The Implementation of Arduino Based Single axis Solar Tracking System

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Abstract - *A 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. 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 project is designed with AT89S52 MCU. 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 project 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.*

***Key Words*: solar panel, Arduino, Light Dependent Resistor, DC motor, H Bridge Driver, 16*2 LCD Display.**

1. INTRODUCTION

Solar energy is a very large, inexhaustible source of energy. Solar energy has become a very attractive energy source in the world due to the rise of oil prices and the negative environmental effects that conventional energy production cause. In photovoltaic systems, trackers help minimize the angle of incidence between the incoming light and the panel, which increases the amount of energy. Solar trackers must be angled correctly to collect energy. All concentrated solar systems have trackers because the systems do not produce energy unless directed correctly toward the sun. A solar tracker is a device used for orienting a photovoltaic array solar panel or for concentrating of maximum incident light. The Solar Tracker is a proven dual-axis tracking technology that has been custom designed to integrate with solar modules and reduce system costs. Therefore, it's suitable for rural are a usage. Moreover, the effectiveness of output power which collected by sunlight are increased.

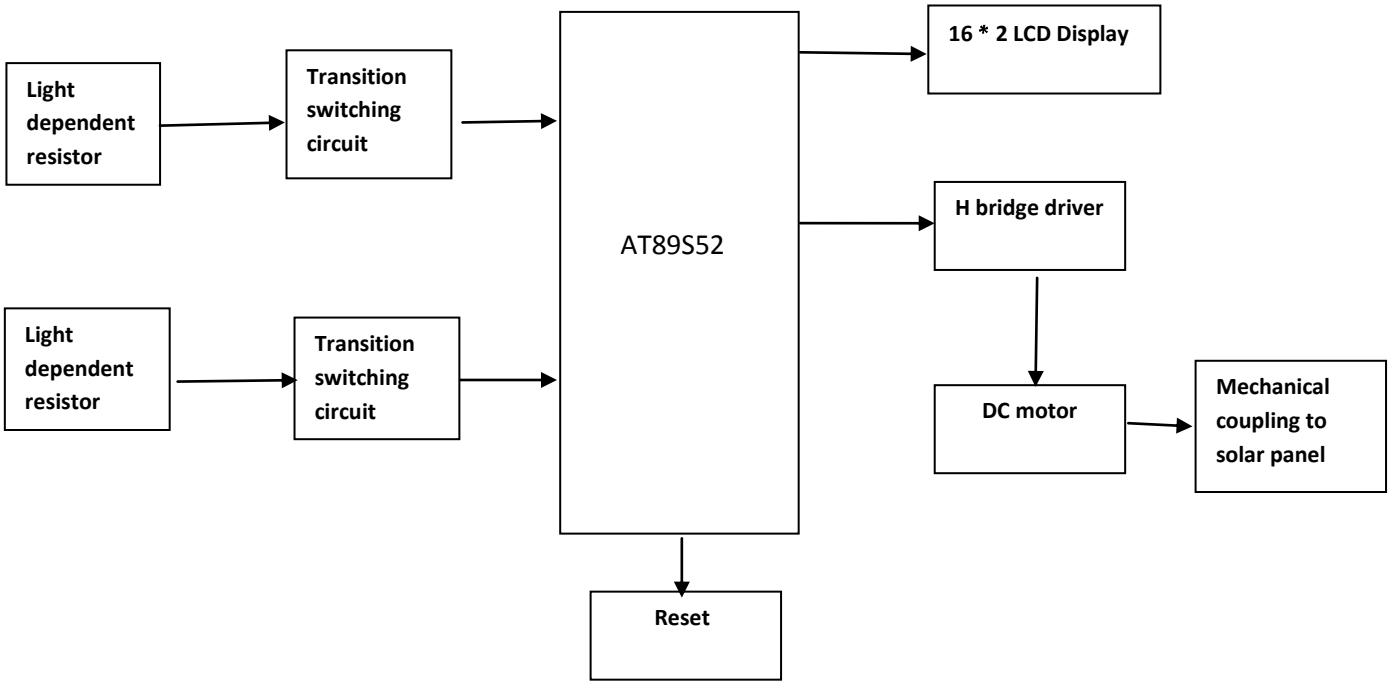
1.1 Application Areas

- Office automation
- Industrial automation
- Medical electronics
- Computer networking

1.2 Block Diagram

The circuit design is an embedded application system. Arduino is based tracking system using LDR and DC Motor. In this paper is mainly developed into three parts, Construction of hardware, Tracking System and Arduino Processing Unit. This solar tracking system uses the Arduino UNO board, DC motor, 2 LDRs and 2 resistors to rotate the solar panel towards the sun or a source of light. The solar trackers have the advantage of increasing the efficiency of capturing solar energy as the earth continues its noble movement. The 2 LDRs are working as light detectors. They are placed at each side of solar panel and DC motors are used to rotate the solar panel. If the same amount of light falls on LDRs, then DC motors will not rotate. Solar panel will always follow the sun light and will always face

towards the sun to get charge all the time and can provide the supply maximum power. The maximum power can be received from a stationary array of solar panels at a particular time



2. EXPLANATION OF EACH BLOCK

2.1 Arduino

The Arduino Uno is a microcontroller board based on the AT89S52.This is not a chip, board, company or manufacture, programming language, and computer architecture, although it involves all of these things. It has 14digital input/output pins.6 analog input pins, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. The intention is that the board is immediately useful to an application developer, without them needing to spend time and effort in developing the controller hardware.

2.2 Light Dependent Resistor

The simplest optical sensor is a photon resistor or photocell which a light sensitive resistor is made of two types, Cadmium Sulfide (CdS) and Gallium Arsenide (GaAs). Four Cadmium Sulfide (CdS) photocells are used in the sun tracker system designed here for sensing the light. The photocell is a passive component whose resistance is inversely proportional to the amount of lightly intensity directed towards it. The photocell to be used for the tracker is based on its dark resistance and light saturation resistance. Normally the resistance of an LDR is very high, but when they are illuminated with light, resistance drops dramatically. When the light level is low, the resistance of the LDR is high. LDRs or photo resistors are often used in circuits where it is necessary to detect the presence or the level of light.

2.3 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 microcontroller.

2.4 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.

2.5 LCD Display

16 X 2 LCD is used to display the operating instructions and status of the output. HD44780U is used in the project. 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.

3. Measuring Solar Efficiency

Efficiency is measured by the comparison of power generated by tracked and stationary solar panels. Mathematically efficiency is the percentage of the ratios of output power into the input power. In this case, power generated by the tracking system was considered as the reference to measure the efficiency.

$$EFFICIENCY = \frac{P - S}{P} \times 100\%$$

Where P = tracked solar; S = fixed solar

4. RESULTS

The following tables shows voltage drawn by solar panel with and without tracking respectively. In this experiment we are using 17v solar panel.

TIME	FIXED SOLAR (V)	TRACKED SOLAR (V)
8 AM	9.7	11.5
10 AM	14.3	15.3
12 PM	16.8	16.8
2 PM	11.6	16.3
4 PM	8.5	11.8

5. ADVANTAGES OF THE PROJECT:

1. This system is more efficient compare with normal solar panel system

2. Solar power is non-conventional energy source so it is pollution free whenever using.

3. Single axis solar tracking system able to optimum maximum output power and this power almost constant a time period.

6. CONCLUSION

This project 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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