Automation and design of solar tracking system by using NI Lab VIEW

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***Abstract* - As the world population is increasing gradually the need for energy is increasing equally. Every day we depend on energy for the purpose of electricity, hot water and fuel for automobiles. Majority of this energy come from fossil fuels, such as coal, oil and natural gas. These are a non renewable energy source, which means that if we use them all up, we can never get more during our life time, so it is important that we use other energy sources, like renewable energy sources these are energies that can be used again and again such as sunlight, water and wind.**

The main aim of our project is to absorb maximum solar energy from the solar panel. The solar tracker is the one which traces the sun's movement continuously, such that maximum amount of sunlight falls on the solar panel which we have designed. The design has two parts, hardware and the software. A hardware part includes servo motor, arduino Uno, solar panel, charge controller and battery. The Graphical User Interface (GUI) is built using the Lab View in the software part.

Keywords: Lab View, Arduino Uno, Servo motor, solar panel, Battery and Diode.

I. INTRODUCTION

As the world population is increasing gradually the need for energy is increasing equally. Non renewable resources like coal which are widely used now a day are getting depleted and cannot be replenished. So we go for renewable resources. Renewable resources are the one which gets regenerated over short interval of time. This type of resource is used today to make electricity where other power supplies are absent .One of the main renewable resource is solar energy. It is the energy which the earth receives from the sun that can be converted to other forms of energy and is now in a great demand when compared to non renewable resources. The main objective of this proposed work is to improve solar trackers. They are classified into three types: active trackers, passive trackers and chronological trackers**.** Active trackers are the one which traces sun's direction from west to east with the help of electronic sensors and motor or actuator drives. At the time of cloudy conditions, the tracker fixes itself to the brightest area of the sky to capture the maximum amount of sun's radiation.

Passive tracker is the one which uses a compressed gas fluid with low boiling point and tilts to the side that receives more sun radiation. Chronological tracker are the one which traces the sun by calculating the solar time, which changes as the earth rotates around the sun and changes on a present interval. In this proposed paper chronological trackers are used.

The software used to implement the solar tracking system is NI LabVIEW. It is computer aided software for graphical representation.

II. METHODOLOGY

SOLAR TRACKER is the one which changes the position of the panel in a way that makes the sun's rays to fall perpendicular to the panel so that the efficiency of the system can be improved. The sun can be tracked exactly with the use of single axis or dual axis tracking.

Single Axis Tracker: In this tracking system, the panel rotates around the centre axis. These consist of horizontal single axis tracker and horizontal single axis tracker with tilted modules, vertical single axis tracker and vertical tilted single axis trackers and polar aligned single axis trackers. The position of the module with respect to the tracker axis is signified at the time of designing module. These trackers also have many other applications.

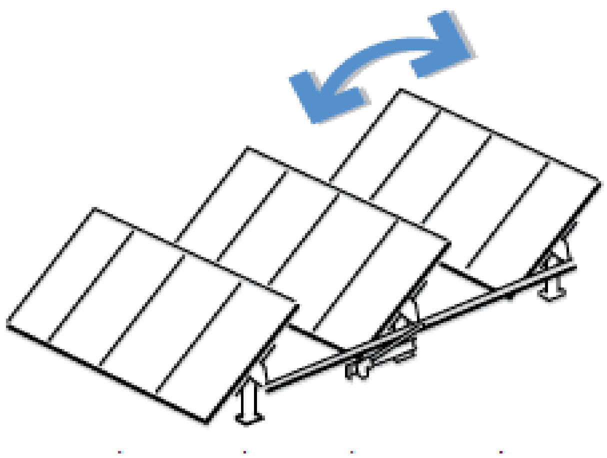

Fig. 1: Single Axis Tracker

Dual Axis Tracker: These tracking system involves both horizontal and vertical axis, by using which the sun's apparent motion can be tracked anywhere in the world. These tracker tracks the sun's motion in all four directions that is from east to west and as well as from north to south for added power output.

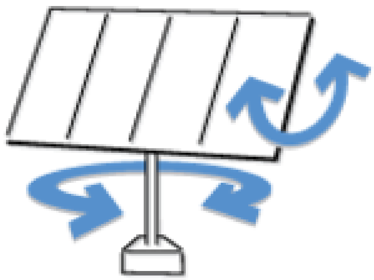

Fig. 2: Dual Axis Tracker

Primary axis is the one which is considered with reference to the ground and the secondary axis is the axis which is considered with reference to the primary axis.

III. OBJECTIVE

- Control of servo motor.
- Fixing the solar panel in x y plane with respect to earth's movement.
- Finding the maximum voltage with respect to axis point and orients solar panel towards the sun.
- Use valuable dc resource for home appliances and monitor it through charge inverter.

IV. BLOCK DIAGRAM

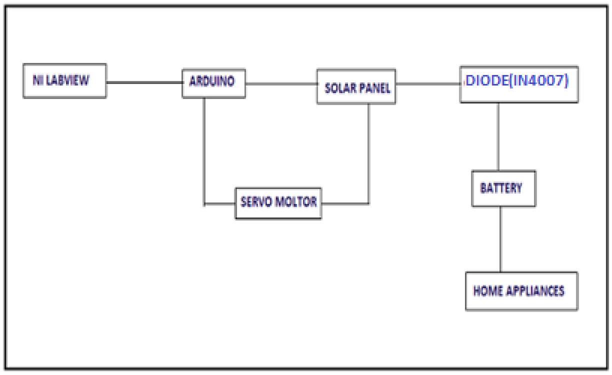

Fig. 3: Block diagram of Solar Tracking system

Figure 3 shows the Block diagram of solar tracker which involves NI Lab VIEW where the coding for the control of servo motor and solar panel is done. Initially input is sent to arduino which rotates the solar panel using servo motor. Output of solar panel is sent to arduino and data is analysed using lab view. After determining the maximum voltage, servo motor receives signal from arduino, and solar panel aligns its position where the intensity of light is maximum. Energy generated is stored in battery using diode and further used for home appliances. The design has two parts hardware and software.

Hardware part includes Servo Motor, Solar panel, Diode and Battery. Servo motors are arranged in such a way that it controls the motor speed at high torques. It utilizes power for its speed of rotation or motion. The major types of Servo motor are – 1. DC Servo motor, 2. AC Servomotor. Servo motor has feedback devices and hence errors are detected by encoders. This also increases system performance and has control mechanism using feedback system. Here servo motor has been used to step the solar panel at maximum light intensity.

Fig. 4: Servo Motor

Solar panel Features

- Dimensions: 180x90 mm
- Typical voltage: 5 V
- Typical current: 260 mA
- Maximum load voltage: 9 V
- Model number: DS-A-1.3

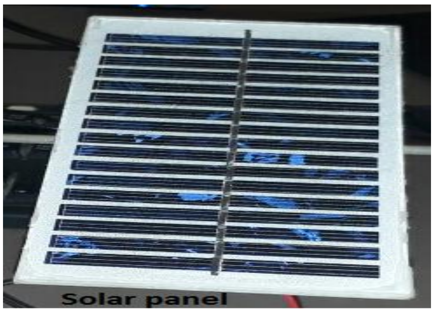

Fig. 5: Solar Panel

Function: Servo motor sweeps solar panel from 30 to 180 degree while recording voltage value in an array for 30 degree each and will step the solar panel to the location where the intensity of light is high.
Battery: 6v battery is used. It has long life and can be charged once it's empty. Shock, vibration, and heat resistant battery case.
Type: sealed lead acid battery

Fig. 6: Battery

Software Part includes NI Lab View. NI Lab View: It is a graphical representation and differs from other languages like C, C++, and JAVA etc. Lab View programs have 3 components: block diagram, front panel, and connector panel.
Block Diagram holds graphical source code. Front diagram is constructed by using controls and indicators. Connector panel holds structures and functions that perform operations on control and supply data to indicators.

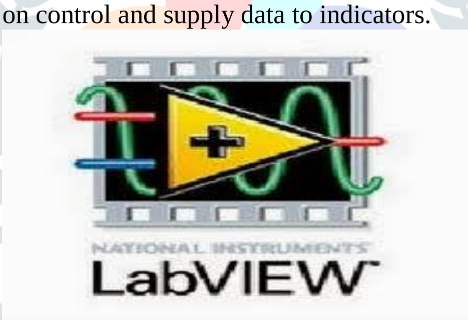

Fig. 7: NI Lab VIEW

V. ALGORITHM

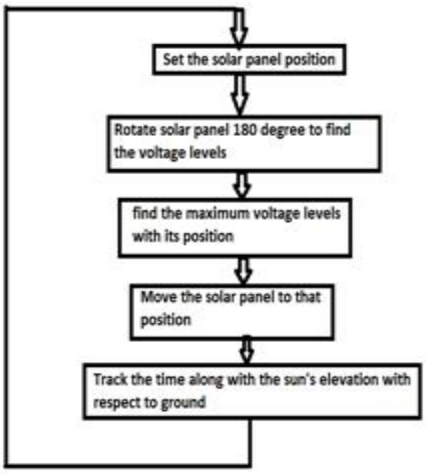

Fig. 8: Algorithm for Solar Tracker

Brief description of the algorithm:
[1] Set the solar panel to its initial position.
[2] Rotate the solar panel 180 degree to find the voltage levels.

[3] Compare the voltages and find the maximum voltage level with its position.
[4] Allign the solar panel to its maximum voltage level position where the intensity of light is high.
[5] Track the time along with the sun's elevation with respect to ground.
[6] Repeat the procedure as sun moves to different position.

VI. RESULT AND DISCUSSION

Data extracted from the Lab View are examined to indicate the characteristics of the effective solar system. We know that earth keeps rotating around the sun, thus to gain maximum voltage suns position is important. More the intensity of light falls on solar panel more will be the output voltage. If the panel is static then the intensity of light on panel decreases and the hence the resulting output voltages will also be low. So moving panels are more efficient than the static panels.

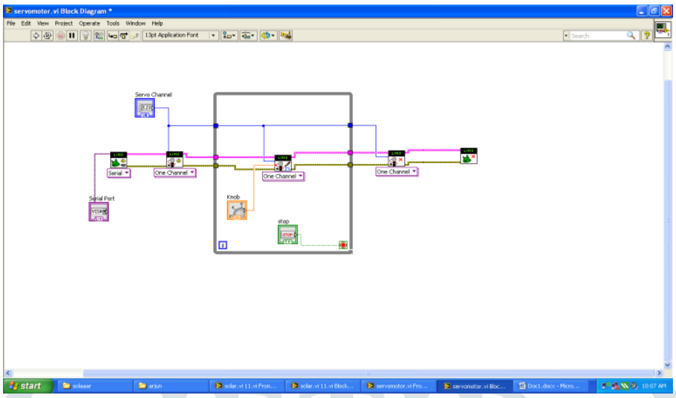

Fig. 9: Block diagram of servo motor program

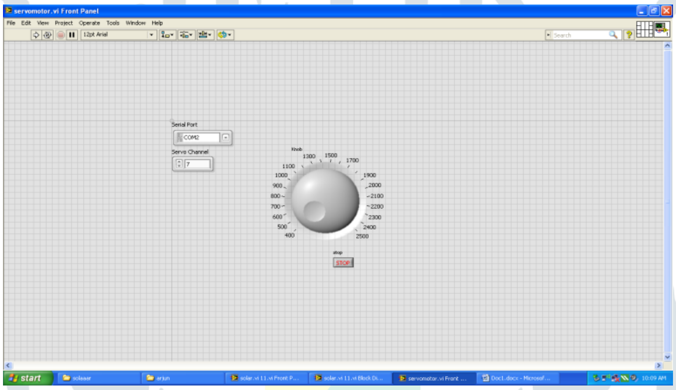

Fig. 10: Architecture of the front end panel of Servo motor program

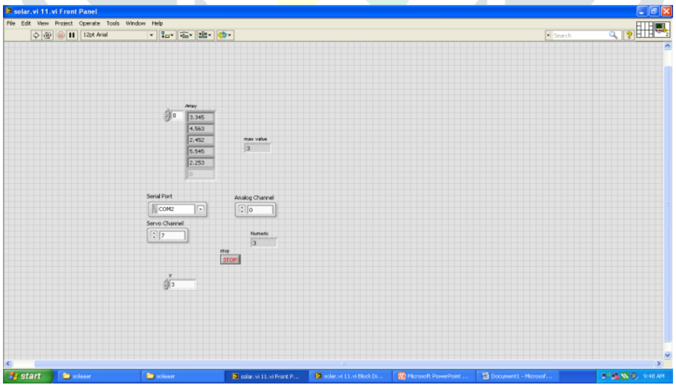

Fig. 11: Architecture of the front end panel of Solar Panel program with pins and ports of Arduino board

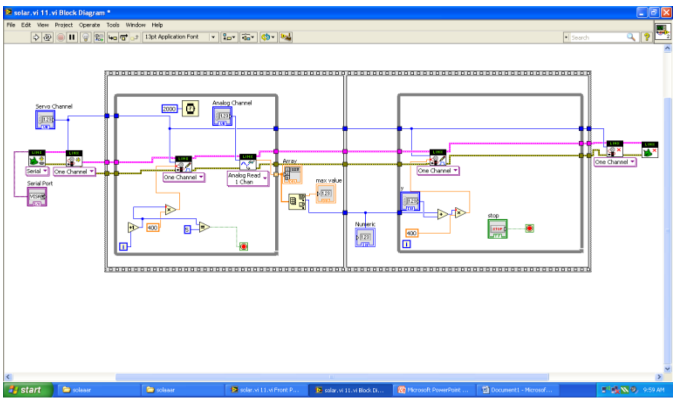

Fig. 12: Block diagram of the Solar Panel

Voltage variations with respect to time and its corresponding graph is represented in Fig. 13

TIME	VOLATAGE IN VOLTS
8:00 AM	2.56
8:30 AM	2.72
9:00 AM	3.15
9:30 AM	3.75
10:00 AM	3.99
10:30 AM	4.25
11:00 AM	4.89
11:30 AM	5.36
12:00 PM	5.92
12:30 PM	5.90
1:00 PM	5.75
1:30 PM	5.63
2:00 PM	5.61
2:30 PM	5.55
3:00 PM	5.30
4:00 PM	5.01
4:30 PM	4.87
5:00 PM	4.35
5:30 PM	3.89
6:00 PM	3.22
6:30 PM	1.92

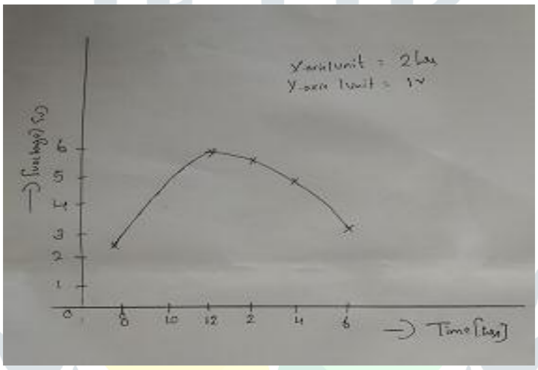

Fig. 13: Graph showing voltage versus time

From the above voltage readings, it is observed that maximum voltage is obtained in the afternoon that is at 12pm. Using arduino and servo motor it would be easier to design solar tracking system.

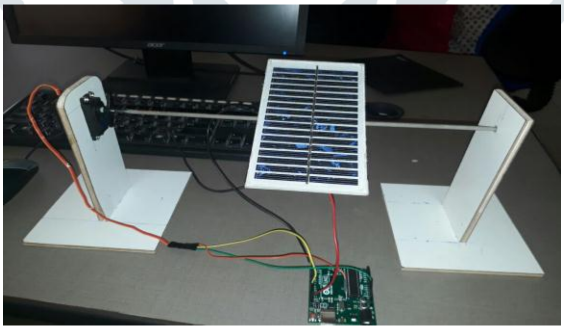
Fig. 14: Solar Tracker setup

VII. CONCLUSION

This project which was upgraded with the scope to take care of the conventional fuels is successfully achieved. The main intension is to enhance the utilization of inexhaustible source for the generation of power is ideally executed. Taking in to consideration the further energy scenario in the world, solar energy would be an extreme energy source. Observable advantage of single axis solar tracker happens on morning and evening session and obtains its maximum voltage.

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