

SOLAR TRACKER USING ARDUINO UNO 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, 4 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

The world population is increasing day by day and the demand for energy is increasing accordingly. Oil and coal as the main source of energy nowadays, is expected to end up from the world during the recent century which explores a serious problem in providing the humanity with an affordable and reliable source of

energy. Renewable energy is derived from natural processes that are replenished constantly. 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 1.8×10^{11} MW, 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 grasp 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

In 1998 F. Huang et al. had aimed a microcontroller based automatic sun tracker combined with a new solar energy conversion unit. 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.

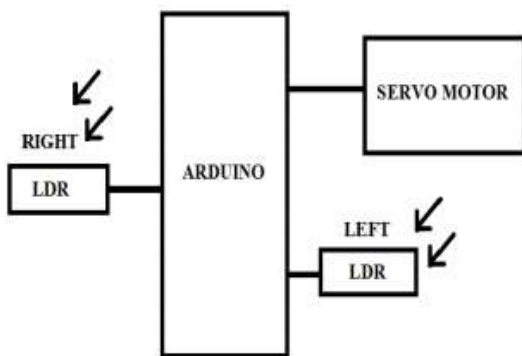
1.3 Evolution Of Solar Tracker

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

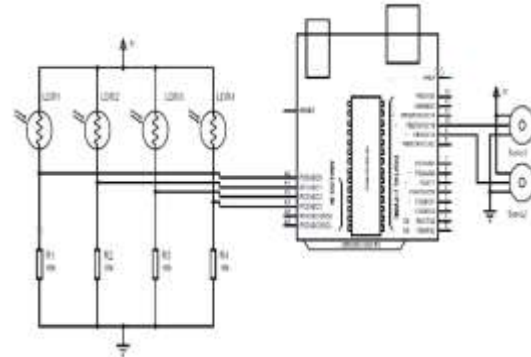
In this projects include design and construction of an arduino based solar tracker. This solar tracker system uses the arduino board, a servomotor, 2 LDR and 2 resistors to rotate the solar panel towards the sun or a source of light. In this project LDR was selected since it has no polarity, and easy 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.



The circuit design of solar tracker is simple but setting up the system must be done carefully.

Four LDRs and Four 100KΩ resistors are connected in a voltage divider fashion and the output is given to 4

Analog input pins of Arduino. The PWM inputs of two servos are given from digital pins 9 and 10 of Arduino.



LDRs are used as the main light sensors. Two servo motors are fixed to the structure that holds the solar panel. The program for Arduino is uploaded to the microcontroller. The working of the project is as follows.

LDRs sense the amount of sunlight falling on them. Four LDRs are divided into top, bottom, left and right.

For east – west tracking, the analog values from two top LDRs and two bottom LDRs are compared and if the top set of LDRs receive more light, the vertical servo will move in that direction.

If the bottom LDRs receive more light, the servo moves in that direction.

For angular deflection of the solar panel, the analog values from two left LDRs and two right LDRs are compared. If the left set of LDRs receive more light than the right set, the horizontal servo will move in that direction.

If the right set of LDRs receive more light, the servo moves in that direction.

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 below.

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 Arduno 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.

6. REFERENCES

1. M.D.Singh and Khanchandani: "Power Electronics
2. Electrical Machines "Ashfaq Hussain
3. <http://www.solar-tracking.com/>
4. International Journal of Advanced Research Computer Science and Software

Engineering Research Paper www.ijarcsse.com

5. International Journal Of Engineering And Science at www.Researchinventy.com

