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Enhancement in Efficiency of Solar Power System using LDR

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Abstract: In 2010 US goes through about 19 million barrels of oil per day for generating electricity and we all know that fossil fuels will not last forever so we have to switch to alternative energy resources. Among it Solar energy is one of the greatest renewable energy source. The energy that is received from sun in an hour is more than that is consumed by us in a year. So we can make use of solar energy to generate electricity through solar panel and to what extent it is reliable and efficient. The main objective of this paper is to increase efficiency of conversion of solar power to electrical energy by providing rotation to solar panel as per intensity of light that is incident on the solar panel. The rotation is provided by servo motor. Here we use LDR (light dependant resistor) which acts as a sensor to check the intensity of light. By doing this we can increase the efficiency upto 5 to 10 % of any solar panel without increasing the surface area of panel. Here we use AVR microcontroller Atmega328 to control the system.

Keywords: Atmega328, LDR, Servo Motor, Solar Panel, Efficiency.

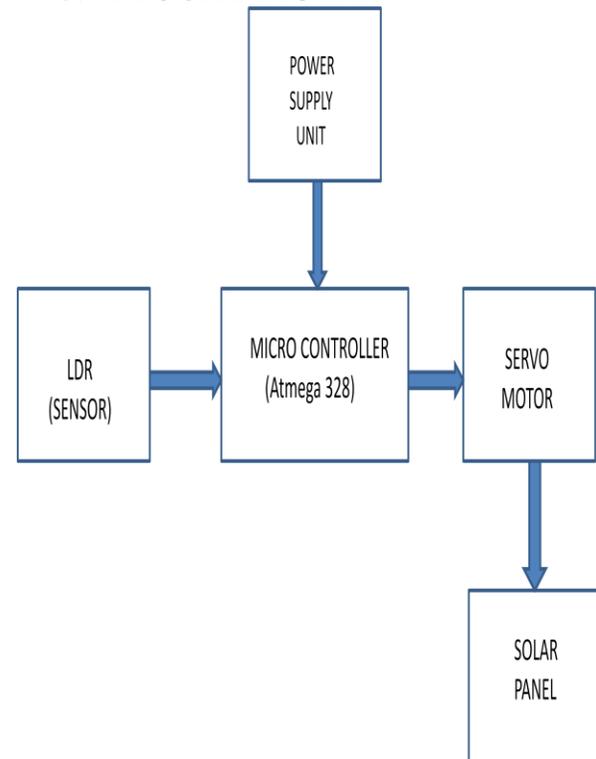
1. INTRODUCTION

In 2010 US goes through about 19 million barrels of oil per day for generating electricity and we all know that fossil fuels will not last forever so we have to switch to alternative energy resources. Among them solar energy is one of the prominent one. It is non-renewable energy resource So we can make use of solar energy to generate electricity through solar panel and to what extent it is reliable and efficient. Normally record efficiency of solar panel is 42.8percent .So we can make solar panel more efficient to generate more electricity. In this only one light sensor is employed to check the intensity of light and Our system is completely automatized by the usage of another light sensor similar to above sensor so that it checks the intensity of light and conversion is initiated when sufficient amount of light is present this saves power.

2. REQUIREMENTS

- Micro controller – Atmega328
- Servo motor
- Solar panel
- LDR

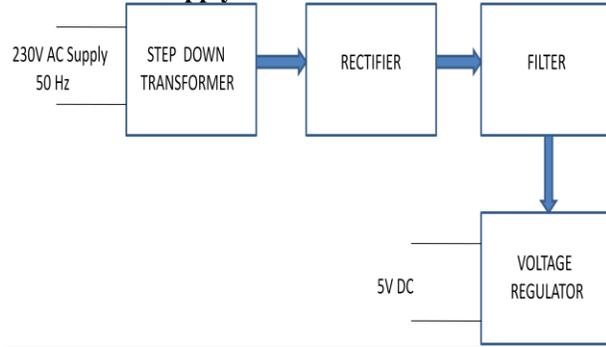
3. BLOCK DIAGRAM



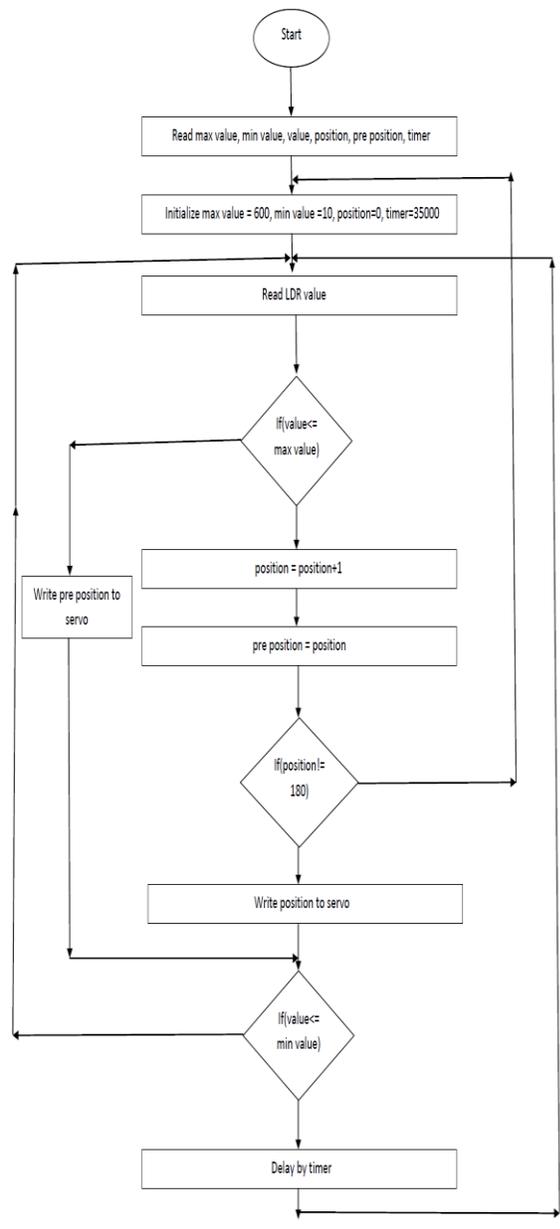
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3.1 Power Supply Unit



4. ALGORITHM



5. EXPERIMENTAL SETUP



6. OPERATION

Normally solar panels are in fixed position on a mounted surface. But sun travels from east to west so intensity of light falling over the solar panel changes. By changing solar panel direction we can get more amount of electrical energy. Here we use LDR (Light dependent resistor) to check the intensity of light. The resistance of LDR increases as the intensity of light illuminated on it decreases. The below depicted plot shows the LDR characteristics.

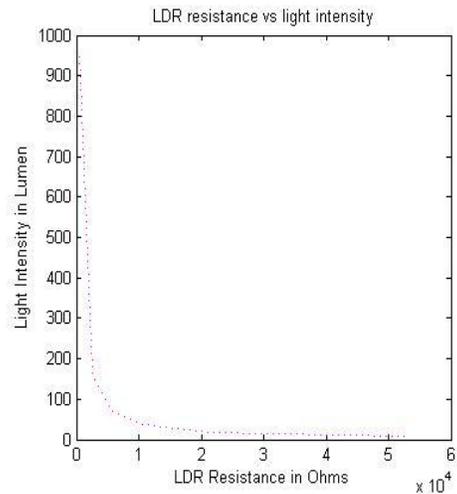


Figure 1. LDR Characteristics

As per intensity of light servo motor rotates from morning to night. For next day it resets to its Initial position. Initially we read the LDR value if it is less than maximum threshold limit it increments servo position by certain value. If condition fails servo remains in same position. If the condition less than minimum threshold limit it offers delay of certain time period which we include in the variable timer.

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7. RESULTS AND MATHEMATICAL ANALYSIS

Solar cell efficiency is the ratio of the electrical output of a solar cell to the incident energy in the form of sunlight. The percentage of energy conversion efficiency of a solar cell is the solar energy to which the cell is exposed that is converted into electrical energy. This can be calculated by power output (in watts) at its maximum power point (P_m) by the input light (E in W/m^2) and the surface area (A_c in m^2). From the above description we can determine the efficiency of one solar cell as follows:

$$\text{Percentage (\%)} \text{ of efficiency} = (P_m) / (E * A_c) \text{ -- (1)}$$

Here we consider a solar panel comprising of 72 solar cells consisting an area of $0.173 m^2$. Hence the maximum efficiency of the solar panel with LDR is 10.4% theoretically and without LDR is 5.2% theoretically. The below depicted plots shows how efficiency varies with and without LDR.

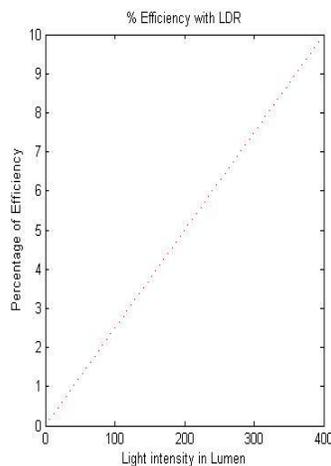


Figure 2. Efficiency with LDR

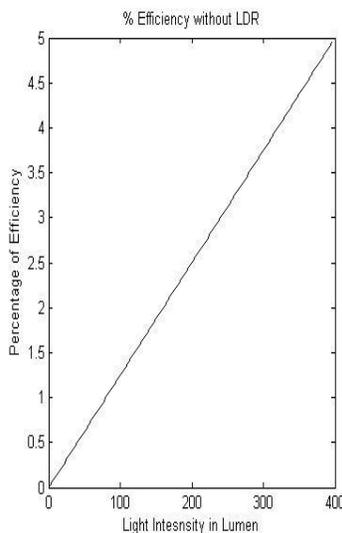


Figure 3. Efficiency without LDR

The below depicted plot shows the comparison of the efficiency with and without usage of servo motor according to sun's light intensity.

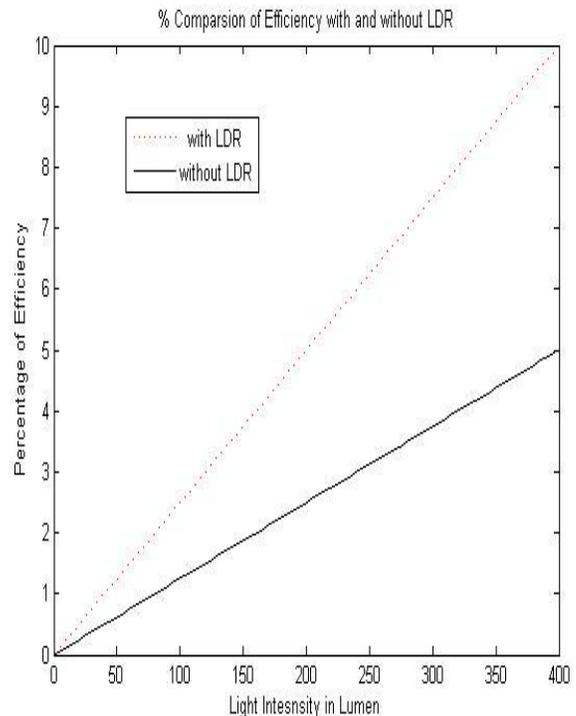


Figure 4. Comparison of Efficiency with and without LDR

From the above considerations we can observe that the efficiency increases approximately by 5% when we use servo motor to rotate solar panel according to sun intensity.

8. CONCLUSION

Practically an 8% efficient 12 watt module will have twice the area of a 16% efficient 12 watt module under standard test conditions (STC). Now-a-days to increase the efficiency of the solar panel surface area of solar panel should be increased there by increasing the cost of the solar panel since large number of solar cells are deployed in solar panel increases as area increases and space occupied by it also increases. These all can be avoided by rotating solar panel using servo motor according to intensity of sunlight. So that we can achieve efficient solar panel without disturbing the surface area of it hence there may be reduction in cost and area occupied by it.

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