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Automatic Solar Tracking and Monitoring System Using LABVIEW

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ABSTRACT: The world population is increasing day by day and the demand for energy is increasing accordingly. Since oil and coal are getting depleted and it cannot be replenished, we opt for an alternative 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 quite simply the energy produced directly by the sun.
This project 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 Graphical User Interface (GUI) is constructed by using LabView

KEYWORDS: Arduino, LabVIEW, Solar monitoring, Solar tracking.

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 nowadays, 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. Electricity losses in India during transmission and distribution are extremely high and vary between 30 to 45%. 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 quite simply the energy produced directly by the sun. Solar energy is radiant light and heat from the sun harnessed using a range of technologies such as photovoltaic, thermal electricity and etc.Today, solar energy accounts for about 0.4% to total energy generation compared to energy from thermal and nuclear plants. Solar energy if used efficiently will not only meet the power shortage but also reduce the burden on our natural oil reserves. Introduction of solar panels at homes is a solution. This project aims at the development of process to track the sun and attain maximum efficiency using Arduino uno 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.

Various tracking methods have been proposed and validated around the world in previous works and each of them has its pros and cons in terms of efficiency, complexity and cost. Normal solar panels have a full day efficiency of about 45-50%. Introduction of single axis and dual axis trackers would increase the overall efficiency to about 30% more than what we already have. Using the power generated by solar power in conjunction with the existing power system of household the per capita power consumption from natural resources can be reduced. The cost recovery of the entire unit

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is possible within 3-4 years without any appreciable maintenance charges. Unless high efficient solar panels are invented, the only way to enhance the performance of a solar panel is to increase the intensity of light falling on it. Apparently, the difference in solar tracking efficiency varies greatly among the countries reported due to different geographic location, local landscape and climate. Moreover, the efficiency of solar tracking in the same region during different seasons also differs significantly. The efficiency normally top in the summer, with a marginal performance in winter and the spring and fall have average efficiency. Solar tracking system is a combination of electronics and mechanical system for aligning the Photovoltaic (PV) panels to the position of the sun. Efficiency of solar tracker works reported around the world the sun will fall on the solar panels and leads to maximum electrical energy gained. Basically, solar trackers can be categorized in to three types which are active tracker, passive tracker and chronological tracker. Electrical motors, light sensors and mechanical parts such as bearing and gears together with an electronic controller are used to direct the active tracker towards the sun's position. A preset algorithm for tracking the sun would be programmed into the controller beforehand. On the other hand, a passive tracker utilizes a compressed gas fluid with low boiling point that would become imbalance and tilt to the side that received more sun radiation. Consequently, the passive tracker will move accordingly until the gas fluid is balance again. Chronological tracker tracks the sun by computing the solar time (hour angle) which changes as the earth rotates around the sun and changes on a preset interval. There are prior designs which use different approaches on sun tracking mainly on dual-axis solar tracking.In the proposed method we have not used any sensor.

Fig.1 Basic Block diagram of proposed system

This paper proposes the use of dual-axis solar tracker. The paper continues with specific design methodologies pertaining to Light Dependent Resistor (LDR), DC motors, solar panel, and a software. The dual-axis tracker is a very compatible system to be developed with the usage of LabVIEW Interface for Arduino. The controller received an analog input from the Light Dependent Resistor (LDR) and converts it into digital signal 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.

II. LITERATURE SURVEY

From the literature, various tracking methods have been proposed and validated around the world in previous works and each of them has its pros and cons in terms of efficiency, complexity and cost. Apparently, the difference in solar tracking efficiency varies greatly among the countries reported due to different geographic location, local landscape and climate. Moreover, the efficiency of solar tracking in the same region during different seasons also differs significantly. The efficiency normally top in the summer, with a marginal performance in winter and the spring and fall have average efficiency.

Malaysia as a country which lies at 1° to 7° north of equator has an equatorial climate and long hours of sunshine throughout the year. There are enormous potential for solar energy to be success at this land. However, the potential for the DAST is rarely reported and investigated in this region. Hence, a quantitative advantage of DAST over SSS in this country is still remains unknown although the consistently long sun hour suggested a promising outcome. Solar tracking system is a combination of electronics and mechanical system for aligning the Photovoltaic (PV) panels to the position of the sun. Efficiency of solar tracker works reported around the world the sun will fall on the solar panels and leads to maximum electrical energy gained.

Basically, solar trackers can be categorized in to three types which are active tracker, passive tracker and chronological tracker. Electrical motors, light sensors and mechanical parts such as bearing and gears together with an electronic controller are used to direct the active tracker towards the sun's position. A preset algorithm for tracking the sun would be programmed into the controller beforehand. On the other hand, a passive tracker utilizes a compressed

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III. METHODOLOGY

The main impulsion is to design a high quality solar tracker. This paper consists of two parts; hardware and software. It consists of three main constituent which are the inputs, controller and the output as shown in Fig 1.A Light-dependent resistor (LDR) is a light-controlled variable resistor. They are very useful especially in light/dark sensor circuits. Normally the LDR resistance is very high, up to 1000 000 ohms, but through illumination with light, resistance drops dramatically. LDR's are inexpensive and has a simple structure. A DC motor relies on the fact that like magnet poles repels and unlike magnetic poles attracts each other.

DC motors consist of one set of armature winding, inside another set of coils or a set of permanent magnets, called the stator. Voltage applied to the coils produces a torque in the armature, resulting in motion. DC stepper motor is being used here.L293D IC having two channels is used to drive the DC motors. A DC stepper motor driver is used to achieve the desired speed in moving the solar panel .The Dc motors can turn either clockwise or anticlockwise direction depending 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 Dependant Resistor (LDR). Four LDR's are connected to Arduino analog pin AO to A4 that acts as the input for the system. The built-in Analog-to-Digital Converter will convert the analog value of LDR and convert it into digital. The inputs are from 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 position 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 clockwise.
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 from Labview will be analysed 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 achieve a maximum illumination from the sun from its standard position. As referring to graph, the output voltages for panel are slightly fluctuated. The comparison between static and moving panels shows that the solar panel with tracker produced higher output voltages as it gets optimum absorption. Fig 4. Shows the graph for a period of interval obtained from the experiment.

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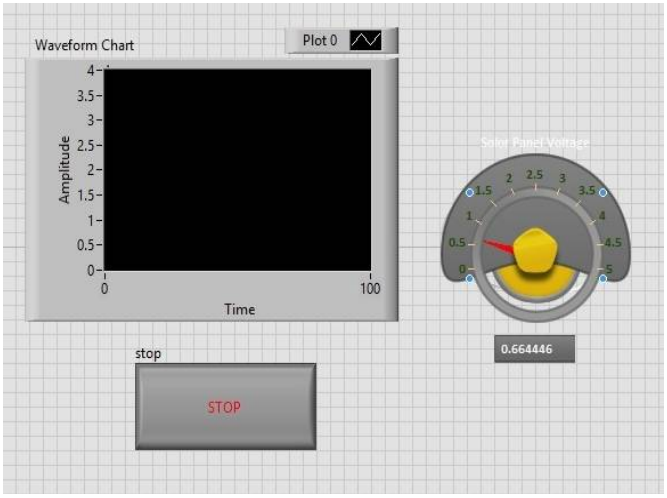

Fig.2 Front panel of LABVIEW

In the fig 2, The waveform chart shows the real time monitoring of solar panel voltage and the voltmeter shows the panel voltage. In the fig.3, it shows the structure of the front panel. It also shows the pins and ports of the Arduino board.

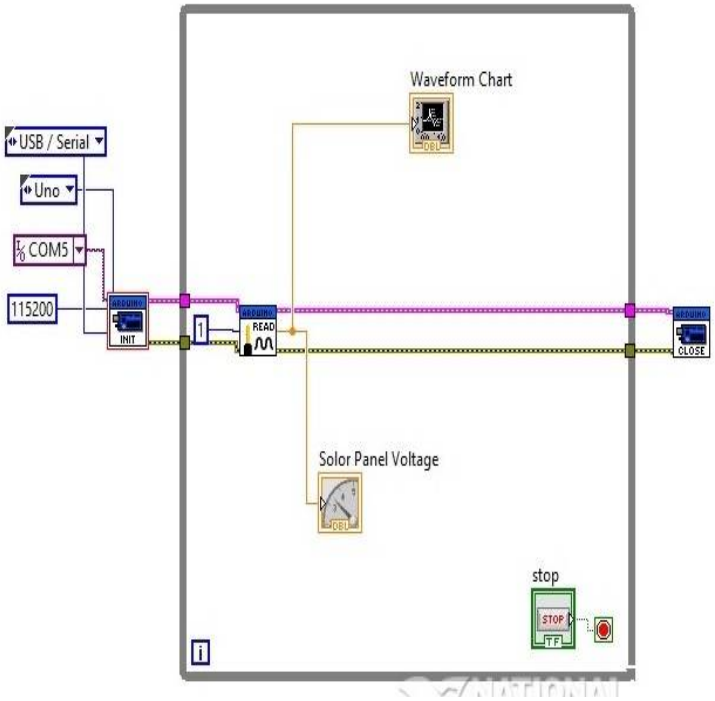

Fig.3 Back panel of LABVIEW

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 out to be an easy platform implement the control strategy.

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V.CONCLUSION

This project which was enhanced with the scope of conserving the conventional fuels is successfully completed. The main objective, to increase the usage of renewable energy source for power generation is perfectly implemented. Taking into consideration the future energy scenario in the world, solar energy would be a major energy source. Apparent advantage of dual axis solar tracker occurs on morning and evening session due to the ability of dual axis solar tracker to follow the sun's position throughout the day as compared to the static position of Static solar system.We wish that our project would be a mini encyclopaedia for those who want to implement the above system.

VI.ACKNOWLEDGEMENT

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