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PHOTO-VOLTAIC SOLAR TRACKING SYSTEM BASED ON PERIPHERAL INTERFACE CONTROLLER

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ABSTRACT

With this project, we intend to make use of the non-conventional resource to generate power. The idea behind this project is to put the solar light in use to generate power by tracking its maximum intensity. Sun, being a renewable resource is available in abundance. There is no limit to its use. By making use of this resource we lessen our dependency on conventional resource as they are limited in nature. To implement this we make use of components like LDR, PIC microcontroller, photo voltaic panel & DC motor. To achieve the maximum efficiency, we have to track the sun's maximum intensity. The microcontroller is programmed such that the solar panel tracks the solar intensity. It is programmed with the help of light dependent resistor (photo resistor) and then activates the motors attached to solar panel to align the panel so that it achieves the maximum solar intensity. The application of this generated power is the battery protection. This mechanism increases the efficiency of the solar panel and also reduces the cost. This mechanism allows us to locate the location of sun more accurately. It is a more reliable way of tracking the sun's intensity as compared to other ways as sun is available in abundance. It is cost effective and environment friendly way of generating voltage as compared to other ways namely thermal power plants and gas power plants.

Keywords: ADC, Controller, Interface, Panel, Peripheral, Photovoltaic, Solar, Tracker.

I. INTRODUCTION

Human life is being driven by the energy which is also contributing to human development. Knowing that the conventional resources are getting depleted at a very fast rate and in the coming years we will be left with very less fossil reserves. Continuous use of the fossil fuels leads to its depletion, rise of fuel prices, and increment of global warming. Global warming is a serious threat to the living of human life. Burning of fossil fuels leads to greenhouse gas emission which has a major impact on the environment. Thus we are left with the solution of using non-conventional resources namely solar energy, wind energy. The harnessing of wind energy proves to be very costly as compared to solar energy. These resources are constantly available in abundance and are eco-friendly. This solar tracker provides an easily deployed, cost effective and a solution which is reliable. It is easy to be installed and cam be transported very easily as compared to other resources. More power is obtained by tracker as compared to stationary modules. [2] The latitude, climate and the type of tracker vary the output of the tracker. They are able to enhance the maximum energy of photovoltaic cell by aligning the panel perpendicular to the sun's intensity.

II. LITERATURE REVIEW

Solar trackers can be classified as:

1. Passive thermally operated tracker

We mechanically operate passive trackers [2] and there are no electrical components present so they function more accurately and they have less cost as compared to active electrically operated model. They have a slower response in winters as the intensity of sun decreases in winters as compared to summers. They are unable to follow the seasonal altitude changes as per the seasons and have to be manually handled. Sensors and motors are not required. These trackers are incorporated with tubes positioned on either side of photovoltaic array. These tubes are filled by liquid refrigerant Freon. On the striking of sunlight on the tracker, the liquid gets expanded. The tracker is rotated according to the heavy weight as observed by the expansion of the liquid.

2. Active electrically operated tracker

In Active trackers [2] photoelectric sensors are used to determine the angle of the sun. They are more accurate and are powered by electricity. They are not generated by the sun's heat and therefore could be used in cold and winter climates. Active trackers are further classified as microprocessor and electro-optical sensor type, PC controlled date and time based, auxiliary bifacial solar cell based and a combination of these three systemsFor electrical usage, transmission lines form the backbone of power systems. With regard to reliability and maintenance costs of power delivery, accurate fault location for transmission lines is of vital importance in restoring power services and reducing wastage of time as much as possible.

On the **basis of motion** the trackers can be classified as:

1. Single axis tracker

This tracker [2] consists of one degree of freedom. They are aligned along a true north meridian. Horizontal single axis trackers, vertical single axis trackers, tilted single axis trackers and polar aligned single axis trackers are included in this type.

2. Dual axis tracker

This tracker [2] consists of two degree of freedom which act as axis of rotation and are normal to each other. Tip-tilt dual axis trackers and azimuth-altitude dual axis trackers are included in this type.

III. METHODOLOGY

From the sun's intensity, we can generate electricity with much higher efficiency. The sun keeps changing its position from dawn to dusk. The microcontroller is programmed such that maximum power is generated.

Basic Principle

The basic principle use is the use of six sensors whose operation depends upon the intensity of sunlight falling on solar panel [3]. All sensors having different functionality send their output to microcontroller AT89c52. According to this output, the microcontroller executes the predefined task written in the software.

Three conditions [3] which are to be taken care of are:

A. Normal day light condition: - We use3 LDRs to determine the maximum intensity of the light.

B. Bad weather condition: - When we observe a cloudy sky, the microcontroller is unable to take accurate decision due to the changing nature of the light.

C. Bidirectional rotation: -In the day time the tracker will rotate in one direction i.e. east to west. After the sunset, the sun again rises up from east thus, the tracker has to go in the east direction again. At this moment, we turn off the supply to the tracker till the next morning until the sun rises.

BASIC COMPONENTS OF THE SOLAR TRACKER

1. Solar Panel

Solar panel consists of solar array [1] made of polycrystalline silicon mounted on the flanges. It is the collection of photovoltaic modules connected together and used in the tracker for absorbing sunlight. Light energy of the sun is converted to electrical energy with the help of these solar panels.

2. DC Motor

DC motors are preferred to stepper motor as the former has high speed, less weight and less cost. DC motors when interfaced with a microcontroller can be used to perform various functions namely we can control the speed, direction of the motor and keep a track of how many turns a motor makes.

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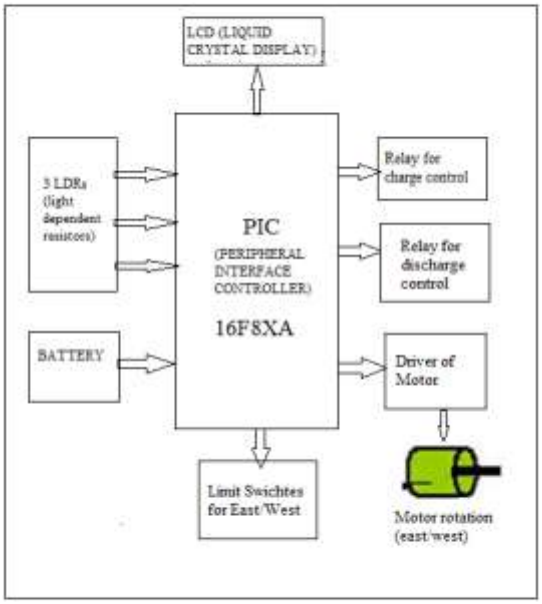

Figure 1 A Solar Tracker Prototype

3. Light Dependent Resistors

It detects the light intensity changes on the resistor's surface. On the increment of the sun's radiation falling on the LDR, the resistance of the LDR decreases. The LDR is connected in series with a resistor in order to make its use as a detecting element.

4. PIC16F87XA

It is referred to as PIC microcontrollers (Peripheral Interface Controller). It is used due to its features [4] such as:

High-Performance RISC CPU- Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory

Peripheral Features- Timer0, Timer1, Timer2, Two Capture, Compare, PWM modules, PWM max. Resolution is 10-bit, Synchronous Serial Port (SSP) with SPI™ (Master mode) and I2C™ (Master/Slave), Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection, Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only)

Analog Features- 10-bit, up to 8-channel Analog-to-Digital Converter (A/D), Brown-out Reset (BOR)

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Special Microcontroller Features-Programmable code protection, Power saving Sleep mode, Selectable oscillator options, In-Circuit Debug (ICD) via two pins

CMOS Technology- Low-power, high-speed Flash/EEPROM technology

5. A Display Unit

We use LCD to display the voltage and the current reading of the solar panel at the instant of sun's illumination.

Software Requirements: Software such as MPLAB, Languages like embedded c etc.

IV. ALGORITHM AND FLOWCHART

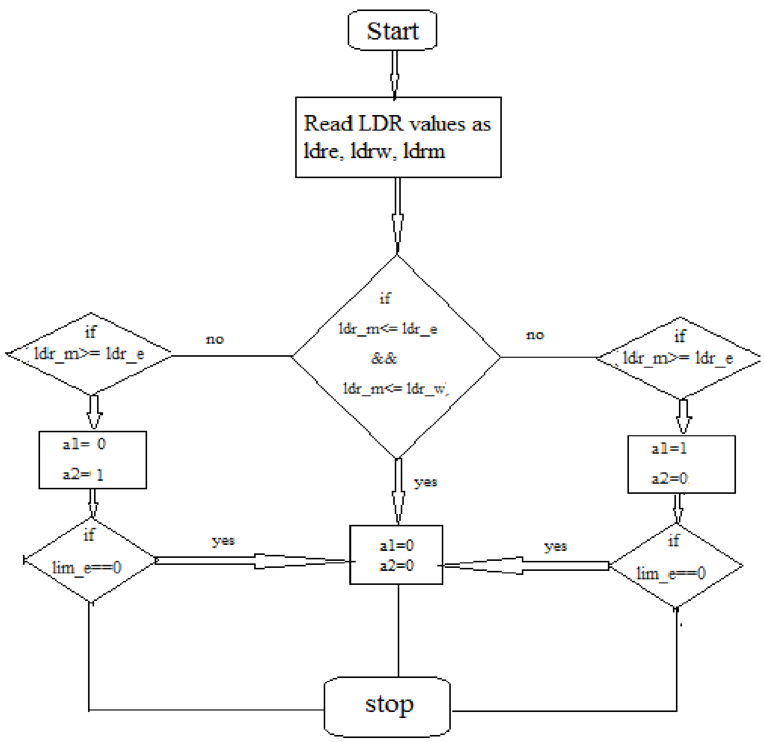

Figure 2 Flowchart of Solar Tracking

Step 1: Read the analogue value of LDR connected to port A

Step 2: This analogue value is converted to digital value via ADC in PIC

Step 3: This digital value is displayed on LCD via interfacing.

Step 4: Make port A as input port.

Step 5: The values of LDR that are read are displayed on the LCD

Step 6: Compare the values of the 3 LDRs to make the motor rotate in the required direction

V. CONCLUSION

As the demand of the fossil fuels is increasing, these are getting depleted day by day. So, there is a need of the usage of the renewable resources which is a global phenomenon worldwide. With the use of this method, we propose to make a solar array at a sufficiently perpendicular to the sun. This method provides a software working solution to track the maximum intensity of the sun. The efficiency of solar panels can be increased by 30% for single axis and 6%additionally for dual axis. With the proposal of this project, we intend to make people realize the use of renewable resource (solar energy). We have tried to get the maximum output by using this resource i.e. to get the maximum electrical energy from the available solar energy. In this paper the exact location of short circuit fault at a particular distance in the underground cable from feeder end in km can be located by using arduino 8051.For this we use simple concept of OHM's law so fault can be easily detected and repaired.

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