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Dual Axis Sun Solar Tracker System

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Abstract*—In this paper, a construction of a Solar system is done through means of Dual axis solar trackers which associated with PV (photovoltaic) panels for maximum detection of Sun rays for generation of effective solar energy as compared to existing system i.e. single axis solar tracking system. The backbone of system is Arduino UNO which runs on Battery which handles solar plates. In sunny condition according to whether sun changes its position daily and seasonally too, so that in case of this Dual axis solar tracking system gives a higher amount of solar energy by producing it through panel which placed on tracker which rotating vertically as well as horizontally respectively.

***Keywords*—Arduino UNO, Battery, Solar plates, PV panel.**

I. INTRODUCTION

In comparison to other energy sources, solar energy has the largest availability. Solar energy is a cleaner and more convenient source of energy. Solar Photovoltaic Systems can transform the solar energy that is accessible in our surroundings into electrical energy (SPV). On a sunny day, the earth's surface is expected to receive 1000 Watts of power per square meter. According to a recent analysis, solar-based renewable energy accounts for 24 percent of worldwide energy, albeit this varies by location and country.

Renewable energy sources account for 21.22 percent of India's energy consumption. India has set a target of 175 GW of renewable energy capacity by 2022, including 100 GW of solar power.

As of present, a large portion of energy comes from nonrenewable sources such as fossil fuels and coal, which are rapidly decreasing, necessitating the development of a new, preferably renewable energy source. Solar photovoltaic plates (PV) are widely regarded as a cost-effective way to convert photons in the sun into electricity. So this is how actually a solar tracking system works to detecting sunlight to generate solar energy.

II. SOME COMMONLY USED COMPONENTS

A. SERVO MOTOR

A servomotor is a rotary machine or a liner circulatory machine that allows for precise angular momentum or linear position, velocity, and acceleration control. It generally incorporates an approximation motor which coupled to a sensor which offend controlled by any micro controller such as Arduino UNO, Raspberry pie, etc.

A servomotor is a closed loop that uses the servomechanism, which is a well-known mechanism that basically employs within the position. It uses feedback to control its movement and final location. The servo motor is designed for fast positioning with high precision. As a motor that can control the rotation angle and speed with precision.

The rotation position and speed of the motor shaft are fed back to the driver via a rotation detector (encoder) installed on the motor. A servo (servomechanism) is an electromagnetic device that uses negative feedback mechanisms to transform power into precise controlled motion. Depending on the type of servo, it can be used to generate linear or circular motion.

fig.1.Servo Motor

B. LDR (Light Dependent Register)

Light sensors are photoelectric devices that transform light energy (photons) into an electrical (electrons) signal, whether visible or infrared light. A Light Sensor produces an output signal representing the intensity of light by measuring the radiant energy that exists in a relatively narrow range of frequencies commonly referred to as "light," which ranges in frequency from "infrared" to "visible" to "ultraviolet."
The light sensor is a passive device that converts visible or infrared light energy into an electrical signal output. “Photoelectric Devices” or “Photo Sensors” are other terms for light sensors. Because the convert light energy (photons) into electricity (electrons).

Photoelectric devices are divided into two types: those that generate electricity when lighted, such as photovoltaics or photo missives, and those that change their electrical properties in some way, such as photoresistors or photoconductors. As a result, the devices are classified as follows.

fig.2.LDR

C. ARDUINO UNO

It's an Atmega328-based microcontroller board created by Arduino.cc. Electronic gadgets are getting more small, flexible, and affordable, allowing them to do more functions than their predecessors, which took up more space, were more expensive, and could only perform a limited number of operations.

The microcontroller was introduced into the electronics industry with the goal of simplifying operations that require a remote connection or automation in some way.

Microcontrollers are commonly employed in embedded systems, allowing things to function according to our demands.

A USB port, 14 digital I/O pins, 6 analogue pins, and an Atmega328 microcontroller are included in the electronics. It also has Tx and Rx pins for serial connection. There are several other Arduino boards on the market, such as the Arduino UNO.

however, the Arduino Uno and Arduino Mega are the most popular variants. If you're working on a project involving digital electronics,

to embedded systems, robotics, or the Internet of Things, the Arduino Uno is the finest tool to utilize.

Fig. Arduino UNO

D. SOLAR PANEL

Solar panels are solar panels that capture the sun's rays and convert them to power or heat.On the surface of solar panels, these cells are organized in a grid-like arrangement.

As a result, it can alternatively be described as a collection of photovoltaic modules put on a supporting framework. A photovoltaic (PV) module is a 610 solar cell packaged and linked assembly
.

These panels are extremely durable when it comes to wear and tear. Solar panels deteriorate at a glacial pace. Over the course of a year, their effectiveness drops by only one to two percent.

Crystallized silicon solar cells are used in the majority of solar panels.

Fig. Solar Panel interacted with sun rays

II. LITERATURE REVIEW:

A. *Design and Implementation of a Laboratory-Scale Single Axis Solar Tracking System:*

The project teaches how to plan and execute a project. A single-axis sun tracking device on a laboratory scale. The system becomes portable and convenient to be assigned at a suitable workplace for solar tracking by using the laboratory-scale system. The plant was operated by a DC geared motor because the microcontroller was used as an integrated control unit during this project.

During the installation of this project, a single axis solar array was used, with only one axis capturing sun rays. As a result, only one direction is capable of receiving rays and turning them into solar power.

Just a small number of rays are caught from the sun by this single axis technique since only one axis of rotation is rotated.

B. *Design and Development of Tilted Single Axis and Azimuth-Altitude Dual Axis Solar Tracking System:*

The planning, development, and manufacturing of two prototype sun tracking systems with single-axis and dual-axis solar tracking controllers are detailed in this work.

During this project, the solar tracking system (Tilted Single Axis Tracker and Azimuth-Altitude Dual Axis Tracker) is designed. For the projects, LDR was employed as a sensing unit.

The systems' negative feedback circuit was powered by an Atmega8 microcontroller that was configured to detect daylight via LDR sensors and then operate a DC geared motor using an L293D motor driver to position the solar array.

C. *A Review of Principle and Sun-Tracking Methods for Maximizing Solar Systems Output:*

This study presents an entirely new design for a dual-axis solar tracking PV system that takes advantage of the utilities afforded by the system's feedback.

To provide reliable system performance, control theory is combined with a light dependent resistor (LDR) sensor and simple electronic circuitry.

To achieve solar tracking, the suggested system employs a single dual-axis AC motor and a stand-alone PV inverter.

III. EXISTING SYSTEM

As from traditional method, Single axis solar system used.IN this system how solar system works let's see in detail below:

Single Axis Solar System-

This system purposes solar plate which uses for capturing rays by only one axis and in a stable position. Sun changes its position daily and seasonally so that most of sun rays are didn't in contact with that solar plate.

According to survey, 65% of solar rays are doesn't contact with single axis solar plate which now a days everywhere used. By means of this solar plate sun rays are converted into solar energy from solar plate. Just need to keep that plate in a fixed position for a whole day where sun rays came.

So, this is how Single Axis Solar System was used Respectively.

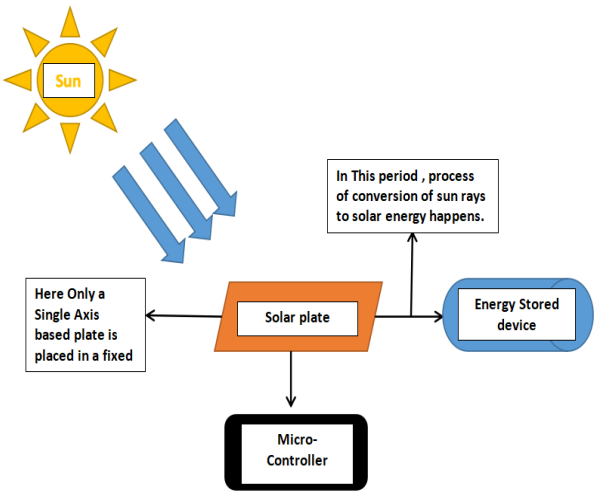

Fig. Single Axis Solar System

IV. PROPOSED SYSTEM

We create a proposed system which named as Dual Axis Solar Tracker System. So how its working let's see in details:

Dual Axis Solar Tracker System-

The Dual Axis Solar Tracking System as its name suggest having dual axes i.e. Vertical and Horizontal Axis. By means of this two Axes can rotate a single solar plate in both the direction for capturing more sun rays and being more effective as compare to single axis solar tracker system.

According to Dual Axis Tracker System, 74% of Sun rays are captured means 9% of sun rays are more captured as compared to single axis solar tracker system.

As per position of sun changes, dual axis also changes position of solar plate so that it can always perpendicular to the sun so that capturing more sun rays and these will be converted into solar energy which being more effective.

So, this is how Dual Axis Solar Tracker system works respectively.

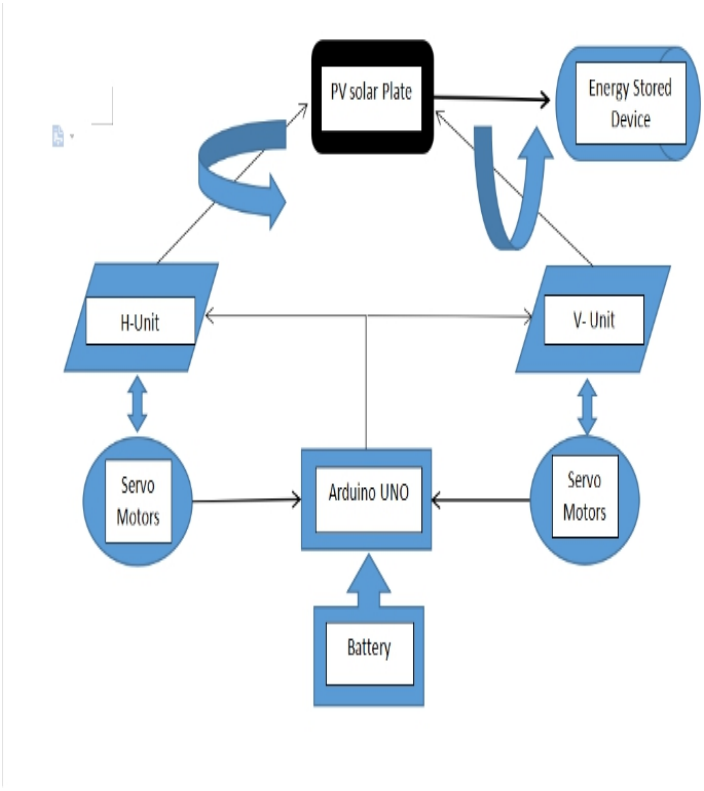

Fig. Dual Axis Solar Tracker system

V. CONCLUSION

Usually, Single Axis Solar Tracker System having only Single Axis so that it keeps as it is in their position. That's Why Dual Axis Solar Tracker System is required because it has two degree of Freedom so that it captured more sun rays and produces effective amount of solar energy.

When Sun changes its position dual axis solar panel also changes its position so that rays are captured by a solar plate which rotate with two degree of freedom i.e. vertically and horizontally. These two axes play a major role in dual axis sun solar tracker system which manages all by means of main part i.e. Micro-controller Arduino UNO which manages the rotation of solar PV plate through means of servo motor. Means Arduino control the motors as well as give commands to the motor of rotation vertically and horizontally.

VI. FUTURE SCOPE

The project work can be more improved with a few adjustments in the design and some changes according to design in coding of micro- controller as well.

Instead of the sensors used here for Seasonal Tracking, a Real Time Clock (RTC) can be utilized.

VII. REFERENCES

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