Solar Tracking System Using Arduino

Nidhi S. Nadkarni[1] Bijo Raju Meldon[2] X. Fernandes[3] Prof. Kimberly Morais[4]
[1,2,3]UG Student [4]Assistant Professor
[1,2,3,4]Department of Electronics & Telecommunication Engineering
[1,2,3,4]Don Bosco College of Engineering, Goa

Abstract— With the ever increasing scarcity of non-renewable resources we have seen that the masses have increasingly changed their priorities to alternate resources of energy. We also know that among all the available resources we have sun which is the most easily available resource and the highlight of this resource is that it can be converted to electrical energy .A popular fact is that a solar panel can convert solar energy into electrical energy but as we see the sun's position from east to west, to track the sun is a tedious task so the proposed work in this paper solves the issue of the current scenario where the sun cannot be tracked respectively .This paper is proposed on the basis of a solar panel which is coupled to a stepper motor for tracking the sun energy so as to get the maximum energy derived from the sun onto the panel to extract the energy at any time of the year. We also see that the proposed idea is induced such as to get better output than the fixed panel. The system used in this scenario is tested and is workable so as to yield best results compared to the static solar panel, the system is also capable of giving phenomenal outputs so as making it the best option for high efficiency, solar harvesting applications. In future this model can be improved by using a real time clock to follow the sun. Thus helping in marinating the intended required position of the solar panel for instance even if the power is interrupted for some time.
Key words: Solar panel, LDR, Stepper motors, solar energy

I. INTRODUCTION

As in the current 21st century we see that the massive demand for energy and the ever declining resources in regard to fossil fuels as well as the environmental hazards that threaten the ecosystem, has led to the production of renewable resources which are eco-friendly and are clean and provide electrical energy such as solar energy, kinetic and wind energy, terrestrial, heat, biomass energy, sea waves, temperature difference of sea etc.

Highlighting solar energy we see that as a renewable resource, it has a greater potential as we convert it to get electrical energy in which this planet needs respectively. As conversion of solar energy into electrical energy is initiated we see that it possess a lot of promise and innovation for the future of renewable source energy. Energy resources such as wind energy, solar energy which are reliable and clean and available in plenty are the apex of energy technologies. Since they have low maintenance and minimal ecology impact, solar energy is freely available in the atmosphere and is an important aspect of having an eco-friendly environment. Solar panels are virtually maintenance free since the batteries require no water or other regular service and will last for years. Once, solar panels are installed, there are no recurring costs, such facts state that solar energy is the best energy for the tracking mechanism in our proposed model, solar panel now days have been used for many applications in our day to day life and efficiency of the panel is best at maximum of 21%, as the solar trackers are still expensive and are yet to be installed in big cities and rural areas. It would be prominent to bring it to the rural areas where it would benefit the masses.

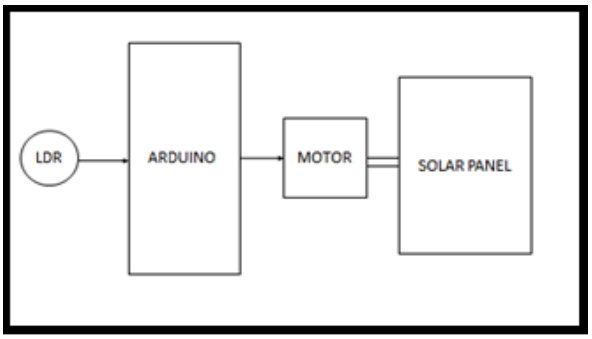

Fig. 1: Block Diagram for Solar Tracking System

II. MATERIALS REQUIRED

A. Solar Panel

In today's world as non-renewable energy resources such as fossil fuels, natural gas, nuclear energy are decreasing the use of renewable sources for production of electricity are increasing. The growing demand for energy has lead mankind to adopt many new technologies using renewable sources of energy such as solar energy. The solar energy plants with rated power are becoming popular day by day as they are non-polluting and hence use of Solar panels is continuously increasing. Solar panels are a form of active solar power that harvest sunlight and convert it into electricity. The surface of the solar panel consists of solar cells or photovoltaic cells arranged in grid-like pattern. Solar panels are constructed with crystalline silicon and gallium arsenide which is mainly produced for use in photovoltaic cells.

Fig. 2: Solar Panel

Solar panels absorb energy from the sun and actively convert it into electricity. The energy from the sun is stored in the battery and can be utilized when required. Solar panels are continuously placed towards Sun direction so that they absorb sun's energy to maximum extend. Solar panels continuously rotate in the direction of Sun making the system highly efficient. The light dependent resistors are fixed on the corners of the solar panels. LDR's produce low

resistance as light falls on them. The light falling on two LDRs is compared and panel is rotated towards LDR having higher intensity. The solar panel is rotated towards direction of sun by means of stepper motors at certain angle. If the light falling on left LDR is more, the panel is slowly rotated towards left and when intensity is more on right side of solar panel it moves towards right. When the sun is ahead at noon time the intensity of light on both sides is the same. As a result there is no rotation and the panel remains constant.

Parameters	Comments
Dimensions	35*30*2.2 cms
Rated Power(Pmax)	10W+-3%
Open Circuit Voltage(Voc)	21.5V Short
Circuit Current(Isc)	O.65A
Maximum Power(Vmp)	17.7V
Maximum Power(Imp)	0.57A
System Voltage	600V

Table 1: Specifications of the Solar Panel

1) Applications of Solar panels

1) Solar panels can be used to power the appliances in homes using solar power.
2) Solar panels are mainly used in industries as they require less maintenance and save more energy by rotating the panel.
3) These panels can be used in solar hot water systems and also to power up traffic lights and street lights.

B. Light Dependent Resistor (LDR)

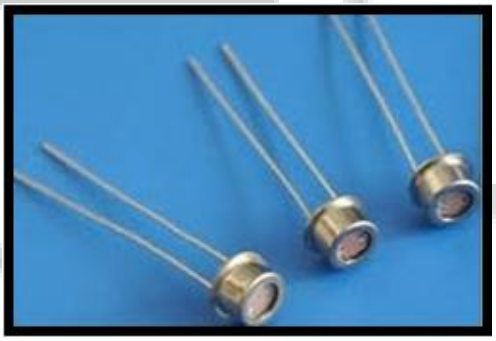

Fig. 3: LDR Sensor

A Light Dependent Resistor (LDR) also known as photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Therefore LDR's are light sensitive devices. In solar tracking system light dependent resistors are basically use to track the solar panel in the direction of sun. The LDR consists of disc of semiconductor material with pair of electrodes on its surface. When light falls on the device, the photons are absorbed by the semiconductor. Hence electrons in the valence band of the semiconductor material are excited to the conduction band. The energy of photons in the incident light should be greater than the band gap of the semiconductor material to cause the electrons jump from the valence band to the conduction band. Hence more and more electrons are excited to the conduction band when light having sufficient energy strikes the device which results in large number of charge carriers. The result of this process is when the circuit is closed larger amount of current starts flows through the device and hence it is said that the resistance of the device has been decreased. This is the working principle of LDR.

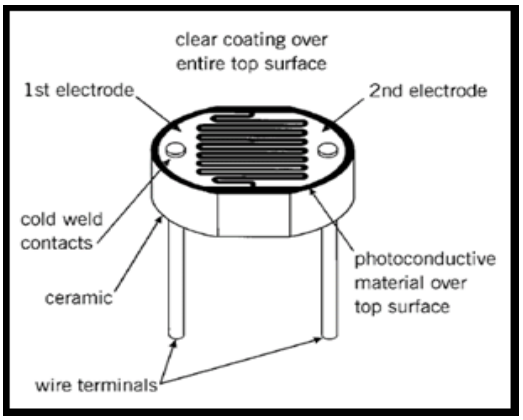

Fig. 4: Typical Construction of Plastic Coated Photocell

Photocells or LDR's are nonlinear devices. There sensitivity varies with the wavelength of light incident on them. LDR's are light dependent devices whose resistance is increased in the dark and that is decreased when light falls on them. The resistance of LDR when kept in dark is very high and is known as dark resistance. Figure below shows resistance vs. illumination curve for a particular LDR.

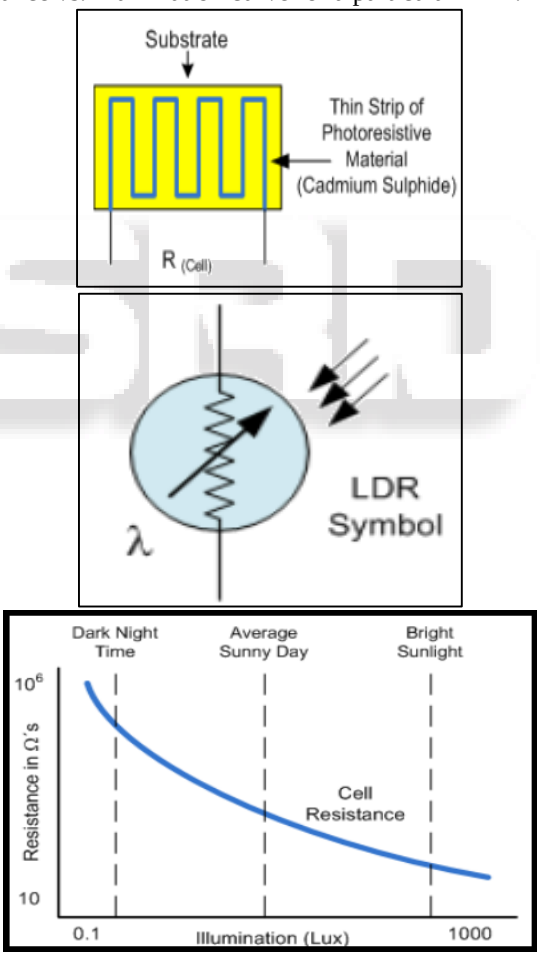

Fig. 5: Characteristics of LDR

1) Application of LDR

1) LDR's have Simple structure and are low cost. They are used as light sensors.
2) They Used in burglar alarm circuits , alarm clock, street lamps, light intensity meters, for counting the packages moving on a conveyor belt, etc.
3) They are used in a camera light meter where there is a need to detect absence or presence of light.

C. Stepper Motor

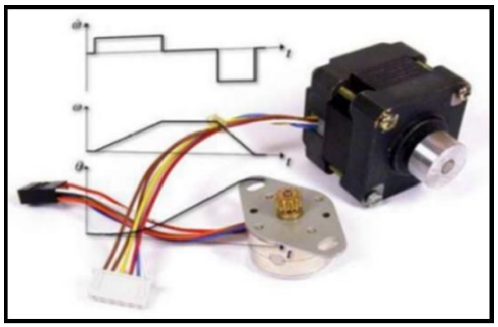

Fig. 6: Stepper Motors

A stepper motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. They have multiple coils organized in groups called "phases" of the motor. The motor will rotate one step at a time by energizing each phase. First one electromagnet is given power, which magnetically attracts the gear's teeth and makes the motor shaft turn. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. When the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one. In this way the process is repeated. Each of these rotations is called a "step", with an integer number of steps making a full rotation. As a result, motor can be turned by a precise angle.

In solar tracking system the solar panel is rotated towards direction of sun by means of stepper motors so that it can utilize with high accuracy. This tracking movement is achieved by coupling a stepper motor to the solar panel such that the panel maintains its face always perpendicular to the Sun to generate maximum energy. This is achieved by using a programmed microcontroller to deliver stepped pulses in periodical time intervals for the stepper motor to rotate the mounted panel as desired.

III. FLOWCHART

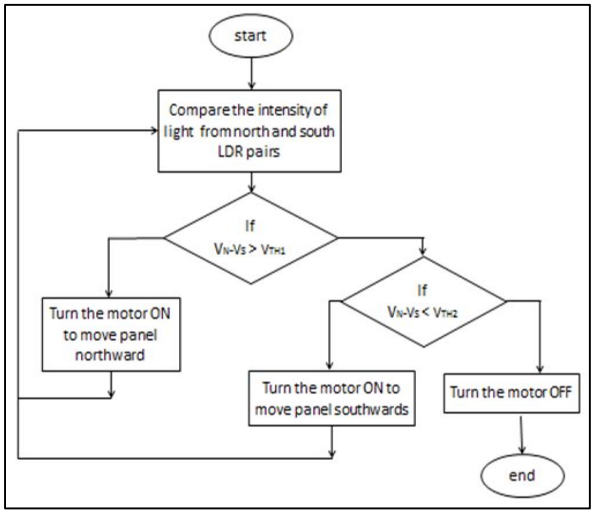

Fig. 7: Flowchart for solar tracking system

IV. RESULTS AND DISCUSSION

Fig. 8: Circuit Implementation

V. CONCLUSION

This Project here was taken up as an initiative for conserving the conventional fuels and using renewable source of energy. Here it deals with a smaller solar tracking system and it works efficiently. However for larger system that is for commercial use, the system can be developed further and modified to meet its required efficiency. Also further enhancement can be made in the project by implementing dual axis tracking. A voltmeter and Ammeter can be installed with the Arduino to check the output of the solar panel.

REFERENCES

[1] International Journal of Scientific and Research Publications, Volume 5, Issue 3, March 2015 ISSN 2250-3153.
[2] International Journal of Electronics and Electrical Engineering. ISSN 0974-2174,Volume 7,Number 6(2014),pp.561-566.
[3] 6th International Conference on Electrical and Computer Engineering ICECE 2010,18-20 December 2010, Dhaka, Bangladesh.

