# SINGLE AXIS SOLAR PANEL CONTROLLER, POWER OPTIMIZATION AND MAINTENANCE USING LAB VIEW

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**Abstract**
**The Population of the world is increasing day by day and the demand for energy is also increasing rapidly. Since coal and oil are getting depleted and it cannot be replenished, and an alternative source of energy is Renewable energy which is derived from natural processes and those are replenished constantly. The energy comes from the natural resources such as sun, tides, waves, and from geothermal heat. Solar energy is quite simply, the energy produced directly by the sun. Sun is a very abundant source of power.**
**This paper aims at the development of automatic control over the solar panel, which will result in getting complete sun rays from all directions to attain maximum efficiency. This is achieved by giving movement or rotational power is given to the panel by using stepper motor and light dependent resistor (LDR) are placed at arch and depending on the LDR's intensity the stepper motor will rotate. The solution was developed as a virtual instrument, using the graphical programming environment, Lab VIEW. This allows for fast deployment, versatility and scalability**
**Keywords: My-DAQ, Lab VIEW, servo motor, LDR sensor, Solar panel.**

## I.INTRODUCTION

The Population of the world is increasing day by day and the demand for energy is also increasing rapidly. The main source of energy is Oil and coal which is expected to be end up from the world during the recent century which will creates a serious problem in providing the humanity with a reliable and affordable source of energy. Electricity losses in India during transmission and distribution are extremely very high and it is varying between 30 to 45%, and also the concern about the fact of environmental pollution pushed researchers to explore new technologies for the production development of electricity from clean sources, renewable such sun, tides, waves, and from geothermal heat, etc. Solar energy is the oldest primary source of Energy; Sun is a very abundant source of power. It is a source of clean, renewable energy and it is found in abundance in every part of the world. The solar energy is possible to convert it into mechanical energy or electricity with adequate efficiency. The prime importance for the development of a solar energy system is depends on the Information tracking about the quality and amount of solar energy available at a specific point location. However, the amount of electricity energy that is obtained is directly proportional to the intensity of sunlight falling on that panel. In order to obtain a larger amount of solar energy the different types of photovoltaic systems have been studied by a large number of scientists and engineers.

In general, there are three possible ways to increase the capacity of photovoltaic systems. The first one is to increase the efficiency of power which is generated from the solar cells, the second method is related to obtaining the efficiency of the control algorithms for the energy conversion, and the third approach deals to adopt a tracking system with achieving of the maximum solar energy. The interesting in the photovoltaic tracking systems as a new method for studying and teaching increased in the Past years. A vast number of papers, such as [2] and

[1], describe a consistent number of photovoltaic panel solar tracker applications and their area of employment. Paper [4] describes the potential system benefits of simple tracking solar system design based on a stepper motor and light sensor. In [3] a single-axis sun-tracking system with the help of two sensors was designed. The data acquisition, monitor and control of the mechanical movement of the photovoltaic module were implemented based on a programmable logic-controlling unit.

This paper is an attempt to come up with an idea of inexpensive tracking system so that is can be used extensively. Also it needs to be robust so that the entire device can be left alone in remote areas, without requiring further repairing. The problem that exists with such devices is the tracking system. Using of an IR sensor for tracking is generally very expensive. This adds to the start-up price. Also if in any case the sensor may be damaged or does not get the proper input then the entire system will stop functioning. Normal solar panels have a full day efficiency of about 45-50% . Introduction of single axis trackers would increase the overall efficiency to about 35% more than what we already have. Using the power generated by the solar power in conjunction with the existing power system of household the per capita power consumption from natural resources can be reduced. The cost of recovering the entire unit is possible within 2-4 years without any additional maintenance charges. Unless if high efficient solar panels are invented, the only way to enhance the performance of a solar panel is to increase the light intensity which is falling on it.

## II. METHODOLOGY

The block diagram that has shown in Fig. 1 shows the proposed method in which the My-DAQ is the most important parameter. At initial stage the setup are done by setting up the hardware of the solar panel. The solar panel will be fixed on a frame which will be free to move. The solar panel fixed on a frame is basically rotated by the help of servomotor. The Light dependent resistor(LDR) sensors around the frame will decide the position of that panel. The signals from the sensors will be fed through the DAQ device to the PC. The position of the panel will be passed to the My-DAQ unit and based on the position the controller unit will send the signal to servo motor to set the position of the panel respect to the day time

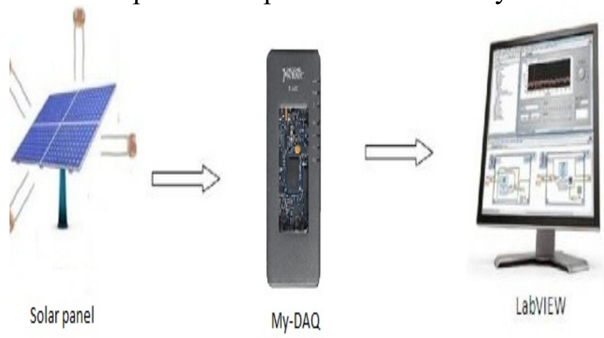


Fig.1 Basic Block diagram of proposed system

### *A. Calculation of Solar Position*

In order to understand how to obtain the energy from the sun, one must be able to predict the location of the sun which is relative to the collection device. In this part it describes the all required necessary equations by use unique vector approach. This approach will be used in this work to develop the equations for the sun's position relative to a tracking solar collector. Assuming that which is related to the tropical zone, where solar panels are most effective one and there is about 10 hours sunshine every day.

Total angle to be covered=180-150º

Time taken for the sun to travel from sunshine to Sunset= 10 hours= 10 X 60= 600mins

Degree travelled per minute = 180/ 600 mins

= 0.3°/min

Which is the too small an angle to account for, so we take a minimum angle which should be at least 5 degrees for each pulse that is to be given to the servo motor to rotate.

∴ Time after which each pulse is to be given= 5÷ 0.3 =16.777 min

Thus a pulse is to be given every 17 minutes for the solar panels to properly track the sun.

To make the tracker more accurate we have to modify the programming so that the hours of sunshine as given in the program is changed every 14 days by doing adding or subtracting 20 minutes to the total hours of sunshine, depending on the time of setting up of the device. After the sun sets the panels have to be reset their initial position to allow further tracking the next day.

### *B. LDR* Sensor

The block diagram that has shown in Fig. 2 shows the working method of LDRsensors. A photo resistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

A photo resistor (light-dependent resistor) is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high as several me ohms (MΩ), while in the light, a photo resistor can have a resistance as low as a few hundred ohms. If incident light on a photo resistor exceeds a certain frequency , photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photo resistor can substantially differ among dissimilar devices. Moreover, unique photo resistors may react substantially differently to photons within certain wavelength bands.

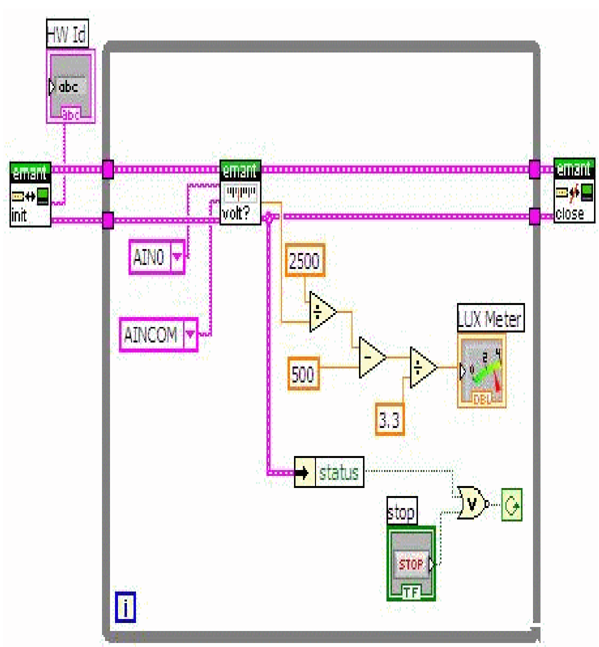


Fig.2 Basic Block diagram of LDR Sensors

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

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 towards clockwise.

Step 4.If LDR1<LDR2 Then the top motor will rotate towards anticlockwise.

Step 5. If LDR3>LDR4 Then the down motor will rotate towards clockwise.

Step 6. If LDR3<LDR4 Then the down motor will rotate towards anticlockwise.

### *C.* Block diagram of the LabVIEW code

Fig. 3 shows the block diagram of the LabVIEW code generated for the purpose of monitoring. The signal from DAQ assistant is given to an array which is indexed in the next step. The DAQ used is NI USB 6221. It has 16 analog input channels. We have used 6 of them. They have to be configured for a maximum of +/- 10KΩ range. The array is next passed to the maximum and minimum function. As explained above, the LDR with minimum resistance is to be considered. The index option gives us the required position. This value is an integer and is passed to a switch case structure which in turn switches ON the correct LED depending on the position of the sun. Real time monitoring of the power could also be done, provided that the value is less than that of the safe operating of the DAQ card.

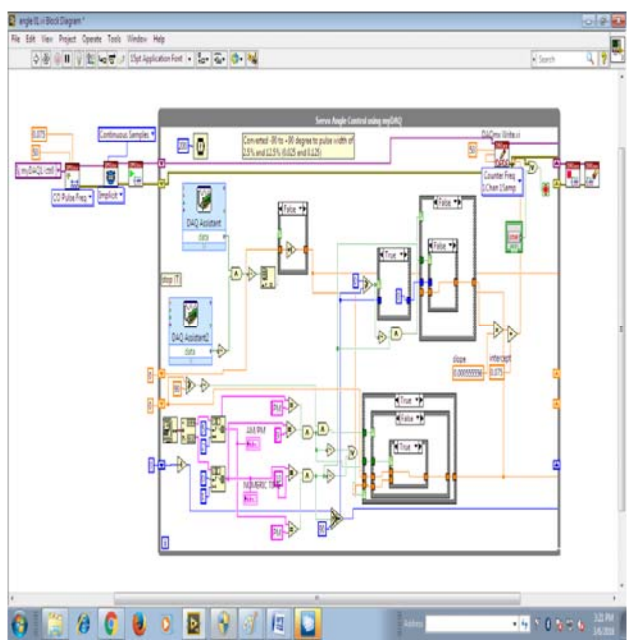

Fig.3 Block diagram of the Lab VIEW code

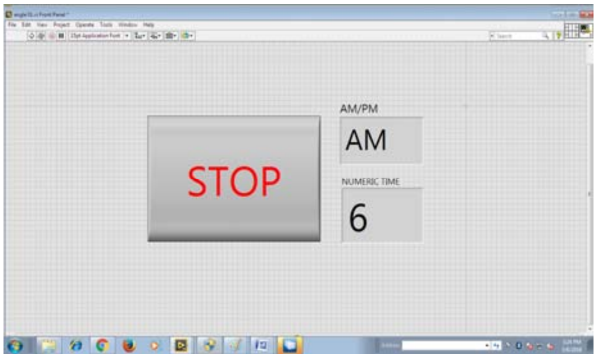


Fig.4 Front panel Block diagram of the LabVIEW code

## III. RESULT ANALYSIS

The tracking system was successful as theoretically suggested. The net power generation is increased drastically specially during the morning and afternoon hour.

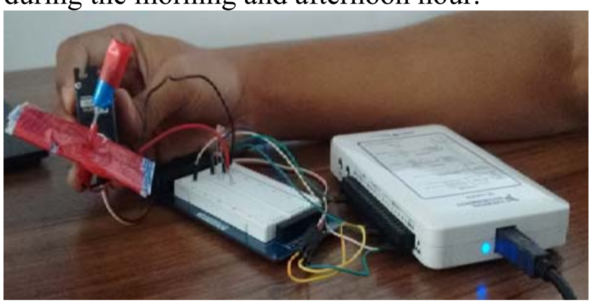

Figure 5. Tracking system installed in a solar panel

This Fig. shows the tracking system is implemented on a single panel. The solar panel is fixed on a frame which is free to rotate and the shaft of the frame is connected to the motor. The motor will be controlled by the microcontroller unit based on the signal coming from the LDR sensors. The Fig. 6 was captured at 3:00 PM. It can be seen that the solar panel is facing the sun in the most optimum position possible

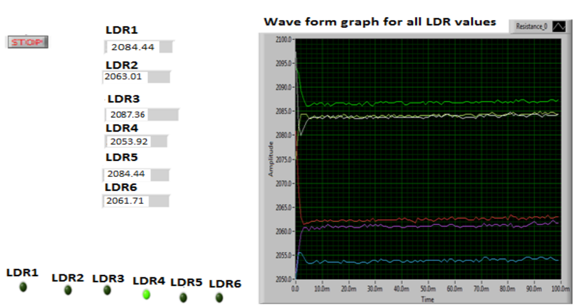


Figure 6. Front panel of monitoring system

From Fig. 6 it can be seen this is the real time monitoring part for the position of the sun. LDR 4 has been exposed to direct sunlight so it has the minimum resistance; correspondingly the LED for LDR 4 is glowing. This system can be used to monitor the solar position.

## IV.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 Overall, solar trackers are highly efficient installations and are a great fit for both large and small project sites given the proper location and site conditions. So all in, it will be generating a profit while generating clean energy. The efficiency of the system can be further increased by considering dual axis tracking to cover north to south movement of the sun.

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