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SOLAR ENERGY TRACKING USING ROBOT

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ABSTRACT

Solar tracking system for renewable energy day by day increasing in India. Solar energy is future of next generation to working of more company and human life. In years to come we may have source of energy that will cover future generations with a sustainable energy. A few better reasons to improve our solar energy market are because electricity is need of human being today.The use of highly portable, efficient solar trackers are very useful to the military, industrial or residential society . To produce an efficient solar generation system a scaled down single axis solar tracker is designed, built and tasted.At most, the solar tracker within perpendicular to the light source.

Solar tracking systems are used to continually orient photovoltaic panels towards the sun and can help maximize your investment in your PV system. They are beneficial as the sun's position in the sky will change gradually over the course of a day and over the seasons throughout the year. They can be used most effectively in areas with low horizons and locations that are shade free from dawn to dusk each day.

Throughout the year the tracking array will be able to utilize the wide open access to gain every available electron from the sun. This way, energy production is at an optimum and energy output is increased year round. The standalone PV home kit system is a very reliable and uncomplicated source of energy production; the panels don't move and require little maintenance.

Keywords: Distributed Generation Systems, Earth-Orbiting Satellite, Photovoltaic, Solar Panel, Uninterrupted Reflection.

I. INTRODUCTION

The increasing demand for energy, the continuous reduction in existing sources of fossil fuels and the growing concern regarding environment pollution, have pushed mankind to explore new technologies for the production of electrical energy using clean, renewable sources, such as solar energy, wind energy, *etc*. Among the non-conventional, renewable energy sources, solar energy affords great potential for conversion into electric power, able to ensure an important part of the electrical energy needs of the planet.

The conversion of solar light into electrical energy represents one of the most promising and challenging energetic technologies, in continuous development, being clean, silent and reliable, with very low maintenance costs and minimal ecological impact. Solar energy is free, practically inexhaustible, and involves no polluting residues or greenhouse gases emission .Solar energy refers to the utilization of the radiant energy from the sun

solar is used interchangeably with solar energy, but refers more specifically to the conversion of sunlight into electrically by photovoltaic.

1.1 Need

The tracker is the one which follows the sun's movement throughout the day and provides uninterrupted reflection to the solar panel. The sun rays will fall on the solar panel in two ways, which is, they will fall directly on the solar panel and also the reflector will reflect the incident rays on the solar panel. Suppose at the time of sun rise the sun is in extreme east the reflector will align itself in some position by which the incident rays will fall on the solar panel. Now when the earth rotates and the sun gets shifted for its earlier position the reflection of the incident rays will also change. Thus as a result the light will fall on the sensors kept on each side of the solar panel. The tracking circuit is so designed that when reflection falls on say the sensor attached to the right of the panel, the tracker will move towards the left, and visa-versa. Similar is the case when the reflection falls on the sensor attached at the top of the panel, circuit will make the tracker to move downwards. We here have tried to bring two simple principles together. One being, the normal principle of incidence and reflection on which our tracker works. And the other is the principle on which the solar panel works, which is on the incidence of the solar rays the photovoltaic cells, will produce electricity. This both principles are combined there and as a result of which we are able to fetch nearly double the output which the panel gives normally. Precisely speaking the tracker is liable for two kinds of rotations, on is on the vertical axis and other is on the horizontal axis. The earlier is for the right-left movement of the reflection and the latter is for the up-down movement of the reflector, for aligning reflection on the panel [1].

1.1.1 Solar Tracker

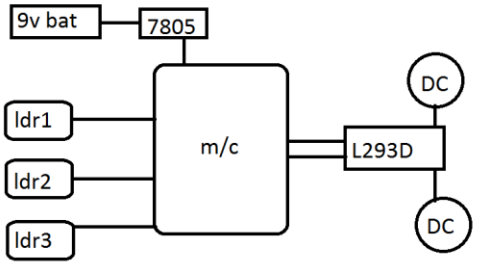
Photovoltaic is the field of technology and research related to the application of solar cells as solar energy. Solar cells have many applications. Individual cells are used for powering small devices such as electronic calculators. Photovoltaic arrays generate a form of renewable electricity, particularly useful in situations where electrical power from the grid is unavailable such as in remote area power systems, Earth-orbiting satellites and space probes, remote radio telephones and water pumping applications. Photovoltaic electricity is also increasingly deployed in grid-tied electrical systems. Renewable energy is rapidly gaining importance as an energy resource as fossil fuel prices fluctuate. One of the most popular renewable energy sources is solar energy. Many researches were conducted to develop some methods to increase the efficiency of Photo Voltaic systems (solar panels). One such method is to employ a solar panel tracking system . This project deals with a microcontroller based solar panel tracking system. Solar tracking enables more energy to be generated because the solar panel is always able to maintain a perpendicular profile to the sun's rays. Development of solar panel tracking systems has been ongoing for several years now. As the sun moves across the sky during the day, it is advantageous to have the solar panels track the location of the sun, such that the panels are always perpendicular to the solar energy radiated by the sun. This will tend to maximize the amount of power absorbed by PV systems. It has been estimated that the use of a tracking system, over a fixed system, can increase the power output by 30% - 60%. The increase is significant enough to make tracking a viable preposition despite of the enhancement in system cost. It is possible to align the tracking heliostat normal to sun using electronic control by a micro controller.[1]

II. OBJECTIVE

The objective of work is to present a solar energy collection technology by a photovoltaic cell. To present this efficient solar distributed generation system, a solar tracker is designed, built and tested. The robot tracker actively tracks the sun and changes the position of solar polar accordingly to maximize the power output. The designed tracking system consists of sensors, and microcontroller operated control circuits to drive motors and solar panel arrangements with supports and mountings.

2.1 Block Diagram and Description

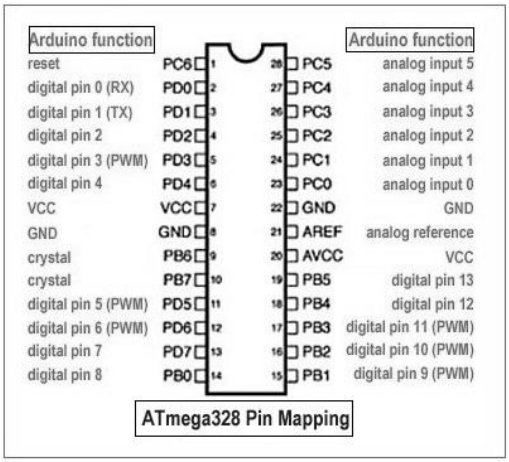
As you are able to see in the above fig. there is the engineering block diagram of our project that we have designed at the primary stage of our project .So the block diagram consist of Battery, voltage regulator IC, ldr, motor driving IC, DC motor, microcontroller *etc*.



"Fig. 2.1: Block Diagram of Solar Tracking System"

The block diagram of solar tracking system is as shown in above figure

2.1.1 Microcontroller (AT MEGA 328P)



"Fig. 2.1.1: Pin Configuration of Microcontroller AT Mega 328P"

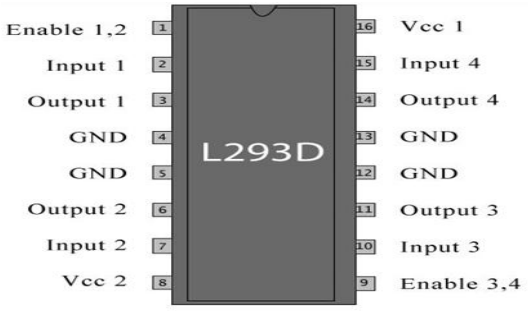
AT mega 328 is used for this project with total28 pins out of which 14 digital pins & 6 analog pins are used. Pin 7 is connected at Vcc & pin 8 is connected to ground. Internally pin no.20 is connected to Vcc & pin no. 22 is connected to ground respectively. Pin no. 9, 10 are connected to crystal oscillator of 16 MHz with ceramic capacitor of 22pF.These capacitors are used to reduce the noise.

2.2 Voltage Regulator 7805

IC 7805 is a DC regulated IC of 5V. This IC is very flexible and widely employed in all types of circuit like a voltage regulator. It is a three terminal device and mainly called input, output, ground.

.2.3 Motor Driver L293D

Motor driver IC which allows DC motor to drive on either direction i.e. anticlockwise and clockwise. In a L293D IC there are two H-bridge circuits which can rotate two DC motors independently that's why we used IC L293D.

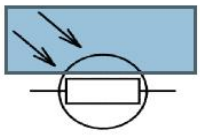


"Fig. 2.4 Pin Description of Driving IC L293D"

2.4 Light Dependent Resistor (LDR)

An LDR (Light dependent resistor), as its name suggests, offers resistance in response to the ambient light. The resistance decreases as the intensity of incident light increases, and vice versa. In the absence of light, LDR exhibits a resistance of the order of mega-ohms which decreases to few hundred ohms in the presence of light. It can act as a sensor, since a varying voltage drop can be obtained in accordance with the varying light. It is made up of cadmium sulphide (CdS). An LDR has a zigzag cadmium sulphide track. It is a bilateral device, i.e., conducts in both directions in same fashion. A photo resistor or light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. It can also be referred to as a photoconductor or CdS device, from "cadmium sulfide," which is the material from which the device is made and that actually exhibits the variation in resistance with light level. Note that CdS is not a semiconductor in the usual sense of the word (not doped silicon).

A photo resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.



A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, e.g. silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire band gap. Extrinsic devices have impurities, also called dopants, and added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (i.e., longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of

an extrinsic semiconductor .Photo resistors are basically photocells Applications. Photo resistors come in many different types. Inexpensive cadmium sulphide cells can be found in many consumer items such as camera light meters, street lights, clock radios, alarm devices, and outdoor clocks. They are also used in some dynamic compressors together with a small incandescent lamp or light emitting diode to control gain reduction. Lead sulphide (PbS) and indium antimonide (InSb) LDRs (light dependent resistor) are used for the mid infrared spectral region. photoconductors are among the best far infrared detectors available, and are used for infrared astronomy and infrared spectroscopy.

III. TESTING AND RESULT

3.1 Testing

1)Check the Continuity of the tracks on the PCB board with the help of Multimeter setting on the continuity mode.

2)Check the Voltage on the all IC pins with the Multimeter.

3)Once the all connections of components are correctly placed then it is ready to use the system.

3.2 Result

Solar Tracking System prototype model is successfully developed. The designed system is focuses on designing controller part and the main concern is to design appropriate circuits and the circuits supposed to be able to control DC motor rotation direction without considering motor speed. The system is able to track and follow Sunlight intensity in order to collect maximum solar power regardless of motor speed. The unique of developed system, motor speed is not critical consideration because the DC motor offers low output rated speed and high output rated torque. Therefore any types of DC motor can be used for this system regardless of motor speed controller unit as long as the speed and torque of the motor are following the given specification. The constructed system model can be applied in the residential area for alternative electricity generation especially for non-critical and low power appliances.

IV. CONCLUSIONS

Single Axis Solar Tracking System prototype model is successfully developed. The designed system is focuses on designing controller part and the main concern is to design appropriate circuits . The system is able to track and follow Sunlight intensity in order to collect maximum solar power with the help of automatic robot. The Constructed system model can be applied in the residential area for alternative electricity generation especially for non-critical and Low power appliances.

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