

AUTOMATIC SUN TRACKING SYSTEM

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Abstract

The aim of this paper is to solve the problem of energy crisis which is considerably serious issue in today's period. It is becoming essential to increase use of renewable sources of energy namely solar energy as compared to conventional sources for energy generation. A technology namely solar tracking system is introduced to improve efficiency of solar cells by tracking sun's energy. It uses 8051 microcontroller and stepper motor to move solar panel according to position of sun. Photo resistors are also used to detect light intensity.

Keywords: solar energy, Photo resistors, Solar panel and microcontroller.

1) Introduction:

This solar tracking system is a power generation method of solar energy. One of the most promising technology of converting solar energy to electrical energy is Photovoltaic effect. A solar tracker is a device in which solar photovoltaic panels are mounted towards the sun by using photo sensors connected with motor. It is one of the simple and cheaper way for producing electricity. This structure of solar tracker moves with position of sun over the course of day in order to produce maximum KW

2) Functional Principle:

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.

Trackers are used to keep solar collectors/solar panels oriented directly towards the sun as it moves through the sky every day. Using solar trackers increases the amount of solar energy which is received by the solar energy collector and improves the energy output of the heat/electricity which is generated. Solar trackers can increase the output of solar panels by 20-30% which improves the economics of the solar panel project.

Its major components are:

hours. The heart of this circuitry is microcontroller for tracking and generating power from sunlight and controls the direction of motor to get maximum light intensity. In 2013, china was the leader of new PV installations and ranks now second behind world leader Germany in total capacity. The worldwide photovoltaic capacity grew that year by 38 percent to a total of 139 GW. Solar tracking system will help us to utilize sun's energy in a efficient way.

- Solar Panel
- Power supply circuit
- Microcontroller
- Stepper motor

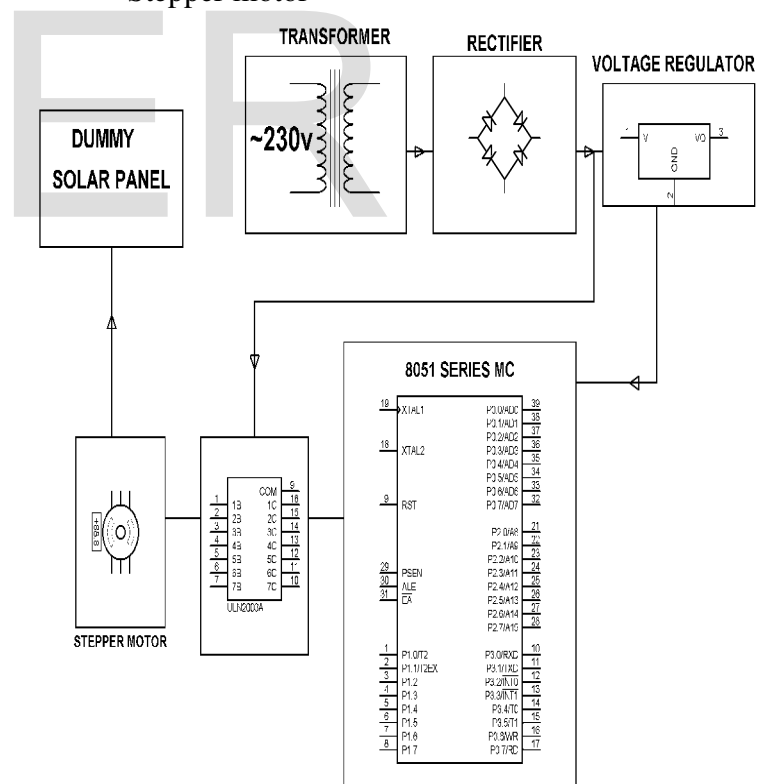


Figure 1: Block diagram of Automatic sun tracking system

2) LDR Theory:

A light dependent resistor is a device whose resistance is a function of light intensity. The resistance of photocell is inversely proportional to the light intensity.

Suppose we place two LDR'S nearby and place a metal sheet in between two sensors and sun is on right hand side and position of panel as shown in fig.(a). SO LDR2 will receive more light and LDR1 will be in dark. On sensing this the microcontroller will rotate motor to right until it senses light on both sensors as shown in fig. (b).

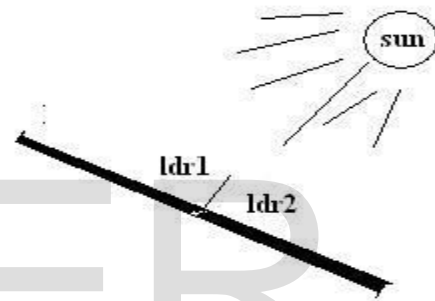
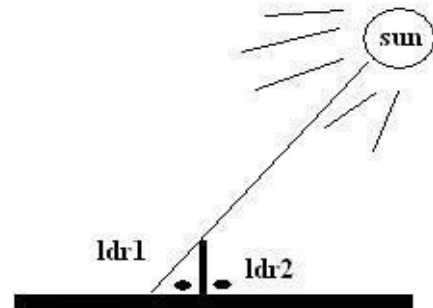


Figure:2

Figure :3

3) Power supply circuit:

The aim is to design power supply section which converts 230V AC to 5V DC. It is preferred to use a transformer with a current rating of 500mA. Here the diode used is IN4007 as it can withstand higher voltage of

1000V. The 7805 Voltage regulator IC used has a input voltage range of 7V-35V provides a regulated voltage of 5V for microcontroller.

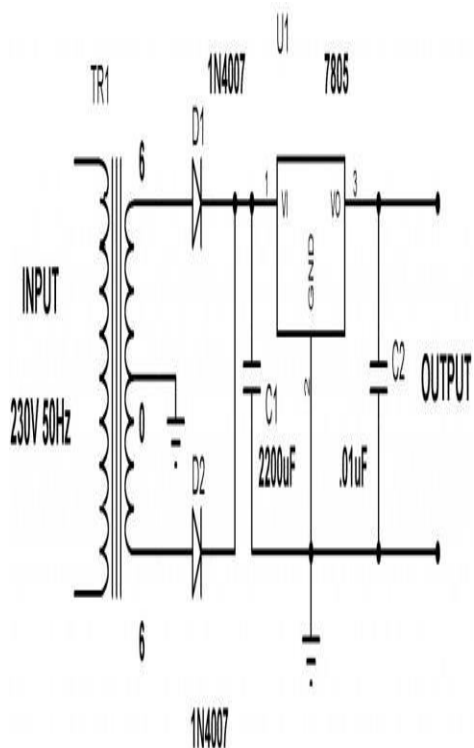


Figure 4: Power supply Circuit

4) Microcontroller Section:

We can use 8051 family microcontroller for our application. We can use AT89C51 series of 8051 microcontroller but it is more convenient to use AT89S52 controller because of inbuilt ISP (inbuilt system programmer) option. It is a 40 Pin microcontroller.

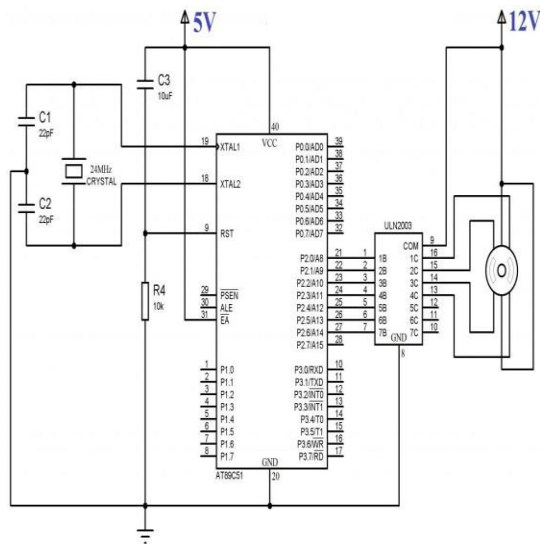


Figure 5:Interfacing

of microcontroller

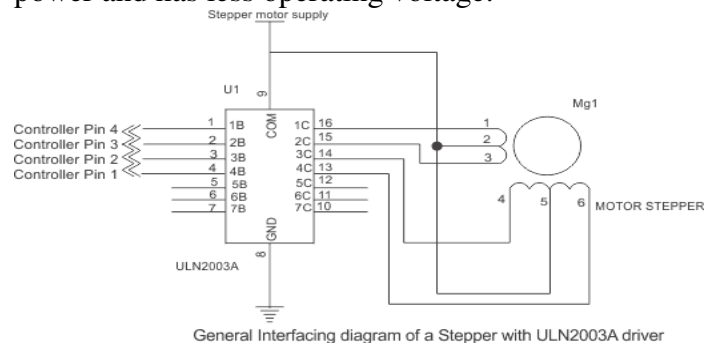
Here an microcontroller 8051 is used. Here an ADC convertor is used to convert an analog signal from LDR to digital signal for processing by microcontroller. Here an crystal oscillator is also used. Out of 4 ports of microcontroller one port is used for interfacing with stepper motor using driver IC ULN2003.

Controller then takes the decision according to then algorithm and tilts the panel towards the direction of the max energy given by LDR with the help of stepper Motor . The Motor is used to rotate the LDR to sense the max solar power. Limit sensors or Touch sensors are provided to sense the starting and ending position of the solar panel.

5) Stepper motor:

It is a position controlled device which is used to translate electrical pulses into mechanical movement of solar panel. The leads of stator winding is controlled by 4 bits of 8051 port. Stepper motor is interfaced with microcontroller using driver IC

ULN2003. The reason behind this is that microcontroller cannot provide enough current to drive the motor. It consumes less power and has less operating voltage.



6) Conclusion:

Here we studied sun tracking system based on 8051 microcontroller. The basic thought behind this study is to get maximum utilization of renewable sources of energy namely Sun's energy for power generation. The tracker can initialize the starting position itself which reduces the need of large number of photoresistors. Use of microcontroller has made the system lighter as less number of components are used. Since it is software based there is less chances of error and is cost effective way of energy generation. This application is adopted widely because its basic requirement is sun's energy which is free of cost. It has a bright future scope further.

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