IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 2, Apr-May, 2014
ISSN: 2320 – 8791(Impact Factor: 1.479)
www.ijreat.org

Dual Axis Solar Tracking System with Low Power Consumption and Increased Efficiency

Riddhi Bhavsar[1], Shreya Gandhi[2], Nidhi Padiya[3], Megha Brahmbhatt[4], Dr. J. M. Rathod[5], Dr. T. D. Pawar[6], Dr. V. N. Kamat[7]

[1,2,3,4] Final Year Student, Electronics, Birla Vishvakarma Mahavidyalaya, Vallabh Vidyanagar-388120, Gujarat, India

[5]Associate Professor, Electronics, Birla Vishvakarma Mahavidyalaya, Vallabh Vidyanagar-388120, Gujarat, India

[6]Head of department, Electronics, Birla Vishvakarma Mahavidyalaya, Vallabh Vidyanagar-388120, Gujarat, India

[7] Principal, MBICT, New Vallabh Vidyanagar, Beyond Vithal Udyognagar, GIDC, Anand-388345, Gujarat, India

Abstract

Our project is based on harnessing of solar energy using a dual axis solar tracker with the help of microcontroller unit. Solar trackers are used to improve electric power radically of photovoltaic panel by using sensor. These sensors retrieve the solar radiation. Using microcontroller based solar tracker of two degrees (Horizontal & Vertical) of rotating freedom in order to achieve the right positioning of photovoltaic solar cell, we can maximize the impact of sunlight during the day light session and as a result produce more electricity. This tracking system is developed with two direct current (DC) motor operated by an ARM microcontroller which processes the information provided by the sensors (LDR) using an internal ADC-analog to digital converter. The microcontroller commands the motor by providing correct logic to the motor driver which operates the motors accordingly.

Keywords: *Solar Panel, DC Motor, LDR, Lead-Acid Battery, Charge Controller, Microcontroller*

1. Introduction

During recent times due to the shortage of electricity, the search for an alternate source of power has been increased. Solar power has proved to be one of the best alternative power sources since it is abundant in nature. It is a renewable resource that is clean, economical, and produces less pollution compared to other resources of energy. Therefore, solar energy is rapidly gaining popularity as an important means of expanding renewable energy resources. As such, it is vital that those in engineering fields understand the technologies associated with this area. Solar panel is the fundamental solar-energy conversion component. A photovoltaic panel is a device used to capture the sun's radiation. These panels consist of an array of solar cells. The solar cells are made up of silicon (sand). They are then connected to complete a photovoltaic (solar) panel. When the sun rays are incident on the solar cell, due to the photovoltaic effect, light energy from the sun is used to convert it to electrical energy.

2. Description

2.1 LDR Arrangement

Two pairs of LDR as sensor are used [2]. There is an oblique slit in between them. One such arrangement is placed on the solar panel and another one is placed on the PVC pipe. As soon as sun changes its position, one of the two LDR's (LDR pair) will be shadowed and the other will be illuminated. The output voltage of the LDR pair is given to the ADC pins of microcontroller (LPC 1343). It computes the voltage difference, compares it with the threshold voltage and commands the motor to rotate the panel such that both LDRs are equally illuminated. In that way, the solar panel will always be aligned perpendicular to the sun and give maximum efficiency [2]. Figure 1 shows the block diagram of the entire system.

2.2 Programming Software

LPCXpresso is a low-cost development tool platform, available directly from NXP that provides a quick way to develop advanced applications using NXP's highly efficient and low-power LPC microcontrollers. It includes everything to take end users from evaluation to final production. [1]

2.3 Solar Charge Controller Circuit

A solar charge controller or charge regulator limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may prevent against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. Whenever charge controller found that the battery has reached the full charging voltage levels, it then stops the charging from solar panel [Fig 3].

3. Figures

3.1 Block Diagram

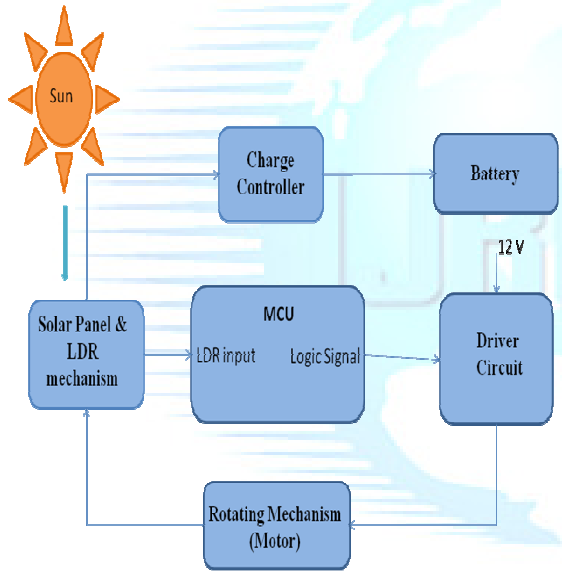

Fig. 1 Block Diagram.

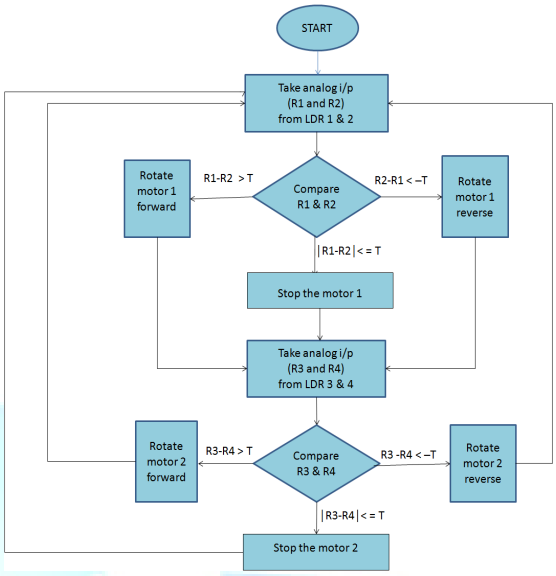

Fig. 2 Flow chart.

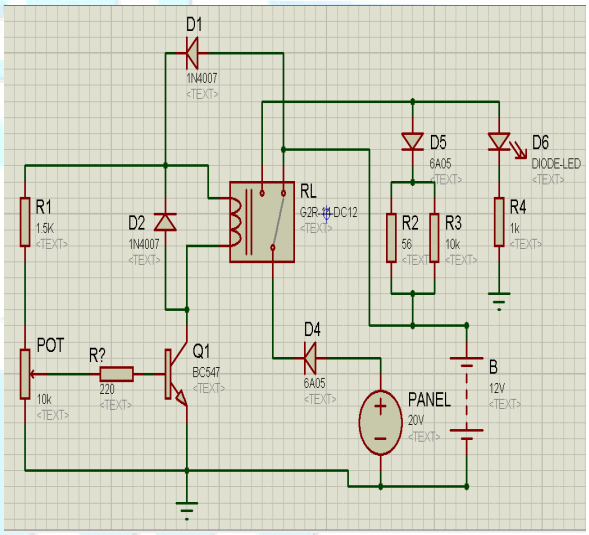

Fig. 3 Solar Charge Controller Schematic Diagram

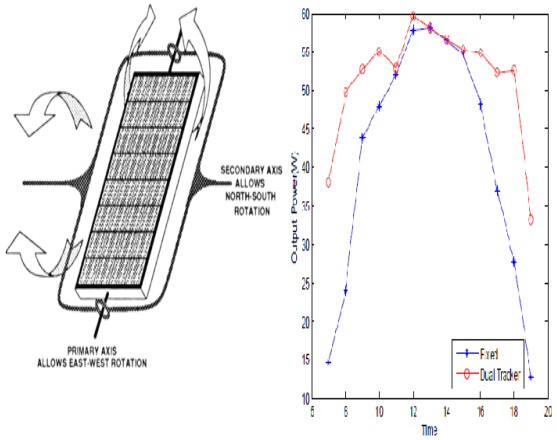

Fig. 4 Fixed v/s Dual Axis Solar Tracker [3]

4. Conclusions

Microcontroller based dual axis solar tracker will rotate in such a way that the solar radiation is always perpendicular to solar panel. Hence, power can be generated more efficiently [Fig 4]. After the study of ARM Cortex-M3, we concluded that if a dual axis solar tracking system using that controller is made, the entire circuitry would be compact. Also power consumption would be less as well due to inherent features of the ARM controller and less hardware requirement. We have used LPCXpresso, a low-cost development tool platform for programming.

Acknowledgments

We would like to express our gratitude and sincere thanks to Principal, BVM Engineering College for imparting profound knowledge and for encouraging us for the research. We also thank authorities of Baroda Electric Meters Ltd. for helping us with all the resources and instruments needed for the project.

References

[1] http://www.nxp.com

[2] http://kennarar.vma.is/thor/v2011/vgr402/ldr.pdf

[3] M. Serhan and L. El-Chaar, "Two Axes Sun Tracking System: Comparison with a fixed system", International Conference on Renewable Energies and Power Quality (ICREPQ'10), March 2010