# SUN TRACKING SOLAR PANEL USING L293D MOTORDRIVE AND ATmega328P MICROCONTROLLER

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**Abstract :** As the increase in need for electricity is rising there should be some extra ways to produce the maximum amount of electricity and also ways to store it efficiently. Maximizing power output from a solar system is desirable to increase efficiency of a solar panel. The purpose of this method is to capture the maximum amount of energy dissipated from the sun in the form of solar rays using solar panels. The position of the Sun with respect to the solar panel is not fixed due to the rotation of the Earth. For an efficient output, Solar panel should absorb energy to a maximum extent. This can be done only if the panels are continuously moved in the direction of the Sun. The combination of a DC motor with a Solar panel which is controlled by an ATmega328P microcontroller helps in the movement of the solar panel according to the direction of the Sun.The amount of rotation is determined by the microcontroller, based on inputs retrieved from the two LDR sensors located next to the solar panel.Therefore, we can say that the suggested method helps in rotation of the panels such that they could absorb the maximum amount of solar energy dissipated by the Sun.

**Keywords :** Solar energy, Solar panels, LDR's, DC Motor, ATmega328P microcontroller, L293D Motor Drive .

## 1.Introduction :

In today's era of Hi-Tech technology, energy is the main aspiration for socio and economic development. But due to the incremental rate of environmental concern, renewable energy provides a significant interest not only in INDIA but all around the World. This alternative power source is continuously achieving greater popularity especially since the realization of fossil fuels shortcomings. As this continues the scope of our project also increases.In this project ,When the light rays fall on the solar panel the panel starts producing the electrical energy and store them in the battery and when the direction of the sun changes and the intensity of the light falling on the solar panel decreases when compared to the maximum intensity which is measured by the LDR's placed on the panel ,the ATmeg328P microcontroller with the help of inputs given by the LDR's about the light intensity falling on the panel the microcontroller governs the DC motor thus there would be a change in the direction of the solar panel accordingly .As all the components used in the circuit were of 5 volts as the panel we used in this prototype is of 10.8 volts(measured when maximum intensity of light is falling on the panel) we have used Rectifier diode to avoid fluctuations of power supply to the components and all the supply is given through the voltage regulator as to step down the voltage and to

reduce the supply to 5 volts so that it doesn't affect any of the components in the circuit ,and the voltage generated by the panel is seen in the LCD display connected to the circuit .So by using this idea we can increase the output electricity generated by the solar panel in a simpler way.

### Literature Survey:

As this is a universal problem there are many others who worked on this project but in a different way.

1.Use of Solar Tracking System for Extracting Solar Energy.

(International Journal of Computer and Electrical Engineering, Vol.4, No.1, February 2012 by Gagari Deb and Arijit Bardhan Roy.)

In this paper the source of solar energy is assumed as numeric value in Lab view software. Two sensors placed in two directions are joined with the input values with the help of wire. Here two thermometers are used as a sensor. The outputs of the thermometers are connected to meters which show the intensity of two directions. The output of the thermometer is multiplied with a value of 2400. After measuring the intensity of two directions, then it compares the intensities and moves the panel accordingly to achieve maximum power output.

When we compare this with our proposed idea we can say that our model requires less power to operate and in this paper thermometers are used whereas we used LDR's for determining light intensity.

2. Sun Tracking Solar Panel.

(International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 03 | Mar-2018 by Arbaj N, Sanket G, AsifAli)

In this paper, the sun tracking system is developed based on an 89C51 microcontroller. The components used in this idea are 89C51 Microcontroller, Dummy Solar Panel, Stepper Motor, Voltage Regulator, Diodes, Relay driver IC, Transformer. The microcontroller 89C51 based circuit is used in this system with a minimum number of components and the use of stepper motors which enables accurate tracking of the Sun.

When we compare this idea with our proposed one we have used ATmega328P microcontroller which is most reliable in nature compared to 89C51 microcontroller and also the operation voltage of our circuit is very low.

## 2.Theoretical Analysis:

The methodologies we used in this project comes from Lambert's Cosine Law and Inverse Square Law. These two laws tell us how the distance and angle of the panel results in the efficient panel output generation .

Lambert's Cosine Law stresses the fact that the illumination received on the surface is directly proportional to the cosine of the angle between the direction of the light rays that are incident on and normal to the surface at the incidence point.Thus when we change the direction of the panel according to the sun the output voltage generation increases when compared to the panel at fixed position .

The angle is also calculated by :

$$E\theta = E\cos\theta = I\cos\theta/D*D$$

Thus Lambert's Cosine Law is helpful in determining the angle at which the panel gives an efficient output.

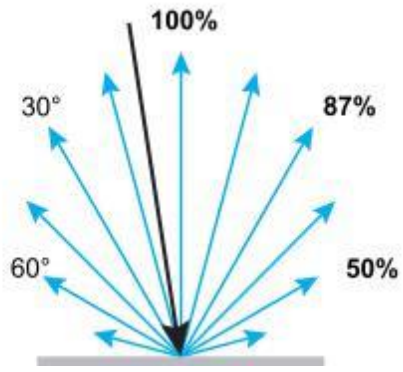



Fig 2.1 : Lambert's Cosine Law (panels output generation with respect to angle of incidence).

Inverse Square Law also stresses the same fact about how we can achieve the maximum voltage generation with respect to distance by changing the angle and when we change the panels direction with respect to the Sun then according to Inverse Square Law the output voltage gets increased . Theoretically we can also calculate the output with the help of the below formula i.e.,

$$\text{intensity} \propto \frac{1}{\text{distance}^2}$$

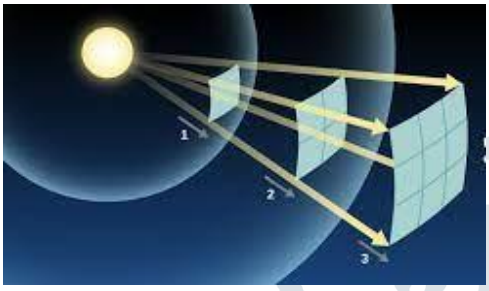



Fig 2.2 : Inverse Square Law (the above diagram shows how distance and angle acts as major factors in solar rays absorption).

## 3. Block Diagram Implementation :

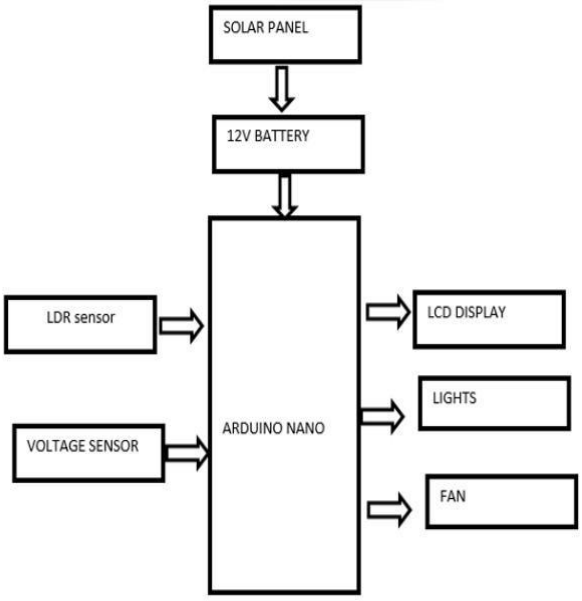



Fig 3.1 :Block Diagram of Sun Tracking Solar Panel using L293D motor drive and ATmeg328P microcontroller .

In this working model each and every component plays an important role .

LDR sensors play a prominent role in the working model as the inputs given by the LDR sensor are considered by the Arduino Nano (Arduino with ATmega328P microcontroller) and necessary alignment of the panel is done so maximum illumination can be received by the panels.

Voltage Sensor Module in this working model is used because all the components used in this circuit are of 5 volts each and could not withstand any higher voltages thus a voltage sensor is used to check and with the help of voltage regulator the voltage flow is maintained to all the components.

The main use of the L293D motor drive is to control the 2 DC motors, one placed in combination with the panel and one which acts as a Load. This motor drive IC interconnected with the Arduino Nano helps in the movement of the panel in the required manner (in required direction). A Rectifier diode is used in this working model because if there occurs a situation where input voltage fluctuations occur then the rectifier diode makes sure that the alternating voltage is converted into direct voltage. The use of the LCD display on this working model is to indicate the voltage generated by the solar panel and show if the loads are connected or not we have used a DC motor of 5rpm and an DC light strip to act as an load as all the requirements are in advance coded in the microcontroller when the load gets connected it displays in the LCD screen , and also the LCD screen is interlinked with the voltage sensor and panel thus when the voltage is generated then it is displayed on the LCD (how much voltage is generated .

So to control all the equipment used an ATmega328P microcontroller is used.2 DC motors are used in this working model, one (10 rpm DC motor) is coupled with the solar panel and the other (5 rpm DC motor)and DC lights act as the load.

The whole circuit is supplied voltage by Solar panel the solar panel used in this is of 10.80 volts (5 watts).

## 4.Results and Analysis:

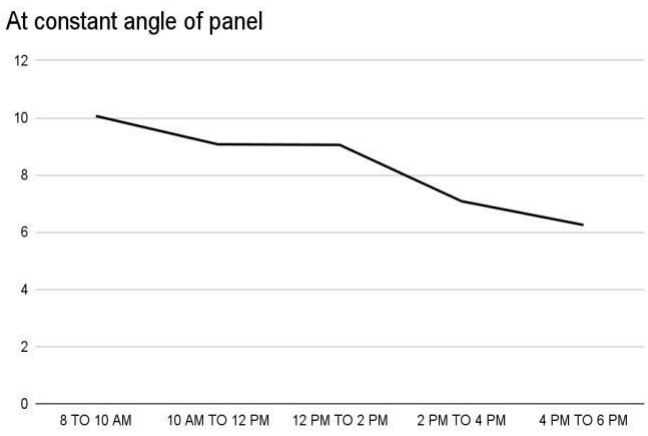
As we know solar panels are now-a-days used even at homes as an extra hand for power consumption and in some places panels are installed above the street lights such that the power generated by the panel is used for the working of street light individually , this in short scenario may look as an small amount but in an long run of power consumption this may be a part of decreasing load on the grid so if we manage to produce the maximum solar energy through the panels already installed (or) panels that are going to be installed, all the time during the day this may be a solution to power shortage problem in many cases as we can also send the extra power which could not be stored by the batteries to the grid, this may also be helpful not up to a large extent but could be utilized to manage the demand when marked up to a higher scale .

So here our project (or) our idea comes into play as a solar panel at an constant angle could not generate the maximum amount of energy all the time throughout the day as the direction of the sun changes all the time throughout the day so when we tilt the panel according to the direction of the sun we could acquire the maximum amount of sun rays and generate the maximum voltage that could be generated by the panel .So , in the below tabular columns we are going to see the difference between the amount of voltage generated by a constant angle solar panel and a continuous moving solar panel .

**4.1 Case (1)** :At Constant angle of Solar panel(Without change in the position of the solar panel throughout the day)

| TIME | OUTPUT VOLTAGE |
|---|---|
| 8AMTO10AM | 10.06 VOLTS |
| 10 AM TO 12 PM | 9.07 VOLTS |
| 12PMTO2PM | 9.05 VOLTS |
| 2PMTO4PM | 7.08VOLTS |
| 4PMTO6PM | 6.25 VOLTS |

Table 4.1 : At Constant Angle of Panel

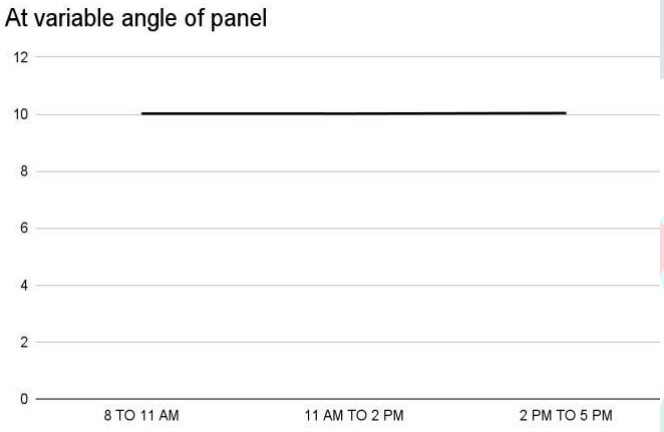



Graph 4.1 : At Constant Angle of Panel

**4.2 Case (2)** :At VARIABLE angle of panel. (Change in position of the panel w.r.t the sunlight throughout the day)

| Panels Position | TIME | OUTPUT VOLTAGE |
|---|---|---|
| At Initial position | 8TO11AM | 10.02 volts |
| At a tilt of 45 degrees from initial position | 11AMTO2 PM | 10.18 volts |
| At a tilt of 90 degrees from initial position | 2PMTO5PM | 10.36 volts |

Table 4.2 : At Variable Angle of Panel




Graph 4.2 : At Variable Angle of Panel

So, by using the above analysis of data we can say that using our idea we could produce the maximum amount of energy by the solar panel throughout the day.

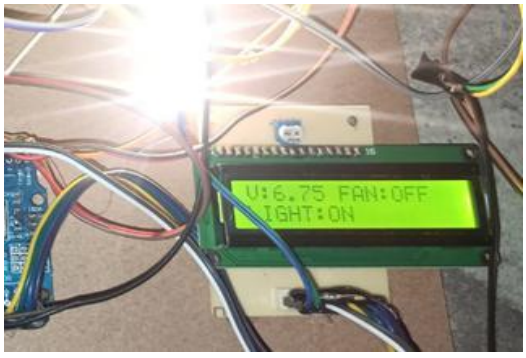



Fig4.1


Fig 4.2

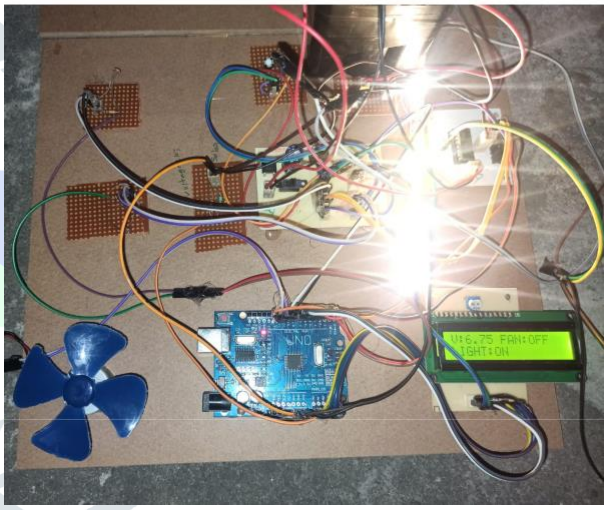


Fig 4.3

Fig 4.1,4.2,4.3 : Implementation of Sun Tracking Solar Panel using L293D motor drive and ATmeg328P microcontroller.

## 5.Conclusion:

In this project the circuit is developed by using an **ATmega328P** microcontroller. By using this we can control the direction of the solar panel according to the direction of the sun and could maximize the voltage output generated by the solar panel throughout the day. If we use this idea in all the installed

panels then we could use the panels to the maximum extent of its efficiency.

When we compare the output voltages generated by the panel using a microcontroller and without using the microcontroller, we can clearly observe the difference and how the use of our circuit maximizes the generation of output voltage.

So, we can say that the proposed solar tracking mechanism is an efficient method of maximizing the light energy received from the sun.

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