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DUAL AXIS SOLAR TRACKING SYSTEM WITH WEATHER SENSING

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ABSTRACT: Solar energy systems have emerged as a viable source of renewable energy over the past two or three decades, and are now widely used for a variety of industrial and domestic applications. Such systems are based on a solar collector, designed to collect the sun's energy and to convert it into either electrical power or thermal energy. In general, the power developed in such applications depends fundamentally upon the amount of solar energy captured by the collector, and thus the problem of developing tracking schemes capable of following the 11 trajectory of the sun throughout the course of the day on a year-round basis has received significant coverage in this paper.

In Aden city (Yemen), the improvement in the performance of a solar cooker during summer was found to be as much as 40% for higher elevation angle and 70% for lower elevation angle, based on the developed tracking algorithms. Moreover, it was shown that the amount of solar energy captured by a tilted collector could be increased by more than 40% by adjusting the tilt angle on a seasonal basis.

This paper is designed with AURDINO NANO. Depending upon the light falls on LDR the data will be read by the Microcontroller and the direction of the motor will be changed. With this direction the solar plates which are fixed to the stand will also rotates to gain the maximum sun rays. This paper uses regulated 12V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

Keywords: ARDUINO NANO, LDR, Solar Plates.

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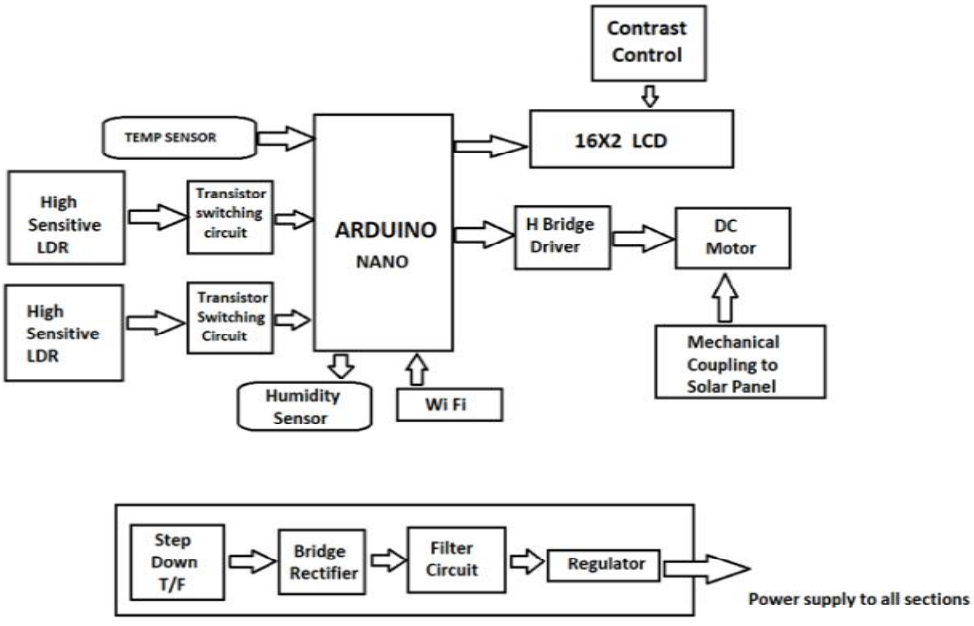
INTRODUCTION

The green energy also called the regeneration energy, has gained much attention nowadays. Green energy can be recycled, much like solar energy, water power, wind power, biomass energy, terrestrial heat, temperature difference of sea, sea waves, morning and evening tides, etc. Among these, solar energy is the most powerful resource that can be used to generate power. So far the efficiency of generating power from solar energy is relatively low. Thus, increasing the efficiency of generating power of solar energy is very important. In the past, solar cells have been hooked with fixed elevating angles. They do not track the sun and therefore, the efficiency of power generation is low. For example, the elevating angle of a solar cell for the largest volume of illumination in daytime is 23.5°in southern Taiwan.

Since the fixed-type solar panel cannot obtain the optimal solar energy, the transformation efficiency of solar energy is limited. Many scholars have proposed different methods for tracking the sun [3-9]. Many different light source sensors, light intensity sensors, intelligent vision techniques, and CCD equipment's were applied to compute the absorbed time of the sun radiation in everyday for measuring the volume of solar energy. So far the majority of solar cell panels worldwide are hooked with fixed angles. Thus, it is clear that the method of tracking the sun is a technique worthy of being developed. In this paper, the main goal is to design and implement a solar tracking control system using field programmable gate array (FPGA). The CdS light sensitive resistors are used. From the experimental results, the proposed tracking system is verified more efficiently in generating energy than the fixed system.

Design:



Solar Cell

The solar cell is composed of the semiconductors of the P-N junctions. It can convert light into electric energy. Therefore we can assume that electricity produced using sunlight shining on the solar cell can be used like common electricity.

Arduino

This is the heart of the paper. The complete control logic program is stored in this microcontroller. It sends and receives control and data signals to LCD, Stepper motor and to the other Devices based on the program logic.

Solar Panel

This is a photo voltaic cell. This converts light energy into electrical energy. The output voltage of the solar panel depends on the amount of light falling on the panel.

Voltage Sampling Circuit

The output voltage of the solar panel is given to voltage sampling circuit. This is a voltage divide network. The sample voltage is given to Analog to Digital converter circuit.

High Sensitivity LDR

This is a light dependent resistor. The resistance of the device is inversely proportional to the amount of light falling on its surface. This is used to detect the day – night mode.

Transistor Switching Circuit

In this section a NPN transistor is used as a switch. The transistor is driven into saturation and cut off region based on the output voltage of the LDR. This sends a logic HIGH or LOW signal to micro controller.

H-BRIDGE

An H-bridge is an electronic circuit which enables DC electric motors to be run forwards or backwards. These circuits are often used in robotics. H-bridges are available as integrated circuits, or can be built from discrete components.

DC Motor

The DC motor is used to rotate the solar panel. The DC motor makes actual and exact number of turns or degrees of rotation instructed by the micro controller.

16X2 LCD

16 X 2 LCD is used to display the operating instructions and status of the output. HD44780U is used in the paper. The HD44780U dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver. A single HD44780U can display up to one 8-character line or two 8-character lines. The HD44780U has pin function compatibility with the HD44780S which allows the user to easily replace an LCD-II with an

HD44780U. The HD44780U character generator ROM is extended to generate 208 5X8 dot character fonts and 32 5X10 dot character fonts for a total of 240 different character fonts.

Contrast Control

It is a simple variable resistor (pre-set) with linear characteristics. This is used to adjust the contrast of the display.

Reset control circuit is used to reset the micro controller at any stage of work. This section also comprises of auto power on reset. If the reset switch is pressed, the micro controller restarts and the function will start from the begin. This circuit is connected to 9th pin of micro controller.

Crystal

A crystal is used to supply clock frequency to the micro controller. The clock frequency is 11.0592MHz. 11.0592 MHz crystals are often used because it can be divided to give you exact clock rates for most of the common baud rates for the UART, especially for the higher speeds (9600, 19200). Despite the "oddball" value, these crystals are readily available and commonly used.

Power Supply Section

This paper needs 5V regulated DC power supply. This power supply is built with a full wave bridge rectifier, C- filter and a three terminal voltage regulator. An LED is provided for visual identification of the power supply. 230V / 18V step down transformer is used to step down the AC 230 V to 18V AC.

TECHNICAL SPECIFICATIONS

ATmega328Microcontroller	
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O	Pins 14 (of which 6 provide PWM
Analog Input	Pins 6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by boot
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

RESULT

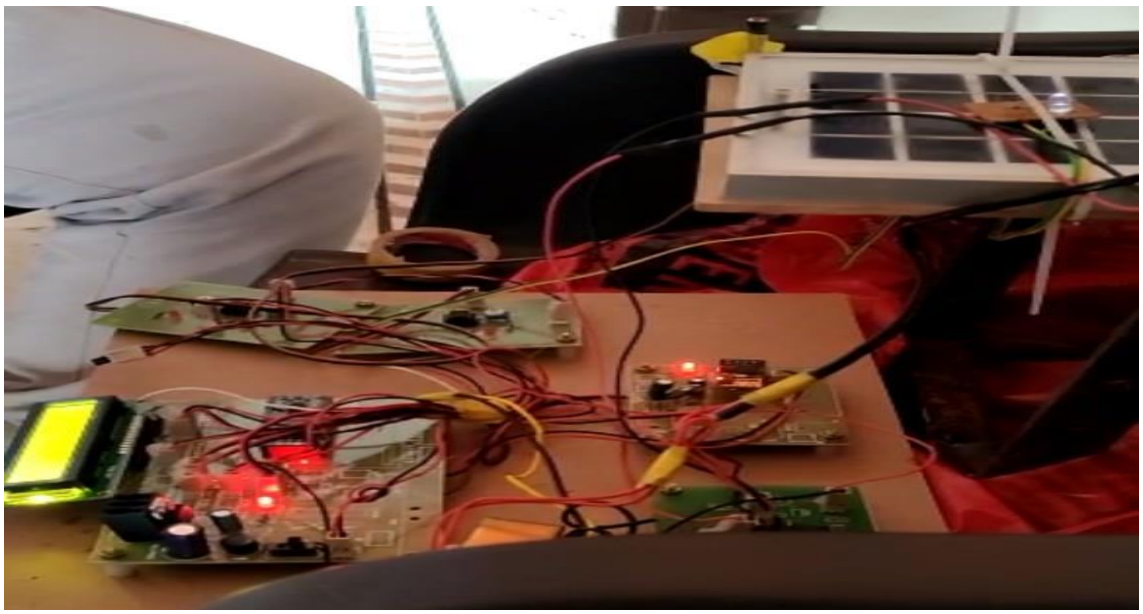


Figure: Solar Power Generation

The Figure shows that higher generating power efficiency is indeed achieved using the solar tracking system

CONCLUSION

This paper presents a solar tracking power generation system. The tracking controller based on the closed loop algorithm is designed and implemented with Atmel 89S52 MCU in embedded system domain. Set up on the solar tracking system, the light sensitivity resistors are used to determine the night – day vision. The proposed solar tracking power generation system can track the sun light automatically. Thus, the efficiency of solar energy generation can be increased. Experimental work has been carried out carefully. The result shows that higher generating power efficiency is indeed achieved using the solar tracking system. The proposed method is verified to be highly beneficial for the solar power generation.

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