

SUN TRACKING SOLAR PANEL USING STEPPER MOTOR

1st Mrs. N. Vijayalakshmi M.sc., M.phil.,

Assistant professor ,

P.G. Department of computer science

Bon Secours College for Women, Thanjavur.

2nd Ms.T. Arifa begum M.sc., computer science,

P.G. Department of computer science

Bon Secours College for Women, Thanjavur.

ABSTRACT

The project uses a solar panel coupled to a stepper motor to track the Sun so that maximum sun light is incident upon the panel at any given time of the day. This is better compared to light sensing method that may not be accurate always for example during cloudy days. With the impending scarcity of nonrenewable resources, people are considering to use alternate sources of energy. From all other available resources sun energy is the most abundant and it's comparatively easy to convert it to electrical energy. Use of solar panel to convert sun's energy to electrical is very popular, but due to transition of the Sun from east to west the fixed solar panel may be able to generate optimum energy. The proposed system solves the problem by an arrangement for the solar panel to track the Sun. 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. The microcontroller used in this project is from 8051 family. The stepper motor is driven by an interfacing IC as the controller is not capable of handling the power requirements of the stepper motor. The project is provided with a dummy solar panel which can be used for demonstration purpose only. Further the project can be enhanced by using RTC (Real Time Clock) to follow the Sun. This helps in maintaining the required position of the panel even if the power is interrupted for some time.

1. INTRODUCTION

This project deals with the research and development of a Sun tracking system. Now a day's Renewable energy solutions are becoming increasingly popular. Maximizing power output from a solar system is desirable to increase efficiency. In order to maximize power output from the solar panels, one need is to keep the panels aligned with the sun, means that the tracking of the sun is required. This is a far more cost effective solution than purchasing additional solar panels. This system is designed with specific methodology, this system using 89C51 Microcontroller, Dummy Solar Panel, Stepper Motor, Voltage Regulator, Diodes, Relay driver IC, Transformer. Solar panels collect solar radiation from the sun and actively convert that energy to electricity. Solar panels are comprised of several individual solar cells. These solar cells function similarly to large semiconductors and utilize a large area p-n junction diode. When the solar cells are exposed to sunlight, the p-n junction diodes convert the energy from sunlight into usable electrical energy. The energy generated from photons striking the surface of the solar panel allows electrons to be knocked out of their orbits and released, and electric fields in the solar cells pull these free electrons in a directional current, from which metal contacts in the solar cell can generate electricity. The more solar cells in a solar panel and the higher the quality of the solar cells, the more total electrical output the solar panel can produce. The conversion of sunlight to usable electrical energy has been dubbed the Photovoltaic Effect. A solar tracker is a device that orients a payload toward the sun. The use of solar trackers can increase electricity production by around a third, and some claim by as much as 40% in some regions, compared with modules at a fixed angle. In any solar application, the conversion efficiency is improved when the modules are continually adjusted to the optimum angle as the sun traverses the sky. As improved efficiency means improved yield, use of trackers can make quite a difference to the income from a large plant.

Commercial purpose of solar tracking system:

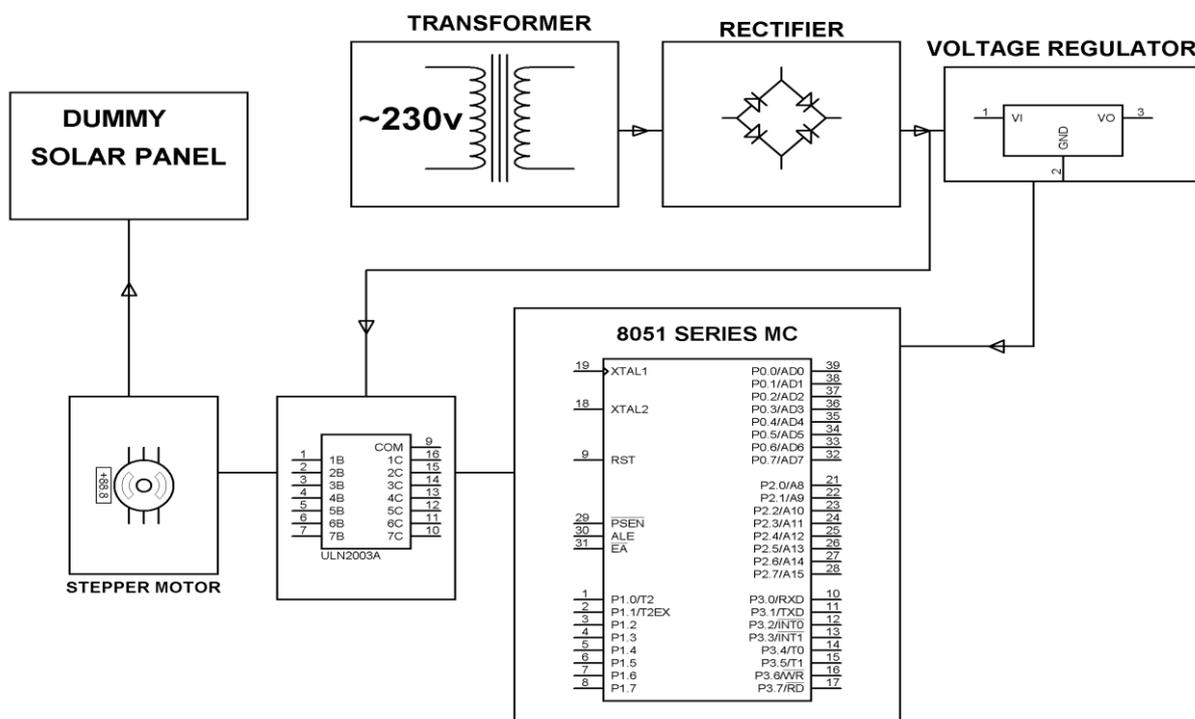
- Increase Solar Panel Output.
- Maximum efficiency of the panel.
- Maximize Power per unit area.
- Able to grab the energy throughout the day.

are continually adjusted to the optimum angle as the sun traverses the sky. As improved efficiency means improved yield, use of trackers can make quite a difference to the income from a large plant.

Solar energy conversion is one of the most addressed topics in the field of renewable energy. Solar radiation is usually converted into two forms of energy: thermal and electrical energy. The solar electricity has applications in many systems such as rural electricity, water pumping and satellite communications. The efficiency of the photovoltaic (PV) system depends on the climate conditions of solar radiation, ambient temperature and wind speed, matching of the system with the load and appropriate placement of the solar panels. A majority of solar panels in use today are stationary and therefore do not consistently output the maximum amount of power that they can actually produce. A solar tracker will track the sun throughout the day and adjust the angle of the solar panel to make the sun normal to the solar panels at all times. The orientation of the solar panels may increase the efficiency of the conversion system from 20% up to 50%. [1-3]. The sun tracking solar power system is a mechatronic system that integrates electrical and mechanical systems, and computer hardware and software.

2. METHODOLOGY

Excepting all the other available resources, the solar energy is the most abundant and it is comparatively easy to convert into electrical energy. The usage of solar panel to convert Sun energy into electrical energy is very popular, but due to the transition of sun from east to west, the fixed solar panel may not be able to generate optimum energy. This is achieved by using a programmed microcontroller to deliver stepped pulses in periodical time intervals for 12 hours for the stepper motor to rotate the mounted panel in one direction and then return to the start point for next day light as desired. The microcontroller used in this project is from the 8051 family.



3. RESULT AND DISCUSSION

Working of light sensing circuit: In this circuit constant current is given across LDR and constant voltage is given across 555 timer. 555 timer is used for monostable circuit. In monostable circuit a triggering pulse is needed; this pulse is given by LDR arrangement. LDR is negative temperature coefficient device, so when the circuit is kept under light, resistance across the LDR decreases. As current across the LDR is constant and resistance decrease with light intensity, voltage starts to change its state, this voltage is working as triggering pulse in monostable circuit. From monostable multivibrator circuit we get voltage waveform, which remains in high state at first, then changes its state with varying light intensity.

3. CONCLUSION

In this project, the sun tracking solar panel is developed based on 89C51 microcontroller. The microcontroller 89C51 based circuit is used in this system with a minimum number of components and the use of stepper motors enables accurate tracking of the sun. It has been shown that the sun tracking systems can collect maximum energy than a fixed panel system collects and high efficiency is achieved through this tracker, it can be said that the proposed sun tracking system is a feasible method of maximizing the light energy received from sun. This is an efficient tracking system for solar energy collection.

5. REFERENCES

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