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Development of Sun Tracking Solar Panel using MSP430 Launch pad

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ABSTRACT - Barring all the other available resources, the solar energy is the most abundant and it is comparatively easy to convert into electrical energy. The usage of solar panel to convert Sun energy into electrical energy is very popular, but due to the transition of sun from east to west, the fixed solar panel may not be able to generate optimum energy. The proposed system solves this problem by an arrangement for the solar panel to track the Sun. This paper presents the use of a solar panel mounted to a programmed servor motor to track the sun so that maximum sun light is made incident upon the panel at any given time of the day. This is better compared to the traditional method that may not be accurate always – for example, during cloudy days.Also tracking the direction,position of sun improves energy production or yeild by 40% which in turn reduces the cost and the number of panel required will be reduced.
This tracking movement is achieved by coupling a servo motor to the solar panel such that the panel maintains its face always perpendicular to the sun to generate maximum energy. This is achieved by using a programmed microcontroller to deliver pulses by sensing light intensity in periodical time intervals during daytime and gives signals to servo motor to rotate the mounted panel in one direction and then return to the start point for next day light as desired. The MSP 430 microcontroller used in this project . Furthermore, this project can be enhanced by using an RTC (Real Time Clock) to follow the sun. This helps in maintaining the required position of the panel even if the power is interrupted for some time.
KEYWORDS — Sun tracking, renewable energy, microcontroller, MSP430, data transfer control.

I. INTRODUCTION

As the non renewable energy resources are decreasing, use of renewable resources for producing electricity is increasing. Solar panels are becoming more popular day by day.Solar panel absorbs the energy from the Sun, converts it into electrical energy and stores the energy in a battery.This energy can be utilized when required or can be used as a direct alternative to the grid supply. Utilization of the energy stored in batteries is mentioned in below given applications.The position of the Sun with respect to the solar panel is not fixed due to the rotation of the Earth. For an efficient usage of the solar energy, the Solar panels should absorb energy to a maximum extent.This can be done only if the panels are continuously placed towards the direction of the Sun. So, solar panel should continuously rotate in the direction of Sun.

The process of sun tracking helps for high power generation by setting the equipment to get maximum sunlight automatically. This system is tracking for maximum intensity of light. When there is decrease in intensity of light , the system automatically changes its direction to get maximum intensity of light.we are using two LDR sensors in two directions to sense the direction of maximum intensity of light. The difference between the outputs of the sensors is given to the microcontroller unit.we are using the microcontroller for tracking and generating power from sunlight. It will process the input voltage from the comparison circuit and control the direction in which the motor has to be rotated so that it will receive maximum intensity of light from the sun.The power generated from this process is then stored in a lead acid battery and is made to charge an emergency light and is made to glow during night.

II. PRINCIPLE OF WORKING

The principle of working of the suntracking solar panel is described as follows.

The usage of solar panel to convert Sun energy into electrical energy is very popular, but due to the transition of sun from east to west, the fixed solar panel may not be able to generate optimum energy. This tracking movement is achieved by coupling a servo motor to the solar panel such that the panel maintains its face always perpendicular to the sun to generate maximum energy. This is achieved by using a programmed

microcontroller to deliver stepped pulses in periodical time intervals for 12 hours for the servo motor to rotate the mounted panel in one direction and then return to the start point for next day light as desired. The microcontroller used in this work is from the MSP 430 family.

This project employs a solar panel mounted to a programmed servo motor to track the sun so that maximum sun light is made incident upon the panel at any given time of the day. This is better compared to the other methods that may not be accurate always as the light intensity is being tracked – for example, during cloudy days. With the impending scarcity of non-renewable resources, people are considering to use alternate sources of energy. Barring all the other available resources, the solar energy is the most abundant and it is comparatively easy to convert into electrical energy.

Two light dependent resistors are arranged on the edges of the solar panel. Light dependent resistors produce low resistance when light falls on them. The servo motor connected to the panel rotates the panel in the direction of Sun. Panel is arranged in such a way that light on two LDRs is compared and panel is rotated towards LDR which have high intensity i.e. low resistance compared to other. Servo motor rotates the panel at certain angle.When the intensity of the light falling on right LDR is more, panel slowly moves towards right and if intensity on the left LDR is more, panel slowly moves towards left. In the noon time, Sun is ahead and intensity of light on both the panels is same. In such cases, panel is constant without rotation

A. Software &Hardware requirements

- Msp 430 lunch box - For controlling operations
- 2 Ldr's - For sensing Light Intensity
-
- Servo motor - Rotating the solar panel
- 10k-Resistors - Biasing
- Jumper wires - For connecting components
- Dummy solar panel - Replica of a solar pannel
- 9v-battery - To supply power
- Code Composer Studio (CCS) - IDE used for the project
- PUTTY - To interface Microcontroller with Pc Your paper must be in two column format with a space of 4.22mm (0.17") between columns.

III. CIRCUIT & BLOCK DIAGRAMS OF THE PROPOSED WORK

The Block Diagram of sun tracking solar panel is shown in the figure 3.1.It consists of 2 Ldr sensors which sense the intensity of the light and is compared using the microcontroller and correspondind signals are send to motor to rotate.The figure 3.2 shows the Circuit Diagram.

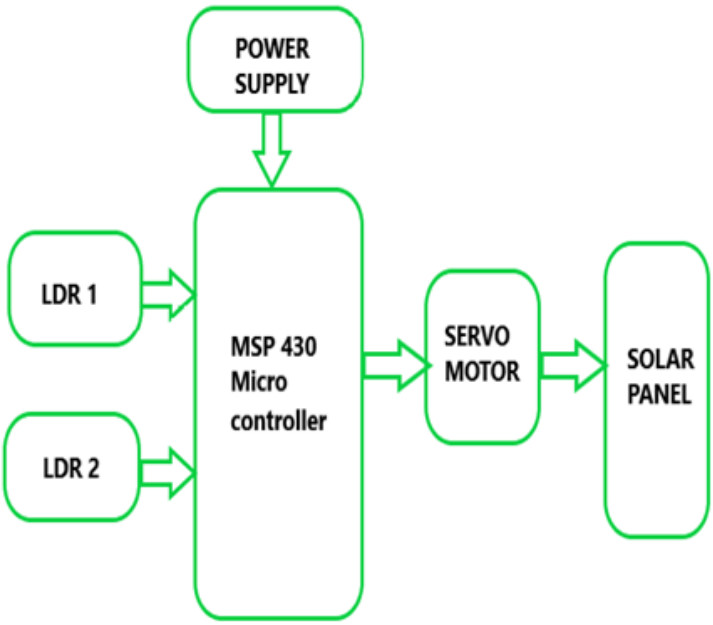

Fig.3.1 Solar Tracking System Block Diagram

We will use the native Code Composer studio platform instead of using the Arduino IDE, this way as a designer, we get more flexibility. Code Composer Studio is an integrated development environment (IDE) that supports TI's Microcontroller and Embedded Processors portfolio. Code Composer Studio comprises a suite of tools used to develop and debug embedded applications. It includes an optimizing C/C++ compiler, source code editor, project build environment, debugger, profiler, and many other features.

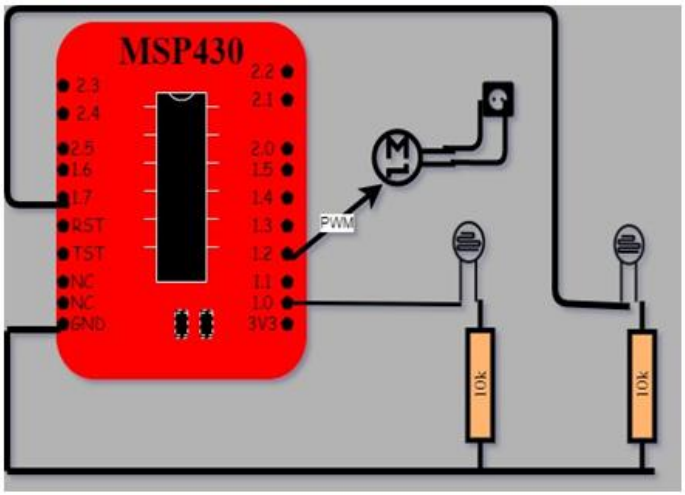

Fig 3.2 Circuit Diagram of the developed work

Explanation of Internal Registers used in MSP430:

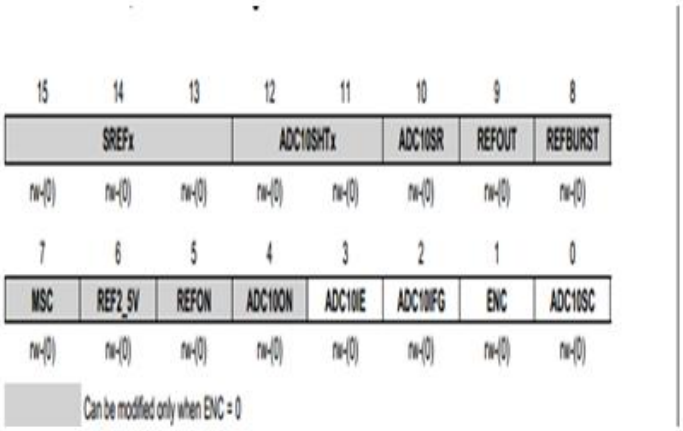

Fig 3.3 - ADC10CTL0

ADC10 Introduction

The ADC10 module supports fast, 10-bit analog-to-digital conversions. The module implements a 10-bit SAR core, sample select control, reference generator, and data transfer controller (DTC). The DTC allows ADC10 samples to be converted and stored anywhere in memory without CPU intervention. The module can be configured with user software to support a variety of applications. MSP430 uses this analog to digital converter to take analog reading and operate on them. ADC10 contains a control register ADC10CTL0, ADC10CTL1, analog input port register ADC10AE0. Using these two registers we handle the data. Memory register ADC10MEM was used to store the data.

IV. RESULTS & DISCUSSION

The Solar panel is rotated as shown in the Figures below. using the servo motor whenever there is change in the light intensity.

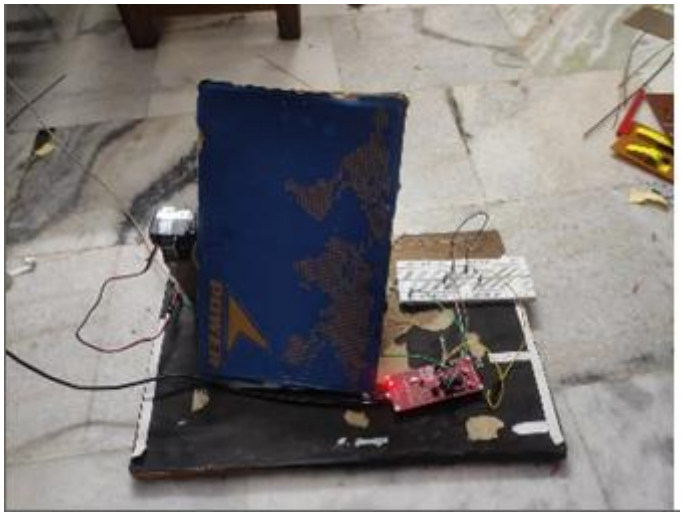

Fig.4.1 When Light is not applied

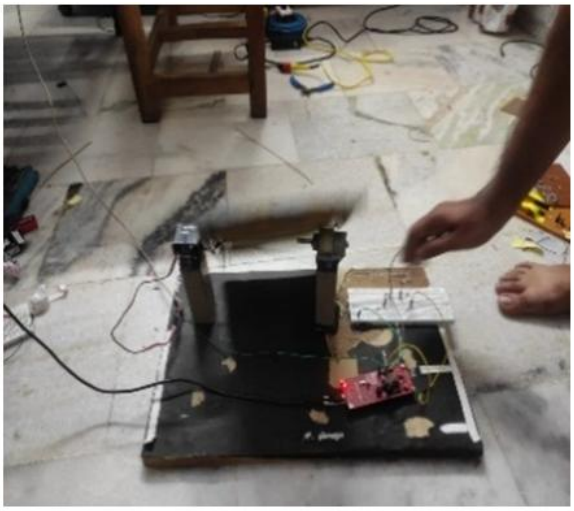

Fig. 4.2. When Light intensity is high on top side it starts moving

Fig 4.1 is the position of the solar panel with there is no light.Fig 4.2 represents the solar panel rotation when the light intensity is high on the topside. Fig 4.3 is the position of the solar panel when the light intensity is maximum. The servo motor stops when the light intensity is maximum.

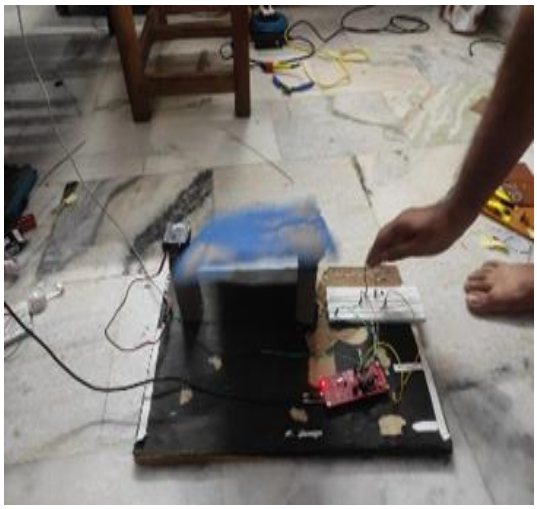

Fig. 4.3.When Light intensity is maximum it stops Moving

The Fig. 4.4 shows the solar panel rotation when high intensity of light downside. In this case the servo motor starts again its rotation. When the light intensity is again maximum it stops moving and is given in the Fig 4.5.

Fig. 4.4. When Light intensity is high on down side it starts moving

Fig.4.5. When Light intensity is maximum it stops moving

V. CONCLUSIONS

In this project, the sun tracking system is developed based on MSP 430 microcontroller.The microcontroller based circuit used in this system with a minimum number of components and the use of servo motors enables accurate tracking of the sun.It has been shown that the sun tracking systems can collect maximum energy than a fixed panel system collects and high efficiency is achieved through this tracker, it can be said that the proposed sun tracking system is a feasible method of maximizing the light energy received from sun. This is an efficient tracking system for solar energy collection.It is better compared to the other methods that may not be accurate always as the light intensity is being tracked – for example, during cloudy days.

Automatic solar tracking system offers a prototype for implementing a large array type solar tracker. This will be an expansion of mechanical as well as electronic system

Following additions can be made to the prototype to maximize the power conversion:

1. By connecting the solar panels in an array more energy can be extracted.
2. Using aluminum type of material for the assembly set up the weight upon the motors can be reduced which will automatically reduce the power consumption of the system.
3. With the monocrystalline PV panel in use the efficiency of the project can be increased.
4. Monocrystalline PV panels have also more lifetime than polycrystalline panels.
5. In Zigbee transmitter- receiver pair by interfacing range extension modules signal range can be extended up to 10 miles.

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