THE IMPLEMENTATION OF SOLAR TRACKER USING ARDUINO WITH SERVOMOTOR

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Abstract - *The aim of this project is to consume the maximum solar energy through solar panel. A Solar Tracker is a device onto which solar panels are built-in which tracks the motion of the sun ensuring that maximum amount of sunlight strikes the panels all over the day. Power output from a solar cell will be maximum when it is facing the sun i.e. the angle between its surface and sun rays is 90 degree. Solar tracking allows more energy to be produced because the solar array is able to remain aligned to the sun. The components used for its construction are servo motor, Arduino and LDR. The active sensors continuously monitor the sunlight and alternate the panel towards the direction where the intensity of sunlight is maximum. In this project, it's divided by two categories; hardware and software. In hardware part, 2 light dependent resistor (LDR) has been used to trace the synchronize of sunlight by detecting brightness level of sunlight. For rotation part, one standard servo motor has been selected. In software part, the code is constructed in C programming and inserted in Arduino. This project is designed for low power and portable application. Therefore, it's suitable for rural area usage. Moreover, the effectiveness of output power which collected by sunlight are increased.*

*Key words***:** *Solar Tracker, Light Detecting Resistor (LDR), Arduino, Atmega 328, Servo Motor.*

1. INTRODUCTION

Renewable energy is energy which originates from natural source such as sunlight, tides, wind rain, wave and etc. Solar Energy is the energy consequent from the sun through the form of solar radiation. Solar energy is a very large, inexhaustible source of energy. Today solar energy is the major eco-friendly & pollution less method of producing the electricity. The power from the sun interrupted by the earth is approximately 1.8*1011MW, which is many thousands of times larger than the current consumption rate on the earth of all commercial energy sources. The main objective of this paper is to improve solar tracker. Solar Tracker is a Device which follows the movement of the sun as it rotates from the east to the west each day. Using solar trackers upturns the amount of solar energy which is received by the solar energy collector and develops the energy output of the heat/electricity which is generated. The solar tracker can be used for more than a few applications such as solar day-lighting system, solar cells and solar thermal arrays. The commercial persistence of solar tracker is rise solar panel output, maximum efficiency of the panel, able to grap the energy throughout the day.

At the present time, clean renewable energy sources attract a great attention as an essential mean for solving the energy crisis around the globe. Solar energy is frequently offered free of charge all over the world although it is not a continuous energy source. One of the most promising renewable energy sources characterized by a huge potential of conversion into electrical power is the solar energy. The green energy, also called renewable energy, has gained much attention now a day. Some renewable energy types are solar energy, hydro potential energy, terrestrial heat, wind energy, biomass energy, sea waves, temperature difference of sea, morning and evening tides, etc. Among these, solar energy is one of the most useful resources that can be used. However, so far the efficiency of generating electric energy from solar radiation is relatively low.

The main objective of this paper is to improve solar tracker. The solar tracker can be used for several applications; these are solar cells, solar thermal arrays and solar day-lighting system. Nowadays, the highest efficiency of solar panel is 19%. So, the efficiency can be enhancing by using solar tracker. Albeit, the price of various solar tracker are still costly because solar tracker is still fresh and only a few countries use it as South Korean and USA. Furthermore, this project is considered for rural area which extreme from main supply and absolutely low cost.

2. RELATED WORK

The following is a brief description of the papers that were studied to understand about solar tracker.

1.1 Technology Of Solar Panel

Solar panels are defined as to convert light into electricity. They are called solar after the sun because the sun is the best powerful source of the light obtainable for use. They are sometimes called photovoltaic which means "light-electricity". Solar cells or PV cells depend on the photovoltaic effect to absorb the energy of the sun. Each solar cell provides a comparatively small amount of power, a lot of solar cells spread over a large area can provide enough power to be useful. To develop the most power, solar panels have to be pointed directly next to the Sun. A solar panel is a

collection of solar cells. The development of solar cell technology begins with 1839 examination of French physicist Antoine-Cesar Becquerel and he observed the photovoltaic effect while experimenting with a compact electrode in an electrolyte solution. Subsequently he saw a voltage developed when light fell upon the electrode.

According to Encyclopaedia Britannica the first honest for solar panel was built around 1883 by Charles Fritts. He used connections formed by coating selenium (a semiconductor) with an extremely thin layer of gold. Crystalline silicon and gallium arsenide are usual varieties of materials for solar panels. Gallium arsenide crystals are grown especially for photovoltaic use, but silicon crystals are obtainable in less-expensive standard ingots, which are produced mostly for intake in the microelectronics industry. Norway's Renewable Energy Corporation has confirmed that it will construct a solar developed plant in Singapore by 2010 - the largest in the world. This plant will be able to produce products that can create up to 1.5 Gw of energy every year. That is enough to power several million households at any one time. Last year the world as whole formed products that could generate just 2 GW in total.

1.2 Microcontroller Based Automatic Solar Tracker

F. Huang et al. had aimed a microcontroller based automatic sun tracker combined with a new solar energy conversion unit in 1998 .The automatic sun tracker was implemented with a dc motor and a dc motor controller. The solar energy transformation unit involved of an array of solar panels, a step-up chopper, a single-phase inverter, an ac mains power source and a microcontroller based control unit. High efficiency was achieved through the automatic sun tracker and the MPP detector. In this system, the MPP finding and the power conversion were realized by using the same hardware circuit. In the existed MPP detectors, the detection of the MPP was achieved by using analog computing, comparing, and holding. In compare to the existed ones, in the fresh system, the MPP was detected by software which was embedded in a microcontroller [F. Huang et al., 1998].

1.3 Evolution Of Solar Tracker

Since the sun transfers across the sky through the day, in order to receive the best angle of exposure to sunlight for collection energy. A tracking mechanism is frequently incorporated into the solar arrays to keep the array pointed in the direction of the sun. A solar tracker is a device onto which solar panels are fixed which tracks the motion of the sun across the sky ensuring that the extreme amount of sunlight strikes the panels throughout the day. When relate to the price of the PV solar panels, the cost of a solar tracker is comparatively low. Most photovoltaic solar panels are fitted in a secure location- for example on the inclined

roof of a house, or on framework fixed to the ground. Since the sun moves across the sky and yet the day, this is far from an ideal solution. Solar panels are usually set up to be in full direct sunshine at the medium of the day in front of South in the Northern Hemisphere, or North in the Southern Hemisphere. Consequently morning and evening sunlight triumphs the panels at an acute angle decreasing the total amount of electricity which can be generated each day.

3. PROPOSED SYSTEM DESIGN

In this projects include design and construction of an arduino based solar tracker. This solar tracker system uses the arduino board, a servomotor, 2 LDR and 2 resistors to rotate the solar panel towards the sun or a source of light. In this project LDR was selected since it has no polarity, and easy to interface with circuit, cheap, reliable and is described by high spectral sensitivity, so that difference in high intensity is represented immediately by change in its resistance value. The block diagram of proposed system as shown in figure 1.
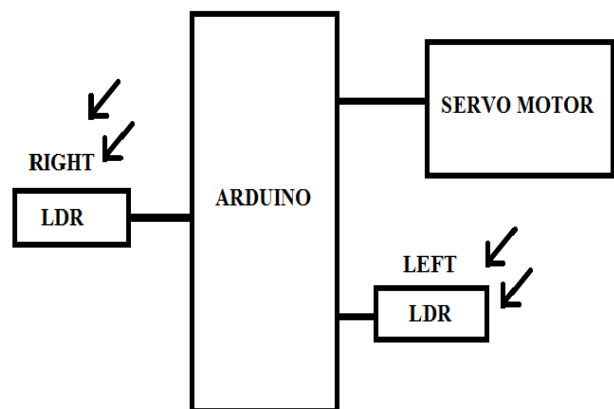

Fig -1: Block Diagram of Project

In constructing the solar tracking system, LDRs are used to determine solar light intensity. The 2 LDRs are connected to pin A0 and A1 on the board. One servo motor is used for rotation part. Usually the servo has a yellow wire that is used to control the cycle and it must be associated on pin 9 on the board. When light falls on the LDR, its resistance differs and a potential divider circuit is used to obtain corresponding voltage value from the resistance of LDR. The voltage signal is send to the microcontroller. Constructed on the voltage signal, a corresponding PWM signal is send to the servo motor which origins it to rotate and finally attains a position where intensity of light falls on the solar panel is maximum. The schematic diagram of proposed system as shown in figure 2.
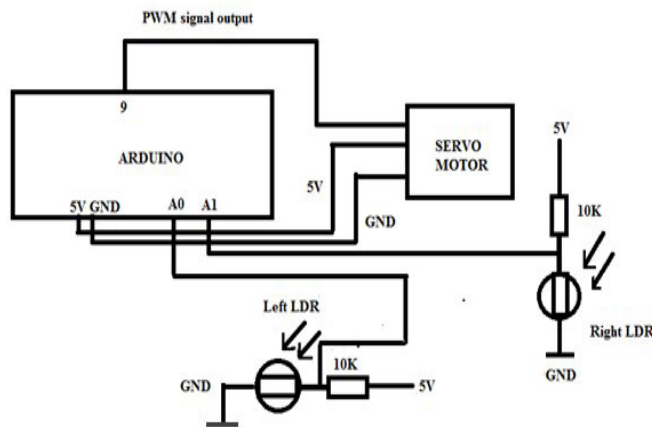
Fig -2: Schematic Diagram of Project

In this project the angles are designed by finding which LDR is in shadow. For example if high source is right with respect to right LDR will receive maximum light and left LDR will be in shadow. The major components of this system are as follows, Light dependent resistor, Arduino board, Servo motor, 10 k resistor.

3.1 Circuit Design

In this project divided by two categories; hardware and software. The Arduino Uno is a microcontroller board based on the ATmega328. It consumes 14 digital input/output pins (of which 6 can be used as PWM outputs), and 6 analog inputs. The technical specification is as shown in table 1.

Table -1: Technical Specifications

Microcontroller	ATmega328
Input Voltage (limit)	6-20V
PWM Digital I/O Pins	6
Digital I/O Pins	14
Analog Input Pins	6
DC Current at 3.3V Pin	50 Ma
DC Current per I/O Pin	40 Ma
Operating Voltage	5V
Flash Memory	32 KB
EEPROM	1 KB
Clock Speed	16 MHz
Length	68.6 mm
Weight	25 g
Width	53.4 mm

4. RESULT AND DISCUSSION

Result of this project is, when light falls on the LDR, its resistance varies and a potential divider circuit is used to obtain corresponding voltage value (5v) from the resistance of LDR. The voltage signal is send to the Arduino microcontroller. Established on the voltage signal, a corresponding PWM signal is send to the servo motor which causes it to rotate and to end with attains a position where intensity of light falls on the solar panel is maximum.

5. CONCLUSIONS

An arduino solar tracker was designed and constructed in the current work. LDR light sensors were used to sense the intensity of the solar light occurrence on the photo-voltaic cells panel. Conclusions of this project is summarized as ,The existing tracking system successfully sketched the light source even it is a small torch light, in a dark room, or it is the sun light rays. The Arduino solar tracker with servo motor is employed by means of Ardiuno ATmega328p microcontroller. The essential software is developed via Arduino Uno. The cost and reliability of this solar tracker creates it suitable for the rural usage. The purpose of renewable energy from this paper offered new and advanced idea to help the people.

REFERENCES

[1] Koyuncu B and Balasubramanian K, "A microprocessor controlled automatic sun tracker," IEEE Trans. Consumer Electron., vol. 37, no. 4,pp. 913-917, 1991.

[2] Konar A and Mandal A K, "Microprocessor based automatic sun tracker," IEEE Proc. Sci., Meas. Technol., vol. 138, no. 4, pp. 237-241,1991.

[3] Rizk J. and Chaiko Y. "Solar Tracking System: More Efficient Use of Solar Panels", World Academy of Science, Engineering and Technology 2008.

[4] Filfil Ahmed Nasir, Mohussen Deia Halboot, Dr. ZidanKhamis A. "Microcontroller-Based Sun Path Tracking System", Eng. & Tech. Journal, Vol. 29, No.7, 2011.

[5] Ashok Kumar Saxena, V.Dutta. "A Versatile Microprocessor Based Controller For Solar Tracking".Proc. IEEE, 1990', pp.1105-1109.

[6] Damm, J "An active solar tracking system, Home Brew Magazine " Issue #17, June/July 1990

[7] GamalM.Dousoky,Abou-Hashema M.EL-SAYED,MasahitoShoyama. "Maximizing Energy-EfficencyInSingle Axis Solar Tracker Photovoltaic Panels".8th International Conference on Power Electronic-ECCEAsia –May 30 June, 2011.

[8] Alimazidi Mohammad, Gillispie J, Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", an imprint of Pearson Education, 2006.

[9] Mehta V K, Mehta Rohit, "Principles of Electronics", S. Chand & Company Ltd, 2008.

[10] Balagurusamy E, "Programming in ANSI C", Tata McGraw-Hill Publishing Company Limited, 2008.

[11] MohdZulkifli,M.A.; Zolkapli.M.;Al-Junid,S.A.M. "High-Efficency Dual Axis Solar Tracking DeveloptmentUsing Arduino" international conference of technology, informatics, management, engineering, and environment(TIME-E), 2013.

[12] Han Wan Siew, "Solar tTracker"SIM University,2008.