PV Module Traction and Monitoring the Power Generation Using Embedded System

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Abstract- **As the energy demand and the environmental problems increase, the natural energy sources have become very important as an alternative to the conventional energy sources. The renewable energy sector is fast gaining ground as a new growth area for numerous countries with the vast potential it present environmentally and economically. Solar energy plays an important role as a primary source of energy, especially for rural area. This paper aims at the development of process to track the sun and attain maximum efficiency using Arduinouno and LabVIEW for real time monitoring. The project is divided into two stages, which are hardware and software development. In hardware development, four light dependent resistor (LDR) has been used for capturing maximum light source. Two DC motors have been used to move the solar panel at maximum light source location sensing by LDR. The GUI is constructed by using LabVIEW. The performance of the system has been tested and compared with static solar panel. This paper describes the design of a low cost, solar tracking system.**

Index Terms- **Solar Tracking, Arduino Uno, LabVIEW, Temperature Sensor, RTC(Real Time Clock).**

I.INTRODUCTION

The world population is increasing day by day and the demand for energy is increasing accordingly. Oil and coal as the main source of energy nowdays, is expected to end up from the world during the recent century which explores a serious problem in providing the humanity with an affordable and reliable source of energy. Renewable energy is derived from natural processes that are replenished constantly.

Renewable energies are inexhaustible and clean. The energy comes from natural resources such as sun, wind, tides, waves, and geothermal heat. Solar energy is directly by the sun. Solar energy is radiant light and heat from the sun harnessedusing a range of technologies such as photovoltaic, thermal electricity and etc.

A solar cell (also called photovoltaic cell) is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. The majority of modules used water based crystalline silicon cells or thin film cells based on cadmium telluride or silicon. The structural member of a module can either be the top layer or the back layer.

Electrical connections are made in series to achieve a desired output voltage and in parallel to provide a desired current capability. Several types of solar cells are available. Monocrystalline solar cells, Polycrystalline solar cells, Amorphous Silicon (a-Si) solar cells, Cadmium Telluride (CdTe) solar cells.
LabVIEW (short for Laboratory Virtual Instrument Engineering Workbench) is a system-design platform and development environment for a visual programming language from national instruments. The software is perhaps the most important component of the system. The main routine, or VI, provides a front panel interfacethat allows the operator to control and monitor system. It callsto perform functions that gather analog input, send analog output.

The front panel is what allows the operator to control and monitor the process. It includes software controls and indicators that mimic physical controls such as buttons, sliders, LEDs, and charts. The block diagram is a graphical representation of the underlying software program. It consists of icons that represent typical programming elements such as constants, variables, subroutines, and loops. Arduino is a single-board microcontroller, intended to make the application of interactive objects or environments more accessible. It's an open-source physical computing platform and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino has some advantages for educational and interested recreational over other systems like Inexpensive, open source and extensible software, extensible hardware.

The LabVIEW interface for Arduino (LIFA) allows user to control sensor and acquire data through an arduino microcontroller using the graphical programming environment LabVIEW.Arduino microcontroller acts as I\O engine that interface with LabVIEW VIs through a serial connection. This helps to move information from Arduino pins tolabview without adjusting the communication, synchronization. using the common open,read/Write,close convention in LabVIEW,we can access the digital,analog,pulse-Width-modulated,I2C,and SPI signals of the Arduinomicrocontroller.The LabVIEW software package from National Instruments is used to develop the custom data acquisition.

II. SOLAR TRACKER

Sunlight has two components, the direct beam that carries about 90% of the solar energy, and the diffuse sunlight that carries the blue sky on a clear day and increases proportionately on cloudy days. As the majority of the energy is in the direct beam, maximizing collection requires the sun to be visible to the panels as long as possible. A typical solar panel converts only 30 to 40 percent of the incident solar irradiation into electrical energy.

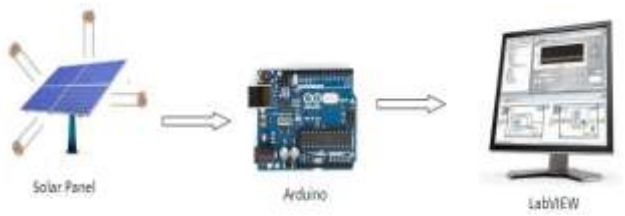


Fig.1. Block diagram of system

This paper proposes the use of dual-axis solar tracker.The paper continues with specific design methodologies pertaining to Light Dependent Registor (LDR), DC motors, solar panel, and a software.The dual-axis tracker is a very compatible system to be develop with the usage of LabVIEW Interface for Arduino. The controller receiver an analog input from the Light Dependent Resistor (LDR) and converts it into digital singal by Analog-to-Digital converter.The program is designed in the environment of LabVIEW.The output given to the DC motor will determine the movement of the solar panel.

III.METHODOLOGY

The main impulsion is to design a high quality solar tracker.This paper is divided into two parts; hardware and sofware. It contains of three main constituent which are the inputs, controller and the output as shown in Fig 1.A photo resistor or Light-dependent resistor(LDR) or photocell is a Light Dependent resistors are very useful especially in light/dark sensor circuit. Normally the resistance of an LDR is very high,sometimes as high as1000 000 ohms, but when they are illuminated with light resistance drops dramtically.LDR's have low cost and simple structure.

A DC motor relies on the fact that like magnet poles repels and unlike magnet poles attract each other. DC motor consists of one set of coils,called armature winding, inside another set of coils or or a set of permanent magnets, called the stator.

Applying a voltage to the coils produces a torque in the armature,resulting in the armature,resulting in motor. DC motor with gear arrangment have been selected since they are cheaper than servo and stepper motor.L239D IC having two channel has been used to achieve the desired speed in moving the solar panel. The most important effect of using DC motor with gear mechanism in dual axis tracking system is getting mechanical stabilityof solar pane without spending much power for DC motor. The Dc motors can turn either clockwise or anticlockwise direction adepending upon the sequence of the logic signals. The sequence of the logic signals depends on the difference of light intensity of the LDR sensors.

The principle of the solar tracking system is done by Light Dependent Resistor (LDR).Four LDR's are connected to Arduino analog pin AO toA4 that acts as the input for the system. The built-in analog-to-digital converter will convert the analog value of LDR, Arduino as the controller and the dc motor will be the output. LDR1 and LDR2, LDR3 and LDR4 are taken as pair.if one of the LDR in a pair gets more light intensity than the other, a difference will occur on node voltages sent to the respective Arduino channel to take necessary action.The DC motor will move the solar panel to the positoin of the high intensity LDR that was in the programming.

Algorithm had been constructed using LabVIEW programming.The algorithm of the program is given as steps in the following

Step 1. Read all analog voltages from analog channels
Step 2. If all voltages are equal then motor will be in stop position.
Step 3. If LDR1>LDR2 Then the top motor will rotate anticlockwise.
Step 4. If LDR1<LDR2 Then the top motor will rotate anticlockwise.
Step 5. If LDR3>LDR4 Then the down motor will rotate clockwise.
Step 6. If LDR3<LDR4 Then the down motor will rotate anticlockwise.

IV.RESULT AND DISCUSSION

Data collected through the monitoring system will be analyzed to identify the features of the effective solar system.The sun position is one of the main factors that caused instability measurement output voltage.The solar panel will not be able to achive a maximum illumination from the sun from its standard position.As referring to graph,the output voltages for panel are slightly fluctuated. Thecomparision between static and moving panels with trackr produced higher output voltages as it gets optimum absorption.Fig.4.shows the graph for a period of interval obtained from the experiment.

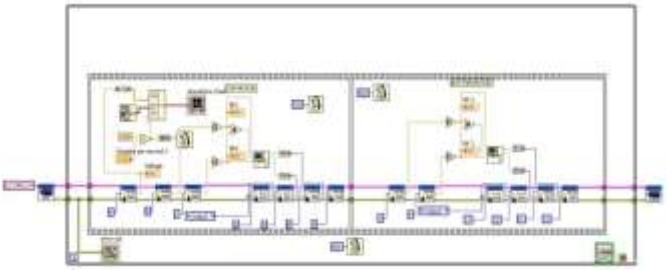
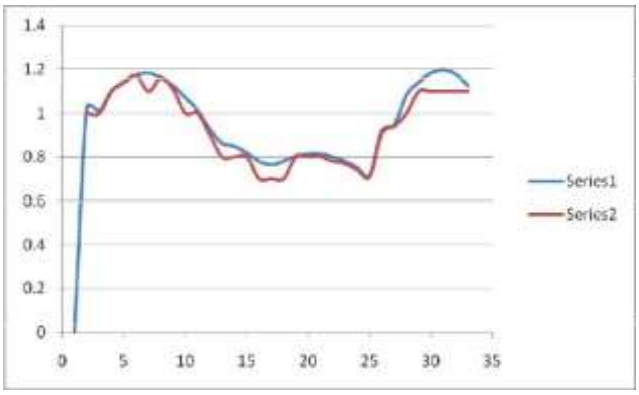


Fig.2.Block diagram of system in LabVIEW

Fig.3.Output voltage comparative of solar panel



Based on the results obtained, it can be concluded that the system will react at their best with a constant voltage is

produced. Arduino Uno turned outto be an easy platform implement the control strategy.

V.CONCLUSION

The progress in science & technology is a non-stop process new things and new technology are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place.

The proposed system based on Atmel microcontroller is found to be more compact, user friendly and less complex, which can readily be used in order to perform. Several tedious and repetitive tasks. Though it is designed keeping in mind about the need for industry, it can extended for other purposes such as commercial & research applications. Due to the probability of high technology used this is fully software controlled with less hardware circuit.The features make this system is the base for future systems.

The principle of the development of science is that "nothing is impossible". So we shall look forward to a bright & sophisticated world.

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