

Use of Microcontroller in tracking Solar Radiation

Akshat Bhalla¹, Shripad S. Desai²

¹Student, department of electrical Engineering, Bharati vidyapeeth Deemed University, College of Engineering, Pune, India

²Assistant professor, department of Electrical engineering Bharati vidyapeeth Deemed University, College of Engineering, Pune, India

Abstract - Renewable energy like solar energy is gaining more and more importance in the world and becoming one of the most favorable method to produce electricity for consumption. The amount of the fossil fuel left is very less as compared to before, they are in their last reserves. Because of this there is a need for alternative form of energy. TO use the solar energy the efficiency of the instruments used should be maximized. This paper presents how microcontroller can be used to in tacking of sun to receive direct sun rays or radiation to give maximum output possible. The instruments are designed using a programmable microcontroller which is connected to motors and sensors and control the movement of pvc panel. This hybrid model can maximize output of electricity.

1.INTRODUCTION

Renewable energy sources are aiming importance in this world with growing needs. Not only these are preferable because they do not produce harmful emission but also, they add much needed flexibility on energy sector by decreasing the dependence of electricity generation from the same old fossil fuels. Solar is among the most sought-after alternate form of energy. Regardless of the intermittency of sunlight solar energy is available everywhere and anywhere and its free of cost.

Currently solar lights and solar heaters are widely used as human race is starting to realize their efficiency. Photo voltaic cells are getting recognized and widely used system for conversion of electricity from solar energy photo voltaic cell is used in conversion of solar energy (radiation) to direct current without harming the environment or any kind of harmful emission. The dc can be used in inverter to convert it to AC current to be used in local load or sent in grid or store it. Sun is the most important and only source of energy that powers this world, even the fossil fuels we use are

not possible to create in absence of sun. Solar energy is the most renewable energy used. Within all the electricity generation sources Photo voltaic cells are the only sources that can in the coming millennia replace the primary fossil fuel generation methods of producing energy. Photo voltaic cells are made of the primarily semiconductors like silicon. Silicon has its maximum usage efficiency of around 24%.

[1] Solar trackers are the most appropriate and proven technology to increase the efficiency of solar panels through keeping the panels aligned with the sun's position.

To increase the efficiency of the solar panels is to only increase the amount of sun light it will be receiving unless a high efficiency photo voltaic panels are invented.

This the far most cheapest, reliable, and cost-effective solution for the current generation.

A prototype of microcontroller automated solar tracker using a ensures that efficiency is maximum is suggested in the paper.

2. SUN TRACKING SYSTEM

The photo voltaic cells are working on the principle showed in Fig 1. The most convenient source of renewable energy is solar radiation, which can be generated by photo voltaic cells. Photovoltaic cells are the basis of solar system [1]. The photovoltaic word is derived from the word “photo” and “voltaic”. Photo meaning light and voltaic meaning producing energy, so together they mean producing energy from sunlight. The output power of a photovoltaic cells depends on how much amount of light it gets.

There are various factors that affect the output power is time of the day, season, position of the panel and the orientation of the system. PV cells are the smallest part present in the panel. Solar cells provide maximum

energy when the solar cell is directly aligned with the panel.

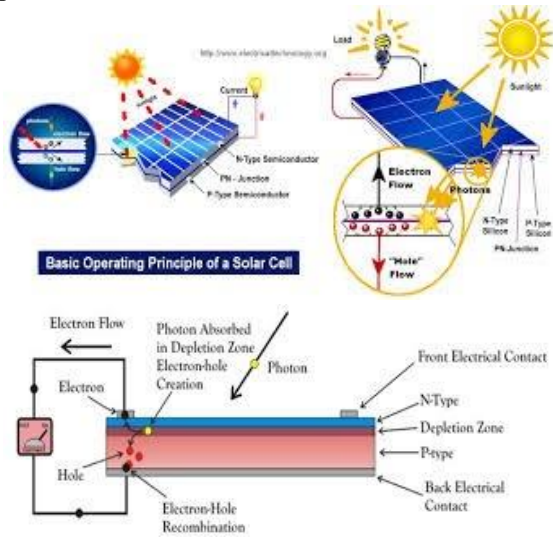


Fig1. Describing the working of microcontroller automation and use of solar cell.

Various methods are used for implementation for tracking the position of sun. The simplest of all uses light dependent resistor is to detect light intensity changes on resistor's surface. Other methods use two phototransistors covered with a small plate to act as a shield to sunlight [4].

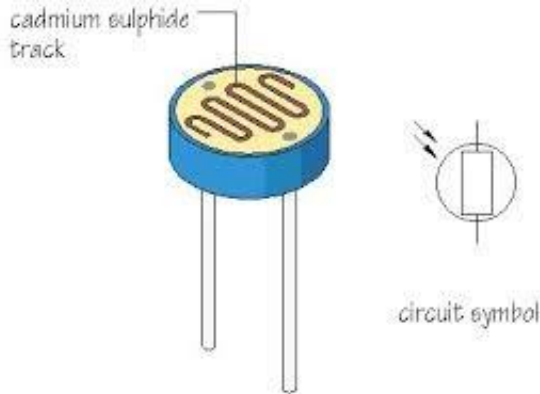


Fig 2. Basic phototransistor
During morning hours, the phototransistor turns on sending a signal to the motor until the shadows appear again. Phototransistors have a very narrow range of sensitivity when they are places in a bias condition in a circuit.

3. DESCRIPTION OF SOLAR TRACKER

A- Electrical System

The electrical subsystems and mechanism are integrated in the solar tracking system. The solar

tracker consist of of charge controller , lead acid battery and photovoltaic cells , LDR sensors , voltage regulators and microcontroller board.

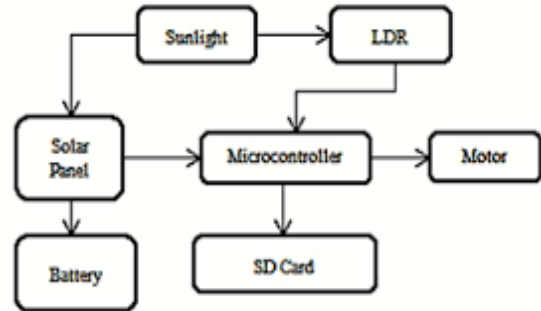


Fig 3. Flowchart of electrical system used

B-Mechanical subsystems

The solar tracker physical structure consists of solar panels, servomotor, LDR, Power supply, programmable Microcontroller. The physical structure can be reinforced with aluminum rods. The panel should be designed to move as per the requirements but also stoppers to limit the rotation of the location it is placed.

C-Programmable microcontroller

The microcontroller is 89C51 programmable microcontroller that can be programmed using the C language. The microcontroller is the controlling unit of the whole system.

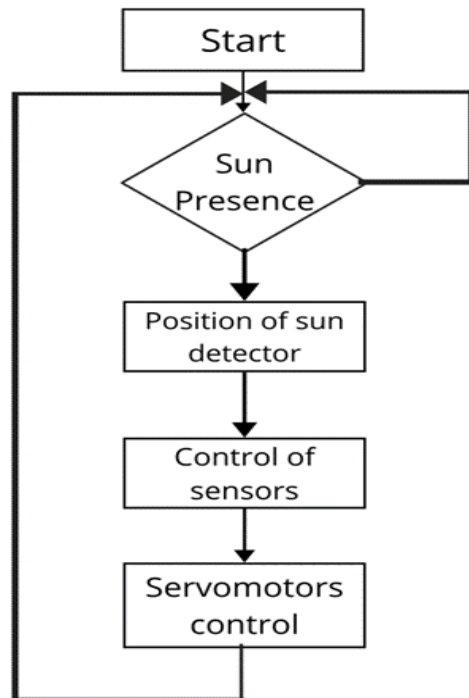


Fig 4. Flowchart of programmable microcontroller
The control unit received data from the sensors in form of binary codes [0 & 1]. The binary system tells that sun position to the sensors. The microcontroller receives the data and send signals according to the data received.

D- The moving mechanism

The driving mechanism consists of servo motors that are used to move according to signals sent to the motors by data received by the microcontroller. The controller uses the pulse width modulation signal to drive the servo motor at a controlled speed. The microcontroller targets in system is used to control it as per signals from light dependent resistor.

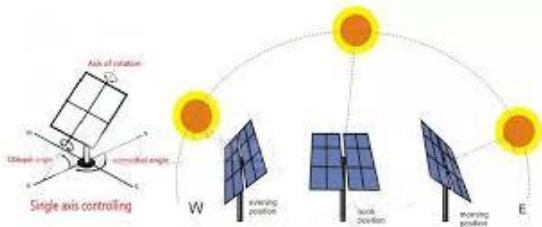


Fig 5. moving and mechanical system

4. WORKING AND OPERATION

There are three modes of operation which are manual, automation and preset.

1. Manual mode- The angle and position of the panels can be determined by the user.
2. Automation made- The solar panel is adjusted according to the data received by the LDR.
3. Preset mode- The solar panel sets itself at a fixed angle and position till sunset.

5.CONCLUSION

The tracking system is based on the data processed by a microcontroller and sent to it by the light dependent resistor. The microcontroller present can be programmed and used in a system with minimum number components and the dc servo motors are used for movement. The tracker system can give maximum efficiency as it follows the sun and aligns it to the sun to get direct sun radiation.

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