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# Automatic Solar Tracker for Energy Management

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**ABSTRACT - This article describes the design and implementation of a solar tracer that ensures that the amount of sunlight falling on the panel remains constant as the sun's path changes. Renewable energy is becoming more important as it is more cost effective and as technology advances, it will reduce greenhouse gas emissions as it is environmentally friendly. The most distinguishing characteristic is that it will not draw energy from the earth but will instead obtain energy directly from the sun. The sensors in the device continuously track the position of the sun and rotate the panels automatically via motors without the need for human intervention as the light changes direction, the panels switching the motors on and off by themselves.**

***KEYWORDS -Solar Panel, Arduino UNO, DC Motors, Potentiometer, LDR Sensor.***

## I. INTRODUCTION

In the recent years the usage of electricity has heavily increased as the other energies are becoming more hard in terms of management, human interference.To meet this necessity the usage of renewable energy becomes easy to use as there is no human intervention. Solar energy is the most easiest way if we get compared to other energy sources that are already available. As the solar energy getting technology is already exists but it will use the solar power in better way. The solar energy will reduces the cost, and it is free of use, it will not consume any kind of fossil fuel to start, and it is pollution free as it is a eco-friendly. Once it is placed in better place it will automatically change its direction with respect to sun. as sun will available every day.The Operation cost of solar panels is very low (0.01$) when compared to Thermal plant(0.1$)

While the cost of installing the solar plant is high compared to thermal plant but the invested amount will get within 3 years and also by this we can supply power to need by storing. Solar tracer is used to increase the solar energy output. Arduino will be used here to make the prototype of solar tracer. A solar tracer is a system which used to move the solar panel modules in a way that they will be continuously facing the sun with the aim of maximizing the irradiation received by the solar panel array

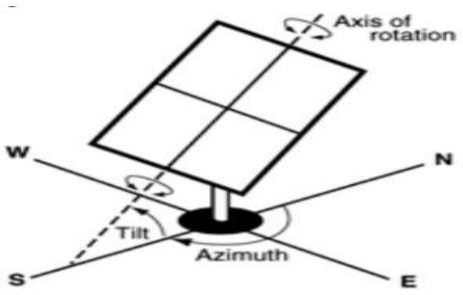
## II. AUTOMATIC SOLAR TRACKER

Solar tracker is a electronic circuit design to track the movement of the sun from any angle and direction. Normally the solar panel are fixed in a single direction with inclined angle. Maximum solar panel are inclined 30 degrees north direction to receive maximum energy. But the power generate is maximum in 11 AM to 2PM .

So it limit the maximum potential of solar panel. We use automatic solar tracker to track the sun from morning to evening(6 AM to 6PM) and adjust the solar panel. The photo-voltaic cell produce the maximum output when solar panel is perpendicular to sun. We use solar tracker to maintain. It increase the 30 to 40% of the power . It helps the growth in the solar based power generate systems. The angle of elevation sun does not change in month but It changes in yearly 10 degrees. So , dual axis is more better than single axis solar tracking.

3.1 :Single axis tracker :

Single axis tracker is generally has only single direction and it can move from the east to west with respect to sun movement of the earth. It is very easy to construct and very cheap. But the latitude of the sun changes nearly 10 ° every year. The power that is generate is decrease. So the single axis tracker is less efficient than dual axis tracker.




One axis tracking PV array with axis oriented South

Fig 3.1 Single axis tracer

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Dual axis tracker:

3.2 :Dual axis tracker is generally has two directional tracker and it can move east to west or north to south . so it can adapt to the changes in the latitude of the sun in yearly. The efficiency of the system increase and power generate is also increase. But it is some complicated to construct .The efficiency is overcome the complexity of design.

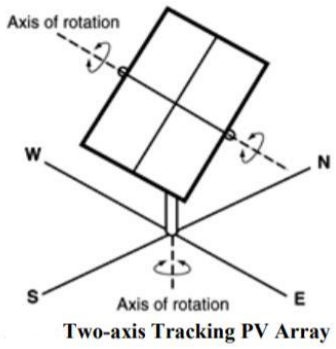


Fig 3.2 Two axis tracer

## III. LITERATURE SURVEY

The automatic solar tracker system provides best angle to obtain the maximum energy( efficiency). The proposed Automatic Solar Tracking System (ASTS) The light-dependent resistor (LDR)1&2 placed in the above solar panel and check the average value of 1&2 compare to the average value of 3&4. It moves to the high average value side (1&2 > 3&4) and gives a signal to the control circuit to change in position of the solar panel to the up side.

LDR 3&4 below the solar panel it detects sun and check the average value (3&4 > 1&2)and gives the signal to the control circuit to adjust the motor move to the down side.

In the same way LDR 1&3 that detects sun in the direction and compare the value (1&3 >2&4) move to the left side direction. The LDR 2&4 that detects the sun and check the above process and moves to the right side. This article provides the best results by the experimental results done by the hardware implementations only.

## IV. PROBLEM STAEMENT AND OBJECTIVE

Now a days the non-renewable are decreasing day by day such as coal, natural gases etc. We are mainly depend on the non-renewable energy to use in our daily life. We need to adapt to use of Renewable energy's such Solar,Wind, Hydro energy. I think solar energy is most popular and ease to build. It can build maximum any place that reach the sunlight. The cost of the build of solar is affordable price by every one. Many researchers developed the methods to increase the power increased by solar panel. One of the method is the solar tracking.

We know that solar energy is increase by solar panel is perpendicular to the sun. By tracking the sun by using the solar panel. it will always be perpendicular to the sun. The energy produced by the solar panel increase . it is estimate that power generate more than the fixed solar panel. The increase in energy is 40 to 60 percentage . The increase in efficiency is more despite being the enhancement of system cost.

The tracking is mainly controlled by the Arduino UNO. It is the controller of the system. The tracking of the solar panel is has to be very accurate. So Arduino is very accurate to control the dc motors adjust according to the sun movements. It is done by the using minimum equipment as possible. The major components are

1) Solar Panel
2) Arduino UNO
3) DC motors
4) Battery
5) LDR sensor
6) L293D
7) Resistors

It is the most minimized version of Automatic solar tracking system. It can be implemented with less complexity and affordable price. It can generate more energy.

## V. METHODOLOGY

The Methodology of this system is simple this project will be designed by using Arduino and we are using battery for storing the power the LDR module sensors detects the light that falls on it and it passes the signal to the Arduino and further Arduino runs the code and sends the output signal to the L293D Module then based on the output the module supply the proper output to one of the motor which it needs to run as the motor is connected to the solar panel it rotates the direction where the light falls or the intensity of the light is high. We used the Liquid crystal display for checking the working of the LDR sensors. Further the output which is in the form of power stores in the battery it will be used as the supply for the L293D .

## VI. PROPOSED SYSTEMS

Automatic solar tracker is mainly used to increase the power generated by the solar panel. The solar tracker works using the Arduino as controller to adjust the angle and direction of solar panel. LDR sensor detects the directions of the solar light and changes it's direction accordingly. The potentiometer adjust the speed of the DC motor. The power that generate is stored in battery that attached to the solar panel.

The power generate by the Automatic solar tracker is more efficiently. Now a days , people are wasting the electrical energy . Mainly the street lights are biggest waste of electricity in day light. I have seen so far street lights always power on the street. I have seen in rural areas, some parts of the urban areas. The people are neglecting the duties and wasting the electricity.

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The LDR sensor used to detect the sunlight on it and closes the circuit. The LDR sensor is works on the transistor. which works switch according to change in the resistance in the circuit. The changes in the resistance is used to open the circuit and close the circuit

In this project we use the automatic on and off LED lights. These lights automatically power off when is a day is light. It can automatically power on when there is no light using the LDR sensor. LDR sensor act as like power controller (switch). It can be used in many places such as houses, industries etc. With this we can reduce the consumption of electricity.

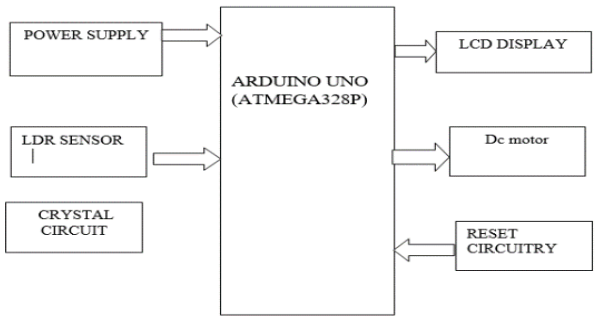


Fig 6.1 Block diagram

## VII. SOLAR PANEL

Generally we get infinity energy from sun by using the silicon available in earth we made solar panel. We need to make silicon 99.9% accuracy by combining sand+carbon and purification of carbon .the electrons bonded tightly in silicon wafer, by injecting the phosphorus atoms inside wafer a free electron is generated so electrons can move easily by giving sufficient energy to them like striking the sunlight by doing same in P type doping from that holes will be caused and by combing both p and n type electron tries to combine with hole and from a depletion layer (no free electrons and holes) from that we can generate dc current. By doping heaving we can generate more electricity because the depletion layer will become board. We cover silicon panel with EVA sheet on bottom and top because of saving sheet from humidity, shock. Two types of panels called poly-crystalline and mono-crystalline . we use poly in most because mono is more of cost and takes complex making process. Mono is in black colour and poly is blue in colour.


Fig 7.1 Solar Panel

## VIII. ROTATING MECHANISM

The solar panel is fixed in a frame is attached to the motor of the circuit. The motor of the speed is controlled by the potentiometer. Motor receives the signal from the control unit to change the direction of the solar panel . It moves the panel in direction adjust the sunlight.

## IX. SENSOR

LDR depends on light it has semiconductor material on the top called cadmium sulphite. If light falls on the sensor its resistance becomes low if it places in dark resistance becomes high. Due to the semiconductor metal sensor is dependent on light. If the resistance is high the current passes through it is low. Nowadays street light are made up on LDR it automatically off its light when its day. Due to this there is no human intervention for on/off the light.

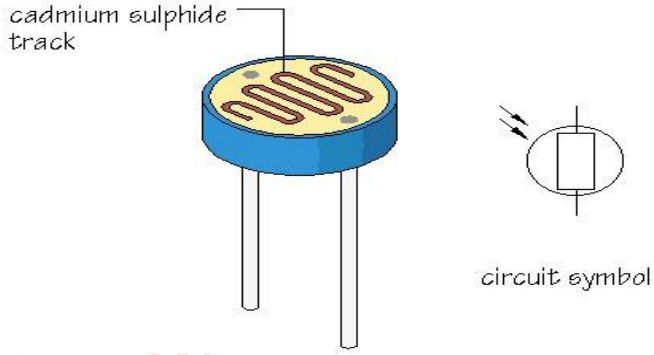


Fig 9.1 LDR sensor

There are different symbols used to indicate LDR . light dependent resistor works on the principle of photo-conductivity. It is an optical phenomena in which the materials conductivity is reduced when light is job by the material when photons falls on the device the electrons in the valance band of the semiconductor are exited to the conduction band these photons in the incident light should have energy greater than band gap of the semiconductor material to make the electrons jump from the valance band to the conduction band then when the light is having enough energy strikes on the device more and more electronare exited to the conduction band in which it results in the large no of charge carriers .

## X. CONCULSIONS AND RESULT

We implemented a low-cost automatic solar tracker with minimal equipment in this article. The system we build would improve power efficiency by 20% to 30% compared to other fixed solar designs. There are some solar trackers on the market right now. Different systems, on the other hand, have varying costs, performance, and system reliability. It may also have a range of maintenance costs.

We planned the system with low maintenance costs and high system performance in mind. It is inexpensive to instal and can be done anywhere. In this project, we used the fewest parts possible and installed them with the least

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amount of difficulty. The Arduino was used as a controller to power the DC motors, which changed directions in response to it. The LDR sensor was used to determine the angle and direction. Using the LDR sensor on street lights and industries, we harness the power of solar energy to increase performance. It would cut down on the amount of energy wasted by used lights during the day. As a result, we will be able to provide electricity to a large number of rural areas. and takes the input from the LDR module sensors and produces a motor as an output.Then the motor rotates in which the light falls on solar panel in the direction . As the result the solar panel can able to move freely in the direction where the light falls or where the light is Maximum . We can use solar panel in every house so that we can produce our own power and it is much useful for the Agriculture purpose

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