-tracking System using Microcontroller

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In this paper, a new micro-controller based solar-tracking system is proposed, implemented and tested. The scheme presented here can be operated as independent of the geographical location of the site of setting up. The system checks the position of the sun and controls the movement of a solar panel so that radiation of the sun comes normally to the surface of the solar panel. The developed-tracking system tracks the sun both in the azimuth as well as in the elevation plane. PC based system monitoring facility is also included in the design.

Keywords: Solar energy; Solar-tracking system; Solar collector; PIC Microcontroller

INTRODUCTION

In years to come the need for energy will increase manifold while the reserve of conventional energy will deplete in rapid pace. To meet the growing demand of energy harnessing of non-conventional / renewable energy is the necessity. Among all the available non-conventional sources, solar energy is the most abundant and uniformly distributed. Though the technology of trapping the solar energy is in existence the process can be improved to increase efficiency and make it cost-effective. Solar energy is free – it needs no fuel and produces no waste or pollution. Solar power is renewable. The sun will keep on shining anyway, so it makes sense to use it. In this paper, the design of existing solar collector system has been improved to provide higher efficiency for lower cost. The existing system receives maximum sun energy only from 11 am to 2 pm because always the solar collector kept at 30° and charges a small battery. A new method is developed, where sun light is tracked from morning 6 am to 6 pm by moving the solar collector along with the movement of the sun using stepper motor based on PIC. Microcontroller and multiple batteries can be charged one after another. When this system is implemented, at least 30% extra energy can be created compared with the existing system. The panels are the fundamental solar-energy conversion component. Conventional solar panels, fixed with a certain angle, limits their area of exposure from the sun during the course of the day. Therefore, the average solar energy is not always maximized. Solar tracking systems are essential for many applications such as thermal energy storage systems and solar energy based power generation systems in order to improve system performance. The change in sun’s position is monitored and the system always keeps that the plane of the panel is normal to the direction of the sun. By doing so, maximum irradiation and thermal energy would be taken from the sun. The elevation angle of the sun remains almost invariant in a month and varies little (latitude ± 10°) in a year. Therefore, a single axis position control scheme may be sufficient for the collection of solar energy in some applications.

GENERAL BLOCK DIAGRAM

In this paper, the sun’s light is tracked in order to generate power very effectively. For that purpose 5 LDR’s are used for sensing the light from the sun. Here 5 LDR’s are used so that the sun’s path can be divided into six columns of 180° (East-West). The LDR outputs have been compared and the sun’s angle is traced. Hence the solar panel is moved towards the sun’s angle with the help of microcontroller by using stepper motor. In this operation the signal from the light sensor is given to the signal conversion circuit and then it is filtered before passing into the microcontroller.

Once the solar panel is completely moved to the west it will automatically turn into east direction for the next day using position sensors. In this operation the signal from the position

Figure 1 Block diagram of the system

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sensor is given to the zener circuit in order to protect the PIC IC from the over voltage before passing into the microcontroller. In this paper, the solar panel generates voltage up to the maximum value of 9.3 V.

Here both the position sensor and solar panel is kept in the mechanical model. In order to rotate the solar panel the stepper motor has been used. Here 12 V stepper motor is used. The stepper motor driving circuit is used to drive the stepper motor. The power supply have been given to both the stepper motor and PIC IC are 12V and 5V, respectively by using step down transformer.

The opto coupler has been used to avoid the back-up voltage passing from stepper motor circuit to the PIC IC. The LDR’s output and the generated voltage were used to the personal computer through RS 232 for monitoring purpose.

**EXPERIMENTAL RESULTS**

The solar tracking system presented here is tested experimentally. One solar collector panel is employed in the test. The sunlight has been successfully tracked by using various sensors, stepper motor and microcontroller. The power also generated successfully by using solar panel from the sunlight up to the maximum voltage of 9.3 V. The generated power has been stored in the battery separately and it will be charged fully after 6 h. The charged battery can be utilized during the absence of sunlight. Since LDR’s are very light sensitive the light rays has been detected and hence the solar panel has been moved towards sun’s light.

At the time of testing, the various angles of LDR’s output and the generated voltage have been monitored as shown in Figure 2.

**CONCLUSION**

In order to collect the greatest amount of energy from the sun, solar panels must be moved according to the movement of sun. For this purpose, a new solar tracking technique based on microcontroller was implemented and tested in this study. The tracking system presented has the following advantages: In sunny countries, solar power can be used where there is no easy way to get electricity to a remote place. Handy for low-power uses such as, solar powered garden lights and battery chargers. The tracker provides also PC based system monitoring facility. Since the tracking system is controlled completely by PIC microcontroller; the PC, used for monitoring the panel only. In this paper, the sun’s light is tracked only in vertical axis (east - west). But still the power generation by tracking the sunlight in horizontal axis (north - south) is improved.

**REFERENCES**

